International Development Management Center

MICROCOMPUTER ADOPTION IN DEVELOPING COUNTRIES: OLD MANAGEMENT STYLES AND NEW INFORMATION SYSTEMS

A Case Study of Microcomputer Adoption in Kenya and in Indonesia

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LIST OF ACRONYMS

AS - Assistant Secretary
DPD - Development Planning Division
HIID - Harvard Institute for International Development
GOK - Government of Kenya
GOI - Government of Indonesia
MALD - Ministry of Agriculture and Livestock Development
MOA - Ministry of Agriculture
MLD - Ministry of Livestock Development
MOF - Ministry of Finance
PAIK - Pusat Analisa Informasi Keuangan (Center for the Analysis of Finance Information)
PS - Permanent Secretary
RPP - Rural Planning Project
SAS - Senior Assistant Secretary
TAP - Technical Assistance Pool
USAID - United States Agency for International Development

CHAPTER I

INTRODUCTION

In a government office in Central Java, a young woman punches numbers into a microcomputer. A few kilometers away men walk behind oxen-drawn ploughs and women weave and dye cloth, using techniques that differ little from those of generations before them. Scenes like this are rapidly being replicated throughout the third world. The apparent incongruity of microcomputer use in such settings raises a myriad of questions and contentions. Are microcomputers, as some believe, a too-sophisticated, "inappropriate" technology that will displace labor while concentrating power in central government offices in the capital? Or, as others maintain, do they offer a means for developing countries to leapfrog into the 1980's, to improve management, efficiency and effectiveness, engendering unprecedented development?(1)

The questions are critical. Yet the answers will only emerge from a long chain of experience and research, of which the first links are only currently being forged. The study presented here was undertaken with a vivid realization that the rate of introduction of microcomputers in developing countries has far outstriped understanding of the implications of such adoption. What little has been written about microcomputer use in developing countries has been primarily descriptive rather than analytical. The central concern of this paper, therefore, is to contribute to the early stages of analyzing microcomputer use and impact in less developed countries (LDCs).

The focus of this study is on one important form of microcomputer adoption, the use of microcomputers as management tools in the public sector. The concern with management issues reflects their critical role in the success of development programs. In its Eighth Annual Report on Project Implementation and Supervision (World Bank, 1983), the Projects Advisory Staff of the World Bank emphasized the importance of management resources in determining program outcomes. The report, which generated much controversy, concluded that "among the major types of implementation problems, managerial problems remain the most common..." Others in the field also note that availablity of management skills is often a key determinant of the relative success of development projects and programs, as well as ongoing government operations.(2)

The goal of this study is a modest one: to identify key issues associated with effective adoption of microcomputers in public sector managment, to consider some tentative hypotheses, and to examine potential impacts on organizational behavior and management processes, and the factors associated with them. The product is a framework for further analysis of the use of microcomputers as management tools in the public sector of

developing countries.

There is no question that governments of developing countries can benefit from improved information systems. Noting that decision-making and implementation require considerable information, Herbert Simon (1973) has suggested that handling information is, therefore, "the central activity in which the organization is engaged."(3) Yet the governments of developing countries are constrained by underdeveloped information systems and limited human skills in information analysis. Decision-making too often becomes a pro forma process in which decisions are made by "rule of thumb," or rule of private interest, rather than on the basis of efficiency and effectiveness.(4)

Proponents of microcomputer use cite a number of ways in which microcomputers can ameliorate some of these problems. One important area in which microcomputers might offer assistance is in the management of government operations and projects. By rapidly providing useful management information, microcomputers may be able to ease the constraints associated with limited management skills, and promote more informed decision-making.(5) Most LDCs face tightening budgets and increasing demand for public resources. Microcomputers may be able to help administrators improve monitoring of expenditures by making accurate financial information readily accessible.(6) Microcomputer statistical packages and spreadsheets may provide a tool with which planners and policy-makers can better determine optimal allocation of limited resources.(7) Word processing capability may enable government secretarial staff to produce numerous drafts of documents more quickly and accurately than is possible using typewriters. In addition, some anticipate that microcomputer use will provide a means to deconcentrate power by bringing local areas more directly into the decision-making process.(8)

Accompanying those potential benefits, however, are equally impressive potential costs. One fear is that microcomputer adoption will eliminate much-needed employment opportunities, from clerical to management positions.(9) In countries with factor proportions that favor labor intensive technologies, microcomputers seem to many to be singularly inappropriate. Another, less commonly expressed fear is that microcomputers will be used to concentrate power at the center.(10) There is concern that the central government will seek to control more and more information about activities throughout the country.(11) There are also muted worries that microcomputer output will be perceived as inevitably correct, "because it comes from the computer," cloaking those who use it in the mantle of irrefutable authority.(12)

In attempting to assess these contending scenarios, this study utilized three bodies of literature. Organizational change theory, technology transfer, and technology diffusion literatures examine the adoption of new technologies from varying perspectives.(13) Although the three seem to work in isolation

from one another, there are several areas in which their hypotheses and conclusions coincide. All three, for example, identify six factors as important determinants of the outcome of an organization's adoption of a new technology. Those factors are organizational structure, reward-sanction systems, power relationships (formal and informal),(14) skill bases, cultural beliefs, and the role of leaders.(15) In examining microcomputer adoption, this study focused on the roles of those six factors.

The study approach also recognizes several ways in which microcomputers differ from technologies generally examined in the technology transfer/diffusion literature. Most technologies do not, for example, require distinctive analyses of the adoption of the technology and the adoption of the products of the technology (pages 12-13 discuss the distinction between use of the microcomputer and use of its products). Ordinarily, technology change literature considers only the technology user; the products user is outside the frame of analysis. An example is new agricultural technology that produces essentially the same crops as had been grown previously; the unit of analysis is the technology user, not the products (i.e., crops) users. Microcomputers are a special case, however: a new technology that can produce a new technology. Consequently, such issues as coordination and communication between microcomputer user and microcomputer product user, and the factors that determine the use of products, can become extremely important.

The second way in which microcomputers differ from most of the technologies examined in the literature is in the microcomputer's unusually responsive nature. Most technologies of concern in the literature are available within a fairly narrow set of options. Those technologies' comparative responsiveness to particular user needs is primarily a function of their divisibility. Thus, while divisible technologies are more responsive to differences in individual user needs than are "chunky" technologies, the particular attributes of the technologies do not change. In contrast, microcomputers offer an array of new tools which can be adapted to the individual needs of the user. The microcomputer's degree of flexibility is, in fact, one of its most exciting qualities. Adoption of microcomputers can not only improve the user's ability to do desired tasks, it can also generate interest in and the ability to carry out new tasks - whether for good or ill. As integrated software becomes more sophisticated, flexibility will be even further increased.

METHODOLOGICAL ISSUES

Selection of the Cases

The choice of cases was a difficult one. Since one objective of the study was to identify factors that operated across various LDC contexts, at least two cases were in order. Although examining a number of cases would have provided more extensive comparative information, financial and time constraints made two

cases the most feasible option.

It was also important to choose countries that represented a different constellation of socio-economic and management characteristics. The work of Harvard Institute for International Development (HIID) advisors in Kenya, documented by Cohen, Leonard, and Pinckney (Pinckney, et al., 1982; Leonard, et al., 1983) made Kenya an attractive choice. Microcomputers had been introduced in the attempt to improve finance and budget operations and its use had spread to other areas. The fact that microcomputers had been introduced independently in the Ministry of Agriculture and Livestock Development and the Ministry of Finance and Planning provided an opportunity to compare two cases within very similar political-economic circumstances. In addition, HIID advisors could provide valuable perspectives on the issues of concern and were willing to share their insights for this study.

The choice of Indonesia as the second country was somewhat more difficult. Little had been written about microcomputer adoption in the country. Indonesia did, however, have much to recommend it. Discussions with foreign advisors in the field made it clear that the Ministry of Finance, Indonesia, was moving ahead very fast in its adoption of microcomputers. It was also placing them in local offices of the ministry. HIID staff were using microcomputers in projects to assist the government in various management, finance and budget operations. Those advisors could provide insights into the use of microcomputers as well as an entre to Indonesian officials whose offices were using microcomputers. In addition, the researcher had lived in Indonesia, and spoke Indonesian, facilitating communication with government staff.

These three cases, the Ministry of Agriculture and Livestock Development and the Ministry of Finance and Planning in Kenya, and the Ministry of Finance in Indonesia, are on the cutting edge of microcomputer experience in LDCs. The two countries face many of the macroeconomic difficulties widely experienced in developing nations: relatively labor-heavy factor proportions, declining trade revenues, increasing demand for limited resources with the concomitant need to use existing resources more efficiently and effectively, and a relatively low reservoir of skilled labor both in management and in computer technology.

Research Design

The research design for this study used an inductive rather than a deductive approach. A deductive method is appropriate in the social sciences when there is sufficient knowledge about the relevent processes, activities, and conditions to permit framing explicit operational hypotheses that are likely to reveal the nature of those factors and relationships. The current state of our knowledge about microcomputer adoption in LDCs cannot support that level of analysis. The technology is too new, the available

studies are extremely limited, and systematic examinations of experience are even scarcer. Before it will be appropriate to use a deductive method to study microcomputer adoption in LDCs, we must understand far better than we do now the dynamics of adoption and the relationships between activities and conditions of adoption and their impact.(16)

This study therefore utilized an "informed inductive" method. Based on the literature, tentative hypotheses were developed. The hypotheses were framed in very general terms. The study utilized those hypotheses to guide the case studies, to elicit identification of important factors, and to explore the relationships between them. Additional hypotheses were also suggested by the field work. The study thus used hypotheses as a framework for exploring the experience of the cases, rather than to test the validity of particular relationships. The study then assessed the hypotheses to identify those that appear to contribute most to explaining the process and impact of microcomputer adoption. The intent has been to provide some valuable hypotheses to be more narrowly operationalized and more rigorous tested.

The study utilizes a simple, informal model as the organizing conceptual framework for examining microcomputer adoption. The model envisions the adoption process as having three basic stages of microcomputer adoption: introduction, use, and institutionalization. Those stages are abstract constructs representing what are in reality overlapping and interactive processes. While the discussion of the cases will attempt to capture the interlinking nature of the three stages, the distinction between the three will be preserved to enhance clarity. The model assumes that factors associated with introduction, use, and institutionalization are critical in determining the impact of the microcomputers. The literature on technology change, technology transfer, and diffusion of technology supports that assumption.

For each stage of adoption, tentative hypotheses were examined to consider the role of factors that appear to be critical in determining the outcome of that stage. In addition, hypotheses were developed regarding the impact of microcomputer adoption. A larger number of hypotheses were framed than could be examined, allowing the researcher flexibility in ascertaining which hypotheses appeared to be most valuable in view of the field data. The hypotheses found to be most illuminating are listed below, and discussed at length in Chapter VI-IX.

In the research model, the first stage of adoption is the introduction of the microcomputers. Introduction begins with the initial proposal (however informal) that microcomputers be adopted. It extends roughly to the point at which microcomputers are placed at the site and are first used. Studies of organizational change in both the public and private sectors,(17) the literature on technology diffusion,(18) and some of the technology transfer literature,(19) coincide in identifying

certain factors as important determinants of the extent to which there will be receptivity to an innovation within an adopting organization. Some of those factors appear to be particularly applicable to microcomputer adoption. They include:

- The influence of the initiators
- The initiators' understanding of the conditions of the organization in which the innovation is to be adopted
- Commitment of the formal leadership to the innovation, expressed in verbal and written messages and leadership actions.
- The "critical weight" of the key decision-makers in support of adoption
- The goals of decision-makers related to the innovation, and the extent to which there are shared goals
- Users' perceived need for change
- Users' perception that the innovation is necessary/valuable
- Users' acceptance of roles and responsiblities necessary for effective innovation
- Availability of sufficient requisite resources
- The extent to which the change associated with adoption of the innovation is perceived as marginal or comprehensive

The research model used in this study anticipates that "effective" introduction contributes to the adopting organization's receptivity to the microcomputers. Receptivity is revealed both by "objective" conditions, such as availability of requisite physical resources, and intangible conditions, such as potential users' attitudes toward the microcomputer. To the extent that introduction is "effective," there will be:

- Commitment to adoption on the part of at least a majority of influential decision-makers
- Available requisite resources, including time for potential users to become familiar with the microcomputer and sufficiently adept at using it so that its use adds value to their output
- A positive approach to the microcomputers on the part of users of microcomputers and output.

The second stage of the model examines use of the microcomputers. There are numerous aspects of use that are of interest in

understanding microcomputer adoption in a developing country setting. For this study, the issues related to use are fairly narrow. They concern the factors that determine how the microcomputers are used, who uses the microcomputers, and the way and extent to which microcomputers and microcomputer output is utilized. The three bodies of literature also suggest the importance of certain factors related to use of microcomputers and their output:(20)

- Training
- Communication channels within the organization
- Organizational systems that provide incentives and disincentives for behavior related to microcomputer use
- Role delegation and responses to changes in roles
- Individual values, attitudes, skills and experience

The model anticipates that the more effective and widespread the use of microcomputers and products, the greater the likelihood that microcomputer/product use will become "embedded" in the system. For this study, "effective" use is reflected by the extent to which the purpose for using microcomputers are achieved. Assessment of effectiveness utilized the subjective judgements of users, key decision-makers, advisors, and the researcher.

The third stage of the model is institutionalization. There is an extensive literature that examines the institutionalization of innovation.(21) Without attempting to address the issue in its entirety, this study will consider some aspects of particular concern for microcomputer adoption in developing countries. Institutionalization is defined as a measure of the extent to which the innovation becomes a valued and regular part of ongoing operations.(22) Although it is too early in the experience of Kenya and Indonesia to determine the degree of institutionalization of microcomputers, it is useful to examine whether certain indicators of institutionalization are emerging. The key factors reflecting institutionalization include:

- The extent to which supply of essential material resources is part of an established system
- The extent to which supply of human resources is linked to established systems, including training and incentive systems
- The extent to which microcomputer use is necessary to maintain an acceptable level of operations
- The extent to which key decision-makers and microcomputer users expect that microcomputers will

continue to be used after external supports are withdrawn

The final issue with which the study is concerned is the impact of microcomputer adoption. Again, it is too early in the experience of the two countries to evaluate the overall impact of microcomputer use. Nevertheless, microcomputer use has clearly begun to affect certain processes in Kenya. The study examined the apparent impacts thus far, and the way in which those impacts relate to organizational structures and systems that conditioned use of microcomputers. Key areas to be considered are impacts on employment and job quality, the quality of decision-making, the distribution of power within ministry headquarters, and between the central and the local levels of the federal government. There is also an attempt to offer some projections about potential impacts in those key areas.

The Hypotheses to be Examined

Several hypotheses were used to examine the first stage of adoption, introduction of microcomputers. The hypotheses suggest possible determinants of the extent to which there is receptivity to microcomputer use within an adopting organization. They focus on factors identified in the literature, which seem to be particularly important in the introduction stage: leadership receptivity to microcomputers, the explicit and implicit messages key leaders send about microcomputer adoption, power relationships, organizational structure.

Five hypotheses emerged from the study as most useful:

- Hypothesis 1: Clear and consistent messages by organizational leadership, in support of microcomputer adoption, will be a critical factor generating acceptance of microcomputers among people in the organization.

- Hypothesis 2: The greater the external pressure for change, the more likely leaders are to support adoption of microcomputers.

- Hypothesis 3: The extent to which those who advise adoption of a microcomputer are trusted by organizational leaders, the greater the likelihood microcomputers will be effectively introduced.

- Hypothesis 4: The "critical weight" of key decision-makers influence must support adoption if introduction is to be effective.

- Hypothesis 5: Planning for sufficient resources is best done early in the process of introduction.

The second stage of adoption involves the use of the microcomputers. The hypotheses suggest key factors determining the effectiveness of microcomputer use. Those factors include the in-place skill structure, methods of developing microcomputer-related skills, the responsiveness of microcomputers and microcomputer products as a form of incentive to users, the organizational incentive-sanction system, and the structure of decision-making.

Seven hypotheses guide the examination of microcomputer use:

- Hypothesis 1: The better the training "fit" with organizational needs and operator skills, the more effective the microcomputer use.

- Hypothesis 2: The closer the "fit" between in-place skills and skills necessary for particular microcomputer applications, the more effective the use of those applications.

- Hypothesis 3: Training in the use of new microcomputer products enhances effective use of those products.

- Hypothesis 4: The more "responsive" the microcomputer is to the users' needs, the more effective will be the microcomputer use.

- Hypothesis 5: The more "responsive" the microcomputer output, the more effective the use of the output.

- Hypothesis 6: An incentive-disincentive system that supports use of microcomputers and microcomputer products will be critical to developing effective use.

- Hypothesis 7: The more comprehensive the change associated with using microcomputers or microcomputer products, the more difficult it will be to induce effective use of the machines or their products.

- Hypothesis 8: Building "ownership" among those who are to use the microcomputers or microcomputer output will enhance acceptance of microcomputer use among those groups.

The third stage of adoption concerns issues of institutionalization. Because microcomputers have been used for a relatively brief period, the observations regarding institutionalization are extremely tentative. Based on the experience in the two countries, nine "indicators" that operationalize the concept institutionalization are proposed. Chapter VIII discusses the following indicators in detail.

- Indicator 1: The broader the scope of use of microcomputers and microcomputer products, the greater the degree of institutionalization.

- Indicator 2: The greater the "intensity" of use, the greater the degree of institutionalization.

- Indicator 3: The longer the "generational age" of the microcomputer use, the more highly institutionalized the use.

- Indicator 4: The greater the extent to which users of microcomputers and microcomputer products anticipate continued use, the more institutionalized the use.

- Indicator 5: The greater the extent to which training is run by government staff rather than outside advisors or consultants, the more institutionalized the microcomputer use.

- Indicator 6: An effective requisition and procurement system established and operated by government staff reflects more highly institutionalized microcomputer adoption than a system operated by advisors.

- Indicator 7: An effective disbursement and allocation procedure operated by government staff reflects more highly institutionalized microcomputer adoption than a system operated by advisors.

- Indicator 8: The greater the extent to which costs of the microcomputer system are known to and accepted by government decision-makers, the more highly institutionalized the system.

- Indicator 9: The greater the extent to which government staff is able to choose, alter, and develop microcomputer systems, the more highly institutionalized the microcomputer system.

Hypotheses are also examined regarding the relationships between institutionalization and three factors: organizational structure, power relationships, and the incentive system.

- Hypothesis 1: Distribution of control over critical resources must support institutionalization of microcomputer use if that use is to be institutionalized.

- Hypothesis 2: Incentive systems must support institutionalization if microcomputer use is to be institutionalized.

- Hypothesis 3: The less comprehensive the change in activities related to microcomputer use, the more easily that use is institutionalized.

Although the objective of this report is not to evaluate impact, preliminary observations about some apparent effects of microcomputer adoption are in order. The major impacts of concern include effects on centralization/decentralization of authority, effects on distribution of power within levels of the adopting organization, effects on job quality and employment, effects on the quality of decision-making. Seven hypotheses emerged as particularly valuable:

- Hypothesis 1: Use of microcomputers and microcomputer products will be associated with greater decentralization of authority.

- Hypothesis 2: The use of microcomputers and microcomputer products will be associated with changes in power within organizational levels.

- Hypothesis 3: The use of microcomputers and microcomputer products will be associated with changes in the hierarchy of skills, but not concomitant changes in the hierarchy of rewards.

- Hypothesis 4: Job quality will improve for those who use the microcomputer and/or its products.

- Hypothesis 5: Microcomputer adoption is associated with labor displacement.

- Hypothesis 6: For some in the organization, the perceived effect of microcomputer use will be negative.

- Hypothesis 7: Use of microcomputers will be associated with greater utilization of information in decision-making than was previously possible.

Implementation of the Research Design

This study's analytic approach began with the tentative hypotheses. Field work, including interviews, field observation, and document review, was conducted in Kenya. The objective was to assess the hypotheses for their relative value in capturing the ministries' experiences with microcomputers. Additional hypotheses suggested by the field work were also framed. The hypotheses that emerged as most useful were then examined through interviews and field observation in Indonesia.

Field work was conducted from mid-August to mid-September 1984, in Kenya, and mid-September until October 3, 1984, in Indonesia. The field information was gathered from several sources. A major source of information were interviews with government officials and staff who are key decision-makers, users of microcomputers, and users of microcomputer products (in some cases, these groups overlap). Another important source of information were interviews with expatriate advisors who have been working with

the ministries in which the microcomputers are used. A third source of field information was examination of documents being produced by the microcomputers, and those which the new documents replaced.

The interviews utilized in-depth, open-ended, directed discussions rather than a structured survey instrument. The intent was to use as wide a net as possible to capture all factors that significantly affect microcomputer adoption. Identifying those factors and clarifying their roles in microcomputer adoption was more important, for the purposes of this study, than was measuring precise relationships between factors.

Special Terms

This paper makes a distinction that is ordinarily not made in considering microcomputer use in the United States: the explicit distinction between use of microcomputers and use of microcomputer products. The distinction may seem extraneous and misleading by those whose experience has been primarily in the West. In the United States, for example, the microcomputer usually functions as a personal productivity tool, to enhance the ability of the user to do his/her own work. Use of the microcomputer is inextricably linked with use of the applications. In fact, the motivating force for learning to use the microcomputer is primarily interest in the application. As the user becomes more comfortable and adept at using the microcomputer, he/she becomes interested in additional applications, which motivate further learning about operating the machine.

This model, which captures the bulk of experience in the United States, does not, however, reflect what is going on in Kenya and Indonesia.(23) What is an unnecessary distinction with reference to microcomputer use in the United States, is critical to understanding microcomputer use in Kenya and Indonesia.

There are three stages of utilizing information in decision-making. First, accurate information must be obtained. Second, the information must be processed and made available to the user in a useful form. Third, the information must be applied to decision-making. In the United States, the microcomputer operator is generally the person interested in applying the information to some decision. In Kenya and Indonesia, however, the microcomputer operator is usually <u>not</u> the person who actually uses the information in decision-making. The assumption that interest in applications is inevitably linked to microcomputer use is therefore a very dangerous one for analysis of microcomputer use in LDCs. It blurs an important distinction between processing information (using the microcomputer), and using the information in various forms of decision-making (using microcomputer products). The sources of this distinction are related to several factors, including status concerns, basic

skills necessary to use some programs, and the incentive system.

This point can be clarified by comparing the use of microcomputers and the use of mainframe computers in the United States (as well as in Kenya and Indonesia). An example is an accounting system of a large organization. In such systems using mainframe computers, jobs are often highly differentiated. An accounting clerk enters the information into a terminal. An administrative person performs very simple programming to prepare alternative report formats upon request, without necessarily understanding the information in the reports. A computer programmer develops more sophisticated software for some applications, in response to needs of those utilizing the information. A financial officer receives and analyzes the information. Top management receives a summary and highlights of the implications of the data, and uses it to make major policy decisions.

Use of the microcomputer has often collapsed some of these jobs in Western organizations. The finance officer, for example, may program the microcomputer to provide the report formats he/she wants. In some cases, even top management may program his/her microcomputer to get information for decision-making.(24) It is worth noting, however, that there continues to be task differentiation in many Western organizations.(25)

It is, of course, possible that the pattern of task differentiation in Kenya, Indonesia, and other LDCs will eventually replicate that of countries like the U.S. In the ministries of Kenya and Indonesia, however, the distinctions remain. As the cases show, structural conditions are apt to sustain that pattern. The real distinction between "microcomputer user" and "microcomputer products user" in Kenya and Indonesia has several implications. There are implications for how microcomputers are used, discussed in Chapter VI; implications for how microcomputers become institutionalized, discussed in Chapter VII; implications for the impact of microcomputers, discussed in Chapter VIII.

OVERVIEW OF THE REPORT

This report examines adoption of microcomputers by examining the experience of the three ministries at two levels of analysis. The first, lowest, level of analysis presents the detailed case studies. Of course, even the most detailed case study must pick and choose among the massive amount of information present in the real world. Determination of the details to be presented depends on the researcher's perception of what constitutes critical information. Thus, Chapters II-V present the cases so as to illuminate what appear to be the factors and relationships that were most important in the introduction, use, and institutionalization of the microcomputers, and in influencing the impact of microcomputer adoption.

The chapters differ in the relative attention they give to various aspects of the adoption process, depending on the apparent importance of the aspect for the case under consideration. All four chapters, however, present the ministries' experiences related to certain important issues. The chapters describe the conditions that appear to have contributed to inducing the ministries to adopt microcomputers. They consider initial use and later expansion of microcomputer applications, and the conditions that encouraged, or discouraged, expanded use. The approaches to training are discussed, and the apparent response from ministry staff. The chapters also describe the perceived effects of the microcomputers on the jobs of microcomputer operators, and those officers who use microcomputer output.

Because microcomputers had been used much longer and for more applications in the Ministry of Agriculture and Livestock Development (MALD), Kenya, than in the other two cases, the study devotes two chapters to that case. Chapter II presents the adoption of microcomputers in the finance division of MALD. Since introduction of microcomputers in 1981, that experience has been rich in various applications. The chapter examines use of microcomputers in several areas, and the ways in which those applications developed, expanded, and changed during three and a half years of use. The chapter also describes responses by clerical and professional staff to the training in use of microcomputers and microcomputer products.

Chapter III discusses adoption of microcomputers in the planning division of MALD. It describes the factors that led to the initial rejection of microcomputers in 1981, and the acceptance of microcomputers in 1982. Particular attention is given to the response of planning officers to the microcomputers, and the ways in which the microcomputer is most and least readily utilized by the professional planning staff.

Chapter IV presents the case of the Ministry of Finance and Planning (MFP), Kenya. MFP adopted its first four microcomputers in spring, 1983. By the time of the field work for this study, the ministry had 14 microcomputers. Because MFP has been using microcomputers for a relatively short time, applications in the two Directorates comprising MFP, the Planning Directorate and the Finance Directorate, are much more modest than those in MALD. The chapter therefore includes in its discussion microcomputer adoption in both directorates. It illucidates the differing applications as they appeared in the two directorates, and the contrasting ways in which the directorates anticipate expanding microcomputer use.

Chapter V presents the case of the Ministry of Finance (MOF), Indonesia. Although MOF had a few microcomputers before 1984, they were scattered and had had little impact on the ministry. In the summer of 1984, the ministry adopted 200 microcomputers, with the intention of substantially changing the operations of various directorates within the ministry. The chapter discusses

the role of the ministry computer center, which initiated and guides the use of microcomputers. It describes the ways in which the directorates and the administrative levels within the directorates have responded to the introduction of the microcomputers.

Chapters VI through IX undertake analysis of the cases and assessments of the tentative hypotheses described above. The chapters examine the evidence provided by the cases, and discuss some of the implications of that evidence. Chapter VI considers the hypotheses concerning introduction of microcomputers. Chapter VII examines hypotheses about use of microcomputers. Chapter VIII discusses hypotheses related to institutionalization of microcomputers. Chapter IX examines hypotheses concerning the impact of microcomputers.

Chapter X summarizes the findings, and presents tentative conclusions regarding the factors that encourage effective adoption of the microcomputers and their products. Chapter XI suggests areas for further research, with respect to both substantive issues and methodological concerns.

CHAPTER II

MICROCOMPUTER ADOPTION IN THE MINISTRY OF AGRICULTURE AND LIVESTOCK DEVELOPMENT, KENYA: THE FINANCE DIVISION

OVERVIEW OF THE CHAPTER

This chapter recounts the microcomputer adoption process in the Ministry of Agriculture (MOA) and the Ministry of Livestock Development (MLD), which were later merged into the Ministry of Agriculture and Livestock Development (MALD). The chapter begins by presenting the conditions that led to introduction of microcomputers. It then considers how microcomputers are used in the ministries. There are several applications in the ministries, each with differing requirements for training and implementation, and each making different contributions. To clarify the ways in which the microcomputers are used, the chapter therefore examines each area of application separately. It first discusses the initial applications. It then considers the modification of early uses, and the expansion of applications.

For each application, a section discusses critical events, including the conditions that induced that use of the microcomputers, the way in which the application was developed, the training of Kenyan staff in using the microcomputer for that application, the training of Kenyan staff in using the microcomputer output, the effects of the application, and some of the responses to microcomputers on the part of those who used them and their output.

PROBLEMS IN BUDGET AND FINANCE FUNCTIONS: PRESSURE FOR CHANGE

By the end of 1981, the Government of Kenya (GOK) was under considerable pressure to improve its finance and budget processes. High interest rates and oil prices, significant levels of debt service and foreign exchange deficits, and projects that failed to pay any return, all sent powerful macro-level economic signals. The government had less than half the money it needed to meet its contributions to donor projects, and the World Bank began to complain that its projects were suffering as a result. The International Monetary Fund, to whom the government had to appeal for assistance, severely criticized the government's financial management. The GOK Treasury responded to those signals by putting pressure on the operating ministries to show greater fiscal responsibility, more expenditure control, better scrutiny of projects, and more efficient use of resources.

The Ministry of Agriculture

Lack of accurate information and difficulties in organizing information in a useful way had been ongoing problems in the budget and financial management systems in Kenya's Ministry of Agriculture.(1) (To simplify the discussion, only MOA will be described, although the same conditions applied to MLD). The consequences of those inadequacies became increasingly apparent as overall public revenues declined in the late 1970's and early 1980's. While the ministry's budget as a whole was consistently underspent, its donor supported projects often suffered from the lack of pledged Kenya Government contributions. To compound the problem, the ministry had failed to submit claims for the substantial funds it had spent on donor-aided projects. Furthermore, the ministry seemed to have no control over its budget development process, submitting budget requests to Treasury that were far in excess of the amount it could reasonably expect to receive. In response to MOA's poor financial performance, Treasury cut MOA's budget proportionately far more than the budgets of other ministries.

As a result of these circumstances, MOA was under severe pressure to improve its budget and financial management system. Specifically, it was incumbent on the ministry that it: (1) bring its budget requests far closer to the ceiling set by the Treasury, (2) formulate the budget in a more rational manner, with greater attention to policy priorities, so that budget requests could be reasonably well defended against challenges from the Treasury's Budget Supply Officer.

The need for those changes was made painfully clear in the budget process for fiscal year 1980-81. In that year, the ministry's budget request was more than twice the ceiling established by the Treasury. Making matters worse, ministry officials were hard pressed to defend those requests, since the budget had been formulated with little regard for policy priorities. As a result, Treasury cut deeply in the ministry's budget, allocating it even less than had been projected for it in the three-to-five-year forward budget. Since Treasury had even less field and expenditure information than did MOA officials, the cuts were often arbitrary. In some cases they seriously impaired important projects or basic ministry work.

The ministry's financial difficulties did not end with the formulation of the budget. Funds were allocated inefficiently or were misallocated. The ministry's Authorities to Incur Expenditure (AIE's) were consistently issued late, sometimes reaching the spending stations as much as two to three months after the beginning of the fiscal year. In addition, the ministry's ability to monitor expenditures during the year was seriously impaired by the lack of timely, accurate and accessible information. One result was that creditors, who were not paid promptly, cut off delivery of goods to ministry spending stations. Another was that over- or under-spending by spending

stations was not identified by headquarters until the end of the year.

INTRODUCTION OF MICROCOMPUTERS FOR FINANCIAL MANAGEMENT

In 1981, a number of conditions coincided to support improved fiscal management in MOA. A new officer assumed the position of Principal Finance and Establishment Officer (PF&EO), the top financial office in the ministry. The new PF&EO was worried about a ministry budget and finance system that seemed to be out of control. He was determined to establish better control over the expenditure process. The pressure from Treasury helped support his attempts to develop new measures to improve the budget process and tighten financial controls.

Foreign advisors in the ministry were also under pressure. Members of the Technical Assistance Pool (TAP), a multilaterally funded project begun in mid-1976, were responsible for assisting MOA (and MLD) to improve agricultural planning activity and management systems.(2) In 1979, TAP management advisers had established a Management Systems Unit (MSU) to focus on such administrative problems as budgeting, personnel management, and vehicle monitoring. They developed a monthly expenditure reporting system and suggested improvements for the budget estimates process. Ministry officials had shown scant interest in implementing those recommendations, however. By the end of the first four years of the project, little improvement in finance and budget systems had been achieved.

In 1981, one of the first steps taken by the new PF&EO and the Senior Assistant Secretary for Finance was to adopt the proforma developed by the TAP advisors for reporting monthly expenditures. They were also responsive to other TAP recommendations to improve the fiscal system.

It was within this atmosphere of change that the goddess serendipity made a well-timed entrance. The head of the TAP project was approached by a colleague about the potential for microcomputer use in the planning division of MOA. The ensuing demonstration of microcomputers presented to MOA's planning division generated little excitement, however. In part, the lack of enthusiasm stemmed from a generally low level of morale in the division, and lack of leadership for change. It was also unclear how the microcomputer could help improve the activities then conducted in the planning division. The advisors in the planning division were as skeptical as the Kenyan officers about the likelihood that the microcomputer was appropriate or would be used effectively there. An additional factor, although it is difficult to assess its influence, was past experience with computers in the planning division. A German advisory team had introduced a Hewlett Packard (HP) microcomputer in 1978, because of delays associated with using the Central Bureau of Statistics facilities. The HP had little memory (24K), was difficult to service, and required relatively extensive programming expertise

in the language BASIC. Only one Kenyan planning officer learned to use the machine and the output was little used, particularly after the German advisors went home.

The planning division thus made it clear that it was not interested in adopting a new microcomputer. The head of TAP, sensitive to the problems in the finance division, explored with the microcomputer consultant the possibility that the machine might be able to assist in finance. Demonstrations in finance and budget applications were promptly prepared. It quickly became apparent to the advisors that the microcomputer had the potential to provide much needed assistance in budget preparation and financial management. The PF&EO was interested, and saw that the microcomputer would cause some excitement and create an opportunity for making changes that he wanted to make. Although he did not know exactly how the microcomputer would be used, the positive relationship between himself and TAP, and TAP's considerable experience with the ministry's management and budget system, enhanced his confidence that the microcomputer would prove a valuable asset.

In late 1981, TAP introduced an Apple II Plus microcomputer into the finance division of MOA.(3) The Apple was chosen on the advice of the microcomputer consultant. The Apple was considered the best alternative because: 1) there is a large amount of software available for it, 2) it is relatively resistant to fluctuations in power, 3) service for the Apple is available in Nairobi. Accompanying the microcomputer was a new TAP advisor who was specifically responsible for developing appropriate software, and for training Kenyans to operate the machine. The advisor was an economist rather then a programmer. His major concern was with working with Kenyan officers and other TAP advisors to develop useful software that required little programming expertise.

TAP arranged to supply hardware and software resources, e.g., the microcomputer, the programs, the printer, ribbons, paper, as well as servicing for the system. The PF&EO, as senior finance officer, provided the microcomputer staff by directing the clerks who had previously prepared finance reports manually to learn to prepare those reports using the microcomputer.

Reactions among Kenyan finance officers were not uniformly enthusiastic, however. Many MOA finance officers were fairly skeptical about the value of the microcomputer in the division. They fell into line, however, once it became clear that the PF&EO was a strong proponent of microcomputer adoption.

EARLY APPLICATIONS OF MICROCOMPUTERS IN THE FINANCE DIVISIONS OF MOA AND MLD

Expenditure Monitoring

The first application of the microcomputer was in expenditure

monitoring.(4) The TAP advisors made the decision to begin using the microcomputers in an on-going ministry process, rather than attempt to start something new. Expenditure monitoring was clearly a worthwhile point of departure. Information was coming to the ministry from the field, but was processed too slowly to be of use in monitoring expenditures, and was replete with errors. That information was also of particular interest to the PF&EO. According to the TAP advisor in charge of microcomputer operations, the PF&EO "had a clear idea of what he wanted and had the disaggregated information. It was simply a question of getting it on the machine and aggregating it in various ways to produce useful reports."(5) It was a task "tailor-made" for the microcomputer.

The first report produced with the microcomputer was requested by the PF&EO. The TAP advisor prepared the report and gave it directly to the PF&EO. It soon became clear that in doing so, he had committed an inadvertant error in protocol. Ordinarily, the expenditure reports had flowed through a middle level officer. That officer was angry about being bypassed and subsequently spent a good deal of time calling attention to as many errors as he could find, in order to show that the new system would not work as well as the old one had. Because the PF&EO was strongly committed to the new system, and had the power to directly assign work to the junior officers, he could go around the middle level officer. The situation therefore posed no serious problem for implementation of the system.

During the first few months after the microcomputer's introduction, the TAP microcomputer advisor worked with TAP management advisors and MOA finance officers to develop useful formats for regular expenditure reports. Based on his discussions with MOA finance officers and TAP advisors, the microcomputer advisor prepared a series of templates using a package spreadsheet, Visicalc. Each template provided detailed budget information for the recurrent and development budgets. Among the most important of the new documents were summary tables of expenditure information. The summary sheets presented less data, but made the important implications of the information much clearer to top decision-makers.

Developing the content and format of the microcomputer products was an incremental process. Although the advisors had some initial ideas about how the computer could be used in expenditure monitoring, the perception of what was needed changed over time. Although the Kenyan finance officers had a general understanding of the kinds of things the microcomputer could do, it was difficult for them to translate that potential into their own concrete needs. As those officers used the reports, their questions and requests for information indicated modifications required to make the reports more responsive to their needs. In part, this process was a result of the fact that the advisors were learning about the microcomputer along with the Kenyans. In part, it is an integral dimension of developing a new information system.

With guidance from the microcomputer advisor, the professional finance officers the finance division quickly learned to use Visicalc to produce and revise the new expenditure reports. Clerical staff rapidly mastered data entry techniques. TAP management advisors began extensive work with the finance officers to help them learn to analyze the financial information the microcomputer was making available for decision-making.

Use of the microcomputer spreadsheets helped to improve the expenditure monitoring system in several ways. Reports could be prepared far more quickly, making them a more current, and therefore more relevant, document for use by decision-makers. In addition, interim reports could be made available when decision-makers needed updated summary information before all spending stations had reported. Accuracy was also improved. Errors in calculation were eliminated. Typing errors were reduced by having finance officers enter the data for which they were responsible, rather than giving the data to typists for whom the numbers were meaningless. One important source of inaccuracies, the field reports, could not, however, be affected by using the microcomputer.

Another major advantage of using Visicalc was the ease with which report formats could be modified. As a result, TAP advisors were able to design reports that were easier for senior MOA finance officers to read and utilize. In addition, reports could easily be designed so they highlighted information the advisors felt needed attention.

Limiting Overexpenditure

The microcomputer was also applied to the effort to limit overexpenditure of the 1981/82 recurrent budget of the Ministry of Livestock Development (MLD). By early March 1982, it was clear that overspending of MLD's recurrent budget was a serious problem. Senior finance officers in the ministry hoped that upwardly revised allocations from Treasury would resolve the problem.

TAP advisors arranged for the microcomputer to provide summary information on the year-to-date expenditures and projections of expenditures in the recurrent budget for the remainder of the fiscal year. It became readily apparent to both advisors and MLD finance officers that even with Treasury's upward revisions, the ministry would overspend its allocations.

MLD finance officers responded by ordering a detailed report of expenditures, which was prepared by a TAP advisor and a senior finance officer. The microcomputer was used to quickly produce the new detailed report, and summary tables. Subsequently, a meeting was held for senior staff. For the meeting, TAP advisors used the microcomputer to prepare two alternative approaches to resolving the overexpenditure. Those presentations were used to

initiate discussion. TAP advisors also brought the microcomputer into the meeting. During the meeting, the figures MLD officers assigned for "critical items" were entered directly into the microcomputer. Using Visicalc, the resulting balance and the level of cuts necessary for other items were immediately calculated.

Participants in the meeting decided it was necessary to get more up-to-date expenditure data. They ordered February expenditure returns to be quickly collected and compiled. The returns were collected in about 10 days, and entered into the microcomputer and presented in a summary format two days later.

A second senior staff meeting was called. Again, the microcomputer was used to enter figures as the officers revised the allocations for each item. As a result, "it was possible to calculate within 15 seconds exactly how much each decision would save (even when it was being made across several budget categories) and what the cumulative progress was toward the goal" (Pinckney, 1982: 38). Using the microcomputer in that way provided a valuable support to decision-making. The finance officers did, however, have the most critical parts of the process, such as projections of salary costs, calculated manually by officers experienced with those figures.

Thus, use of the microcomputer permitted data to be processed rapidly and accurately. Although the calculations could have been done manually, it would have required significantly more staff than were available. Even with additional staff, the information could not have been made available as quickly as with the microcomputer. The unique contribution of the microcomputer was in its instant calculation of the results of decisions made in the staff meeting. According to TAP, "Without the machine and the ease of calculation and presentation which it provided, much of what was done would not have been attempted or would have been done so slowly as to have been without an effect on operations" (Pinckney, 1982: 7).

The Budget Estimates Decision-making System

Another application of the microcomputer was in the budget preparation process. Although the formal budget process is quite rational in principle, it was severely flawed in its actual operation in both MOA and MLD. The central problem related to failure to develop reasonable budget requests. The forward budget process, which was supposed to be an exercise to review programs and policies, was instead a purely mechanical aggregation of what were essentially wish lists from the spending stations.

In the budget preparation process for fiscal year 1982/83, the microcomputer was used to attempt a serious review and reduction of those wish lists to some reasonable level. One obstacle to working with the figures was the sheer volume of information.

The budgets usually include more than 100 pages of detail, and there had been no summary documents available for decision makers.

Working with MOA financial officers, TAP advisors developed summary sheets presenting tables of basic financial data for each of the ministry's programs. (A similar process was carried out in MLD.) Referring to those figures, MOA budget development sessions cut program requests. After each meeting, the summary tables were updated to reflect the level and distribution of the cuts that had been made. The information was then distributed at the beginning of the next session. Also included for each meeting was a summary of the total amount tentatively allocated, the percentage of requests granted, and the average percentage that would have to be cut in order to stay bring the budget within the ceiling set by the Treasury. TAP advisors worked with the finance officers before, during, and after the meetings to assist in analyzing the financial information and preparing a better crafted budget.

Although the results of the budget review brought the recurrent and development budgets closer to the ceiling set by Treasury, the bottom line remained substantially greater than the ceiling. A meeting of all senior officers, except those from the Development Planning Division, was called to address the need for further cuts. Again, the summary document was used to help officers to focus on the problem areas and keep track of the budget cutting process.

Although both the recurrent and the development budgets remained above their respective ceilings, they were brought close enough to the ceilings to make them a serious basis for discussion with the Treasury officials. The budget reviews also helped MLD finance officers define policy priorities so that they were better able to defend the ministry's submissions.

External Aid Claims System

At the end of 1981, the Treasury directed all ministries with externally funded projects to keep records and submit reports that would support prompt reimbursement by external donors. Treasury had put teeth into its requirements for the external aid reports by holding back funding for projects that did not provide the correct information.

Both MOA and MLD were unable to comply to Treasury's regulation because they lacked such critical information as the number of donor assisted projects in their budget, the percentage of donor contribution to each project, and the claims filed with donors for each project. Several reasons had created this situation. In part, the problem was related to the ministries' management systems. For example, some spending stations in the ministries reported directly to Treasury. They rarely gave a report to the

ministries on direct payments made by donors. Nor was there any standardized channel through which spending stations receiving external funds were to report to the ministries or to Treasury. In addition, the ministry's information system was poorly organized and did not permit tracking of claims and payments.

To enable MOA to comply with Treasury requirements, the PF&EO and the Accounts Controller of the ministry, with the assistance of TAP advisors, reorganized the External Aid Unit and its information system (a similar process occurred in MLD). They used the microcomputer to experiment with various formats for an external aid report, and developed a table that incorporated the necessary information and could be revised as necessary.

The basis of the external aid report was the monthly expenditure report, discussed above. The Kenyan officer in charge of the External Aid Unit, an accountant who had never used a computer before, rapidly learned to use the microcomputer's Visicalc package to transfer data from the expenditure reports to the external aid report. As new claims were reported, he entered them into the machine, where the totals were automatically recalculated. The information could then be sent to Treasury, in compliance with the directive.

EXTENSION OF MICROCOMPUTER APPLICATIONS IN THE FINANCE DIVISION

In the summer of 1982, about eight months after the first microcomputer was adopted, TAP introduced a second machine. During the previous eight months - and, indeed, until the time of this study - there have been few problems with the microcomputer hardware. The microcomputers proved to be extremely resiliant against dust, heat, and electric power fluctuations. With the exception of a defective hard disk purchased from England in 1984, the few breakdowns that occurred were remedied using services available in Nairobi.(6)

After several months of microcomputer use in MOA and MLD, however, it became clear that the software being used, Visicalc, had significant limitations. In their paper describing the adoption of the microcomputer, Pinckney, Cohen and Leonard (1984: 13) describe the limitations of Visicalc for expenditure monitoring: One important problem was inflexibility. Aggregating data along various characteristics, e.g., spending station or type of expenditure, was a cumbersome and time-consuming process with Visicalc. Providing relationships between data items, to expose problem areas, was equally difficult. Nor did Visicalc offer any convenient method for checking typographical errors.

There was an additional consideration, which was tied to macropolitical events. In 1978, upon his succession to the Presidency of Kenya, President Moi had expressed commitment to making the districts the operational centers of rural development planning and implementation. The President stated "the districts

will become the centres for development in the rural areas, and I have instructed all ministries to ensure that is new approach is put into full operation by the first of July, 1983."(7) In 1983, a District Focus circular was issued by the Office of the President, approved by the Cabinet, and adopted as national policy (Office of the President, 1983). The intent of "district focus" was to devolve financial authority and development planning from the national and provincial levels of the federal bureaucracy to the district level. The impetus for the policy was the assumption that local bureaucrats are more in touch with the needs at the local level and can make better decisions about appropriate projects for the particular area.

Part of the aim of district focus is to make the districts the center for allocation of funds. In keeping with this objective, the government enacted various measures designed to strengthen the district financial institutions. One of the most important was to give the district treasuries much tighter control over the expenditures in their jurisdiction than they had previously.

In order for the ministries to comply with district focus, they had to be able to disaggregate the ministerial budget by districts, and monitor expenditures by districts. Unfortunately, at MOA and MLD (as at other ministries) no one knew what projects and activities were being carried out in each of the districts.

To remedy that situation, TAP and senior finance officers in MOA and MLD decided to use the microcomputer to begin to implement district focus. They would do so by disaggregating financial information so that they could monitor and allocate expenditures at the district level. It was obviously advantageous to use one software package for both the expenditure monitoring and the expenditure allocation system. The TAP advisor therefore decided to shift from using Visicalc to a relational database management system, dBase II.

The Expenditure Monitoring System

The microcomputer advisor began to use dBase II only a few months after the introduction of the microcomputer, to prepare the reports for the expenditure monitoring system. He created a series of menu-driven programs that produced standard expenditure monitoring reports. In addition, he used dBase II to create special reports in response to specific requests from finance officers or TAP advisors working with them.

The software created with dBase II has solved several problems. The most important advantage of the new system is its flexibility. By coding each record along every important data item, reports can quickly be compiled according to each item. Thus, standard monthly reports produced with the microcomputer present expenditures by spending station, by program (e.g., agricultural extension), and by type of expenditure (e.g., inputs). In addition, each month a report examines a particular

type of expenditure across programs to ascertain common problems related to that type of expenditure. Accuracy has been further improved by designing data entry screens to look like the printed forms, thereby reducing keypunch errors. Using dBase II, the TAP advisor also designed data validation routines which automatically check the accuracy of data entry.

In September 1983, MOA and MLD were merged into the Ministry of Agriculture and Livestock Development (MALD). At about the same time, TAP introduced three more microcomputers to meet the expanded workload and to use as training devices.

The expanded microcomputer system as it currently operates in MALD provides an increasing number of regular expenditure reports, as well as responding to special requests for information. The regular reports are distributed to the Undersecretary, the Deputy Secretary in charge of Administration and Finance, the Senior Assistant Secretary (SAS) for Finance, the Assistant Secretaries (ASs), the head of the External Aid Unit, the Accounts Controller, the Estimates Officers, who monitor expenditures, and the Chiefs of Divisions, who submit budgets for their divisions to the Undersecretary and Senior Assistant Secretary.

Special reports created with dBase II include summaries of expenditure data requested by TAP management advisors working with ministry finance officers. TAP advisors also frequently request various microcomputer reports that can illuminate policy issues and help to focus the attention of officer meetings on ministry priorities and the consequences of previous decisions. Occasionally, a Division Chief or AIE holder requests a report on the expenditures for which he/she is responsible.

Utilization of the Expenditure Monitoring Reports

The SAS and ASs use the microcomputer-produced expenditure monitoring reports as a source of information for their routine reports, or to provide information in response to requests from their superior officers. Estimates Officers utilize the information to identify over- and under-spending by spending stations. The Estimates Officers are responsible for notifying the spending stations of unacceptable rates of spending, and requesting an explanation. External Aid Officers use the expenditure monitoring reports to prepare regular reports on the financial status of donor-aided projects.

The extent to which the information is <u>applied</u> to decision-making, however, is less evident. The expenditure monitoring system functions primarily as a record-keeping system, rather than, as is intended, a support for decision-making. Thus, although various expenditure reports prepared with the microcomputers provide information that was not available previously, virtually all of the financial analysis and actual application of information in decision-making is done with the

direct participation of TAP management advisors. Although project expenditures are better monitored, there are no follow-up mechanisms. There is no regular analysis of the causes of over- and under-spending. There are no procedures to ensure conformity with expenditure guidelines.

In addition, the senior finance officers do not act as though they put a high priority on an efficient information system. In meetings with TAP management advisors, senior finance officers have been reluctant to use the information from the microcomputers to make explicit decisions about allocation policy. They want to retain flexibility, in order to be able to respond to demands and needs that might arise. The finance officers' response to the new information system has convinced some TAP management advisors that the microcomputer-based information system will lapse if responsiblity for its maintenance is left to the finance officers. During a series of meetings that brought field officers to Nairobi to learn about the new information system, for example, a TAP advisor worried that those who must provide the field expenditure information would not get direction and incentive from senior officers at headquarters. Consequently, he worked directly with field officers to train them to complete the expenditure forms and use the information.

TAP management advisors have developed thorough knowledge of the ministry finance and budget system. In some cases, advisors have even carried out some staff functions. They have worked very closely with the senior finance officers, particularly the Senior Assistant Secretary and the Assistant Secretaries, to encourage and teach them to use financial information for decision-making. The task is made more difficult because many finance officers have no background in finance or related subjects in college. TAP management advisors have been involved in an ongoing process of explaining basic financial information, ways to analyze the information, and application of information to decision-making. The advisors request information from the microcomputer staff which they use to train finance officers in financial analysis, to draw attention to issues that might otherwise be ignored, and to encourage finance officers to consider the implications and importance of policy decisions.

In one case, for example, an advisor raised the question of allocations for uniforms. Before the adoption of the microcomputer the issue would have been dismissed as trivial. Budget information from the microcomputer showed, however, the total amount spent on uniforms was far greater than the officers had realized, and they decided it was unacceptable. As a result, the Senior Assistant Secretary and Assistant Secretaries reassessed the allocation and cut back the item substantially.

One consequence of the limited analytic skills in the division is that the top echelon in MALD cannot rely on those below them to provide summary analyses of financial information. There is simply no officer who is responsible for analyzing data and

presenting a summary for senior decision-makers in the ministry. If the Permanent Secretary, for example, calls a Senior Assistance Secretary about a problem, he will not receive a short memo describing the problem along with a few options for resolving it. Instead, he receives an entire file, with a note directing him to various folios. Those folios are likely to refer him on to other folios. This decision-making style also applies to computer output.

Aggravating these problems is a tradition of frequently rotating senior officers among the various ministries. Often a Senior Assistant Secretary or Undersecretary is rotated every three to four years or less. It is therefore difficult for those officers to develop a high level of expertise in the operations of a particular ministry.

Perceived Importance of Expenditure Monitoring Reports

Although the finance officers do not appear to use expenditure reports to condition decision-making, they have gradually come to consider those reports and the budget summary sheets to be essential to their work. The reports have made it possible for them to respond to ever-increasing demands from their superiors for information. With the rising importance of "district focus," they often have to provide financial information disaggregated to the district level. Doing so would be extraordinarily difficult without the use of the microcomputer. In addition, the microcomputers have begun to be perceived as a valuable tool by some of the senior decision-makers in the ministry. The tacit signals sent by those officials, including requests for information from the microcomputers, have encouraged interest among upper-middle and middle-level finance officers.

The expenditure monitoring reports also facilitate various aspects of the upper-middle and middle level finance officers' work. Monitoring expenditures at the district level, for example, would be impossible without the microcomputers, according to the Estimates Clerks and Assistant Secretaries in charge of such tasks. There is a tremendous amount of data gathered from various reports from the field. Those data must be entered, checked against past expenditures and other information, the reports returned to the field if there are inconsistencies, and the data reentered. The data must be aggregated in various ways in order to determine the levels of spending of spending stations and districts. The summary calculations must sometimes be made periodically before all returns are received. Performing those calculations using a hand calculator was extremely time-consuming. Many aspects of the current system simply could not be done manually, given the available staff. In addition, before the adoption of the microcomputers, senior finance officers spent most of their time doing calculations and proofreading rather than using the information for decision-making.

The Estimates Officers, for example, are responsible for using

expenditure information to identify problems in the rate of spending by district projects. Before the adoption of the microcomputers, the Estimates Officers devoted much of their time simply to aggregating the figures for the year-end expenditure reports. It was impossible for them to calculate the extent to which the level of spending for each project was within the ministy's spending guidelines at various points throughout the year. They had little time to conduct much actual monitoring.

The microcomputer reports have made the figures much more accessible by providing the data, and various aggregate and comparative statistics, in one report in formats that facilitate monitoring. As a result, the Estimates Officers can spend more time considering the information and contacting those who are over- or under-spending their allocations. Using the monthly expenditure reports, the Estimates Officers have been able to monitor spending throughout the year. By doing so, they have been able to intervene early when a particular project is substantially over- or under-spending its budget. They can identify problems and warn project implementers when their project appears to be heading for financial trouble. According to Estimates Officers, who are responsible for keeping track of the expenditures of various AIE holders, the microcomputer output enables them to "do the job we are supposed to be doing, but could barely do before."

The microcomputers have also contributed to easing the tasks of the Assistant Secretaries (AS's). The most important contribution appears to be the disaggregation of expenditure and budget information by district. The four Assistant Secretaries were unanimous in citing the importance of the disaggregated statistics, without which, they say, it would be impossible to do their jobs. One AS commented that without the microcomputers, the Assistant Secretaries "would be working on the estimates all year and still probably would be late."

Training to Provide Expenditure Monitoring Reports

After deciding to adopt dBase II, TAP repeatedly requested professional finance officers to train in dBase II programming. Those requests went unacknowledged for months. Finance officers had little interest in learning to operate the microcomputer. No senior officer directed professional staff to learn to use the machine. Finally, TAP advisors decided to train people who were available to them, namely clerks in the finance division.

Half a dozen clerks began training in dBase II programming in 1982, about five months after the first microcomputer was introduced. Training was difficult for several reasons. First, training in dBase II programming is considerably more demanding than that required for Visicalc. Complicating matters, the standard manuals and other training materials available did not have examples and exercises directly related to the work to be done by microcomputer operators in the ministry. The TAP

microcomputer advisor was kept so busy developing software for the new information systems that he had little time to conduct training, much less to develop new training materials. In addition, for the first eight months of microcomputer use, there was only one machine in the ministry. Time pressure demanded that the most experienced dBase programmer - the advisor - utilize the machine. Kenyan trainees therefore had limited opportunity to gain hands-on experience.

Furthermore, the formal incentive system in the ministry provided no tangible rewards for clerks who learned to program in dBase II. Because they were in the clerical scheme of service, the clerks could not move into higher, more remunerative positions if they mastered dBase II programming. Within six months, all but one of the clerks who began training gradually chose to stop training and return to their old duties. Some of their duties included entering data into menu-driven programs on the microcomputer. Those clerks felt that programming was too difficult. They were also doubtful about whether it was worth their investment of time and effort. According to one, "Some people started to learn [to program in dBase II], but when they saw those who learned weren't going to get anything, they stopped working at it." Only one clerk actually became adept at programming. She was largely motivated by the desire to learn something new and her intrinsic interest in the microcomputer.

In 1983, another clerk was chosen by TAP for programming training. By late 1984, however, it appeared that he would not quickly become highly skilled in dBase II programming. He could, however, take on relatively straightforward programming tasks, freeing the skilled clerk-programmer for the more complicated programming exercises. In 1984, a third clerk also joined the tiny microcomputer staff. After several months, she was only able to enter data into menu-driven programs and do limited interactive work with dBase II.

By the end of 1983, the training system had evolved to the point where people could be trained primarily using self-training methods. The advisor made available training tools such as an interactive training disk that introduces the user to how dBase II works. There is a dBase II manual for reference, and books that discuss uses of dBase II and provide exercises for each discussion. In addition, the advisor has been developing a course booklet that directs the user to read sections of the books and that provides exercises or descriptions similar to the particular kinds of applications the user is likely to confront in his/her work in the finance division. There is also an experienced programmer - either the advisor or the clerk who has become a skilled dBase II programmer - who will answer questions if the trainee does not understand the printed material. But the best training tool, the advisor found, was experience with real tasks that the trainee must struggle with him/herself. "People learn best by having tasks assigned that they have to solve. You can't train someone to become skilled in dBase II just by going through the coursework. They must have an opportunity to try to

apply it." He also encouraged trainees work together because they "learn a lot by teaching others."

His experience in the finance division pursuaded the microcomputer advisor that a certain level of adeptness in mathematics is necessary for someone to be able to master dBase II programming. After the first training group, he made four years of high school mathematics a prerequisite for microcomputer training.

Deciding how many people should be trained in dBase II programming has not been an easy matter. Although the initial training group had six members, the microcomputer advisor later came to feel that training should be limited to those whose work would actually demand the programming skills on a regular basis, with perhaps one person as "back up." He believes that using dBase II is much "like a language. If it's not used regularly, people will forget and end up back where they started." Thus, he believes that the number of people in the finance division who can be effectively trained is limited by the number of machines and the actual need for those skills in the data-to-day work load. The advisor anticipates that if additional people become necessary, the clerk who is skilled at dBase II is now able to train them, along with self-training activities using the interactive training software, the books and booklet.

Because it was difficult getting staff with necessary skills for dBase II programming, the advisor also dedicated much of his time to developing menu-driven programs for a variety of expenditure reports. Those programs reduced the amount of training which was necessary. There are, however, inevitable requests for reports that are sufficiently unique to require a special program.

Thus, by the end of 1984, only one clerk had become highly skilled in dBase II programming. She is able to prepare most of the reports, including fairly complicated reports on request. Nevertheless, she does not understand the implications of the financial information. For new kinds of reports, she requires someone with knowledge of the finance system and some understanding of the principles of microcomputer operations to explain the kind of programming needed. The expertise of a more skilled programmer is still required to prepare a few of the most complicated reports.

Despite finance officers growing reliance on the reports, by late 1984, they had shown little interest in learning to operate the microcomputers themselves. No finance officers had learned the principles of dBase II. An introductory microcomputer study session held by the microcomputer advisor in mid-1984, drew little response from the professional staff. The professionals felt that since clerks were the only staff operating the microcomputers, they were apparently the appropriate level staff to do so. There have been no explicit or tacit messages from top ministry officials to contradict that perception. No senior officer has directed, or even suggested, that the professional

staff below them learn to operate the microcomputers. The formal system of financial incentives provides no reward for professional staff who learn to use the microcomputers.

Furthermore, there is strong status consciousness that has discouraged the finance officers from learning from clerks who can program the microcomputers. The finance officers do not want to learn to type ("it's what secretaries do"). They are reluctant to ask questions of the clerk-programmers because it implies the clerks understand more than do the professional staff. They have attempted to keep the status lines strictly drawn.

The turning point in the professional staff's interest in learning to operate the microcomputers came with the realization, in mid-1984, that the microcomputer advisor was leaving, and no one would be replacing him. Finance officers who use the microcomputer-produced expenditure reports now fear that the reports on which they have come to rely will not be available. They are worried that the Kenyan clerk who will take over for the TAP microcomputer advisor will not be able to do the job adequately. They are concerned - to the point of anger in some cases - that not more people have been trained to program in dBase II. They fear that the single skilled clerk-programmer will be unable to provide all the expenditure reports, might become ill during a time when reports are needed, or may leave the ministry. They worry that the entire system might break down and they would not be able to get the information they have been receiving from the microcomputers. If the reports are not forthcoming, said one finance officer, "we will be grounded."

The Senior Assistant Secretary of Finance and Budget, the Assistant Secretaries, and the Estimates Officers all voiced great concern to this researcher about the lack of replacement for the TAP microcomputer advisor. One Assistant Secretary and two Estimates Officers said they wanted to receive training in microcomputer use. None of the concern, however, had been expressed formally. Estimates Officers and Assistant Secretaries had not registered interest in learning to operate the microcomputers to their senior officers. No one had notified TAP that professional staff were now interested in learning to operate the machines.

Eventually, in late September 1984, one Assistant Secretary explicitly voiced her interest to the Senior Assistant Secretary for Finance. She began some training with the microcomputer advisor. Her concern with delineating the difference between her status and that of the skilled clerk-programmer caused some difficulty, however. She feels that her status should place her in charge of the microcomputers. Needless to say, the assumption has caused consternation on the part of the skilled clerk-programmer, who has become the de facto head of the microcomputer staff. The microcomputer advisor has made it clear that the clerk-programmer is to be in charge of the microcomputer operations. Nevertheless, it is possible that the Assistant

Secretary will attempt to impose her higher status on the microcomputer staff after the TAP advisor departs.

Unfortunately, the Assistant Secretary, like many of the finance officers, tends to underestimate what is involved in learning to program in dBase II. There is a sense that "if a clerk can learn to do it, it must be easy," and the officers expect to be skilled programmers within a short time. Yet the Assistant Secretary's mathematics background is limited. Although she may learn the basics of dBase II programming, she is not likely to want to become a highly skilled programmer, replacing the TAP microcomputer advisor or serving as a backup for the skilled clerk-programmer.

Like the finance officers, the TAP advisors have also been concerned about the limited number of Kenyan staff trained in dBase II. Their feelings have been mixed, however. Some fear that demand for information from the microcomputer will increase faster than the current staff of microcomputer operators can satisfy. They suspect that the departure of the TAP microcomputer advisor will threaten the microcomputer-based information system that has developed. Other TAP advisors feel that the departure of the TAP microcomputer advisor might induce the professional ministry staff to take more seriously the necessity for their learning to operate the microcomputers. While the advisors want to ensure that the microcomputer-based information system will not break down, they feel that TAP can "bail out" the system if it gets into trouble. Meanwhile, problems in maintaining the system will bring home to ministry officers the need to "Kenyanize" the system.

One problem in maintaining the system is the lack of incentives for the skilled clerk-programmer to remain in the ministry. She has come to realize that her programming skills open doors to far more lucrative employment. In order to ensure the continuity of the system, TAP provided their own incentives to the clerk-programmer. They arranged to informally reward her by sending her to a training course in the U.S. In return, they asked for her assurance that she would stay on in the ministry at least one year. They have carried on continuing negotiations with the heads of the government computer services (CBS), and the Directorate of Personnel Management (DPM) to try and engineer a formal promotion for the clerk. The heads of those departments insist, however, that a microcomputer programmer must be qualified under the same conditions as other programmers. He/she must, therefore, be able to program in such languages as COBOL and FORTRAN. The heads of DPM and CBS are considering, however, making an exception of the clerk-programmer, and placing her in the lowest level of the computer scheme of service.

CBS has also recently begun to train its own programmers in microcomputer operations. They have told MALD that any future needs for microcomputer programmers should be directed to CBS. The senior finance officers of MALD, and the advisors, are doubtful, however, about the degree to which CBS is likely to be

responsive to MALD's requests for microcomputer programmers. They feel that MALD will be unable to influence CBS if the programmers are not forthcoming. Furthermore, TAP advisors believe that the most effective microcomputer programmers would be developed from MALD staff who are familiar with the ministry's operations.

The clerks in MALD have responded to the situation of the clerk-programmer with mixed feelings about learning to program the microcomputers. One clerk observed, "We can see if we learn to use the computer, we won't get anything. It's just the same as those who don't learn. It's very discouraging."

Nevertheless, some clerks have been motivated to learn at least some microcomputer operations, and interest in obtaining training on the microcomputer has spread among clerks and secretaries in the finance division. Being able to operate microcomputers is becoming increasingly perceived as a valuable skill, primarily because it can help in obtaining a better job outside the ministry. According to one clerk, such training is "an investment. If I look for a better job, I'll have the advantage." A secretary commented, "One benefit of working for TAP is that you learn to use new equipment - the microcomputer and the dictaphone. You can take those skills elsewhere to get a better job." Another said, "I'll learn WordStar so I can quit the ministry and get a better job."

Yet the difficulties involved in promoting the clerk who is already skilled have dissuaded the advisors from training additional clerks who are interested in learning dBase II programming. TAP advisors are, however, expanding their attempts to build a cadre of professional staff who can operate the microcomputers. One approach has been to encourage selected upper-middle level finance officers to attend an intensive course in computer operations and programming in the U.S. Although those officers will not return to Kenya as microcomputer operators, they will understand the principles of the machine and the way in which it can contribute to the operations of the ministry.

The Budget Estimates Decision-making System

DBase II was also used to prepare new summary formats of expenditures for budget discussions of the 1983/84 and 1984/85 fiscal years. Use of dBase II permitted further clarity and focus in those formats.

Budget drafts are used by the Undersecretary, the Senior Assistant Secretary for Finance, the Assistant Secretaries, and Estimates Officers to develop budget allocations. The Assistant Secretaries and Estimates Officers use the drafts to discuss projects with Provincial and District officers. The Undersecretary and Senior Assistant Secretary use the drafts to develop final budget submissions to Treasury.

Availability of the microcomputers has encouraged reassessments of the budget that had been difficult previously. Using hand calculators and typewriters, any reallocation - and consequent recalculations, typing, and proofreading - of part of the budget had been virtually impossible, given the staff available. With the microcomputers, reallocations can be effected quickly, and calculations made automatically, so that the aggregate effect is known almost instantly. Retyping and proofreading are restricted to the particular errors. The ease with which such changes can be made has supported advisors' efforts to encourage finance officers to consider the need for certain reallocations.

The officers using the microcomputer-produced budget documents discuss those documents in very positive terms. According to those officers, use of the documents in budget review meetings, held by senior finance officers with the participation of the TAP advisor, has helped to bring the ministry's budget submissions closer to the Treasury's ceilings. The budget summaries have also helped MALD finance officers define policy priorities so that they can better defend the ministry's submissions.

The microcomputers are also used to cut stencils of budget documents directly from the corrected drafts. While this may appear to be a rather mundane contribution, TAP advisors point out that that application is actually a significant advantage. Before the use of microcomputers, the budget was invariably submitted late to Treasury, usually a month or more after the deadline. Professional and clerical staff worked under tremendous pressure during the final month of budget preparation, calculating and recalculating, typing and correcting the documents.

More importantly, the Senior Assistant Secretary for Finance had to dedicate almost all his time during the final month of budget preparation to such tasks as proofreading and correcting typographical errors, rather than the far more important tasks of analyzing proposed expenditures and preparing a presentation to Treasury. The use of the microcomputers to cut the stencils for the 1983/84 and 1984/85 budgets largely freed the SAS for those more important responsibilities.

Nonetheless, the microcomputers have not been utilized to prepare the final budget document for submission to Treasury. There are two obstacles. First, the standard format is extremely difficult to prepare using dBase II. The microcomputer advisor has been unable to dedicate the time it would take to develop the program necessary to provide precisely the required format. Treasury has been unwilling to accept <u>any</u> modification in format, even when it includes all required information as clearly as the standard format. The second problem is that only a dot matrix printer is available in MALD, and Treasury finds the quality of production unacceptable. Thus, while interim drafts of the budget are prepared using the microcomputers, the final draft must be produced with a typewriter.

Allocating Authorizations to Incur Expenditure

The usefulness of the microcomputers in expenditure monitoring and budget preparation led to their application to other management areas. One of the most important was in the allocation of Authorizations to Incur Expenditure (AIEs). The value of the microcomputers' contribution was heightened by changes in the allocation process associated with the new "district focus," which made the process much more difficult than it had been.

In fiscal year 1982/83, in conformity with the principles of "district focus," MALD decided to use the microcomputers to allocate expenditure authorizations directly from Nairobi to the districts, bypassing the provincial level. During that period, the PF&EO was already operating under severe time constraints. These were made all the more difficult by the decision to allocate AIEs directly to the districts. Since the Division Chiefs had no records of the distribution of funds by district, the PF&EO had the microcomputer staff, headed by the TAP microcomputer advisor, bypass the Chiefs and go directly to the Provincial officers for records of how funds had been allocated the previous year.

Once the information had been obtained, the TAP microcomputer advisor used dBase II to develop preliminary allocations to the districts on the basis of the previous year's allocations and expenditures. Due to time constraints, the tentative allocations were only briefly made available to finance officers and Division Chiefs at headquarters. The PF&EO and the TAP advisor then prepared budget allocations in the same proportions as had been done the previous year.

In the aftermath, the Division Chiefs expressed considerable anger about being excluded from the process. Their response was all the more serious as it became clear that some errors were made at headquarters. Furthermore, some provincial officers had misallocated funds the previous year, and those misallocations were replicated.

By the following year, however, those difficulties had been resolved. The allocation process became a more interative and participatory process. To initiate the allocation process, the TAP microcomputer advisor and the microcomputer staff used the regular expenditure reports to develop preliminary allocations based on projections of the previous year's expenditures. The results were distributed to the Division Chiefs, as well as the finance officers who were working with TAP advisors. The Senior Assistant Secretary, Assistant Secretaries, and the Division Chiefs then reviewed and modified the figures. The results were then distributed to the district level offices, for review and commentary. It was the first time preliminary allocations had been sent to the district level for review. The SAS, ASs, and Division Chiefs once again reviewed the figures, along with the

comments from the field, and a final allocation proposal was hammered out. Thus, the microcomputers provided new opportunities for officers to develop allocations based on past performance.

Yet it became apparent that more than availability of the information is necessary to induce officers to apply the information to decision-makinig. TAP management advisors worked closely with the finance officers to encourage their utilization of the information in allocating funds. The advisors directed most of the discussions, requested further information when necessary, and pressed the officers to examine and consider the information. Even after the second year of the process, however, some advisors were unsure about the extent to which the officers actually understood how to assess the information, or were interested in doing so.

The Division Chiefs worked independently. It appears that few actually used the expenditure information as a basis for making allocations. In April 1984, for example, the Division Chiefs received a report of all the allocations made in their division, the rate of expenditure for each project, from March 1983 through March 1984, and tentative allocations based on the previous year's expenditures. Some Division Chiefs left the tentative allocations almost entirely intact. Others changed almost every allocation for which they were responsible. Yet few - including those who made extensive changes - actually seemed to analyze and apply the expenditure report information to allocation decisions.

Nonetheless, the use of information has increased somewhat in comparison with previous years, when the Division Chiefs rarely referred to past expenditure records at all in determining allocations.

Production of the AIEs

Before adoption of the microcomputers, first drafts of the allocation documents were calculated using hand calculators and typed on typewriters. If there were many changes in allocations - due to calculation or typing errors - another draft of the entire document often had to be retyped. The second draft then required complete proofreading. If there were new errors, which often happened, the process had to be repeated. A final draft then had to be typed and proofread.

The process was extremely time consuming, and spending stations often did not receive their yearly allocations until eight weeks or more into the fiscal year. The time lag created several problems. Until they received their allocations, spending stations spent funds without knowing how much their yearly budgets would be. Because they invariably had requested far more than they would receive, they often allocated monies inappropriately, and spent at a far greater rate than their actual allocations could sustain.

The old system also put great pressure on headquarters clerical staff who were responsible for preparing the AIEs. Their other work suffered as the clerks tried to get the AIEs completed and into the field as quickly as possible. There was considerable strain during this period, and the neglected work created continuing pressure even after the AIEs were dispatched.

Given the tripling of AIEs sent from headquarters, the old system is likely to have taken 5 to 6 months to dispatch all AIEs to the field. All of the difficulties associated with AIE distribution would have been intensified even further. Without the microcomputer, it would, in fact, have been virtually impossible for the ministry to complete the allocations to all districts within a reasonable length of time.

Using a microcomputer, ministry clerks enter the data and it is automatically calculated. After proofreading, typing errors are easily corrected without affecting the rest of the document. Only the newly entered figures must then be proofread. After finance officers have reviewed and modified the figures, adjustments can be entered quickly, and calculations carried out automatically. The final proofreading of the changes is quickly completed. The microcomputer is then used to cut stencils directly from what had been the working documents, quickly producing the final, legal AIEs.

Draft budget allocations are then submitted to the Treasury. Revisions resulting from discussions with the Treasury Budget Supply Officer are incorporated into the allocations, which are circulated once again before being finalized.

Although three times as many AIEs must be allocated as when allocations had been made to the provincial level, the process using the microcomputer is completed far more quickly than in previous years. Ministry headquarters distributes spending allocations to all districts and other spending stations within two weeks of the beginning of the fiscal year. Because the process required far less time, clerical staff are under less pressure. They can prepare the AIEs within a reasonable period, and prevent other work from becoming seriously backlogged. Thus, the number of clerks has not been reduced; rather, their work is spread more evenly over time.

Training in the Use of Microcomputers to Prepare AIEs

Training in the use of the microcomputers to prepare AIEs has been relatively simple. The TAP microcomputer advisor prepared menu-driven programs that can easily be followed to produce the required documents. The clerks who had been responsible for preparing the AIEs previously were quickly trained to prepare them using the microcomputers. Because the documents for preparing AIEs are produced with the same formats each year, that system has not required training in dBase II programming.

Word-processing Applications

The microcomputer has been used fairly heavily for word processing of various kinds of documents that require several drafts. These include reports by advisors, budget documents, and financial reports requested by the Ministry of Finance and Planning. Two of the microcomputers brought in between 1983 and 1984, are used specifically for wordprocessing. TAP advisors briefly introduced the principles of word processing to the secretaries with whom they worked. The secretaries responded enthusiastically to learning word processing, despite the fact that the package used, WordStar, is one of the most complicated and difficult to master. They trained themselves, using the manual. Other secretaries, not associated with the TAP project began to show interest. Several have spent their spare time learning to use word processing with the help of secretaries who are already skilled.

Developing understanding among the finance officers of the appropriate use of word processing has taken some time. The experience of one advisor is illustrative. A lengthy document requiring several revisions was put on the microcomputer by the advisor's secretary. As finance officers made revisions, the changes were quickly entered and the document re-printed and again circulated. When the document was in the final stage of revision, the advisor had to leave the country for several weeks. He explained that the revisions should be penciled in, and his secretary would quickly make the changes and produce the final document. When he returned, he found that the entire document had been retyped on a typewriter. The finance officers explained that there were many changes and retyping had therefore been necessary. As a result, the advisor and several finance officers had to spend a considerable amount of time proofreading the entire document.

As finance officers have become more familiar with word processing, their use of it has increased greatly. Word processing decreases the time required for proofreading so substantially that the officers have begun to insist that it be used for all lengthy documents, particularly those with many figures. Some advisors observe with concern the growing enthusiasm among finance officers for having documents prepared with word processing rather than typewriters. They worry that word processing may squeeze out other types of applications that are more crucial to improved financial management.

New Applications

During 1984, microcomputers were introduced into two additional areas within the finance division. One important application was in the newly developed projects management system. It was not the first attempt by foreign advisors to help the ministry

establish a viable projects management system. Efforts by other advisory teams to develop comprehensive project management systems had failed for a number of reasons. Most importantly, they had insisted on comprehensive monitoring and evaluation, attempting to monitor inputs and activities as well as outputs and results. The data were bad, the sampling rigor required for such a massive data base could not be sustained, and the necessary information processing capabilities were not available. These were programs devised by technical information systems people, managed by and for technical people, and remote from the actual decision-making system. Ministry finance officers were never really committed to the system, which was not systematically tied to the budgeting process, and there was little incentive for field officers to comply with the extensive data requirements, multiple forms and complex instructions.

Under the pressure of the financial crisis, however, the ministry was ready to try a new projects management system. The perception on the part of senior ministry officials was that development funds were scarcer than before. There was a feeling that if the ministry could better assess their projects, they could make a stronger case to the Treasury and get "their fair share" of project funds. Thus, the ministry leadership was highly motivated to support a new projects management system.

Adding to that pressure, the President and the Cabinet had begun asking for monthly briefings on the status of all projects. Furthermore, the government's new "district focus" initiative directed ministries to begin to shift operational responsibility for rural development projects from the provincial-level government to the districts. In response, the Permanent Secretary of MALD began to make the establishment of a projects management system a high priority.

It is important to emphasize that the projects management system had only recently been implemented at the time of field work for this study. The extent to which the system has made a contribution is therefore unclear. Nonetheless, it is useful to describe the objectives of the system, which will rely on the microcomputer.

One of the most important of TAP's objectives is to have the projects management system provide information that will help make the Forward Budget process function as a period of policy and program review. They also expect the system to improve headquarters' ability to control and monitor district activities. The reports are to do so by incorporating project expenditure information with physical progress reports on a quarterly basis.

Another contribution TAP expects from the projects management system is support for more effective involvement by the districts in the budgeting process. The district focus policy directs headquarters to gather information about the districts and get input from the district officers about the projects needed in the districts. In order to fulfill the directive, headquarters must

have a way of keeping track of the numerous projects for which they are ultimately responsible. The role of the microcomputers will be to put the project information into a useful format. The large quantity of information generated by the system was, in fact, of concern to Kenyan officers who worried about how they were going to handle that much information. A TAP advisor noted, "When we said, `If you have officers who will train to use the microcomputers, you can access the information and use it' - that allayed alot of concern."

The second new application of the microcomputers is for vehicle monitoring. Again this system has been too recently established to ascertain its effect. It is interesting to note, however, that as finance officers have became more familiar with the microcomputers, they have become more receptive to its use in less pressing areas like vehicle monitoring. The microcomputer-based vehicle monitoring project is not an "essential" system. It is not part of an existing decision-making system, nor has one developed around it. Yet it is increasingly receiving attention of senior officers, who are interested in receiving data and reports based on the system.

To establish the vehicle monitoring system, the microcomputer advisor talked at length with the supervisor of the transport division about setting up the system. Based on those discussions, the microcomputer advisor used dBase II to develop a series of interactive, menu-driven programs. The supervisor assigned two transport clerks to learn to use one of the microcomputers. As the clerks learned to use the programs, the microcomputer advisor elicited their comments and suggestions about improving the system. There were also ongoing discussions between the microcomputer advisor and the transport supervisor to make the reports more responsive to the supervisor's needs.

The supervisor's reactions to the system have been generally positive. The system provides information useful to him, e.g., monthly lists of each vehicle, the number of kilometers it has been driven during the month, the amount of fuel it has consumed. The supervisor is somewhat concerned, however, about the extent to which the clerks are actually working when they are working with the microcomputer. For their microcomputer work, the clerks go to a separate room, on a different floor. There is no one to supervise them, to ensure that they are indeed working during the entire time they are with the microcomputers. The microcomputer advisor neither monitors the clerks, nor has any basis for knowing how much work on the system can be done during a given period.

As a result, the supervisor questions the clerks closely when they go to work with the microcomputers. He is particularly skeptical when they go together. Nevertheless, he permits them to go to work on the microcomputer whenever they say they must.

His cooperation apparently is due to the value the microcomputer output holds for him. His support for the system has enouraged

the clerks who operate the machine to feel that they are performing a valuable task. They have been conscientious in querying the field when field information is unclear or does not make sense. By the time the system had been operating for several months, the supervisor himself had voiced interest in learning at least the principles of operating the machine to produce the vehicle monitoring reports. By late 1984, however, he had yet to begin such introduction to the machine.

Impact on Employment

Those in MALD who have learned to operate the microcomputers have been unanimously positive in their assessment of its impact on the quality of their jobs. Secretaries report that it makes their work less tedious. Transport officers and clerks feel that their work has become more interesting.

For certain individuals, the change in roles has been significant. The skilled dBase II clerk-programmer, for example, had been a minor clerk. She now interacts with relatively senior officers, and has considerably more job status. Although she works harder, she enjoys the work more, finding it more interesting. Similarly, the clerk who is now learning to program in dBase II has improved his job status and says his job is more interesting. A third clerk, who had entered expenditure returns by hand and now enters them into the microcomputers, comments that her job is now easier, and the pressure is reduced. She wants to learn more about operating the microcomputers, and says, "If they opened it up to everyone who wanted to learn, they'd have alot of people."

The skilled programmer also commented on the change in her status as a woman worker. She says many men are competitive and now want to learn to use the microcomputers because they want to do better than she has. Also, she felt that because women usually do secretarial work, "they feel they can't do a professional job. But seeing me do it is encouraging to other women. They come and want to learn it. It's easier for them to come and learn from me because I'm more patient and they don't feel shy about coming to learn with me as they would with a man."

For other clerks who enter data into the machines, their jobs have not changed greatly. They use a microcomputer rather than a calculator and pen and pencil. Some of those clerks, e.g., the transport clerks, have more work than before. They report that learning to use the microcomputers has made their jobs more interesting, and that they are glad to have the opportunity to learn to use the microcomputers.

The positions that have been affected most by the microcomputers are the senior administrators, the Undersecretary, the Senior Assistant Secretary and the Assistant Secretaries. They report that the microcomputer output has helped them to do their jobs more effectively. The microcomputer provides information they

need for preparing reports for their superiors, enabling them to respond faster and with better reports. The word processing function frees them from much of the proof-reading and editing of reports.

Issues of unemployment are unlikely to become relevant for the ministry since government policy is not to fire staff. It is not possible to predict whether use of the microcomputers will negatively affect the rate of growth of employment. It does appear, however, that the use of the microcomputers has generated more work in the ministry, suggesting that reduced rates of employment are unlikely, at least in the short term. An ongoing problem in the ministry has been worker productivity, not because people are working to the limits of the existing technology, but because the expected level of production is very low and people perform only to that level. Ideally, generating a more productive work style would be in order, taking the place of at least some of the microcomputers. Unfortunately, there does not seem to be a technology for inducing that kind of change in work style. In the words of one TAP advisor, "I'd much prefer to have a lot of secretaries typing efficiently and turning out the development plan. Word processing isn't something that seems so necessary we should have to do it here, just looking at the factor proportions. But it doesn't work that way." Adding secretarial staff would require more administrative staff with significantly greater management skills. There does not appear to be a feasible technology for quickly developing those management skills in the ministry.

CHAPTER III

MICROCOMPUTER ADOPTION IN THE MINISTRY OF AGRICULTURE AND LIVESTOCK DEVELOPMENT, KENYA: THE PLANNING DIVISION

OVERVIEW OF THE CHAPTER

This chapter discusses microcomputer adoption in the planning division of the Ministry of Agriculture and Livestock Development. The chapter begins with a description of the conditions that lead to the initial rejection of microcomputers, and their later acceptance in the planning division of the Ministry of Agriculture (MOA). At about the same time that microcomputers were adopted in the planning division, MOA was merged with the Ministry of Livestock Development (MLD) to form the Ministry of Agriculture and Livestock Development (MALD).

The chapter considers the types of microcomputer applications that developed in MALD. The first type of microcomputer application discussed is use for planning analysis. The chapter recounts the early resistence of the planning officers to using the machine for planning analysis, the development of microcomputer use for planning analysis, and the training that planning officers received to encourage their use of the microcomputer for analysis.

The second and third types of use are file maintainance/information retrieval, and wordprocessing. For these applications, the chapter describes the conditions that encouraged or discouraged each use, and the response of planning officers to the availability of that type of application.

The chapter closes with a discussion of the planning officers' perception of the value of microcomputers in the division.

INTRODUCTION OF MICROCOMPUTERS INTO THE DEVELOPMENT PLANNING DIVISION

In 1981, when MOA was coming under tremendous pressure to improve its finance and budget processes, the Development Planning Division (DPD) of the ministry was experiencing little of that pressure. While the DPD was also affected by shrinking budgets, planning officers were less directly involved in the processes by which budgets were allocated. For the most part, the planning division had little influence on the policies of the ministry. Planning officers operated primarily as administrators - maintaining files, writing memos, and attending meetings - rather than as planners.

There has been little change in the general conditions and organizational structure of DPD since 1981, although the division

expanded when MOA merged with MLD to become MALD in 1983. The planning division is composed of three sections: projects evaluation and planning, commodity policy, and strategy planning.(1) The projects section monitors ministry projects. Since MALD essentially considers itself an agency that implements projects, this section could potentially have a valuable function. Nevertheless, the projects section provides little input to the process of allocating funds among projects. Project monitoring by planning officers is not systematic, but is based on intuitive and rule of thumb measures. There is virtually no attempt to make comparative assessments of projects.

The commodity policy section is more central to ministry operations, and receives continual requests for information. To many in the ministry, "planning" means the projection of factors related to commodity production and demand. Much of the information that is requested of the commodity policy section requires formal, although not necessarily elaborate, analysis. Unfortunately, the planning officers in this section are forced to respond to the requests from top echelons very rapidly, and most do not have the skills required for the kind of quantitative analysis required.

The third section, strategy, has little effect on the ministry at all. In part that situation is due to the minimal influence which MALD has on strategic agricultural policy decisions that might logically fall within the realm of the strategy section. In part, it is due to the limited analytic skills of officers in this section. Not only do the officers have difficulty conducting formal analysis, but they are not trained in methods for presenting findings in ways that are useful to senior decision-makers.

These were the conditions in DPD when a microcomputer was introduced to MOA in 1981. The first microcomputer demonstrations in MOA were presented to DPD. The TAP advisors and the consultants who introduced and demonstrated the microcomputer assumed that the machine would be best used in the planning division. There, they thought, the microcomputer could assist planning officers in developing econometric models, monitoring food production and distribution, and other projection and modeling efforts.

The response from the planning division was overwhelmingly unenthusiastic, however. While some advisors working in DPD were interested in using the computer, others felt that it was not appropriate for the kinds of work the Kenyan planning officers were doing. The Kenyan planning officers themselves were disinterested. Because it quickly became apparent that the microcomputer was appropriate for work in the finance division of the ministry, and there was so much to do in that division, TAP decided to introduce the microcomputer into finance rather than into DPD.

During the first year that microcomputers were in the finance division, some advisors and Kenyan officers from the planning division slowly and intermittently began using them. Interest began to spread in the planning division as the first year of microcomputer use in the finance division showed growing success. The TAP advisors, and some DPD officers working with the advisors, conducted project analysis on the machine. Some advisors used it for market studies, then met regularly with ministry officials to review the results.

The head of the TAP team resisted bringing microcomputers into the planning division, however, until he was sure that there was some perceived need within DPD, and that at least some planning officers were sure to use them. He decided that rather than introduce microcomputers as a means for generating analysis, he would wait until there were planners who had the skills and the desire to use the machines, and there were some appropriate analytic tasks to be done.

Eventually, some TAP advisors began pressing for the introduction of microcomputers in DPD. When some Kenyan officers also began lobbying for microcomputers, the head of TAP arranged for the introduction of microcomputers into the division. In late summer 1983, DPD received two microcomputers. As one advisor concluded, "It was best, even for the planning division, that the microcomputer was first placed in finance. The model of use in finance has created much more interest and enthusiasm in planning."

USE OF MICROCOMPUTERS IN THE PLANNING DIVISION

Use of Microcomputers for Analysis

Microcomputers were not introduced into DPD to improve any particular system in the division. Rather, they were adopted to encourage a few planning officers who wanted to do quantitative analysis to interact with the machines. During the previous two years, TAP had made a concerted effort to recruit young planning officers who had achieved a high rank in their university class. A few of those young officers had used microcomputers, if briefly, at the university. They had been exposed to quantitative analysis, and wanted to apply those skills in their work. In a sense, use of the microcomputer by those officers has served as a pilot project that other planning officers could observe.

At the time of the field work for this study, about a year after microcomputers had been placed in DPD, only a few planning officers were using the microcomputers regularly to do analysis. They used several statistical packages or spreadsheets, including VisiPlot, MicroStat, and Optimizer. With those tools, they tested models of crop production, demand trends, population trends, and other topics, as directed by a TAP advisor or,

occasionally, in response to a request for information by a senior planning officer.

All of the planning officers using the microcomputers for analysis were hired as part of TAP's drive to recruit highly skilled university graduates; all had been introduced to a microcomputer to some extent in the university. Presence of microcomputers in DPD has not, however, inspired any incumbant officers who did not already know how to use microcomputers to learn to operate them.

Nor are there any incentives in the formal system to encourage the planning officers to learn to use the microcomputers, or to do quantitative analysis generally. Promotion prospects for economists in MALD are very poor, regardless of the quality of their work. Promotions tend to be a reward for having a "good" relationship with the "right" person. Middle and upper levels of the planning division show little interest in receiving the kinds of analysis for which microcomputers are appropriate. According to one advisor, "There is alot of resistence to using that kind of management information, whether it is from a microcomputer or not."

To the extent that such analysis is called for, the senior officers tend to turn to foreign advisors rather than their own staff. In part, their reliance on advisors is due to the severe time constraints under which senior officers often operate. They need results quickly and the advisors are able to respond more rapidly than the Kenyan officers. There is also a tendency for senior officers to perceive their own officers as unable to conduct the analysis they need, despite an advisor's urging that a planning officer can carry out the work.

Aggravating those conditions is the perception on the part of many planning officers that the senior officers send strong negative signals about using microcomputers for analysis. Said one junior officers, "I know the benefits of using the microcomputer, but the senior people feel it's a waste of time. You can do it all and no one reads it." Another commented that "no one cares" what he does. "They want to leave things as they are."

Some planning officers even suspect that if they use quantitative analysis senior officers may perceive them to be "showing off." Use of microcomputers might then lower their chances of promotion. Many junior planning officers also say that when they are asked to prepare reports for the senior levels, they are given so little time to respond that it is impossible to carry out analysis.

In addition, the planning officers feel that their work has little importance for or impact on policy-making. There is little communication between planning officers and the policy-making administration division. As a result, whatever project assessment planners do is framed as though there were no

financial constraints. The planning officers evaluate individual projects without concerning themselves with the need to weigh priorities and allocate limited resources among alternatives. For their part, the administrative staff who make policy decisions generally ignore any input from the planners. Only occasionally are planners asked to provide information in response to specific enquiries from the top administrative cadre.

The planning officers who do use the microcomputer for analysis are responding almost entirely to incentives provided by TAP advisors. The advisors work directly with planning officers to encourage analytic work and to help the officers develop their skills. Although the positive response has come largely from junior officers, a small number of more senior members of DPD have also become interested. The deputy head of the planning division, for example, receives reports produced on the computer and understands their use; he has agreed to attend an intensive course on microcomputer use in the United States in the future.

TAP also sends promising junior economists to the United States for Masters Degree studies. Planning officers' interest in such programs motivates them to develop their analytic skills. Those who have recently returned with advanced degrees are stimulating others to develop analytic skills.

In addition, TAP uses various intangible incentives to encourage planning officers to develop their analytic skills. In cooperation with a few middle level officers, for example, TAP advisors have arranged regular seminars at which planning officers can present their work to other officers and the advisors.

The microcomputers' intrinsic characteristics themselves facilitate TAP's efforts to encourage planning officers to develop analytic skills. Microcomputers are, as one young planning officer said, "more fun and easier to use" than a calculator. According to TAP advisors, the microcomputer helps the planning officers to overcome their biases away from quantitative work, and their lack of background in quantitative analysis. For many of those officers, the microcomputer "gets them over the hurdle." Thus, while microcomputers may not be essential - much of the quantitative work could be done with a programmable calculator - it reduces the drudgery, encouraging a form of analysis that might not otherwise be done. It appears to have helped to establish among younger officers an expectation that they will use the microcomputer for their work, and given them the confidence that they can do so effectively.

Those incentives, and the influence of the early users, have begun to spread interest in learning to use the microcomputers among other junior planning officers. In some cases, middle level and senior officers who have analytic skills have also begun directing the officers below them to carry out statistical operations using the microcomputer. In one part of the planning division, a junior planning officer is "in charge" of

microcomputer functions. Other officers give him their models and he uses the computer to perform the statistical manipulations. Slowly, however, the other officers in that section, particularly the junior officers, are beginning to learn to use the microcomputers themselves.

Training for the Use of Microcomputers in Analysis

The early users of the microcomputers for analysis had received training in quantitative analysis and had been introduced to microcomputers in the university. They learned to use the packaged computer programs available in DPD relatively easily. They work with TAP advisors to develop the substantive analysis, to design the research model, and analyze the results. They learned to use the microcomputers largely through self-teaching. They referred to the manuals, and turned to TAP advisors when they could not resolve a problem alone.

The planning officers who have learned to operate the microcomputers have begun teaching some of the other junior officers to use microcomputers for analysis. They do so by taking the role of the advisors vis-a-vis their fellow officers, helping them design the research model, demonstrating how to enter the data, and assisting in analyzing the results.

The Projects Registry

By late 1984, DPD was also using word processing to produce the projects registry. Although that application was begun after initial use for analysis, it was adopted much more quickly and widely among planning officers.

The projects registry had already existed when the microcomputer was introduced. It was extremely difficult to keep up to date, however, and the records were poorly maintained. Data was recorded by hand, and was then typed by secretaries. There was no system to check on the accuracy of field data. Typing of the registry records took a great deal of time. Proofreading was a time consuming, burdensome task for planning officers, and was therefore done fleetingly, if at all. The registry was replete with errors.

In 1983, however, there began to be increasing pressure for DPD to improve its projects registry. The Treasury and the Cabinet began requesting monthly project status reports from senior MALD officers. The Minister and the Permanent Secretary (PS) of MALD then sought good information on the projects from the planning division. When that information was limited and slow in coming, the PS began to support an improved projects management system, one component of which is the projects registry.

To enable the planning division to respond to requests from senior ministry officers, and to improve the knowledge base about

ministry projects, TAP encouraged the use of word processing to prepare the projects registry. TAP advisors showed their secretaries the principles of word processing. The secretaries, who quickly became adept at word processing, then used it to produce the projects registry.

The projects registry now consists of approximately 180 pages of information on the status of projects that receive foreign aid support or have budgets greater than K 100,000 per year. The registry records the objectives, implementation progress, and financial data for each of 94 foreign-aided projects. It is being expanded to include all development projects. With word processing, the projects registry is revised every month, a task that would be impossible for secretaries using typewriters. The registry report goes to the Office of the President, the Minister of MALD, the Permanent Secretary, the Undersecretary, the Deputy Secretary, the Senior Assistant Secretary for finance, and the Assistant Secretaries. Some planning officers use the registry to maintain their files and prepare project reports.

Unlike use of microcomputers for analysis, use of word processing to produce the projects registry responds directly to perceived needs of senior and middle officers. The registry has, more than other activities, involved Kenyan planning officers in key activities.

Cabinet Memos

One of the most important word processing applications used in the planning division is for Cabinet memos, which go through a number of iterations, and must be prepared within a short time. When the memos, requested by a Cabinet member, require a very fast turn-around, the advisors generally write them. The memos are then circulated among top MALD officers and revised one or more times before the final copy is prepared on a microcomputer. Often, however, it is possible to predict the kind of request the Cabinet is likely to make, and for those papers many more junior economists are involved. Increasingly during the past year, Cabinet memos have included componants of analysis, prepared by planning officers using VisiCalc or statistical packages on a microcomputer. Since those documents go to the Cabinet, some interest in the microcomputer has developed at that level.

Perceived Value of Microcomputers by DPD

The planning officers who have used microcomputers for analysis find that the microcomputers enable them to do work in which they are interested and which raises their self-esteem. Most of the planning officers, however, have used microcomputers only to work with the projects registry. Use of the machines has made it easier for them to obtain information they need to respond to requests from their superior officers. For most, the microcomputers have provided benefits only by helping them to

more easily and quickly perform tasks which they were already carrying out.

Thus, the microcomputers have had only a limited effect on the quality of worklife of most planning officers. With the exception of the few junior officers recruited by TAP and using the microcomputer for analysis, few incumbant planning officers do quantitative analysis. To the extent that they do, they use a calculator and draw charts and graphs by hand. Many of those officers say that they want to use the analytic skills they developed in college, and are discouraged about being able to do so in the ministry. The presence of the microcomputers has not, however, encouraged them to do that kind of analysis.

CHAPTER IV

MICROCOMPUTER ADOPTION IN THE MINISTRY OF FINANCE AND PLANNING, KENYA

OVERVIEW OF THE CHAPTER

Microcomputers had been used in the Ministry of Finance and Planning (MFP) for about a year and a half at the time of field work for this study. This chapter discusses the introduction, current and planned uses, and perceived impacts of microcomputers in MFP. The chapter begins by recounting the process of introducing the machines into the ministry, their initial application, and the controversy that accompanied the early phase of their adoption.

The chapter then describes the ways in which microcomputers have been used during the first year and a half they were in MFP. It presents each type of application separately, discussing the development of the application, its implementation, and the response by ministry officers. The chapter then examines plans for expansion of the microcomputer system, with a description of new applications and the expectations of the ministry officers. It then turns to a discussion of the training program in the ministry. The final section looks at perceived and anticipated impacts of the microcomputers on ministry processes, and on employment and job quality.

INTRODUCTION OF MICROCOMPUTERS AND TRIAL USE

The fiscal pressure under which the Kenya government was operating in the early 1980s was felt particularly keenly at the Ministry of Finance and Planning (MFP). There was growing frustration within MFP about the limitations of the budgeting process. Declining revenues and pressure from the International Monetary Fund demanded more effective and detailed monitoring of financial and monetary aggregates. International and bilateral aid bodies called for better monitoring of and more reliable financial support for foreign-aided projects. With tightening financial constraints, it became increasingly important that allocation of development funds reflect the prioritized needs of the country. The Office of the President made it clear to MFP that there needed to be better monitoring and evaluation of development projects.(1)

In addition, the government's "district focus" policy called for devolution of authority for development projects to the district level. Implementation of district focus required disaggregation of financial and project information to the district level. MFP simply did not have the necessary information processing capability to do so. In order to improve the budget information system and project monitoring, particularly if they were to be

disaggregated to the district level, some way of making information processing more rapid and efficient had to be developed. In addition, MFP was going to have to produce district plans for 40 districts within a very short time.

Among those most concerned about the limited extent to which the ministry could implement district focus policy were advisors in the Rural Planning Project (RPP) in MFP.(2) RPP was funded by the United States Agency for International Development (USAID) to provide technical assistance to improve the ministry's planning capacity.(3) The RPP advisors were charged with helping to strengthen staff skills and institutions for rural development planning and implementation. An important part of that responsibility included providing assistance in advancing decentralization of the planning and financial control of rural development projects. It was clear to the RPP advisors that progress in implementing the district focus policy would require significant improvement in the ministry's information processing system.

In early spring 1983, a RPP advisor examined the potential use of microcomputers to help ameliorate the problems in the information processing system. As a result of his findings, RPP proposed that the ministry accept a small number of microcomputers. The Permanent Secretary agreed. In spring 1983, five microcomputers, one Apple and four Osbornes, were introduced into MFP.

The first applications of the microcomputers were not those originally anticipated. The Ministry of Finance and Planning consists of two branches, the Directorate of Finance, and the Directorate of Planning. The microcomputers were originally introduced with the intention of using their financial applications in the Directorate of Finance. By summer of 1983, however, the most pressing priority in the ministry was production of the district plans, a responsibility of the Directorate of Planning. A previous effort to develop district plans, in 1977, had taken two years to actually produce the plans. This time, the Office of the President had requested the plans within a few months.

RPP advisors decided that the bulk of the district plans should be produced using private word processing companies in Nairobi, and they identified a half dozen firms. As a backup, they trained approximately a dozen secretaries to use word processing on the microcomputers in the ministry. Opinion about the appropriateness of using microcomputers was not unanimous, however. During a presentation about the microcomputers, officers from the government computer center argued that the microcomputers were not necessary, given the availability of the mainframe computer and its future capacity for word processing. The discussion ended, and microcomputer use for the district plans was launched, only after the head of the section in charge of producing the plans said, in essence, "Look, I don't really understand microcomputers, but I'm convinced they are the way the future's going, and it's silly to argue about it. Let's just get

on with it."

During subsequent months, working with District Development Officers to prepare district plans, and managing the production of the plans absorbed much of several RPP advisors' time. Because the planning officers at headquarters did not understand word processing, they participated little in the production process. As the pace accelerated, the private companies could not keep up with the raft of changes in the documents. In the end, the ministry secretaries produced 14 of 40 plans in their entirety and 28 of 40 annexes, which contained all the quantitative material.

For several months after the plans were submitted to the Office of the President, RPP advisors and a small number of MFP staff used the microcomputers to make revisions to the plans. The final drafts were highly polished products of the microcomputers. During that time the RPP advisors also used the microcomputers to conduct analysis in the course of their work at the ministry. One clerk was trained to program in dBase II, and worked with RPP advisors. Secretaries working with RPP used the microcomputers for word processing.

There continued to be strong forces discouraging adoption of microcomputers, however. The President had indicated publically that word processors - and even electric typewriters - were not an appropriate technology for the country. There was general underlying skepticism within the ministry about the value and ultimate benefit of introducing microcomputers into the government.

The question of microcomputer adoption became a real issue in May 1984, when the ministry was offered 10 free Kpro microcomputers. The President's negative public statements about microcomputers had come only a few months before. Furthermore, the head of the government computer center was not supportive. There was, therefore, considerable discussion about whether the ministry should accept the Kpros. The Financial Secretary, under whose jurisdication the government computer center falls, was left to make the final decision.

Given the arguments against microcomputers, citing labor displacing effects and difficulties in servicing the machines, the Financial Secretary requested documentation of the ways in which the microcomputers had been used up until that time. The documentation that RPP advisors presented to him gave the Kpro proposal viability. The fact that RPP had been working in the ministry for more than five years, and had established strong positive relationships with senior Kenyan officers, also helped to support the proposal. The Financial Secretary agreed, since the machines were free, to accept them into the ministry.

The Financial Secretary's acceptance of the free machines is the extent to which a senior officer has visibly supported adoption of the microcomputers in MFP, at least until very recently.

There continues to be skepticism among some senior officers in MFP about the effectiveness and appropriateness for Kenya of the "high Western technology" embodied in microcomputers. Nonetheless, the importance of the Financial Secretary's decision should not be underestimated. That assent to the introduction of microcomputers in MFP was key to legitimizing microcomputers in the government at large. In a sense it was a formal decision to reverse earlier negative informal decisions about microcomputer adoption.

In the summer of 1984, there were increasingly positive public statements about microcomputers by government leaders, including the Vice President, and by newspaper editorials. Yet senior officers in MFP did not offer any explicit advocacy for microcomputer adoption. What they did offer was lack of restriction on adoption and the tacit approval that comes from using the microcomputer products.

USE OF MICROCOMPUTERS IN MFP

For the first year of microcomputer use, there was no attempt to identify a system that would be improved or established with the use of the microcomputers. Rather, the RPP advisors have been using the microcomputers to respond to individual, ad hoc requests from senior officers. A RPP advisor may, for example, talk with the Financial Secretary about pressing problems in obtaining information. The advisor would then quickly arrange for the production of the reports needed.

As the Financial Secretary has become familiar with the capabilities of the microcomputer, he increasingly requests reports for himself and his staff. To a much lesser extent, Budget Supply Officers also request reports of the advisors, or work with the clerk who can program in dBase II to prepare a report they need. Thus, the RPP advisors and the small microcomputer staff have been, in the words of one advisor, "in a responsive mode all the time. We don't go out looking for new things to do. We have more requests for help on various applications than we can fullfil."

Response to requests from the Food Distribution Task Force illustrates one of the most important kinds of tasks for which the microcomputer is used. RPP advisors and a small number of ministry staff use the microcomputers to develop systems to improve the efficiency of distributing food imports for the famine relief program. The effort comes directly out of the office of the Director of Planning, who has a Ph.D. in economics and is familiar with computer-based analysis. The microcomputer applications combine projections and monitoring to determine food needs, assess the pattern and process of distribution, and avoid bottlenecks. The RPP advisors use the machine themselves, or direct the programmer or the clerk-programmer to carry out certain tasks. The Kenyan officers use the microcomputer only by explaining the substance of what they want done to the programmer

or clerk-programmer. The latter then do the all the microcomputer work.

Use of Microcomputers in Budget Preparation

The microcomputers are, of course, still quite new in the ministry, so that many applications are only beginning to be developed. The first application of microcomputers to an regularized system will be in the Finance Directorate, as the machines go on trial at the end of 1984, as a tool to produce the budget. RPP is seeking to build credibility for the microcomputers by producing the budget with the microcomputer exactly has it has always been produced using the manual system, only adding a few useful items of information. In order to develop software that will produce the budget to look exactly like the one that is typed each year, the advisors have had to commit a considerable amount of their own time, as well as using the services of an outside consultant.

The advisors' primary concern with using the microcomputer for budget production relates to hardware. They worry that they will not be able to quickly resolve any serious hardware problem that might occur during the budget production process. They would have to wait two to four months to receive a new microcomputer after ordering it. The microcomputer outlets in Nairobi do not have a large inventory of spare machines. Nor will there be extra machines available for spare parts should there be a hardware problem. The RPP advisors feel that interruption of the budget production system due to the inability to repair a broken machine would seriously impair the credibility of the entire microcomputer system.

Use of Microcomputers in Planning

In the Planning Directorate, the use of microcomputers for record-keeping and monitoring activities has generated much more interest among the planners than microcomputer use for analysis. Even for the former activity, however, the planners' response to the microcomputers has been mixed. Some are enthusiastic about using microcomputers to keep records on projects. One planning officer remarked, "It simplifies the job. Before, I had to write out the information and get it typed and file it." Using the microcomputer, "is more flexible. It's easy to update the information." Others believe that project information is adequately managed using a simple card system. Furthermore, they argue, some advisors like the microcomputer, while others do not. If RPP advisors leave and other advisors come in, they say, the latter may want information kept differently, and discourage use of the microcomputers.

Under the direction of the advisors, the planning officers are developing various data bases, including a projects registry. The planning officers in the projects management section of the

Planning Directorate are organizing, consolidating, and correcting the large, inconsistent records on foreign donor projects that now exist in written files. Once that data base is completed, those planning officers are to learn to enter the data into the microcomputers. The automated projects management system is intended to provide information that will enable planning officers to monitor the financial status of projects more easily.

Another data base, containing information about small rural development projects, is also being organized and will be entered into a menu-driven system to improve monitoring. Eventually, there is also expected to be an inventory of infrastructure data base which the advisors expect will be useful in planning efforts.

While there as been some positive response to these file management applications of the microcomputers, there has been very little interest among the planning officers in using the microcomputers for analysis. Aside from the work of the advisors at the request of senior officers, and the work of a few senior planners who direct the programmers and use the microcomputer output, there is little use of the microcomputers for analysis in planning. In fact, the planning officers who are not involved in developing one of the data bases mentioned above are quite skeptical about the value the microcomputers might have for their work.

There are several fundamental causes of disinterest and uninvolvement among planning officers in MFP. Although there are some notable exceptions, the planning officers currently do not carry out a planning functions. They act primarily as administrators rather than planners. Their planning skills are limited, due in part to their training and in part to their experience in the ministry. There is little incentive for them to improve their work. They are generally poorly motivated, as a result of low salaries, low status, and slim prospects for promotion. Promotions that do come take the form of compensation for meeting particular needs of their superiors, or are the product of relationships with district politicians.

The planning officers in MFP also perceive senior officers in the ministry to be largely uninterested in both analysis and the microcomputers. As one planning officer remarked, "Senior officers don't take analysis seriously. If we do it, we don't get any feedback or encouragement, so we lose interest." Another explained that he and other planning officers just "use rule of thumb" to assess projects because their senior officers will either ignore analysis, or may even respond to it negatively. In addition, several planning officers mentioned that limited and largely inaccurate data make the microcomputers an inappropriate tool for analysis or project evaluation. The few planners who do conduct statistical analysis use the Central Bureau of Statistics services to do the actual statistical manipulations.

Many planning officers also perceive the major impetus for the

microcomputers to come from the advisors rather than senior levels of the ministry. As one planning officer commented, "The upper levels have left it to an advisor. Only the advisors are pushing it, and cautiously."

Future Expansion of Microcomputer Use in MFP

A major expansion in the use of microcomputers in MFP will come with the implementation of a USAID-funded project that was approved in late 1984. The project will introduce 16 IBM Personal Computers into the ministry. The application of those microcomputers is intended to go beyond the establishment of accurate data bases, and preparation of ad hoc reports, to improve the data processing capability throughout the ministry. One aim is to computerize all of the major financial areas of the ministry. USAID and senior MFP officials hope that by making hard data on expenditures more accessible to decision-makers, the project will improve budget and expenditure monitoring.

As part of the USAID agreement, the government computer center has agreed to establish a microcomputer section within the computer center. That section will be responsible for training microcomputer programmers. It will, according to the head of the computer center, eventually constitute a cadre of government microcomputer advisors, who can provide training and programming services to any ministry that needs to develop a microcomputer capacity. The microcomputer section will also evaluate proposals from ministries that want to obtain microcomputers.

The Financial Secretary has also asked the computer center to establish a team that will coordinate and assist government-wide adoption of microcomputers. In response, the computer center has asked for microcomputers to be placed in the center, and for advisors who can provide training and assistance. In view of these recent developments, the Chief of the computer center anticipates that the importance of mainframe computers will gradually decrease and microcomputers increase in the government.

Senior MFP officers, including those in the government computer center, also expect to use the microcomputers in MFP to gain experience in the use and potential effects of microcomputer adoption. That experience will provide a basis for developing overall recommendations for the entire government. The attitudes of the senior officers in the computer center appear to have altered substantially during the first year and a half of microcomputer use in MFP. As was mentioned above, officers from the computer center voiced strong skepticism during the initial meetings to discuss adoption of microcomputers in 1983. Two factors appear to have helped alter those negative opinions.

First, MFP's experience, as well as that in MALD, is perceived by senior government levels to have been very positive. The Director of Planning and the Director of Finance, both powerful

figures, appear to feel that microcomputers have a valuable role in MFP.

Second, the general atmosphere surrounding the issue of microcomputers has changed. About two years ago, microcomputers carried the onus of being deemed by the President to be "inappropriate technology." During the past year, however, the highest levels of government, including the Vice President and other influential officials appear to have been convinced that microcomputers can be both appropriate and useful. Either the President has come to feel that microcomputers are acceptable, or he is waiting to make a final judgement. In any case, he has not made further negative references to microcomputers. He has in fact stated that microcomputer training in schools is worthwhile. In 1984, there were newspaper articles citing the contributions microcomputers can play in development of the country.(4)

Thus, microcomputers do seem, in the words of one computer center officer, to be the wave of the future. Clearly, the computer center cannot afford to be left behind. The computer center has successfully pushed to gain control over computer equipment of all kinds, including microcomputers. They have won the right to insist that any major microcomputer project in any ministry must be approved by the computer center.

Training in the Use of Microcomputers in MFP

Most of the training in MFP is provided by the Ugandan microcomputer programmer who was brought in by RPP as a consultant. He develops software and is available to answer questions from those learning to use the machines. He is also kept busy developing software in response to requests from RPP or senior ministry officers.

The groups that have displayed the most interest in learning to operate the microcomputer have been secretaries and clerks. About a dozen secretaries have been trained in word processing. A few are also using manuals and interactive training packages to try to learn to program in dBase II. The person who has responded most enthusiastically thus far is a clerk who has little evidence of math skills or background. He learned to program in dBase II by working with the interactive training software and the manuals, turning to the programmer-trainer or a RPP advisor when he needed help. He has become the most advanced dBase II programmer on the ministry staff.

It has been very difficult, however, to get finance or planning officers assigned to computer training. Although the philosophy of the RPP advisors in MFP is that it is best to train "two to three times as many people as you think you'll need," the only MFP staff person who has been trained in dBase II programming is the clerk.

There have, however, been signs of change. In mid-1984, the

government computer center sent two programmer analysts to the budget section of MFP to work with the microcomputers. Using the manuals and interactive training packages, they are teaching themselves dBase II and various other software packages. They are also giving limited training in data entry to a middle level officer in the budget section.

RPP has sent two statistical officers to the United States for Masters degrees in the quantitative aspects of regional development planning. Arrangements have been made for those officers to have access to microcomputers so that they will be familiar with them when they return to Kenya.

For most planning and finance officers in MFP, however, there has been little involvement with the microcomputers. The training effort for those officers has been passive rather than active; that is, the officers must take the initiative to go to the computer room. There, the programmer-trainer is available to direct officers to the correct disks and training manuals, and to answer questions. As of the time of this study, in the fall of 1984, however, no finance officer had chosen to begin training (other than the budget officer mentioned above).

The planning officers of some planning sections were supposed to begin training by July 1984. A few have begun to learn word processing. Most, however, went to the computer room for one or two days, but stopped. Their stated reasons were several. One concerned training. The training approach first introduces a planning officer trainee to the microcomputer operating system language (usually CP/M) and its functions. After one or two sessions, the trainee is usually given an interactive training disk for the database management package, dBase II. Planning officers who learn the basics of dBase II will then be introduced to the statistical packages.

To the planning officers, however, the microcomputers seem exceedingly confusing, and there is no systematic training program that dispels the confusion. There is no overview of the ways in which the various software packages are related to planning officers' work. Nor is there any overview of the capabilities of each machine. The initial CP/M training seems exotic and unrelated to their work, discouraging many planning officers. Often, when they go to the computer room the brand of microcomputer on which they had previously been working is in use. Since they do not want to begin learning another type, with another operating language and system, they leave. Adding to those problems is the necessity for planning officers to frequently interrupt training when they go out to the field to review projects. The lack of an organized training program makes it difficult for them to pick up where they left off, and dispels any sense of progress.

Although the trainer is in the computer room full time, and is available to answer questions, both he and the clerk-programmer

are kept busy developing software. The planning officers feel uncomfortable "interrupting" the trainer or clerk with repeated questions. The self-training manuals that the planning officers are to use provide exercises that are unrelated to the kinds of work the planning officers do. The trainer feels that it would be far better to provide exercises directly related to the officers' work, but has not had the time, and is unsure whether he has the authority, to develop such materials.

Other less important circumstances add to the planning officers' discomfort. One is the necessity of working next to clerks and secretaries, who are often more adept with the machines than the planning officers. The planning officers' inability to type makes using the machines frustrating and time-consuming. If the more important problems were resolved, and there were strong incentives to learn to use the machines, these minor disincentives might be easily overcome. As it is, they loom large for many planning officers.

IMPACTS OF MICROCOMPUTER USE IN MFP

At the time of the field work for this study, microcomputers had been used in MFP for only a year and a half, and their impacts were limited. Thus far, the benefits have related primarily to the ability of RPP advisors to respond to ad hoc requests for information by senior officers. Such uses have substantially improved the ability of the advisors to support the implementation of government policies. In some cases, the policies are critical. RPP advisors' design and utilization of a microcomputer system to facilitate distribution of food supplies to drought-striken areas is one example of such an application.

One clear impact of the use of microcomputers in MFP is a change in the attitudes of senior officers in MFP about the benefits of microcomputer use. Senior officers in finance, planning, and the computer center are not yet willing to commit themselves (they "have not decided yet"). It seems clear, however, that, barring a catastrophe related to microcomputer use, there will be a place for microcomputers in the Kenyan government. That microcomputers can be used appropriately within the government has become an accepted view, a significant change in the general atmosphere from that of a year and a half ago. Senior decision-makers, even in the computer center where there are substantial investments in mainframe computers, believe that there are tasks for which the microcomputer is most suitable.

By the end of 1984, however, the benefits of microcomputer use still took the form of objectives rather than achievements. Nonetheless, it is useful to present the kinds of impacts which RPP and MFP officers hope the microcomputer will have. The reader should keep in mind, however, that the following are <u>anticipated</u> rather than actual impacts.

One important contribution MFP senior finance officers expect

from the microcomputer is a reduction in the time needed to produce the budget. Currently, finance officers use hand calculators to add the many figures in the budget. Frequently, a second calculation to check accuracy differs from the first. A great deal of time is consumed calculating and recalculating to obtain accurate figures. If the figures are changed, as they often are during the budget production process, the entire calculation process must begin again. Once the figures are calculated, they must be typed by secretaries using typewriters. The product must then be proofread by the finance officers. Usually the number of typing errors requires several pages of the documents to be retyped in their entirety, then completely re-proofread. Finance officers and secretaries often go through the typing-proofreading cycle several times. The document must then be typeset, requiring yet another cycle of proof-reading, corrections, and further proof-reading. The entire process is made even more difficult because it occurs under severe time pressure.

One senior finance officer gave a vivid description of the conditions that traditionally accompany preparation of the budget estimates. The estimates, he explained, have three parts. If one part is changed, the others must also be changed. "Sometimes people are working 12 hours a day to try and balance the figures. Typing also takes too long. The estimates are thick and the typists are continually making mistakes. People get mad at the secretaries, and go running around looking for a calculator. Then they get directions to cut the submissions, and they have to change everything."

The finance and budget officers anticipate that use of the microcomputer will reduce the amount of time they must spend proofreading and correcting the document. Their discussions with RPP advisors, their limited observation of the microcomputer use in MFP, and what they have heard about MALD, have shaped their expectations. RPP advisors have explained that the microcomputers can improve the situation by performing calculations automatically. The machines will also permit corrections to be made to the original documents, so that only the corrections will have to be proofread. The microcomputers can then be used to cut stencils, making it possible to skip the typesetting stage.

The top echelon within MFP, and RPP advisors hope that use of the microcomputers will enable finance officers to spend more time analyzing the submissions from the operating ministries and interacting with the ministries rather than, as in the past, arbitrarily cutting ministry budget submissions and giving the ministries only a brief opportunity to look over the result before the budget is printed. Without the use of the microcomputers, those problems were likely to intensify. The burden of information processing will increase rapidly as the ministry attempts to comply with the district policy focus by disaggregating the budget by district.

RPP advisors also anticipate that the new finance information system will enable them, and the finance officers, to obtain data in a form that can illuminate problem areas. It will, for example, be possible to aggregate and analyze expenditures such as personnel costs, that are now listed separately according to budget heads. The advisors' expectation is that by doing so, the microcomputer will make possible better control of spending levels.

Finance officers and RPP advisors also intend for the new finance and budget systems to integrate records that are now scattered throughout the ministry. Maintaining central files of those records would be unwieldy using paper copies. Past attempts to organize even smaller central data bases have failed because records are removed and not replaced. The existence of a coherent data base on the microcomputer will, RPP advisors hope, help senior officers to maintain an integrated file.

The payoffs to MFP for gaining better control over financial information would be high. There are, for example, substantial World Bank loans that Kenya has had approved, and is paying commitment fees on, but, due to inadequate management information, has never used. Another area requiring improvement is expenditure monitoring of donor-aided projects. Better monitroing could both help to improve the projects, and enable the government to submit more timely claims for reimbursement. There are many such areas that can be improved with a computerized information system. In most cases, the information is already gathered by the ministry, but is not brought together in a form that makes it available for use in decision-making. It is hoped that by using the microcomputer to produce financial reports more quickly - monthly or bi-monthly rather than quarterly - the information system will become a management tool rather than merely a record-keeping device.

The use of the microcomputers has already made financial information available more widely within the ministry. Much of the information is accessible to anyone who knows how to operate the microcomputer, or who watches someone else use the data. The possibility of increased decentralization of control over information is not a matter about which all senior officers are sanguine. For some, broad accessibility of data raises the spectre of loss of control over ministry processes. Senior officials in MFP have ordered that tighter control be established over access to many kinds of information available on the microcomputer.

Perceived Impacts on Employment in MFP

Because microcomputers have been used for a limited period, impacts on job quality and employment are primarily a matter of speculation. Secretaries who have learned word processing say that the microcomputer helps them to do their work faster and is less tedious to use. Although they know that government policy

is not fire any staff, they also wonder if some secretaries might not lose their jobs if word processing becomes widely used. Some senior officers anticipate that the microcomputer will create employment in some areas while it limits employment in others. One finance officer projects an increase in jobs to analyze the information that will become available.

Some advisors argue that more labor-intensive methods simply can not do many of the requisite tasks within an acceptable time period. Processes that must be done sequentially and rapidly make labor-intensive methods infeasible. They also cite limited managerial skills as an absolute constraint on the number of personnel who can be productively be involved in a process. In their view, the microcomputer permits many processes to be conducted within a reasonable period of time that otherwise would not be done at all.

CHAPTER V

MICROCOMPUTER ADOPTION IN THE MINISTRY OF FINANCE, INDONESIA

OVERVIEW OF THE CHAPTER

This chapter examines microcomputer adoption by Indonesia's Ministry of Finance. It first introduces the general conditions that convinced government officials of the need for improved information systems. It then briefly describes the structure of the ministry, which is important to understanding how microcomputers were adopted and are being used.

The chapter then discusses the circumstances within the ministry that led to the introduction of microcomputers. It considers the local MOF offices' reaction to the microcomputers, which are intended by MOF headquarters to significantly circumscribe alter the autonomous power of district offices.

In examining use of the microcomputers, the chapter considers each directorate separately. For each directorate, a section discusses the conditions leading to adoption of microcomputers, development of the microcomputer system, and anticipated effects of the microcomputer system. A section of the chapter then reviews the training conducted in the ministry. After a brief overview of the approach to training, the section discusses training carried out within each directorate. It describes the efforts to develop staff to operate the microcomputers, and staff capable of effectively utilizing the information provided by the microcomputer system. The final section on microcomputer use considers structural obstacles to effective use.

The chapter closes with a brief description of the impacts on employment and job quality that ministry staff have experienced or anticipate.

PRESSURE FOR CHANGE

Like other developing countries, Indonesia has felt the pressure of world-wide economic slow-down, and experienced a drop in trade revenues. As the volume of government operations has grown, government hiring has kept pace, although productivity per employee is generally limited. The centralization of the bureaucratic structure has generated an ever-increasing flow of documents from the local areas to the center, overwhelming the capacity of the center to deal with the information it receives. There have been few administrative reforms during the past 15 years, while the constraints of limited management skills and increasing costs become more binding. Thus, although the finance and budget systems in Indonesia are not nearly as overwhelmed as was the case in Kenya, the government is facing mounting problems in the efficiency and effectiveness of its operations.

In partial response to these demands on the government's information processing capacity, computerization has been instituted to some extent in all the major ministries, in the military, and in most parastatals. Nonetheless, microcomputer use was relatively new and extremely limited until the fall of 1984.

THE STRUCTURE OF THE MINISTRY OF FINANCE

Before examining the adoption of microcomputers in the Ministry of Finance (MOF), it will be useful to briefly present the organization of the ministry. The head of the Ministry of Finance is the Finance Minister. Beneath him, are directorates, each headed by a Director-General, that are responsible for various sectors of finance, including customs, tax, budget, home affairs monetary conditions, and foreign affairs monetary conditions. Also reporting to the Finance Minister are the Secretary General of the computer center for the ministry, PAIK, and other Bureau heads, e.g., the head of the Census Bureau.

The Center for Analysis of Finance Information (Pusat Analisa Informasi Keuangan, PAIK) is responsible for assessing computer needs within MOF, helping to develop computer applications systems, and training staff in the various sectors of the ministry. In order to meet the needs of each directorate, PAIK staff are divided into groups. Each group consists of two systems analysts and three to four programmers. The groups are each assigned responsibility for understanding and addressing the information system needs of a particular directorate; thus, there is a group for budget, for taxes, for foreign aid, and so on.

Each PAIK group also has counterparts within each directorate. The groups from PAIK and from each directorate work together to develop computerized information systems for that directorate. Within each directorate is a computer center - one for the Tax Directorate, the Customs Directorate, and so on - but they do not include technical staff. Instead, PAIK provides the technical staff, including trainers, and sometimes including computer operators.

Because PAIK is responsible for the information systems throughout the ministry, all the directorates report to PAIK regarding computerized operations, and any directorate can get information about the systems in other directorates by contacting PAIK. The PAIK-directorate teams can propose computer adoption, including microcomputer adoption, to the top decisionmakers in PAIK. If the proposal is convincing, PAIK then presents a formal proposal to the appropriate Director-General, and to the Finance Minister, who make a final decision about adoption.

INTRODUCTION OF MICROCOMPUTERS

Although there have been a few microcomputers in MOF for two or three years, they were used in a very limited way until recently. They were primarily isolated machines used within offices for limited record keeping or report production. In the summer of 1984, however, a major change was initiated. The Ministry of Finance purchased 200 IBM Personal Computers, in response to a proposal from PAIK.(1)

That proposal, spearheaded by the head of PAIK, did not grow out of pressure exerted by external agencies nor specific domestic financial crises. Rather, the decision appears to have developed out of concern for on-going problems in the Tax and the Customs Directorates. As the economy has grown, it has become increasingly difficult to keep track of taxpayers, to control tax and customs collection, and to prevent irregularities in the payment and collection of those fees. It was apparent that in some local districts taxpayers were filing returns and paying taxes, but the taxes never reached Jakarta. The head of PAIK made a strong case to the Minister of Finance that better control over those revenue-generating areas was essential, and that an important component of establishing such a system would be adoption of microcomputers in the district offices of the Tax and Customs Directorates. The proposal was consonant with increasing attempts by government leaders to cut down on corruption at the middle levels of the bureaucracy.

The lack of an efficient information system was also creating other problems. There were long delays before the headquarters of the Customs Directorate received information about customs revenues, limiting its ability to provide necessary information about streams of revenue. It was also extremely difficult to obtain good trade statistics because the information about imports was insufficient and inaccurate.

The decision to place microcomputers in each district tax office and each local customs office was received with a distinct lack of enthusiasm on the part of many local tax and customs offices. District tax officers voiced reluctance to learning to operate a computer and concern about breaches in the security of tax information. In some cases, it was clear that local officers were antagonistic to the introduction of a process that was likely to severely limit opportunities to use their official positions for personal gain. Similar resistence was encountered from local customs offices.

USE OF MICROCOMPUTERS IN MOF

The Tax Directorate

By the fall of 1984, microcomputers had been placed in the 69 district tax offices. The information management system into which the microcomputers were integrated was designed by the

PAIK-Tax Directorate team. The intent of the system is to establish and maintain more accurate and efficient files on taxpayers, while integrating the microcomputers into the larger computer system that was already established at the central and regional offices.

The microcomputers are part of a new system of tax reporting that is designed to reduce irregularities in tax collection and reporting at the district level. Previously, tax collectors went into the field to assess and collect taxes. The tax payments were recorded at the district level, and the details where retained at the district office. Tax payers were audited at the district level, and the local tax office reconciled taxes due and taxes payed. Aggregate statistics were sent to the provincial level, along with the taxes that had been collected. The level of aggregation of tax information forwarded to the provincial office varied among the districts. There was rarely greater detail, however, than the final amount paid by individuals; some districts sent only the total amount collected for villages, or even for the district as a whole.

PAIK, working with expatriate advisors, designed a new system for gathering income tax records and revenues, maintaining files, and analyzing the information. Under the new system, there is no contact between local tax collectors and taxpayers. The taxpayer sends his/her tax form and payment to the local office. A district officer immediately enters the information from the tax form into the microcomputer. The data are then entered a second time by another operator and the two records are automatically checked for consistency by the microcomputer. The microcomputer produces a letter to the taxpayer informing him/her of the tax number assigned, which can be used for three months. The microcomputer also produces a card with the taxpayer's address, which is kept at the district.

These aspects of the new system are considered by both PAIK and the advisors to significantly improve the tax information and revenue collection system. Other aspects of the system, however, worried advisors to PAIK. Although the advisors were impressed by what PAIK had accomplished, its goals for "popularizing" computerization, and the quality of its efforts, they were concerned about the scale of the new system. They believed that there were potential problems, many of which were associated with demands on the communications infrastructure.

Of particular concern to the advisors was the system component that called for mailing microcomputer disks back and forth between the district and regional offices. As the system was designed in the fall of 1984, the district office was to mail the microcomputer floppy disk of taxpayer information to the regional office each week. At the regional office, the information was to be entered into a minicomputer, to produce a cumulative file on another floppy disk. The regions might also make corrections of the data on the disk. The microcomputer floppy disk was then to be returned to the district office, and the minicomputer floppy

disk was to be sent to Jakarta. There, the information was to be entered into the mainframe computer, and taxpayer identification cards were to be produced.

The advisors felt that it would be very difficult to maintain such a system and ensure that records at the district and regional levels were mutually consistent and accurate. The advisors were also concerned about the difficulty with which confidentiality of tax information could be maintained if the disks were transferred back and forth between the local, provincial, and central offices.

Some advisors were also concerned that introducing the microcomputers in such large numbers would make it extremely difficult to preserve security of the data within the microcomputers at the district level. They felt that once the local offices understood how to use the microcomputer, the microcomputers might be used for even greater corruption. That kind of "electronic corruption," they feared, would be even more difficult to identify than what was already occurring. Finally, they were concerned that the level of effort, particularly the training effort, would simply be too great given the skilled labor resources available.

These advisors suggested that a simple, centralized system would avoid many of those problems and enable PAIK to perfect the system before expanding it. A phased approach to expansion, they felt, would permit PAIK staff to deal with each issue on a much smaller scale, enabling them to resolve problems more easily. The advisors were worried that the massive effort might result in a great many errors, as well as lack of confidentiality of tax return information. The result could be alienation from computerization that would take a long time to reverse.

PAIK was aware of the advisors' concerns. Yet they were confident that they could handle the scale of microcomputer introduction as planned. In late 1984, they revised the system to attempt to resolve many of the issues that the advisors had raised.

The revised system no longer calls for floppy disks to be sent back and forth between the district and the regional offices. Instead, all data flows from the district to the regional level. Each week, the districts make a streaming tape of the taxpayer information collected during the week. They send the tape by mail to the regional office. At the regional office, the information is entered into a minicomputer to produce a cumulative file. The regional office sends the data to Jakarta to be entered into the mainframe computer.

At the district level, microcomputers are to be used only to prepare information to be sent to the regional office, and to maintain files on tax information at the district office. At the regional offices and at headquarters, the computer system will be used to keep records, monitor tax collection, automatically check tax returns using auditing routines, analyze trends in individual

and district tax payments, and produce reports.

The district offices are being made aware of the several cross-checks that are performed on the tax information at the regional and central offices. If the regional office does not receive an individual's tax report within a short time of the date of filing, inquiries are made at the district office. If there are questions about tax records, or an audit must be conducted, the region directs the district office to conduct the audit and file a report. The corrected information is than sent to the region, where the cumulative file is updated. The regional office also follows up to ensure that tax payments are corrected.

Although it is too early to evaluate the system generally, and these modifications in particular, it is useful to consider projections by the advisors and PAIK staff. The overall assessment of the advisors is that the system as it is now designed has a good chance of success. They, as well as PAIK, are counting on the psychological impact of the microcomputers to reinforce the formal aspects of the system to prevent corruption at the local level. Initial experience with the system also suggests that PAIK's expectation that the microcomputers will pay for themselves by limiting corruption at the local level is not unrealistic. In some districts that have installed microcomputers, the number of taxpayers doubled since the computer system has been used.

PAIK also expects that the system, of which microcomputers are an integral part, will make it possible to increase control of ministry processes by ministry headquarters. PAIK officers intend for stand-alone microcomputer use to be limited to local administrative office work, or isolated office work within directorate headquarters. For work that is part of a larger network, they envision the microcomputers linked to the mainframe computers and used as terminals, with the actual manipulation of data being done on the mainframe computer. They also anticipate that a systematic effort to improve analytic skills within the directorate will be necessary to realize the full benefits of the microcomputer system.

It should also be mentioned that despite the fact that the highly skilled PAIK staff is underpaid and overworked, there is strong enthusiasm about the microcomputers and the new system. Morale generally appears to be high within the bureau. As one advisor said, "They do these things, and sometimes they just succeed because they don't know it's impossible."

The response of local tax offices affected by the microcomputer system has, in contrast, often been negative. Several district offices have complained about mistakes in tax records entered into the microcomputer, and there is general disgruntlement with having the machines placed in their offices. PAIK headquarters attributes most of these complaints to resistence of local officers to giving up some of their authority and opportunities for private financial gain. They also feel that some of the

reaction is impatience with the inevitable problems associated with getting a system up and running. They believe those concerns will decline as the system improves and people become more comfortable with it.

To some extent, the resistence at the local level is not to the microcomputer *per se* but to the local office's loss of power to headquarters. In part, this reaction may be a response to fewer opportunities for private gain. But it is also a reaction to the loss of certain decision-making powers that local offices are loath to give up to headquarters, which they perceive to be often out of touch with local conditions.

In some district offices, however, there has been a more positive response. Office Directors have become interested in using the machines for office administration, e.g., to keep employee records. It is unclear, however, to what extent PAIK will approve diverting machine use to administrative tasks of the local offices.

The Customs Directorate

In the Customs Directorate, the microcomputers are moving into the field more slowly than in the Tax Directorate. A pilot project is being developed in the office at Tanjung Priok, a large port in Jakarta. After the system is implemented and operating well at Tanjung Priok, it will be duplicated at customs offices in the rest of the country.

There has been resistence from local customs offices that is similar to that from local tax offices. Offsetting that response in Tanjung Priok, has been the opportunity for selected staff to receive extensive and valuable training in microcomputer operations. That opportunity seems to have generated more general enthusiasm and excitement about the machines. There has also been concern in the Customs Directorate about the possibility that introduction of microcomputers will involve loss of some of the directorate's traditional authority to PAIK. The directorate is making a concerted effort to develop technical competency in its staff, by training them in programming and general computer operations. By doing so, they hope to retain control over all the processes within their jurisdiction, rather than turning some over to PAIK.

The microcomputer system in Customs, like that in the Tax Directorate, will initially operate primarily as a record-keeping and limited monitoring system. Senior MOF officers anticipate that the microcomputer system being installed in the Customs Directorate will both improve the accuracy of local work, and delimit some of the independent decision-making authority currently held by the local customs office.

The system is expected to eventually account for every piece of cargo, and ensure that the correct duty is collected. The

information entered into the microcomputers will be used by headquarters to check on the consistency of local office revenue reporting, and to provide data for analysis of trade, import trends, and revenue projections. The microcomputers are also to be used for administrative tasks internal to the local offices. Senior MOF officers also expect that this microcomputer system, like that in the Tax Directorate, will pay for itself through increased revenues. They acknowledge, however, that many of the intended improvements will require improved management skills and analytic skills at all levels of the directorate.

The Budget Directorate

While the major thrust of microcomputer adoption has been in the Tax and the Customs Directorates, microcomputers are also being introduced into other directorates of the ministry. The budget section of PAIK, for example, has had about 15 microcomputers for about a year. PAIK programmers and systems analysts in that section are using software they developed for use in budget activities, as well as packaged spreadsheets for simple calculations. A number of Budget Directorate officers are working with PAIK staff, learning to operate the microcomputers and helping to develop the information system for directorate work.

Thus far, the microcomputers have been used primarily as record-keeping tools and to produce simple reports. PAIK staff also plan to use two microcomputers to help the Budget Directorate produce disbursement invoices to venders, and keep records of those transactions for use in preparing the national budget.

PAIK and budget officers also expect that microcomputers will be used in the Budget Directorate to improve project expenditure reports. Currently a mainframe computer in Bandung is used to compile project expenditures reports received from local budget offices each week. Several problems have been associated with that system, however. Expenditure data from the field are received, recorded, and compiled manually at local offices, resulting in many errors, some quite serious. The information is then sent from the field to Bandung, where additional errors are made as the information is entered into the mainframe computer. Correcting those reports absorbs substantial professional staff time, leaving little opportunity for budget officers to analyze the data.

To help ameliorate at least part of the problem, there will be a pilot project using microcomputers to produce the reports at Bandung. If use of microcomputers seems to improve production of those reports, there will be trial introductions of microcomputers in local offices. The data then can be simply recorded directly into the microcomputer, and calculations performed automatically, at the local office. The diskettes will then be sent to Bandung to be read directly into the mainframe computer.

According to PAIK and top budget officers, improvement of the expenditure monitoring process will require more than adoption of microcomputers. Training is needed to improve analytic skills of directorate staff, as well as to develop some technical skills related to information systems.

Microcomputers may also assist in the preparation of the budget. Currently, many budget preparation procedures are carried out manually. A mainframe computer in PAIK, with terminals in the Budget Directorate, is used to produce the final budget documents and to keep the large data files associated with the budget. It is also used to send lists of approved projects (Daftar Izin Proyek) along with their financial commitments, to the provinces.

Many components of the current budget preparation process are time-consuming and inefficient, however. Each year, for example, estimates are developed for each development project as though the project were new. There is no projection of ongoing project commitments, which constitute most of the development budget, to determine marginal annual estimates. As a result, every year there is substantial unnecessary duplication of effort in producing the development budget. Furthermore, the information system makes little provision for comparative evaluation of projects. When budget cuts must be made there is a tendency to use rather blunt instruments, e.g., cutting certain items, such as travel, across all ministries. If there were better command over the data, budget officers might be better able to make selective and appropriate cuts in appropriations. There is a plan to address some of these needs by processing all budget documents using a mainframe computer at PAIK, with some collateral work done on microcomputers.

Microcomputer Training in MOF

PAIK staff includes skilled systems analysts, programmers, and computer operators. Many of the systems analysts have taken university courses in management, finance, and the social sciences. Most of the PAIK staff are familiar only with mainframes, however, and have only recently been introduced to microcomputers. While they are highly skilled in high level computer languages, they know little about packaged software available for microcomputers. They tend to be overworked and understaffed, and have more than enough to do developing systems for which no appropriate packaged software exists. They would benefit from training that acquaints them with the packaged software that is available for designing reports and other appropriate tasks.

To assist in the design of the microcomputer information systems for the directorates, a number of advisory groups from abroad are working with PAIK staff. Those groups often have differing orientations regarding optimal systems, so that the PAIK staff are exposed to more than one perspective. PAIK staff who are

designing the tax system, for example, have worked with a German Cooperative Team, which exphasizes a decentralized system, and a United States Internal Revenue Service team, which provided training in developing the components of a more centralized system.

A major advantage of microcomputers, in the eyes of PAIK officers, is that they are "easy to handle and everybody can use them."(2) PAIK officers expect that microcomputers can spread "computer literacy" throughout the ministry, helping to develop widespread appreciation and understanding of what computers can do. Several senior officers in PAIK feel that, for most people, microcomputer use should be the first step in learning to use any computer. Only if microcomputers can not do the job necessary, should investments in time and money for training in the use of the mainframe be made. Thus, there is an expectation that microcomputers will be widely used throughout the ministry, with comparatively small investments in training.

Training in the Tax Directorate

For the Tax Directorate, systems analysts and programmers from PAIK, along with staff from IBM, will "train the trainers," from each district office in which microcomputers are placed. The approach to training is based on the assumption that most people are resistant to using computers. They must, in one PAIK officer's words, "first become computer-minded." Therefore, the computers will be introduced with easy first steps, including playing computer games. When people are more comfortable with the machines, they will be introduced to the kinds of tasks microcomputers can do that are directly related to their work.

Because skilled staff are limited, particularly in local offices, PAIK headquarters is designing simple, interactive, menu-driven systems, in Indonesian, that will be used in those offices. PAIK staff wrote the user manuals, established the procedures, and wrote the software. To choose microcomputer operators, the headquarters team communicated with the regional offices, who then directed the district offices to select applicants. Those applicants were given an aptitude test developed by PAIK. The operators who were chosen are generally young; about 10% are women.

The operators are brought to one of the 12 training centers outside Jakarta or four in Jakarta for about a week of training. Training uses the manuals that were developed at PAIK headquarters, and exercises that are directly related to the work in the tax offices. Shifting to the computerized system will be done in stages. In the first stage, during which PAIK expects the operators to make many mistakes, the manual system will continue to be used so that files will be maintained. In later stages, the operators will be expected to be more accurate, and the system will gradually become completely computerized. By moving slowly, stage by stage, PAIK officers expect that

resistance will decline and skills will rise.

Training in the Customs Directorate

In the Customs Directorate, training will also be a gradual process. Although many of the components of training in the Customs Directorate are similar to those in the Tax Directorate, Customs anticipates developing a microcomputer staff that is more independent of PAIK.

The customs office at Tanjung Priok is sending some staff members to a private computer course that is expected to provide a thorough introduction to microcomputer use, hardware and software, some programming language background, and other aspects of microcomputer use. Those staff people will also go abroad for some training in microcomputer operations. Customs Directorate officers anticipate that that background will enable the customs staff to eventually become skilled programmers and the permanent staff running the microcomputer system at Tanjung Priok. That training effort, as part of the pilot project to introduce microcomputers into Tanjung Priok, will be replicated at other local customs offices if the results at Tanjung Priok are satisfactory.

Training in the Budget Directorate

Several of the 20 systems analysts and programmers in PAIK's budget section have learned to operate the microcomputers, usually through self-training. They are training Budget Directorate staff, usually by working with them directly on applications. The intended uses of microcomputers in the Budget Directorate appear to be much more complicated than those in the Tax and Customs Directorates. Budget officers are going to be expected to analyze massive amounts of data. What will therefore be needed, in addition to training in operating the microcomputers, will be training in effective ways to analyze those figures. The latter form of training has not yet been arranged.

A central problem in training the directorates' staff is the difficulty in retaining skilled personnel. Although the staff are generally eager to receive training, and enthusiastic about learning new skills, those who become highly skilled in technical areas often leave the ministry for more lucrative positions elsewhere. The incentives in the Budget, Tax, and Customs Directorates are simply not competitive with those offered by other organizations recruiting technically skilled finance and management staff.

Obstacles to Effective Use

A major obstacle to effective use of the microcomputers in MOF relates to a problem that plagues organizations in the developed as well as the developing countries: the integration of technical knowledge with substantive knowledge in order to develop an information system appropriate to the particular organization.

The difficulty in establishing effective communication between technical and "content" people has been recognized by PAIK officers. They have attempted to resolve the problem by increasing formal communication between the two groups using the team structure mentioned above. Thus, PAIK technical staff have been working for several years in teams with local customs offices. In the Tanjung Priok office, for example, PAIK staff have worked with customs officers for almost five years. In the Tax Directorate, the PAIK-Tax Directorate team has been working together for two years.

It is hoped that by working together, staff for PAIK and the Tax and Customs Directorates' staff will improve their understanding of each other's area of expertise. PAIK expects that the information system that emerges from the improved communication developed in such teams will better meet substantive needs of information users, while taking advantage of technical efficiency and effectiveness.

There are a number of problems with the existing process, however. One difficulty is that the "content" staff (e.g., tax officers) tends to defer to the technical staff (i.e., PAIK officers) in the development of information systems. At the same time, the technical people often feel that the content staff are not capable of making valid decisions, and the design of systems should be left to the technical staff. As a result, the information system often does not meet the needs of the content staff who will be using it. A problem that developed in the Customs Directorate illustrates the point. A system to project customs revenue was developed by PAIK staff without involvement of customs officers. Unfortunately, the technical PAIK staff made assumptions about cargo evaluation which were based on limited understanding of the complexities of the process. As a result, the program used a faulty basis for analyzing revenue, and provided unrealistic projections.

Equally dangerous is the lack of training for "content" people in the principles of the technical system. In the Tax Directorate, for example, there have been problems because the tax staff have difficulty conceptualizing the principles of a computerized information system. They want to simply transfer all the information that is now on paper to the microcomputers, including too much information in a way that does not exploit the advantages of the microcomputers.

There are also indications that enthusiasm for generating data may outstrip even PAIK staff's critical assessment of what is

actually needed. Already there has been some criticism that the teams try to please everyone by including every conceivable bit of information anyone may request, without determining what is actually necessary and the best way to organize it. The result may be an inundation of information that will overwhelm rather than assist decision-makers.

Exacerbating the problem of communications between technical and content staff is the policy of frequently rotating the top officers of the technical-content team. Often, those leaders have just begun to understand both content and technical issues when they are rotated. Since rotation is associated with upward movement, those officers are highly motivated to move on rather than to stay with the team.

Impact on Employment in MOF

MOF staff are generally quite optimistic about the impacts on employment. Secretaries and clerks cite improved job quality: work is easier, less tedious, more interesting. There is also considerable confidence among the secretaries and clerks interviewed for this report that the microcomputer actually generates more work, and will continue to do so. Consequently, they are not worried about possible job loss.

The professional staff in MOF headquarters appears to be equally convinced that job opportunities will, if altered, actually increase with the use of the microcomputers. There will be more work, they believe, analyzing data and related tasks. The ultimate result, they feel, will be more efficient and effective allocation of resources.

CHAPTER VI

ANALYSIS OF THE INTRODUCTION OF MICROCOMPUTERS

The analytic framework of this study distinguishes between three broad stages of microcomputer adoption: introduction, use, and institutionalization. The literature on technology change and organizational change suggests a number of hypotheses that are particularly relevant to the adoption of microcomputers in the public sector generally, and to the three stages of adoption in particular. This chapter, Chapter VI, and Chapter VII discuss the tentative hypotheses about introduction, use, and institutionalization of microcomputers, respectively. In addition, they examine hypotheses that appear to emerge from the data. Chapter VIII considers hypotheses regarding the impact of microcomputer adoption. It should be reiterated here that the intent of the chapters is not to attempt to prove or disprove the hypotheses. It is to examine the tentative hypotheses for their apparent contribution to understanding the processes and effects of microcomputer adoption.

The hypotheses are framed in very general terms, as is appropriate to our limited knowledge of microcomputer adoption in developing countries. Such broad hypotheses seem to be most helpful in identifying useful directions for further research, which is a major objective of this study. The evidence used to examine the hypotheses is qualitative rather than quantitative, indicative rather than conclusive. As we improve our understanding of the relevant factors, the terms of these hypotheses can be sharpened.

Implicit in all of the hypotheses in this and the following three chapters is the caveat, "all things being equal." Although that qualification is not an attractive one in the complicated real world where very little in different situations is likely to be equal, it is an essential part of hypotheses that are explaining the relationship between a very small number of factors.

This chapter examines the first stage of microcomputer adoption, introduction of the microcomputers. Introduction includes the period roughly from the initial proposal for adoption to the first uses. The related hypotheses suggest possible determinants of the extent to which there is receptivity to microcomputers within an adopting agency. The hypotheses focus on four general factors (presented in greater detail in Chapter I): pressure for change, the role of key decision-makers, the response of potential microcomputer operators and users of microcomputer output, and planning for resource supply.

According to the model utilized in this study, "effective" introduction contributes to receptivity of the adopting agency to the microcomputers. To the extent that introduction is "effective," there will be:

- Commitment to adoption by at least a majority of influential decision-makers

- Available requisite resources

- A positive approach to the microcomputers on the part of users of microcomputers and output.

HYPOTHESES CONCERNING INTRODUCTION OF MICROCOMPUTERS

Hypothesis 1. Clear and consistent messages by organizational leadership, in support of microcomputer adoption, will be a critical factor generating acceptance of microcomputers among people in the organization.

Leonard and Marshall have described leadership as "the art of using and manipulating the organization's institutional heritage to make decisions, legitimate them, and mobilize resources for their execution" (Leonard and Marshall, 1982: 24). The support of the leadership has often been cited in the literature as being critical to the adoption of innovation in an organization.(1) Leadership is important not only to ensure requisite resources, but also to legitimize the innovation, to build a common vision of change, and to convince people that the change is real.

In the adoption of microcomputers in LDC governments, it can be expected that clear, consistent messages from bureaucratic and/or public leaders will be important to the organization's receptivity to microcomputers. Those messages include not only explicit statements but also implicit signals. Leaders send signals about their position vis-a-vis microcomputer adoption in a number of explicit and implicit ways. For example, the level of staff that senior officers assign to learn to use microcomputers sends implicit signals to all professional staff about the senior officers' perceptions of the role of the microcomputer. Where only clerical staff are assigned to learn to use the microcomputer, professional staff are likely to interpret that pattern as evidence that the senior levels do not consider operating microcomputers to be an activity for professionals.

The Kenya and Indonesia experiences appear to support this hypothesis. In the finance division of the Ministry of Agriculture and Livestock Development (MALD), Kenya, microcomputers were introduced to improve particular systems that were important to the top finance officer. He wanted the improvements he believed the microcomputer could make, and sent messages throughout the finance division that made clear his commitment to the adoption of microcomputers. Microcomputer use was accepted in the finance division, and there has been little expression of the belief that microcomputers are not appropriate for the division.

Only clerical staff in MFP were assigned to learn to operate the

microcomputer, however. The professional finance staff appears to have inferred from that action the implicit message that microcomputers are machines for clerks and secretaries, not for professionals. They have resisted involvement in microcomputer operations.

The "model of introduction" in the planning division in MALD was very different from that of introduction into the finance division. Microcomputers were not introduced to improve a particular, visible system in DPD. Instead, they were adopted to encourage a few planning officers, all of whom were junior officers, to do quantitative analysis. No top leader in DPD has explicityly supported the use of microcomputers. Although there are other factors involved, to be discussed below, lack of clear leadership in support of microcomputer use appears to have impeded its acceptance in the planning division of MALD.

In the Ministry of Finance and Planning (MFP), Kenya, microcomputers were introduced with the general intention of improving financial processes and planning operations. They were not introduced, however, with the intention of improving any ministry system. The only support from the top leaders for microcomputer use has been the lack of restriction on microcomputer introduction. There has been a good deal more confusion at MFP than at MALD about the "appropriateness" of microcomputers, their permanence in the ministry, and the value of learning to operate them. Ministry leaders are generally perceived by middle officers as being neutral toward microcomputer use, while the advisors are perceived as being the main promoters of the new technology. Although top leaders in the ministry do use, and apparently value, microcomputer output, they interact primarily with the advisors rather than the Kenyan officers, and that form of tacit support is not visible to the Kenyan officers.

The situation in Indonesia contrasts sharply with that of Kenya. Introduction of microcomputers in the Ministry of Finance (MOF) was initiated and implemented by the head of the ministry's computer center. The purposes of microcomputer introduction was very clear from the outset: to centralize MOF operations, cut down on local corruption, and improve the quality of information from the local level. Those objectives have strong, explicit support from top political leadership as well as from leaders within MOF. While there will be some negotiation about such issues as how the microcomputers are used and who has control over their operation, there is little if any doubt on the part of staff throughout the ministry that microcomputers will be a permanent part of the ministry operations. There is a strong commitment to training and developing structures that establish responsibility for operating the microcomputers and using the output.

Thus, while "leadership" is a nebulous quantity, it appears to be important in the early stages of legitimizing microcomputer adoption. The experiences in Kenya and Indonesia suggest that

where the senior decision-makers clearly support microcomputer adoption, there is more likely to be more rapid and widespread acceptance of microcomputers than in contexts where leadership support for microcomputer adoption is less explicit and consistent.(2)

Hypothesis 2. The greater the external pressure for change, the more likely leaders are to support adoption of microcomputers.

This hypothesis suggests that the opportunity to adopt better methods of operation will not alone induce change. In order for leaders to accept change, there must be pressure for change, i.e., external conditions must create the perception that current methods are no longer adequate.(3) The limited evidence from Kenya and Indonesia suggests that for microcomputer adoption, the relationship between adoption and pressure is more complicated than the hypothesis suggests. In Kenya, financial pressure clearly created receptivity to microcomputers in the finance division of both the Ministry of Agriculture and Livestock Development and the Ministry of Finance and Planning. Similar pressure has not been experienced in the planning division of either ministry, and acceptance of microcomputer use is far less evident in those divisions. Interestingly, the computer center's recent support for microcomputer adoption is due, at least in part, to the pressure it has come under to support adoption or lose credibility.

Thus, the experience in Kenya appears to support the hypothesis. In Indonesia, however, there is no evidence of particular pressure that induced support of microcomputer adoption. Rather, the microcomputers were adopted to improve current procedures, based on the calculated risk that the adoption would generate enough revenue to pay for its capital investment.

Why did the Ministry of Finance, Indonesia, adopt microcomputers when there was no apparent external pressure to do so? In this case, it appears that a senior individual was the critical factor. The head of the MOF computer center, PAIK, identified the need for change and spearheaded the adoption of microcomputers to induce that change. It is not unlikely that there were unidentified pressures that convinced that senior officer to initiate changes - pressures of ambition, personal history, or other experiences. There was not, however, the kind of explicit external pressure that affected finance officers and computer center officers in Kenya.

The differences in the experiences of the two countries suggests that the hypothesis stated above may be most applicable in cases where the introduction of microcomputers is initiated by an external agent. In Kenya, foreign advisors initiated the introduction of microcomputers, and the positive response to that initiative appears to be associated with the pressure for change that senior decision-makers experienced. In Indonesia, the initiative came from within the ministry, and the external

institutional pressures that were critical in Kenya's acceptance of microcomputers were apparently not necessary.

Hypothesis 3. The extent to which those who advise adoption of a microcomputer are trusted by organizational leaders, the greater the likelihood microcomputers will be effectively introduced.

This hypothesis also appears to be most applicable to microcomputer introduction initiated by external agents. The hypothesis suggests that the greater the extent to which those external agents understand the conditions of the country, and are trusted by key decision-makers, the greater the level of acceptance of microcomputers.

Support for this hypothesis comes primarily from reports from the advisors in Kenya. According to several who were not themselves key figures in the introduction of microcomputers, the long-term presence of TAP and RPP, and the positive relationships that had been developed between TAP and RPP advisors and Kenyan ministry leaders were instrumental in Kenyan officers' adoption of microcomputers.

Hypothesis 4. The "critical weight" of key decision-makers' influence must support adoption if introduction is to be effective.

This hypothesis implies that there is likely to be some conflict among decision-makers concerning adoption of microcomputers. It suggests that although microcomputers may be introduced into a context where the balance of power does not support their adoption, those conditions of introduction will obstruct effective use and eventual institutionalization.

The only case in which there was clear division among key leaders regarding microcomputer adoption was in MFP, Kenya. The President of Kenya had expressed disapproval of adoption of word processors, and, by implication, microcomputers. Top leaders in MFP were hesitant to display overt support for microcomputer adoption, given the uncertain political signals. That uncertainty has been one factor contributing to middle and junior officers' reluctance to learning to operate the microcomputers. It also led to disapproval by MFP officials of the initial proposal in 1983, (approved a year later) that the U.S. Agency for International Development (USAID) contribute microcomputers to the ministry. Had the balance of leadership opinion not shifted toward microcomputer adoption, it is likely that microcomputer use in both MALD and MFP would have been severely limited.

Hypothesis 5. Planning for sufficient resources is best done early in the process of introduction.

This hypothesis implies two preconditions: 1) Resource suppliers must be committed to providing essential resources in sufficient quantities and in a timely manner; 2) There must be some reasonable estimate of how much is enough. The importance of establishing a reliable supply of resources early in the adoption process was evident in MALD, Kenya. There, a major constraint in training staff has been lack of microcomputers. Crises in providing microcomputer output were related in part to difficulties in obtaining microcomputers when they were needed. Similarly, in MFP, Kenya, the success of microcomputer adoption will depend in part on there being a sufficient supply of standby microcomputers to ensure that breakdowns do not hamper the newly computerized budget process.

The question of "how much is enough?" is more complicated. In MALD, Kenya, the approach to microcomputer introduction can be characterized as "cautious with a clear plan." Advisors, wary of overwhelming the ministry with microcomputers and thereby creating resistance, introduced microcomputers only as a response to explicit demand related to a particular application. In MFP, many more machines were introduced and the approach has been more "confident and ad hoc." For advisors in the latter ministry, the expectation has been that having many microcomputers available would generate sufficient demand to justify their numbers.

There are risks associated with both approaches. If there are not enough machines, it can constrain effective training, leave no margin of extra machines that can be used for spare parts, and impede satisfying demand for output. On the other hand, too many machines can create resistence to what appears to be an onslaught of an untested new technology. In a situation like that of Kenya, where the initiative comes from outside the government and there has not been experience with microcomputers previously, the best alternative may be to introduce only a few machines initially, while ensuring ready access to enough machines to be responsive to rising demand.

It may be possible to proceed less cautiously in cases like Indonesia, where the initiative comes from within the government, there is considerable familiarity with computers, and the microcomputers are introduced with a specific application in mind. Nevertheless, introducing too many machines can create serious problems. The level of training effort will be extremely demanding for skilled staff, and without enough trained staff, the microcomputers may not be usefully employed. Transmitting information in ways that retain confidentiality and accuracy will be difficult if the existing communications infrastructure cannot effectively support communication among many sites. Security can be impaired when the numbers of local users make it difficult for them to be effectively monitored. The problems associated with "too much too fast" can lead to disaffection from computerization that is very difficult to reverse.

CHAPTER VII

ANALYSIS OF MICROCOMPUTER USE

The analytic model used in this study envisions the second stage of microcomputer adoption to be the use of the microcomputers. There are numerous aspects of use that are of interest in understanding microcomputer adoption in a developing country setting. For this study, the issues related to use are fairly narrow. They concern the factors that determine how the microcomputers are used, who uses the microcomputers, and the way and extent to which microcomputers and microcomputer output are utilized.

The organizational change and technology change literature suggest the importance of certain factors related to use of microcomputers and their output:

- Training
- Communication channels within the organization
- Management systems that provide incentives and disincentives for various kinds of behavior
- Role delegation and changes in roles
- Individual values, attitudes, skills and experience

The study model anticipates that the more effective and widespread the use of microcomputers and products, the greater the likelihood that microcomputer/product use will become "embedded" in the sytem. For this study, "effective" use is reflected by the extent to which the objectives of microcomputer use are attained. Assessment of effectiveness utilized the subjective judgements of users, key decision-makers, advisors, and the researcher.

HYPOTHESES CONCERNING USE OF MICROCOMPUTERS

The issues related to microcomputer use are extensive and complicated. This discussion will be confined to a small series of hypotheses that appear to be particularly valuable in explaining the factors important to developing effective microcomputer use.

Hypothesis 1. The better the training "fit" with organizational needs and operator skills, the more effective the microcomputer use.

This hypothesis identifies a key component of effective training in microcomputer use: relevance to the trainee's job. In both Kenya and Indonesia, trainers emphasized the importance of hands-on training using exercises directly related to the tasks the trainee is called upon to do in his/her work. In MALD, Kenya, the advisor-trainer found that one drawback of the standard training manuals were the exercises, which were unrelated to the actual applications Kenyan operators would use. He developed a booklet for the finance division of MALD which included a series of exercises directly related to the kinds of on-the-job applications the Kenyan operators would be called upon to carry out. In Indonesia, PAIK has invested considerable skilled staff time to develop microcomputer manuals with exercises directly related to the work of the trainees.

In MOF, Kenya, the approach has been different. Training is more abstract, introduced with explanations of fairly technical concepts and operations processing principles. Trainees use standard manuals with examples that have no relationship to the actual work they do. To the planning officer-trainees in MFP, microcomputers seem complicated, and it has been difficult for them to understand how microcomputer use relates to their work. The budget officer who is learning to operate the microcomputer is also having difficulty making his way through a manual that does not present exercises related to the applications he will use. The trainer in MFP, a computer programmer, feels that training would be more effective if there were exercises directly related to the work people will be doing with the microcomputer.

A corallary to this hypothesis was suggested by an expatriate working in Kenya: The better the training "fit" with the culture, the more effective the training. It is his view that in Kenya, the culture may make the self-training aspect of microcomputers particularly attractive. He feels that Kenyans are generally reluctant to ask questions and are particularly reluctant to do so with expatriates or Kenyans of Indian extraction. He links these responses in part to the colonial experience, when one method used by the colonial power to maintain control was to control learning. He hypothesizes that if training is designed so that trainees can work independently, without having to ask many questions, they will be more likely to learn to use the microcomputer.

Without attempting to assess the accuracy of this hypothesis, it is interesting to note that many planning officers mentioned their embarrassment at having to repeatedly ask questions of trainers. They attributed at least some of their reluctance to learning to operate the machines to their discomfort at having to frequently "interrupt" the trainer with their questions. They felt that better training instructions should be available so that they could learn to use the microcomputer without having to

refer so often to the trainer.

Hypothesis 2. The closer the "fit" between in-place skills and skills necessary for particular microcomputer applications, the more effective the use of those applications.

Implicit in this hypotheses is the notion that different kinds of microcomputer use require different kinds and levels of basic skills. There appear to be five general types of microcomputer use, each of which requires different kinds of basic skills: 1) Entering data into menu-driven programs, 2) word processing, 3) use of interactive programming packages, and spreadsheets, 4) use of statistical packages, 5) programming in "high level" languages, including dBase II and BASIC.

The first three types of uses appear to be easily taught to those with basic reading comprehension skills. The fourth type of use requires sophisticated analytic skills in order to be applied effectively. The skills required for the fifth type of use are less clear. The experience of the TAP advisor in MALD suggests that four years of high school mathematics are necessary to become a skilled programmer of dBase II. At MFP, however, the clerk who has mastered dBase II programming has very little math background. The kinds of skills related to aptitude in programming remain unidentified, as do methods for identifying those skills.

The cases make it clear that the training required for a particular system depends on the needs of that system. In the finance division of MALD, Kenya, for example, it was necessary to train skilled dBase II programmers who can produce customized reports for finance officers. In the planning division, microcomputer operators are planning officers who use statistical packages and spreadsheets to produce information they will use themselves. The most rigorous aspect of the planner's training is preliminary to microcomputer use, so that he/she can design a reasonable model, gather appropriate data, and interpret the statistical results. Planning officers who have that background have learned to use packaged computer programs relatively easily, and have been largely self-taught.

The new projects management system in MALD provides a good illustration of the dynamics involved in determining the kinds of training needed. If standardized project management reports can meet the needs of information users, then a series of menu-driven programs can be designed by an advisor or a programmer. Using menu-driven programs will require little training for microcomputer operators. If the projects management information can be presented in essentially standard reports that must be modified in a limited way along a set of given characteristics, one or two people may be trained in interactive dBase II. Again, extensive programming training will not be necessary. If, however, customized reports will be required which cannot be anticipated with pre-designed software programs, then it will be

necessary to train highly skilled dBase II programmers. That level of training will be much more complicated and time-consuming.

The knotty problem confronting those providing the most complicated forms of microcomputer training is deciding who to train. Practically speaking, there may be few options in the field: only a very few people may be available for training. The experience in Kenya suggests that the limitations may imposed by the incentive system (discussed below) rather than the physical presence of people with appropriate in-place skills.

In MALD, Kenya, for example, substitution of dBase II for packaged spreadsheets carried with it requirements for much more demanding training. The advisors wanted to train finance officers to program in dBase II, but were unable to obtain professional staff for that training. Although middle and senior level professional staff were willing, and in some cases eager, to receive the microcomputer output, they had little interest in learning to program in dBase II, at least during the first three years of microcomputere use in the ministry.

Given the lack of interest on the part of the professional staff, the TAP microcomputer advisor was limited to training clerical officers in dBase II programming. The task was difficult, and only one clerk has become a skilled programmer, although a second can carry out simple programming tasks. Yet the effort was successful in preparing at least one MALD staff person to take over programming when the microcomputer advisor departed. TAP hopes that the skilled clerk-programmer will be able to train additional Kenyan programming staff.

TAP's training of clerical staff to program in dBase II raises the issue of "contentless programming." Does it make sense for clerks, who do not understand the financial and budget information, to learn to program? The answer to that question for MALD appears to be yes, for two central reasons.

First, even without understanding the content, the clerk-programmers can, and do, manipulate the information in response to requests by those who do understand the content -- currently, in MALD, the TAP advisors, as well as some finance officers. Clerk-programmers, in effect, take on tasks that might otherwise have to be done by professional staff (see Chapter I for further discussion of differentiation of microcomputer functions). By doing so, the clerks effectively relieve managerial and professional staff of time-consuming chores. Given the scarcity of managerial and professional skills in MALD, as in the governments of most developing countries, that contribution is extremely valuable. Even after some MALD professional staff understand dBase II programming, it is likely that they will leave most of the programming tasks to the clerk-programmers.

There is a second consideration. Recent socio-technical studies in the United States suggest that microcomputers are used most

effectively when job functions begin to overlap.(1) According to this model, microcomputers are used most effectively where there is extensive communication between the clerical/secretarial staff who operate the microcomputers, and the professional staff. The former eventually understand some of the content of the information, while the latter better understand the principles of microcomputer operation. The professionals may key in some data and do some programming, while the clerical/secretarial staff participate in decision-making about the microcomputer applications.

It is too early to tell whether this ideal model will ever be approached in MALD. There is increasing communication between the professional staff and the clerk-programmer, as they discuss the microcomputer output needs. What is pertinent for MALD, and for the Kenya and Indonesia ministries generally, however, is the extent to which that communication will continue to expand. Clerks will not make finance and budget decisions, and finance officers are not likely to take on many of the skilled microcomputer programming tasks. Yet both groups should understand the principles and issues involved with one another's jobs. The greater the communication between them, and their understanding of one another's work, the more effective the system is likely to be. Unfortunately, strong status divisions tend to obstruct communications between clerk-programmers and professional staff.

The MALD experience illustrates that where the microcomputer operators are not the users of the information, it is valuable for them to develop some understanding of the content of the information with which they work. In MALD, for example, clerks carrying out the bulk of the programming tasks must be directed by people who understand both the finance and budget system and the principles of dBase II software. Currently, only TAP advisors can serve that function. Similarly, in MOF, Indonesia, team members must understand the content of the tax or the customs processes as well as the principles of microcomputer operations in order to participate effectively in developing a system for their Directorates.

The cases also illustrate how critical it is that those who use microcomputer output understand at least the principles of microcomputer operations. If those who use the microcomputer output do not understand the principles of microcomputer operations, they often develop two sorts of unrealistic expectations.

One common reaction is to view the computer as infallible and the output as inevitably correct ("it must be right, it comes from the computer"). That perspective on the part of those who use the information is dangerous. Serious mistakes can be overlooked because no one questions the computer results. In MOF, Indonesia, for example, problems in the customs microcomputer information system went unnoticed by customs officers who did not feel they could challenge computer output. Advisors in MALD,

Kenya are also concerned that microcomputer output is accepted there without question by many who use the information. It is interesting to note, on the other hand, that the assumption of microcomputer infallibility has had some positive indirect effects in MOF, Indonesia. At least in the early period of microcomputer introduction, local tax officers assumed the microcomputer could detect errors in tax reporting. The "psychological impact" of the microcomputer therefore supported one objective, more honest reporting of tax information.

The other inappropriate response to microcomputers among those who use microcomputer-produced information without understanding microcomputer operations is underestimatation of what is involved in creating the software necessary for effective microcomputer use. These people tend to perceive microcomputer use as merely "pushing a few buttons." One manifestation of this perspective is demonstrated by the Kenya Treasury's requests for special reports from MALD. Often the formats Treasury requires are very difficult to produce using dBase II. The requests are increasing because Treasury officials feel that MALD "will just do it on the microcomputer." For some reports, however, providing the required format may absorb a full week of scarce skilled programmer time. It will be impossible for MALD to continue to provide many complex reports, particularly after the TAP microcomputer advisor departs. Hopefully, the experience Treasury is gaining with their own microcomputers will provide better understanding of what is involved in preparing the reports.

Hypothesis 3. Training in the use of new microcomputer products enhances effective use of those products.

Microcomputers differ in a fundamental way from most new technologies introduced into developing countries in that they are a new technology that produces a new technology. If the microcomputers are used only to produce precisely the same information as was produced manually, training in products use may not be necessary. Microcomputers are often used to produce information that was not available previously, however. Where that is the case, users of microcomputer products are likely to need training in order for them to use the products most effectively.(2)

MALD well illustrates why training in the use of microcomputer products is often necessary. A central objective of microcomputer adoption in MALD was to improve management operations. One of the most difficult and intransigent obstacles, however, involves professional staff resistence to using the information provided by the microcomputer for decision-making. The problem is due in part to the incentive system (discussed with regard to Hypothesis 6). In part, the problem is related to political concerns (see Hypothesis 6 and Chapter XI). But one important aspect of the problem is due to lack of training and experience.

Insufficient experience and training in management skills among middle and senior finance officers impedes their effective use of the microcomputer output. Many senior finance officers have had no training in analysis of finance information. They are unable to analyze and summarize information for presentation to the top echelons of the ministry. If those decision-makers are to effectively use the massive amounts of data produced by the computer, those data must be presented in an accessible form.

Thus, senior administrative staff in MALD need better understanding of both what the microcomputer can do, and how to use the information that it produces. TAP advisors have been working closely with finance officers to help them develop the skills to analyze the finance information provided by the microcomputers, and apply it to decision-making. TAP has also begun to send younger senior officers to training courses that introduce those officers to the kinds of information systems available with a microcomputer and how the information can be applied to decision-making.(3)

This approach raises the issue of the appropriateness of introducing microcomputers to induce new ways of using information in decision-making. Ideally, the context into which microcomputers are introduced have what may be termed "qualities of receptivity." Those qualities include perceived need among adoptors for an application the microcomputer can provide, in-place skills among adoptors that permit use of the application, and support from relevent organizational leaders for the microcomputer adoption. Thus, microcomputer use should ideally be demand-driven.

The crucial question, however, is whether the microcomputer can be used by outside advisors (or some segment of an organization) to <u>generate</u> demand for its output. Must microcomputer adoption await the existence of such skills as financial analysis and statistical analysis, and the related demand for information? Or can microcomputers be used to <u>stimulate</u> interest in developing those skills?

The cases suggest that the answer is complicated. In both MALD and MFP, Kenya, as well as in MOF, Indonesia, receptivity to microcomputers depended on the ability of the machine to respond to an <u>existing</u> demand for information. In MALD, the microcomputer was first used for expenditure monitoring. This was an existing process for which there was already demand for the information, and for improvement in the speed, accuracy, and clarity of presentation of the information. In MFP, the first uses were to respond to ad hoc requests for information from senior officials. In MOF, the microcomputer was used to respond to the perceived need among top officials for more accurate and rapidly processed information.

Those experiences suggest that the effective early use of microcomputers requires an existing demand for information which the microcomputer can provide faster and more accurately than can

existing processes. The ability of microcomputer operators to provide that information legitimizes the microcomputer and gains it acceptance, at least among those demanding the information. That condition suggests a corollary hypothesis: to gain support for microcomputer use, the machine is best used to respond to information needs from as senior levels as possible. Once the senior officers are convinced that microcomputers serve a perceived need, acceptance of microcomputers will be more easily developed among middle and lower levels of the organization.

The cases of MALD and MFP, Kenya, also suggest, however, that after microcomputers have responded to existing demand for information, they can be a useful tool to help to encourage new ways of using information in decision-making if they are accompanied by training in the use of the information, i.e., use of the microcomputer output.(4)

Within a management training program, microcomputers thus appear to assist in the effort to stimulate new use of information for decision-making processes. In MALD, TAP advisors have used microcomputers very explicitly in that way. The microcomputers provide information that would otherwise be difficult or impossible to obtain. Advisors work closely with officers to impart methods of interpreting the information and applying it to decision-making. They are attempting, in essence, to modify the traditional bureaucratic culture in which decisions are made without reference to data.

One of those advisors hypothesizes that the traditional constraints associated with obtaining accurate information has discouraged managers from attempting to obtain or use information. The managerial style has become one of making decisions on bases other than quantitative or "objective" information. That decision-making style tends to persist even when better information is made available.

That advisor feels that microcomputers can be used to alter that tradition culture. If the microcomputers are used to process information quickly and accurately, and the information begins to be available for decision-making, the culture will change. Application of information to decision-making processes will increasingly become an integral part of the decision-making style. Thus, in MALD, in the words of one TAP report, "the 'cost' of information in terms of time and inconvenience was lowered and senior officers decided to 'buy' more of it" (Pinckney, 1984: 21). Because the microcomputer could make useful information more readily available, it encouraged officers to develop skills to analyze the information.

It is essential to note, however, that the hypothesis presented here does not suggest that changes in information use will be achieved merely by placing microcomputers in an organization in the hope that they will spontaneously be used for improved decision-making. Rather, the use of microcomputers in MALD and MFP suggests that the microcomputers must first "prove

themselves" by meeting existing demand for improved information supply. Afterward, new information provided by the microcomputers must be accompanied by training efforts specifically aimed at improving skills in analysis and application of the information. The availability of the data accompanied by such training can generate demand for microcomputer-produced information to be applied to decision-making. In addition, the formal and informal incentive systems must support use of information in decision-making, and political concerns cannot obstruct it (see Hypothesis 6).

The contrasting experiences of the two ministries in Kenya also suggest that the perceived need for training in the use of microcomputer output may be related to expectations about the role of the microcomputers. In MALD, the microcomputers are considered by the advisors to be part of a larger management training program. The microcomputers are used to provide information that officers have not been accustomed to using. Therefore, training in the use of microcomputer products is considered an essential part of an overall management training program. It seems clear that without that training, effective use of microcomputer output would be much more limited.

In contrast, advisors in MFP conceive the role of the microcomputers to be that of a simple service instrument. Thus far, microcomputer output is either a response to explicit demands from senior officers, or replicas of the documents that had previously been prepared manually, with a few small additions in information. The advisors expect that although microcomputer applications will broaden, the output will continue to be produced in response to requests from ministry officers. Training in the use of the documents is not expected to be an important part of microcomputer adoption. The evidence from MALD suggests, however, that a training component in the effective use of microcomputer output will eventually be necessary in MFP.

In MOF, Indonesia, the training effort in microcomputer operations is so extensive that there has been little thought given to the need for training in the use of output. The expectation is that in the short-term, microcomputer output will replicate the output that is being produced manually, and will not require training in its use. Nonethless, there are plans for using microcomputers for financial analysis and for providing training in the use of microcomputer products.

Hypothesis 4. The more "responsive" the microcomputer is to the users' needs, the more effective will be the microcomputer use.

One way in which microcomputers have revolutionized computer use has been in their responsiveness to user needs and skills. The plethora of packaged software, and the ability of skilled programmers to develop menu-driven programs, makes microcomputers potentially accessible to broad populations of users who have no technical skills.

The experience of TAP in MALD indicates that menu-driven programs can be developed to compensate for the lack of available technical skills. Similarly, in MOF, Indonesia, programmers have been designing menu-driven packages in Indonesian, so that they can be effectively used at the district level, where technical skills are in scarce supply. Thus, it appears that the responsiveness of microcomputers makes them particularly appropriate for use in contexts where technical skills are limited, as is the case in most developing countries.

Hypothesis 5. The more "responsive" the microcomputer products, the more effective the use of those products.

The evidence from MALD, Kenya suggests that if microcomputer operators/programmers are responsive to the needs of product users, the products will make a more effective contribution to decision-making. It also makes it clear, however, that more responsiveness is not necessarily better from an organizational point of view.(5)

Responsiveness is a continuum, ranging from providing standard documents that present the same types of information in the same ways, to providing customized documents for individual product users. There appear to be four levels of responsiveness: 1) The least responsive system is that which produces documents that can be prepared most efficiently, without modifying documents to meet special needs of document users; 2) The next most responsive system allows a standard document to evolve over time in view of users' expressed needs; 3) A yet more responsive system allows the product user to request adjustments from among a small number of standard alternatives in the standard document; 4) The most responsive system is that which provides information according to the particular needs of every information use.

The "cost" of responsiveness, in organizational terms, is, of course, the investment in developing technical skills necessary to prepare the document. It is impossible to calculate precisely when the marginal benefit of responsiveness equals the marginal cost of technical skill invested to produce the document.

The experiences in Kenya and Indonesia provide three alternative scenarios in which the context determines the limits of responsiveness. In one, illustrated in the planning division of MALD, the microcomputer operator and the product user are the same person; responsiveness is limited only by the skills and time constraints of that person. It is, by its very nature, a level 4 system.

A second alternative is illustrated by the finance division of MALD, Kenya. In this type of context, the limits of responsiveness are likely to be a matter of mutual adjustment between microcomputer operators and users of products. Within the finance division of MALD, for example, there are several

systems, which are the outcomes of adjustment between microcomputer operators and products users. Those systems range in responsiveness from level 2 to level 4.

MOF, Indonesia illustrates a third scenario. In MOF, the system is to be designed, then used without further modification in response to those using the documents. Thus, the system appears to be comparable to the least responsive level described above, level 1. MOF is using two methods to develop systems that are sufficiently responsive.

First, MOF is using teams of technical and "content" staff to design the system. The expectation is that the "content" staff will ensure that the system will be adequately responsive to the needs of those using the microcomputer output for substantive decision-making. There have been two important difficulties with this approach: 1) content staff defer to technical staff, and 2) content staff press for systems that do not exploit the advantages of microcomputers. Nonetheless, there is a concerted effort to raise the competency of the technical staff regarding content and the understanding of the content staff regarding technical issues. It is a valuable model for developing an information system.(6)

The second way in which the system in MOF is made somewhat more responsive is by actually conforming to level 2 of the schemata above. Although nominally the system is to be designed by the teams and to be used without further modification, in fact the teams, and more particularly the technical staff, have been responding to criticism from users of the information. That criticism must be strong and sustained, however, to convince system-designers to modify the system. The experience in MOF, and particularly in the Customs Directorate (see page 76) suggests that level 1 systems can have serious shortcomings in meeting the needs of output users. It also indicates that if the system conforms only to level 1 responsiveness, a great deal of effort must be made "up front" to ensure responsiveness. A reasonably reponsive level 1 system may therefore actually cost more than a level 2 system, which can "add" responsiveness over time.

The experiences of Kenya and Indonesia suggest that the degree of responsiveness is critical and should be explicitly considered during the early stages of designing the microcomputer system, in view of the needs and objectives of the system. For a given technical staff, there is a trade-off between degree of responsiveness and the number of people who can be served. Thus, the more responsive the system, the less likely it is to be able to respond to many product users. The most responsive system may not, therefore, be the most effective system. System responsiveness must be appropriate to both the needs of the organization and the supplies of technical labor.

The degree of responsiveness may also change over time. In MALD, finance officers have become so used to the flexibility of dBase

II, and the ease of correcting documents using the microcomputer, that they insist that all documents that include many figures be prepared on the microcomputer. The TAP microcomputer advisor found that demand for individual reports increased at a much faster rate than the supply of technical skills can support. Early high levels of responsiveness therefore have had to be modified.

The microcomputer's successful high degree of responsiveness thus can hold the seeds of its demise if unrealistic expectations persist among senior officers who do not understand the machine's capabilities and limitations. On the other hand, early high levels of responsiveness may be important in developing commitment among key decision-makers. At any point in time, there are also likely to be differing levels of responsiveness for different users, e.g., senior decision-makers may always receive the highest level of responsiveness, while middle level administrators may have to use standard documents.

Hypothesis 6. An incentive-disincentive system that supports use of microcomputers and microcomputer products will be critical to developing effective use.

MALD, which has used microcomputers longest, has had few problems with the hardware, despite heat, dust and electric power fluctuations. Although much of the software training was difficult, Kenyan staff were trained so that they could utilize the software independently of advisors. The human and organizational factors ("orgware" in the vernacular) have not, however, been as accomodating to microcomputer applications as the hardware and software. One of the most important "orgware" factors is the incentive-sanction system.

MALD, Kenya, best illustrates the critical role of the incentive system. In the finance division of MALD the incentive system does little to encourage either clerical or professional staff to learn to operate the microcomputers. Furthermore, some aspects of the incentive system actively discourage staff from learning to operate the machines.

The group that has evinced the most interest in learning to operate the microcomputers has been the clerical and secretarial staff. Yet the structure of the government schemes of service does not provide for any compensation to clerks who learn microcomputer programming. Although clerks in the finance division appear to be a good source for microcomputer programmers, the inability of the civil service to reward to clerks' development of this new skill has created a serious problem. As one of the advisors noted, "All the incentives for the administrative people encourage them not to get involved in the computer. Yet the people who want to get involved, can't be promoted. So it's a Catch 22." Another remarked, "It's a big problem. The only rewards [to clerk-programmers] are increased status, being able to do an important job that keeps you

interested and active, and maybe later you can get a better job in the private sector."

The comments of the clerks attest to the negative effects of the incentive system. They have clearly come to doubt that it is worth investing the required time and effort to learn microcomputer programming when there is no apparent material incentive for doing so.

Yet the lack of incentives within the ministry has to some extent been offset by incentives outside the formal system that induce clerical staff to learn to operate the microcomputers. Some of those incentives are intangible benefits inherent in microcomputer use, e.g., the work is easier, less tedious, more interesting. The only clerk to survive the first dBase II training group, for example, said that she was motivated by the opportunity to do more interesting, more creative work. But she also admits that she will be extremely disappointed if she does not receive a promotion.

Another important set of incentives are tangible incentives external to the ministry. The clerks and secretaries are well aware that microcomputer skills can significantly expand their employment opportunities. One incentive for working for TAP, is, in fact, the opportunity to learn to use the microcomputer. Thus, to the extent that clerks and secretaries in MALD have become interested in learning to operate the microcomputers, they are responding to incentives outside those of the ministry's formal management system. By learning microcomputer skills, they hope to find more remunerative jobs outside the ministry. It seems likely that the clerks who have learned to program in dBase II will leave the ministry unless new incentives to stay are offered.

Even were the problems of promoting clerks resolved, more difficult management issues would remain. Creating and implementing the division's information system requires understanding of content, i.e., the finance and budget information, as well as technical programming skills. Given the lack of incentives for professional staff to learn the principles of microcomputer operation, developing Kenyan professional staff which can direct clerk-programmers is a problem that TAP has not yet been able to solve.

Recently, however, some middle level administrators have expressed interest in learning to operate the microcomputers. That interest has been a response to changes in informal incentives and pressure from above. Microcomputers have made it possible for those officers to respond effectively to requests for information from their superior officers. When it became clear that the microcomputer advisor was leaving, the finance officers realized that it was important to them that the microcomputers continue to operate. The finance officers have responded with limited but growing interest in learning to operate the microcomputer. Their interest also stems in part

from recognition that microcomputer skills can expand their employment or educational opportunities outside the ministry.

The incentive system in MALD also strongly influences the extent to which professional finance staff use microcomputer output. There are qualities inherent in microcomputer products that encourage MALD administrators to use them rather than products of the manual system: microcomputer products are available more quickly, they display relationships in the data that would otherwise be difficult to calculate, they provide information in a clear and readily accessible form.

Yet there continues to be considerable resistence to using microcomputer products to change the basis for decision-making.(7) It was clear in MALD, and to a somewhat lesser extent in MFP, that there is reluctance to using financial information for decision-making, regardless of whether it comes from the microcomputer or elsewhere. Take, for example, the expenditure monitoring reports that are distributed to all MALD Division Chiefs. The reports are intended to help the Division Chiefs determine allocations for the coming fiscal year. Yet many of the Division Chiefs choose not to use the information, and continue to allocate budget funds incorrectly. In their article about microcomputer adoption in MALD, Pinckney, Cohen, and Leonard (1984: 8) suggest several possible explanations for such misallocation: 1) The Chiefs may not consider allocations important since allocations can be changed during the year; 2) They may prefer a simple allocation method such as giving the same amount to each district because it is easier than calculating different allocations; 3) They may be responding to political pressure.(8)

Yet, fundamentally, whatever the dynamics of the foregoing influences, the key to officers' reluctance to using microcomputer output for decision-making lies with the incentive system. Sufficient positive incentives must exist to induce officers to make the effort to use the information to allocate funds. Certainly government bureaucrats in Kenya, like those of other countries, including the United States, respond to many important "political" tasks and goals aside from those of efficiency considerations. Furthermore, in Kenya there are often tensions between a "rational" approach to decision-making and personal or tribal ties that impinge on the decision-maker's choices. Yet it is the role of the incentive system to offset those influences. If information is to be used to improve decision-making, the structure of incentives must be designed to do so; the incentives themselves must powerful enough to do so.(9)

Patterns of response in the planning division of MALD support the observations of the finance division. There are no tangible or intangible incentives for planning officers to use the microcomputers for analysis. According to many planning officers, use of such analysis is ignored by senior officer. To the extent that there is demand for analysis, senior officers generally turn

to the advisors rather than their own officers.

There are even, in the planning officers' view, disincentives to doing analysis. As one advisor noted, planning officers are "not rewarded for doing something right, and penalized for doing something wrong." In confidential interviews, many planning officers complained that they actually got a negative response from their superiors for doing quantitative analysis. Furthermore, the fact that promotion prospects for economists are very poor, regardless of the quality of their work, discourages initiative and hard work.

Several TAP activities have attempted to overcome these obstacles by providing incentives external to the formal system. Particularly effective among those incentives is the opportunity to go the United States for further training. TAP also uses intangible incentives. They provide positive feedback to planning officers who conduct quantitative analysis, work with them to improve analytic skills, and provide forums in which the officers can present their findings to their colleagues.

It is also clear that there are other incentives external to the formal ministry management systems that encourage planning officers to learn to use the microcomputer for analysis. Some planning officers are motivated by interest in the microcomputer and desire to master its use. For many, an important incentive is more tangible: improved employment opportunities outside the ministry.

Although the evidence is less abundant at MFP, because the microcomputers have not been there as long as at MALD, the pattern appears to be similar. Finance officers have shown little interest in learning to use the microcomputer, aside from one middle-level budget officer whose supervisor assigned him the task of learning to enter data into a microcomputer. Planning officers have also shown little interest in learning to use the microcomputer for analysis, citing the same kinds of disincentives as were mentioned by planning officers in MALD. The only planning officer who does use the microcomputer for analysis is working on assignments she receives from an Indian consultant to the ministry. She was already familiar with microcomputers, having worked with them at the university.

As was the case in MALD, the most enthusiastic group in MFP has been the clerical/secretaries staff. They cited expanded opportunities outside the ministry as a primary incentive for learning to operate the microcomputers. The clerk who has learned to program in dBase II also hopes to be sponsored by TAP for additional training outside the ministry.

There is another form of incentive that should be mentioned, although it has affected only a few professional staff. That is the assignment of specific tasks that can best be done with a microcomputer. As one planning officer who encourages his staff to use the microcomputer noted, "You can't just leave an

innovation in an office and expect people will come. They don't like to take risks. They have to be given permission and directed to use it by someone else."

The experience in MFP suggests, however, that the direction to use the microcomputers must be explicit. Otherwise, in the absence of additional incentives, the effect is unreliable. Many officers in MFP, for example, have been given assignments to complete on the microcomputer. Yet rather than learn to do the microcomputer work themselves, they induce the clerk-programmer or the microcomputer trainer to do the microcomputer work for them. Those officers will sit beside the clerk and tell him what they want, step by step, while he operates the machine. This seems to be clearly an inefficient use of the time of both officer and microcomputer operator.

Hypothesis 7. The more comprehensive the change associated with using microcomputers or microcomputer products, the more difficult it will be to induce effective use of the machines or their products.

It has been noted in the literature on organizational change that marginal changes from the status quo have a greater probability of successful implementation than more comprehensive changes.(10) The evidence from both Kenya and Indonesia suggests that the principle applies as well to microcomputer adoption. In both countries, microcomputers were most quickly and effectively applied to making marginal changes in on-going processes rather than to make significant changes or to establish new processes.

TAP advisors in MALD and RPP advisors in MFP feel strongly that microcomputers are most effectively introduced by producing the same work as had been produced manually, only doing so more quickly and accurately, with small additions of directly relevant information, e.g., ratios between items. In both ministries, the rapidity with which microcomputers have been applied to facilitate existing financial operations contrasts sharply with microcomputer use for financial analysis, which is not ordinarily conducted.(11) In the planning divisions of both ministries, planning officers have been much more responsive to learning to use the microcomputer for record-keeping, which they already do manually, but they have shown little interest in using microcomputers for project analysis, which would be a completely new kind of activity. In Indonesia, PAIK officers are arranging for the microcomputers to produce exactly the same output as had been prepared manually "in order to limit resistence."

In both countries, those introducing the microcomputers expect that as people become more comfortable and confident about using the microcomputers, they will use them for new kinds of activities. They anticipate that as people get used to applying information to decision-making, they will increasingly do so.

A pattern of microcomputer applications emerged from the cases.

That pattern may be related to the tendency for microcomputers to

be used first for processes in which there is existing demand for information, and later for decision-making areas that had not previously used the kind of information the microcomputer makes available. The pattern defines the sequence in which various kinds of microcomputer applications become a regular part of government processes. (Microcomputer uses that are conducted solely by advisors as responses to idiosyncratic requests from individuals, are not included in this topology.) The progression is from less to more comprehensive changes in established procedures, and less to more difficulty in institutionalizing the usage.

The first category of applications appears to be in routinized, regular finance and budget processes.(12) Examples are the allocations of Authorities to Incur Expenditure in MALD, Kenya, the distribution of disbursement invoices to vendors in Indonesia, or budget production in MFP, Kenya.

The second category of microcomputer applications seems to be those related to monitoring of various kinds. These applications generally provide the same kinds of information as had been provided by manual methods, only in more useful formats, and with some additional useful statistics. Along with these applications are customized financial reports prepared at the request of individual decision-makers. Word processing in response to individual requests also appears.

The third category of applications includes development of projections for use in policy-making. Those projections require more sophisticated analytic skills than were demanded by the foregoing categories of applications. The analysis is narrow and focused, however, pertaining to a specific category of information, such as linear projections of product consumption or production.

The final category includes sophisticated statistical analysis that considers several aspects of a complex issue. The skills required for such analysis are usually in short supply in the governments of developing countries.(13) In addition, this kind of analysis is most valuable when it provides policy-makers with a set of alternatives and their associated costs and benefits. For such information to be used effectively, however, the policy-makers must be able to understand and weight the alternatives vis-a-vis other demands and constraints within which they operate.

Of course, this topology does not represent an inexorable progression of microcomputer applications. Rather, it suggests the kinds of microcomputer applications that may be more or less easily introduced as part of on-going government processes. The speed with which various applications develop depends on how information is currently being used, and the incentives to change.

The case of MALD suggests that where new information is being provided, or information is being used in new ways, systems must be established to clearly delegate responsibility to analyze information and present it in useful ways to senior decision-makers. There must also be explicit responsiblity to apply the information to decision-making. In the expenditure monitoring system in MALD, for example, microcomputers provide information about problems of project progress or expenditure. Estimates Officers monitor the projects and request information from the spending station if its rate of spending is unacceptable. Yet nothing is done to enforce conformity with spending guidelines, and no analysis is undertaken to determine underlying causes for expenditure problems.

One factor that impedes the linkage of information and policy making in MALD is the lack of integration between the planning division and the administrative division. Currently, there is little communication between finance officers and planning officers. Consequently, finance officers feel that the planning officers do not provide useful project evaluation information. Planners feel that their work is ignored by the administrative staff, and do not feel compelled to analyze projects in ways finance people might find more useful.

A recent effort to establish a closer linkage between information and action is the projects management system, of which an integral part is microcomputer use. Although the system was too new for this study to assess its effects, its objectives in closely tying information to decision-making merit notice. The system includes financial information and planning information. Responsibilities for monitoring project implementation, and for presenting reports on project status and problems to a senior-level decision-making committee are clearly delegated. The system also makes very visible the extent to which senior level officers utilize the information.

TAP advisors expect this system to effectively integrate information from the finance and planning monitoring systems into an overall decision-making system. They hope that the system will also encourage greater communication between the planning officers and the finance officers. As information from the planning division's projects registry is regularly provided to the finance officers, those officers may increasingly view the system as a valuable resource; the planners would in turn begin to feel themselves part of the policy-making system.

Hypothesis 8: Building "ownership" among those who are to use the microcomputer or microcomputer output will enhance acceptance of microcomputer use among those groups.

An important concept in organizational change literature is that of "building ownership" of new processes.(14) The concept suggests that people are more likely to accept and support

innovation if they come to feel they are personally involved in bringing it about. The literature suggests that "ownership" can be built in a number of ways, including discussions with participants about the need for and benefits of the innovation, and the possible approaches to implementing the innovation. The literature also suggests that there is likely to be hostility to innovation if people feel that the innovation is imposed on them, or if they feel "left out" of the process of implementing the innovation.

Although the evidence from the cases is limited, it is worth noting that negative reactions to the microcomputers came primarily from those who were bypassed by new information systems, or who perceived the new systems to threaten their status, power, and/or income.

In MALD, Kenya, what negative response has occurred was related to the way in which the new computerized system was introduced. In the first year that a microcomputer was used for expenditure allocations, for example, the Division Chiefs were strongly critical of the process. Their response appears to have been primarily caused by their near-exclusion from process.(15) Later attempts to incorporate their participation, and to explicitly recognize their authority over allocations in their divisions, were rewarded with greater cooperation and a more positive response to the system.

Another negative response in MALD was also the result of perceived exclusion from the new microcomputer information system. In this case, a middle level officer was inadvertently bypassed by the fledgling microcomputer team. The officer's criticisms of the microcomputer did not seriously impair the new system. If, however, the senior officer supporting microcomputer adoption had been unable to deal directly with junior officers, the middle level officer could have undermined the system. Had the middle level officer had been brought into the system at its onset, it is more likely that he would have been willing to support it.

In MFP, Kenya, the hostility to microcomputer adoption has occurred primarily among planning officers. There has been little attempt on the part of senior officers or advisors to develop "ownership," a sense of involvement and commitment, among the planning officers. The planning officers feel threatened by the presence of a tool which they do not understand and which seems to have little relevance for their jobs. They are embarrassed by their lack of understanding about a tool that seems to be conferring status on those who can use it - primarily clerks and secretaries.

In Indonesia, there has been a concerted attempt to build a sense of "ownership" among tax and customs officers who will use the microcomputers. There is extensive communication between the technical computer staff, who introduced the machines and write the software, and the "content" people, who will use the

information. The result appears to be a positive response among the tax and customs staff who actually use the machine.

Unfortunately, the heads of the local tax offices and customs offices perceive their power to be seriously threatened by the microcomputer system. There has been no attempt to build a sense of "ownership" among those officers, and it is difficult to suggest how that might be done, given their self-interest. In the management literature, it is generally suggested that if personal interests prevent "ownership" from being developed among a particular group, its power should be reduced or eliminated.(16) In the case of Indonesia, however, that option is not available to those interested in ensuring the effective implementation of the microcomputer system. Reducing negative response may depend on altering the incentive system to offset what the heads of local offices perceive to be the disadvantages associated with the microcomputer system.

CHAPTER VIII

ANALYSIS OF THE INSTITUTIONALIZATION OF MICROCOMPUTERS

For the purposes of this study, institutionalization of microcomputers is defined as the process by which microcomputer use becomes a stable, valued and recurring pattern of behavior.(1) Microcomputers have not been used in Kenya or Indonesia long enough to permit any rigorous evaluation of their degree of institutionalization. What will be useful, however, is to consider the extent to which there has been progress in institutionalizing microcomputer use within the ministries.

This study considers the level of institutionalization of microcomputer use in each of the cases to be a function of the activities discussed above: the introduction of the microcomputers, training in the use of the microcomputers and their output, the kinds and extent of use to which microcomputers and microcomputer output are put.

The cases suggest that two aspects of institutionalization should be considered. One is institutionalized supply: the extent to which the use of <u>microcomputers</u> is institutionalized. The other is institutionalized demand: the extent to which use of the microcomputer <u>products</u> is institutionalized.

This dichotomy may appear odd to those who have observed microcomputer use only in the West. What appears problematic within the Western context, however, becomes very reasonable within the context of a developing country. A brief discussion of the differences between the two contexts can help to clarify the importance of distinguishing between institutionalizing microcomputer use and institutionalizing microcomputer products use when examining microcomputer adoption in developing countries.

Generally, in the West, microcomputers are "personal productivity tools." The microcomputer is used by someone who wants the output the microcomputer can provide. Finance officers, for example, may use spreadsheet or datebase management packages as an integral part of their work. The desirability of applications motivates learning to use the microcomputer. Thus, the several functions involved in using a microcomputer - entering data, "processing" data using a software package, and applying data to decision-making - are all bound up into one role.

In the ministries in Kenya and Indonesia, particularly in the finance divisions, the structure of microcomputer use that emerged is quite different. Generally, each of the functions involved in using the microcomputer is carried out by different people. Entering the data is delegated to one job category.

Writing software to process the data is delegated to another job category. A third person or group uses the data in decision-making. Is this a faulty approach to utilizing microcomputers? The structure of skills in LDCs suggests that it is not. There are three important points to consider.

First, there are limited professional skills available in LDC governments. In many cases, those who have financial, planning or management skills would be overwhelmed if they tried to effectively carry out all the tasks assigned to them. The higher the officer, the greater the problem is likely to be. Often, the professional staff becomes bogged down in petty administrative functions or routine tasks (like proofreading drafts of reports). Those officers need to be relieved of some of those tasks so that they can give greater concentration to the policy-making functions that are the most important part of their jobs.

Second, there is a large base of non-professional semi-skilled labor available. The pool of clerks and secretaries is huge. Often, people in those positions do little productive work during an average workday. What work they do must be supervised and checked by the professional staff.

The microcomputer provides a way for the professional time investment to be reduced for some tasks. Those tasks are, in effect, transferred from the professional staff to the microcomputer-using clerical/secretarial staff. The use of word processing provides one example. If text is prepared using word processing, corrections can be made solely to the items that must be changed. The proofreading required by professional staff is far less than if entire pages are retyped, and reproofread, as is often necessary with typewriters. Furthermore, when pages are retyped, new typing errors are often made, requiring another round of typing and proofreading. Another example in which microcomputer use permits the "transfer" of tasks from professional to clerical staff involves entry of figures. In many cases, clerical staff can enter numerical data, and the entries can be "proofread" by microcomputer software routines.

The third consideration is that programming in such languages as dBase II, while far easier than in such languages as FORTRAN or COBOL, still requires considerable training. After training, programming tasks can be quite time-consuming; alone they can constitute full-time jobs for several trained staff. It makes good sense to have staff specifically trained to program in such languages as dBase II rather than to have the finance officers or other professional staff do their own programming.

The cases thus suggest that it is likely to be appropriate, at least in the foreseeable future, for the functions of data entry, data processing, and data application to decision-making, to be conducted by different staff. Of course, that approach does not nullify the need for professional staff to become familiar with the principles of microcomputer operations and programming (see Chapter VI for futher discussion of this requirement). It should

be borne in mind that even in the West, some microcomputer functions are often differentiated from others. In many offices, there is a word-processing staff which is responsible for producing documents using microcomputers. There may be a "computer" staff which conducts various data processing functions on microcomputers and presents the results to decision-makers.

The conditions described above suggest that examination of microcomputer use in developing countries must consider the potential differences in rates of institutionalization of microcomputer use, i.e., supply of microcomputer products, and institutionalization of microcomputer products use, i.e., demand for microcomputer products. One of the most important implications of this dichotomy is illustrated in the cases: it is possible for use of microcomputers to be institutionalized, while use of microcomputer products is not being institutionalized; conversely, it is possible for use of microcomputer products to be institutionalized without use of microcomputers being institutionalized. Although this distinction is not relevant to some applications, it is critical to understanding others.

The literature on technology transfer and organizational change suggest several indicators of institutionalization of innovation.(2) Some of those indicators relate to the way an innovation is used, or the "age" of use of the innovation. Others concern the support systems established to ensure continued use of the innovation. The discussion below presents some of the indicators that appear to be most useful in measuring institutionalization of microcomputer use (supply of microcomputer products), and microcomputer product use (demand for microcomputer products). Although this chapter cannot examine all of the indicators with respect to the cases, identifying those indicators will be helpful to guiding future examinations of microcomputer adoption.

INSTITUTIONALIZATION OF MICROCOMPUTER USE

One set of indicators of the extent to which microcomputer use is institutionalized relates to the way in which the microcomputers are used. Those indicators include: the scope of use of the microcomputers, the length of time the microcomputers have been used, the breadth of functional use of the microcomputers, the "generational age" of microcomputer use, and the expectation that microcomputers will continue to be used.

Scope is measured by the number of people who operate the microcomputers, and the number of administrative levels and sections in which microcomputers are used. It can be hypothesized that the greater the scope, i.e., the number of operators, and the number of administrative levels in which they work, the more institutionalized microcomputer use.

Length of time is measured by how long the indigenous operators

have actually been using the machines to supply output. It can be hypothesized that the longer microcomputers have been so used, the more likely they are to be used in the future, and the more institutionalized the use.

Breadth is measured by the variety of functions to which the microcomputers are put. It can be hypothesized that the greater the number of different functions to which microcomputers are applied, the more likely microcomputer use is to be a regular, stable part of the organization.

"Generational age" is measured by the number of times there has been turnover in the staff of indigenous microcomputer operators. It can be hypothesized that if the original staff of indigenous microcomputer operators has been succeeded by new operators, the use of microcomputers is more highly institutionalized than if the microcomputer staff still consists of the original operators.

The expectation that microcomputers will continue to be used is particularly important in cases in which microcomputers were introduced by external advisors. It can be hypothesized that the greater the extent to which government staff anticipate that microcomputers will continue to be used after advisors leave, the more institutionalized the microcomputer use.

Another set of indicators of institutionalization of microcomputer use relates to the extent to which management systems support continued use of the machines. It can be hypothesized that where incentive systems encourage people to learn to operate the machines, microcomputer use is more likely to become highly institutionalized. It can be hypothesized that where support systems such as training systems, regularized supply requisition systems, and service arrangements are established and operated by organizational staff, microcomputer use in the organization is more likely to be highly institutionalized than where those systems do not exist or are operated by non-organizational staff. Finally, it can be hypothesized that the greater the extent to which the balance of power in the decision-making structure supports continued use of microcomputers, the more likely microcomputer use is to become institutionalized.

INSTITUTIONALIZATION OF MICROCOMPUTER PRODUCTS USE

One set of indicators of the institutionalization of microcomputer products measures the way in which products are used. Those indicators include: the scope of product use, the "intensity" product use, and the expectation that products will continue to be used.

Scope is measured by how many people use the output, and the number of levels of decision-making in which microcomputer output used. Intensity is measured by how important the users at different levels of the bureaucracy perceive the output to be,

i.e., how dependent the system is on the output. Expectation of continued use appears to be particularly important in cases where use of microcomputer output is introduced by external advisors. The indicator reflects the expectation on the part of users that the output will continue to be used after the advisors leave.

Another set of indicators includes management systems that support continued use of microcomputer products. It can be hypothesized that the greater the extent to which incentive systems encourage people to use microcomputer output, the more likely it will be that use of microcomputer products is institutionalized. It can be hypothesized that the existence of training programs to supply skills necessary for effective use of microcomputer output enhances the institutionalization of use of microcomputer output.

Chapter IX suggests analytic tools with which some of the foregoing indicators can be measured. For this study, however, less formal measures were used. Those measures can, nevertheless, suggest the extent of institutionalization of microcomputers and microcomputer products in the cases.

INDICATORS OF INSTITUTIONALIZATION OF MICROCOMPUTERS AND MICROCOMPUTER PRODUCTS

Indicator 1. The broader the scope of use of microcomputers and microcomputer products, the greater the degree of institutionalization.

This measure of institutionalization suggests that the more people using the microcomputers and their products, the more commitment there will be to continue such use. By this measure of institutionalization, microcomputer use is far more institutionalized in Indonesia than in Kenya. In the former case, microcomputers have been introduced in several central Directorate offices, and in 69 local tax offices, a local customs office, and local budget offices, with even wider introduction slated for the near future. In MALD and MFP, Kenya, the total number of microcomputers is less than a quarter of those in Indonesia, and far fewer people actually use microcomputers in the Kenya ministries than in MOF, Indonesia.

Within the ministries in Kenya, the degree of institutionalization differs among different microcomputer products, based on the scope of use. Production of AIE allocations in MALD, for example, affects all spending stations of the ministry, as well as several levels within headquarters. Use of microcomputers to produce those products appears to be relatively highly institutionalized. Budget drafts produced by the microcomputers are utilized by only a few levels in headquarters and, by the "scope" measure, are relatively less highly institutionalized.

Indicator 2. The greater the "intensity" of microcomputer product use, the greater the degree of institutionalization of that use of microcomputer products.

"Intensity" of microcomputer products use is reflected by users' perception of the products' value. By this measure, demand for some microcomputer products is well on the way to being institutionalized in the finance division, MALD, Kenya. The use of microcomputers to allocate Authorities to Incur Expenditure (AIEs), for example, appears to be well embedded in the system. According to ministry officers, it would be impossible to complete AIE allocations within a reasonable period of time without using the microcomputer.

For other applications, which are associated with new models of decision-making, the perceived value of microcomputer products is more problematic. According to finance officers in MALD, microcomputer-produced expenditure monitoring reports are essential to their work, and budget drafts are extremely valuable. The finance officers' concern about the departure of the TAP microcomputer advisor, and the possibility that the microcomputer output will no longer be available, indicates strong "intensity" associated with the use of those products. It therefore indicates that use of those products has begun to be institutionalized.

The finance officers' response to the departure of the microcomputer advisor also suggests another hypothesis: If microcomputer products users are not microcomputer users, high "intensity" of microcomputer products use will induce efforts to institutionalize microcomputer use to produce those products. In the case of the MALD finance officers, their demand for microcomputer products and desire to ensure the availability of products, has created strong support for expanding staff training in microcomputer use, although they themselves may not want to use the microcomputers.

The cases also suggest a third hypothesis: not only must "intensity" of use of microcomputer products be considered, but also the distribution of that intensity, i.e., <u>who</u> values the products. A corollary to that hypothesis is that the extent to which use of microcomputer output becomes institutionalized depends on the extent to which senior officers value that use.

The use of the expenditure monitoring reports illustrates these hypotheses. Expenditure monitoring reports are supposed to be used to determine allocations for the coming fiscal year. Yet there is strong resistence to using the output in that way. The current structures and systems discourage use of financial information as a basis for decision-making. Expenditure reports produced by the microcomputers are therefore used for record-keeping rather than policy-making. As one TAP advisor noted, use of the expenditure reports for decision-making will not become institutionalized in the ministry until senior officers take the

documents more seriously, and consistently ask the officers below them questions relating to the reports.

TAP advisors utilized this concept in designing MALD's projects management system. The project management reports are to provide information that senior ministry officers need to respond to the requests of the Treasury and the Office of the President. Consequently, the microcomputer output will, TAP hopes, develop the constituency among senior officers. Thus, if "intensity" of use of the reports is high among senior officers, it is expected that use of the reports is more likely to become institutionalized.

The planning divisions of MALD and MFP, Kenya, illustrate both the importance of "intensity" of microcomputer products use among senior officers, and the need to develop that intensity among upper-middle and middle levels of officers. In MALD, only a few junior planning officers have the skills to effectively utilize microcomputers for analysis. Most senior planning officers do not have those skills, and therefore do not much value that kind of analysis. Similarly, in MFP, analytic skills are largely restricted to the highest echelon. Most planning officers at upper-middle and middle levels of the Directorate do not have the analytic skills necessary to use microcomputer output for decision-making.

Institutionalization of the use of the microcomputer for planning analysis requires that those in senior positions understand and value the kinds of analysis that the microcomputer makes possible, and demand that kind of analysis in decision-making. It also requires that middle levels of officers are able to respond to that demand, and to direct those below them to provide useful analysis,

In MALD, TAP is consciously attempting to develop analytic skills among junior planning staff. When those officers become senior staff, TAP anticipates, they will push the institutionalization of use of information for analysis.

One microcomputer application that is likely to become institutionalized more easily in the planning divisions is maintainance of the projects registries. The registries provide information that enables senior ministry officers to respond quickly to the Office of the President and the Cabinet. Senior planning officers are therefore likely to provide the constituency necessary to institutionalize use of those microcomputer products.

One application of microcomputers that is highly valued, according to some advisors, is word processing. In MFP, some advisors feel that use of word processing made it possible to produce the district plans within the deadline set by the Office of the President, and thereby is highly valued. Other advisors feel that use of word processing alienated planning officers, who did not understand it and were therefore excluded from managing

production of the plans. It can be hypothesized that to the extent that planning officers felt that microcomputers displaced them from authority, "intensity" of use of microcomputer output may have declined.

Microcomputers are too recently introduced in MOF, Indonesia, to assess the extent of intensity of their use. One aspect of MOF's approach to developing appreciation of microcomputers is interesting to note, however. In MOF, as well as in other ministries, there is a commitment to "demystifying" microcomputers by introducing them widely and emphasizing the ease with which they can be operated. The attempt is to encourage staff throughout the ministry to value and feel comfortable about using microcomputers and microcomputer output. Although the intensity of use is currently limited, and is likely to continue to be so for most ministry staff, MOF thus appears to be taking a long-term view developing appreciation of microcomputer use to support institutionalization.

Indicator 3. The longer the "generational age" of microcomputer use, the more highly institutionalized the use.

This indicator suggests that use of microcomputers and microcomputer products is more highly institutionalized if those who initiated use have been succeeded by others who continue the use of the microcomputers and the products. Of the cases, only MALD has used microcomputers long enough to contribute to understanding the dynamics of this indicator. MALD's experience suggests that in considering the indicator it is useful to distinguish between microcomputer use and use of microcomputer products. It also makes it clear that microcomputer applications within the ministry differ in the extent to which they are institutionalized according to this indicator.

In MALD, Kenya, allocation of AIEs, which appears to be highly institutionalized according to Indicator 2, is also highly institutionalized according to Indicator 3. Use of the microcomputer to produce AIE allocations has survived the rotation of senior officers, and seems likely to continue to be used by future officers. Supply of microcomputer operators who can produce the AIE allocations also appears to be relatively highly institutionalized. Although there are not yet well established procedures for training staff, the TAP microcomputer advisor has helped to ensure future production of AIEs by developing menu-driven programs that make training for that task an easy matter. He has thus helped to ensure that supply will survive the current "generation" of operators.

The production and use of expenditure monitoring reports in MALD demonstrates a quite different level of generational age. Use of the reports was not well established before the rotation of the "first generation" of senior officers who were learning to utilize the information in decision-making. TAP advisors are now training the current officers to use the reports. The advisors

hope that if the use of the reports becomes regularized before the incumbant officers are rotated, new officers will also be motivated to learn to use the reports. If the present senior officers are rotated before use of the reports for policy-making is an established process, however, institutionalization will again be short-circuited.

Production of the standard expenditure monitoring reports uses menu-driven programs that are easy to learn to use. That type of production seems likely to survive the current generation of microcomputer operators. Production of more customized reports, requested by senior officers in MALD or from MFP, appears to be far less institutionalized. The "first generation" that produced these reports, excluding the TAP advisor, continues to be the single clerk-programmer in MALD who has been trained in dBase II programming skills. Such training is difficult and time-consuming, and there is currently no one who has developed sufficient skill to succeed that clerk, nor is there an established process for developing "future generations" of operators with those skills.

Whether or not there is a "critical mass" of skilled computer programmers sufficient to maintain the existing microcomputer systems and to train new operators to succeed them is difficult to assess. Some TAP advisors fear that demand is going to increase more rapidly than the current staff of microcomputer operators can satisfy, and that the departure of the TAP microcomputer advisor will endanger the system. Others are convinced that the operators now available can maintain the system, while the absence of the TAP microcomputer advisor will make senior finance officers more aware of the importance of the microcomputer products and the need to establish regular systems to provide "future generations" of skilled microcomputer operators.

Indicator 4. The greater the extent to which users of microcomputers and microcomputer products anticipate continued use, the more institutionalized the use.

In considering this indicator it is again useful distinguish between institutionalization of microcomputer use and institutionalization of the use of microcomputer products. To assess the hypothesis, ministry staff in the Kenya ministry were asked whether they thought the microcomputers and the microcomputer output would continue to be used after the advisors, who introduced the machines, went home.

In MALD, those who allocate the AIEs were sure that microcomputers will continue to be used to produce the AIEs. They consider use of microcomputers to produce AIEs essential. They are also confident that there will be microcomputer operators available to produce the AIEs, although they themselves do not know how to operate the microcomputers.

Those who use the microcomputer-produced expenditure monitoring reports are equally sure that those responsible for monitoring expenditures will want to use the reports. They are far less confident, however, that there will be microcomputer operators available who will be able to supply that output.

There is considerably more doubt surrounding use of microcomputer output to prepare budget estimates. The ministry officers who are now using that output, as part of a management training effort by TAP, feel that there will be continued demand for the the information. They suspect, however, that there may not be staff available to produce the information on the microcomputers. The advisors working with that management training effort are, on their part, unconvinced that officers would use the microcomputer information for budget preparation were the advisors to leave.

Planning officers in MALD who use the microcomputers for analysis feel that the microcomputers will "probably" continue to be used if there are provisions for servicing the machines after the advisors leave. They are unsure as to whether the ministry will be committed to funding that maintenance, however.

Confidence about continued microcomputer use after the advisors leave is much lower in MFP. This is at least in part because most of the microcomputer applications are relatively new. It also reflects the general uncertainty about the status of the microcomputers, and the limited numbers of officers who have used the microcomputers or their output.

Interestingly, although the microcomputers have only recently been introduced in MOF, Indonesian officers in the ministry headquarters are confident that the microcomputers will become a permanent part of the ministry processes. While there is anxiety in some local offices about the introduction of the microcomputers, there seems to be little expectation that microcomputer use will not be established in those offices.

Indicator 5. The greater the extent to which training is run by government staff rather than outside advisors or consultants, the more institutionalized the microcomputer use.

According to this indicator, microcomputer use is more highly institutionalized in MOF, Indonesia, than in either Kenyan ministry. Although some training in MOF will be carried out by the microcomputer vendor, it is clear that PAIK is managing the training component and will provide most of the training within the ministry. The sophisticated technical staff of PAIK has established a training program and is likely to quickly institutionalize supply of staff with the technical skills necessary to operate microcomputers.

The greatest difficulty in developing microcomputer staff in MOF involves the training of staff who can assess the content needs as well as the technical needs of an effective information

system. MOF is attempting to use "content-technical" teams to provide that staff. For the teams to be effective, however, the technical staff must understand the content of the information. The "content" staff must be sufficiently well trained in the technical concepts so that they have enough confidence, and respect from the technical staff, to participate effectively in system design and implementation. The content staff also need training in analytic skills.

If this kind of "interdisciplinary" training is not effected, there is danger that data will be utilized without real understanding of the meaning of the numbers. The conviction can develop that "if it comes from the computer, it must be right," when the assumptions on which the system is based may be faulty, or the data may simply be bad. Thus, the institutionalization of skills to operate the microcomputers without institutionalization of skills to effectively analyze and utilize output can be detrimental.

The relationship between training and institutionalization of microcomputer use in Kenya is a revealing one. Institutionalization of training in MALD has been obstructed by the difficulty in getting appropriate staff assigned for training. Those who are available for training in microcomputer operations can not be promoted for learning the new skill; those who are eligible for promotion are not available for training. The problem was temporarily resolved by training a clerk in dBase II programming. The expectation is that she will be able to train two other clerks working with her; this is at best an interim measure, however.

What has raised the prospect of institutionalization of microcomputer use in MALD has been recent commitment by the government computer center, in MFP, to develop a microcomputer capability within its staff. Once that team has been trained, it will presumably provide training to other ministries, as needed. Thus, the issue of institutionalizing training in MALD had to be resolved through acceptance and support of microcomputer use by a more powerful ministry, MFP. Had MFP not been committed to providing training, institutionalization of microcomputer training in MALD would have been extremely difficult to achieve.

The following four indicators can only be applied to microcomputer adoption in Indonesia, since in Kenya the processes to which the indicators refer are currently being carried out by TAP and RPP advisors. All four of the indicators suggest that MOF, Indonesia is in the process of establishing many of the supporting systems required to institutionalize microcomputer use. Although the microcomputer system itself is very new, the means by which it was adopted appears to have made institutionalization a relatively rapid process.

Indicator 6. An effective requisition and procurement system

established and operated by government staff reflects more highly institutionalized microcomputer adoption than a system operated by advisors.

Indicator 7. An effective disbursement and allocation procedure operated by government staff reflects more highly institutionalized microcomputer adoption than a system operated by advisors.

Indicator 8. The greater the extent to which costs of the microcomputer system are known to and accepted by government decision-makers, the more highly institutionalized the system.

Indicator 9. The greater the extent to which government staff is able to choose, alter, and develop microcomputer systems, the more highly institutionalized the microcomputer system.

It is worth noting, with regard to the four preceding indicators, that TAP's approach to institutionalizing microcomputer use in MALD recognizes the factors' importance. TAP is commited, for example, to ensuring that servicing for the microcomputers is established. An endemic problem related to all mechanical devices used in MALD is that of repair and servicing. Vehicles, copy machines, and other equipment often sit unused for months or even years waiting for repairs. TAP hopes to institutionalize the servicing of the microcomputers by building maintenance contracts with private firms into the ministry budget when the TAP project ends.

Similarly, TAP will attempt to have supplies adopted as a budget item the year before the end of the project, to ensure that the ministry is committed to maintaining the machines. At that time there will have to be an interest group in MALD that considers the microcomputers crucial, and has the power to support the system. Although the Deputy Secretary and Undersecretary have been involved in negotiations for TAP funding, and thus know the level of spending for the microcomputers and related expenses, it is impossible to predict whether they will be willing to commit ministry funds in the future.

TAP is also considering the potential role for private firms to help MALD evaluate and choose microcomputer systems. No one in the ministry has an overview of different types of equipment, hardware and software, and can evaluate them. Indeed, that is a difficult task even for the advisors. TAP anticipates that a system may have to be established so that the ministry can rely on one of the several competent Kenyan microcomputer consulting firms in the private sector.

One of the issues related to Indicator 9 is that of compatibility. It is an aspect of institutionalization that MOF, Indonesia has been confronting, which is likely to eventually become important in MALD and MFP, Kenya. In MOF, several computerized information sytems are already linked among various ministries and other public organizations. Institutionalization

of microcomputers requires their successful integration into that network. The government staff's ability to design that integration will thus be an important factor in institutionalizing microcomputer use.(3)

HYPOTHESES CONCERNING INSTITUTIONALIZATION OF MICROCOMPUTERS AND MICROCOMPUTER PRODUCTS

The experiences in Kenya and Indonesia related to the indicators of institutionalization discussed in this chapter suggest some hypotheses about institutionalization.

Hypothesis 1. Distribution of control over critical resources must support institutionalization of microcomputer use if that use is to be institutionalized.

The cases of Kenya and Indonesia make it clear that microcomputers are not an apolitical tool. Within any LDC government context there are likely to be those who perceive microcomputer adoption to be positive and those who perceive it to be negative, whether for personal, organizational, or policy reasons. The cases suggest that institutionalization of microcomputers depends on whether those who support microcomputer adoption hold sufficient power over critical resources.

Thus, Hypothesis 1 suggests that gaining the support of those with control over essential resources is critical to institutionalizing microcomputer use. The cases appear to support the hypothesis. In MALD, as in MFP, Kenya and MOF, Indonesia, a critical factor in determining institutionalization of microcomputer use appears to be support of senior people with control over crucial resources. Thus, developing trained microcomputer operating staff, to supply output, and instilling appreciation for the system among senior officers, appear to be best pursued simultaneously.

In Kenya, the key distribution of power determining institutionalization of microcomputer use has been largely inter- rather than intra-ministerial. Because MFP has more power than any other ministry, with the exception of the Office of the President, MFP's decision on whether to adopt microcomputers was pivotal for institutionalizing microcomputer use in MALD, and in the government generally. If the Financial Secretary had refused to accept microcomputers in MFP, MALD would have clearly been out of step with the views of the most powerful forces in government. A TAP advisor in MALD commented that without MFP, microcomputer use in MALD "could have died on the vine. MALD was really only an experiment until a ministry like MFP or the Office of the President adopted microcomputers."

One of the most critical resources controlled by MFP is microcomputer programming staff. The government computer center (Central Bureau of Statistics, CBS) in MFP, and the Directorate

of Personnel Management (DPM) will control future training of microcomputer operators. DPM and CBS have refused to allow MALD promote clerks who have learned microcomputer programming. MALD is therefore limited in the incentives it can offer to encourage its staff to learn to become microcomputer programmers. If the only incentives are those of expanded employment opportunities outside the ministry, it will hardly help to institutionalize microcomputer use within the ministry.

The head of DPM and the head of CBS insist that in the future all microcomputer operators must come from the data operator or computer programmer scheme of service. Whether or not CBS and DPM will actually assign someone from those schemes of service at the request of MALD is difficult to predict. If they are not responsive to MALD requests for programmer personnel, MALD does not have enough power to demand trained microcomputer operators.

Thus, institutionalization within MALD will depend in part on the response of senior officials outside the ministry. Microcomputer use will not be institutionalized until there is a well-functioning personnel system that can provide staff at two levels. One level is administrative cadre who understand the microcomputers, what they can do, and how to operate them at least on the simplest level. MALD may be able to develop those capacities among its own finance officers. The second level is staff who can program the microcomputer in dBase II or another programming language. For that capability, MALD is likely to have to rely on OPM and CBS.

MFP, in contrast, can demand, and enforce, staffing of trained microcomputer operators from the government computer center and DPM. As the need for microcomputer operators develops in MFP, there will be increasing pressure on the personnel system and the computer center to ensure that those operators are trained and available. MFP can also block or permit allocation to MALD of funds for microcomputer systems. The government's recent agreement to accept IBM Personal Computers in MFP constitutes what may be a significant step toward institutionalizing microcomputer use in the government generally.

In Indonesia, many of the issues that arose in Kenya concerning control over resources are not relevant. The power and commitment of the head of PAIK makes it clear that microcomputers are to be a permanent part of the public administration landscape.

The major source of conflict over microcomputer adoption involves levels of authority within MOF. Some local officers perceive microcomputers to be a threat to their authority and/or income. They are attempting to withhold the resources over which they have some power, notably local staff cooperation in establishing the new system. The resolution of that conflict will depend on circumstances that are not directly related to microcomputer use, i.e., the relative power of headquarters and local offices in determining the processes by which local offices are run.

There is also a limited power conflict between PAIK and the Directorates in which the microcomputers have been placed. The conflict is not to determine whether microcomputer use is to be institutionalized, but the pattern of that institutionalization. PAIK wants to continue its control over all computers, including the microcomputers. The Directorates want control over all the processes within their domain. The Directorates have recognized that control over supply of the microcomputer operators supports PAIK's control over the microcomputer operations within the Directorates. The Customs Directorate has begun to develop its own microcomputer programming staff in order to control supply of programmers. Other Directorates may follow suit. It is clear that the control over supply of systems analysts and programmers for the microcomputers will determine the pattern of institutionalization of future control.

Hypothesis 2. Incentive systems must support institutionalization if microcomputer use is to be institutionalized.

In the two Kenya ministries, the incentive structure has clearly impeded microcomputer use among planning officers and administrative staff. Most of the incentives for those officers to learn to use the microcomputers and microcomputer products are external to the formal ministry management system. The incentives are provided by TAP or RPP, or arise from expectations about improved employment opportunities outside the ministry. Similarly, clerks and secretaries are enthusiastic about learning microcomputer skills in response to perceived incentives outside the ministry. Unfortunately, the incentive to learn to use microcomputers in order to get a better job outside the ministry does not help to institutionalize microcomputer use <u>within</u>the ministry.

In MALD, the management systems actually discourage officers from learning to use the microcomputers. One such system is the frequent rotation of senior level administrators. New senior officers are often uninterested in spending a great deal of time learning to use the microcomputer systems, knowing that they will be transferred within a few years to a new ministry. Only if the microcomputer systems, e.g., allocation of AIEs, are already embedded when new senior staff come into the ministry, are those officers compelled to learn to work with the systems.

What is particularly interesting about microcomputer use is that there are incentives to learning to use the machines which are inherent in their use. All of the MALD staff who have learned to operate the microcomputer have been motivated, at least in part, by that fact that using a microcomputer makes their jobs easier and more interesting. While for many people this incentive does not compensate for lack of material incentives, for some it has been a powerful factor motivating them to learn to operate the machines.

An additional intangible incentive for using microcomputer output is the perception that such use enables one to markedly improve performance of tasks demanded by superior officers. Thus, the ability to complete assignments from superior officers more quickly, easily, and/or accurately with the microcomputer can function as an incentive to use the microcomputer or its output. Eventual formal recognition of the improvement does, however, appear to be important to sustaining the force of that incentive.

In Indonesia, PAIK has acknowledged the importance of incentives, and anticipates that ministry staff outside PAIK who learn to operate the microcomputer will receive financial compensation. Yet there are other management systems that discourage development of skilled staff in the microcomputer "technical-content" teams. One of the most important of those management systems is the frequent rotation of top team staff. There is a learning curve that new team leaders must traverse, and often they are rotated just as they are becoming adept in dealing with both content and technical aspects of the information systems. To move up in the system, however, officers must rotate. The incentive is therefore to move on, rather than stay with their teams.

A major obstacle to institutionalizing the microcomputer system in MOF, Indonesia is the opposition of the heads of local tax and customs offices. The structure of incentives within which those officers operate leads them to resist microcomputer adoption in their offices. What MOF has not considered is providing incentives that encourage the heads of local offices to support the new system. It is too early to say whether absence of such incentives will greatly obstruct institutionalization at the local level; what seems to be the case is that providing such incentives would facilitate the process of institutionalization.

Hypothesis 3. The less comprehensive the change in activities related to microcomputer use, the more easily that use is institutionalized.

This hypothesis arises directly out of the microcomputer adoption experience in Kenya, and the comments of PAIK staff in Indonesia.(4) In Kenya, microcomputer use that only substituted for manual processes, but carried them out faster, more easily and accurately, were institutionalized much more quickly than microcomputer use associated with new ways of using information. Thus, AIE allocation system in MALD was institutionalized most quickly.

The expenditure monitoring system has two functions, one of which was institutionalized relatively quickly, one very slowly. The former function demanded greater use of information, but not extensive changes in the ways the information was used; it has been quite successfully institutionalized. The latter function, which requires extensive changes in the ways information is used

for decision-making, has been extremely difficult to institutionalize. The same has been true for other systems, like development of budget estimates, that require comprehensive changes in the way information is applied to decision-making.

The relative difficulty in institutionalizing various applications appears to relate in part to the need for use of information to become an integral part of a decision-making system if it is to be institutionalized. If the information provided by the microcomputer is essentially the same information as is already being used in decision-making, it is relatively easily integrated into that system. Institutionalization of use of that kind of information is relatively easy. If, however, the information is new, or must be used in a new way, integrating the information into a decision-making system is more time-consuming and difficult. Institutionalizing that use of information will be relatively difficult.

TAP has been attempting to integrate microcomputer-produced information into the MALD decision-making process in order to institutionalize use of the information. In contrast, in MFP the microcomputer has been used to respond to ad hoc requests from the top echelon. By using the microcomputer in that way, RPP has developed a constituency at the senior decision-making level. The demand for microcomputer output is, however, dependent on individuals. If those senior officers were to leave the ministry before the information were an established part of the decision-making process, and they were succeeded by new officers with a different orientation, the demand that has developed thus far would largely disappear.

Thus, while developing the support of senior officers is important to institutionalizing microcomputer use (see the discussion of Indicator 2), it is not enough. Integrating the information into a decision-making system is necessary to convert individual ad hoc demand to institutionalized demand. The need to integrate microcomputer-produced information into a decision-making system contributes to the relative ease or difficulty with which microcomputer applications are institutionalized.

In Indonesia, PAIK officers acknowledge the greater difficulty in instituting a system that diverges widely from the established ways of doing things. They plan to introduce the microcomputer system "slowly, step by step," with initial use nothing more than substitution of the microcomputer to produce the same information that had been prepared manually. More extensive changes in using information will await MOF staff's developing confidence in using the microcomputer.

CHAPTER IX

ANALYSIS OF THE IMPACT OF MICROCOMPUTER ADOPTION

Microcomputers have been used in Kenya and Indonesia too briefly to permit evaluation of their impact with any accuracy. The experience in Kenya, and to a much lesser extent in Indonesia, can, however, indicate the value of some hypotheses concerning impact. The intent of this section is therefore to present hypotheses that appear to illuminate the nascent conditions of impact of microcomputer adoption.

Hypothesis 1. Use of microcomputers and microcomputer products will be associated with increasing decentralization of authority.

The experiences in Kenya and Indonesia strongly suggest that microcomputer use does not, in itself, support either centralization or decentralization of authority. The extent to which microcomputer use supports one or the other appears to depend on macropolitical policies.(1)

In Kenya, an important political initiative is the "district focus," which directs ministries to begin to devolve development planning and financial authority away from headquarters and the regional level, toward district-level offices of the federal government. Thus, there would be some degree of decentralization whether or not microcomputers were used in the government. Microcomputer use will, however, facilitate decentralization. In MALD, the microcomputer has made disaggregating and monitoring information at the district level a feasible process. The speed with which budget drafts are prepared using the microcomputers has made it easier for finance officers at headquarters to confer with district officers about tentative allocations. By enabling central officers to monitor activities and expenditures at the district level, the microcomputers may also have reduced central officers' resistence to decentralization. The same kinds of applications in support of district focus have been initiated in MFP.

It must also be noted, however, that it is not the unanimous consensus of advisors and officers in the Kenya ministries that microcomputer use has been entirely supportive of decentralization. Even applications that seem to clearly support decentralization have conflicting implications. MALD's use of microcomputers to allocate AIEs to the districts, for example, appear to support decentralization by making it possible for district level officers to be involved in the allocation process, and for allocations to be made directly to the district level. At the same time, central headquarters' greater ability to monitor and control the activities of AIE holders could become very threatening to the local spending stations. Yet experience

in other countries, including the United States, suggests that in fact there may be no conflict; when the center is better able to monitor activities and expenditures at the local level, it is often more willing to delegate responsibility to the local level.

Other microcomputer applications, particularly word processing of the District Development Plans in MFP, appear to have had a more mixed effect. Some advisors involved in producing the district plans hold that without word processing it would have been impossible to produce the plans within the deadline. The use of word processing, they believe, gave the MFP headquarters more time to interact with district officers and help them to prepare reasonable plans. Some planning officers at headquarters concur with that assessment, noting that the last effort to produce district plans took two years.

Other advisors and planning officers in MPF feel that use of word processing unnecessarily removed the district plans from the authority of district officers. They are convinced that training secretaries in word processing was so time-consuming that typing would have been equally fast, and would also have permitted the plans to be produced entirely at the district level. They are also concerned that the use of word processing extablished an unrealistic standard of what a plan "should look like." As a result, the districts will be even less likely to be permitted to produce their own plans in the future. Finally, they feel that the use of word processing excluded planning officers at headquarters who did not understand and therefore could not supervise the word processing activities. They feel that by excluding planning officers and running the word processing operation themselves, the advisors alienated the planning officers from the overall district planning process.

It is impossible to offer a final assessment of the effect of the microcomputer adoption on decentralization within MFP or MALD. What is clear is that the impact on decentralization will be strongly influenced by macropolitical conditions, which now encourage decentralization of decision-making authority within the government apparatus.

In contrast, in Indonesia, one goal of central decision-makers in the Ministry of Finance is to reduce the power of district tax and customs offices, and to increase the centralization of decision-making in the Directorates. The microcomputers are one element of a computerized system designed to reduce autonomous decision-making power at the local level. The new system is intended to limit opportunities for corruption by removing all responsibility for direct communication with taxpayers from the local tax officers, and conducting tax reviews, cross-checks, auditing, and trends analysis at the provincial and central level. The use of microcomputers at the local level will, PAIK anticipates, improve accuracy, reduce opportunities for tampering with information, and provide a psychological impact that will discourage corruption.

The introduction of microcomputers into district offices is, of course, too recent to permit evaluation of the system's success. It is not impossible that local offices will find ways to circumvent the security measures built into the system, and eventually extend their power with the access to information the microcomputers will make possible. It does seem to be the case, however, that if the elaborate auditing and cross-checking systems are successfully implemented, headquarters is likely to be able to achieve their goal of using the computerized system to limit the power and autonomy of local offices.

Discussion of the differences in the dynamics of microocomputer impact on decentralization in Indonesia and Kenya (and, it can be hypothesized, other LDC contexts) and in the U.S. context is beyond the scope of this paper. It is worth noting, however, that Kraemer and Dutton (1982) found that in U.S. local governments, computing generally does not contribute to shifts in power but to reinforcement of the existing power structure, whatever it may be. Computing "reallocates power or influence only in the sense that it accentuates existing inequalities of influence" (Kraemer and Dutton, 1982: 173).

In contrast, microcomputers are being used as part of an effort to shift the existing power distribution in the Kenya and Indonesia national bureacracies. It could, of course, be argued that the "real" power is actually being serviced by those shifts. But that argument becomes a tautology ("a shift in power toward an actor necessarily means that the actor really already had relatively more power"). The actual dynamics in the national governments of Indonesia and Kenya are more complicated and relate to coalition-building and other features of the national context. Discussion of these issues must be reserved for another paper.

Hypothesis 2. The use of microcomputers and microcomputer products will be associated with changes in the distribution of power within organizational levels.

Can microcomputer adoption alter the distribution of power within levels of an adopting ministry, e.g., within the headquarters? Only MALD has been using microcomputers long enough for any such shifts in power to have become apparent, and observations even about MALD are highly speculative. Because of the importance of the issue, however, it is useful to consider some of the implications of microcomputer use on the distribution of power within the ministry.

One group in MALD which appears to have experienced enhanced power due to microcomputer use are the senior finance administrators in MALD. In effect, the use of the microcomputer translated the latent power of the senior administrators into real power. Previously, for example, although the PF&EO had the formal power to allocate funds, he had little information with which to defend his decisions when they were challenged. Now the

senior decision-makers of the finance division have figures which they can use to support policies they want to implement.(2)

Another group which appears to be increasing the legitimacy of its participation in decision-making is the planning division.(3) With the use of the projects registry, the planning division has been able to provide project status reports to senior administrators upon request. They are consequently being perceived as a more effective branch, and the division officers anticipate having more influence on policy. Within the planning division, an increase in the relative power of the "technocrats," those planning officers who have developed quantitative analytic skills, is more problematic. If decision-making becomes more "technically based," it appears to be more likely to result from the increased seniority of those with technical skills, rather than conferral of power in recognition of technical skills.

Another group whose stock appears to have risen with MALD's use of the microcomputers is TAP. The microcomputers have given TAP greater exposure and helped to raise the interest of the ministry in TAP advisors and their activities. Because the microcomputer project is perceived to be a success, TAP's advice appears to have greater legitimacy across many areas that have nothing to do with microcomputers.

On the other hand, there are risks associated with that kind of exposure. Because the microcomputer activity is very visible, if serious problems develop, they will also be highly visible. Just as the microcomputers have raised TAP's credibility to an extent disproportionate to the actual impact of the microcomputers relative to other TAP activities, a crisis in the microcomputer system can disproportionately reduce TAP credibility. Similarly, in MFP, the microcomputers have made RPP much more visible throughout the ministry. If the use of microcomputers is perceived to be successful, RPP appears likely to enjoy a rise in influence in areas unrelated to the microcomputers. If the microcomputer projects run into serious problems, they may undermine RPP's work generally.

In Indonesia, the introduction of microcomputers appears to have sharpened the issue of relative power between PAIK and the Directorates in which the microcomputers are placed. The differences between PAIK and the Directorates relate not to whether microcomputers will be used, but to the pattern of control over that use. PAIK is interested in maintaining control over all computers, of whatever size. It is therefore attempting to establish a system whereby any computer use that has implications for other offices - as must be the case for almost all applications - must be approved and monitored by PAIK. The Directorates, on the other hand, want control over all processes within their jurisdiction. Although it is too early to predict the outcome, it is clear that PAIK and the Directorates perceive adoption of microcomputers to affect their relative power, and each is maneuvering for control over the new technology.

Hypothesis 3. The use of microcomputers and microcomputer products will be associated with changes in the hierarchy of skills, but not concomitant changes in the hierarchy of rewards.

This hypothesis suggests that microcomputer adoption will effect changes in skills more quickly than the structure of rewards will respond. Certainly the experience in Kenya appears to support the hypothesis. Training in microcomputer programming was given to individuals without considering the difficulty with which those individuals could be rewarded for their new skills. In part, that approach was a response to the lack of available trainees who could more easily have been rewarded within the existing personnel structure. It also appears to be a result of underestimating the difficulty with which the government reward structures would accomodate entirely novel skills.

These conditions appear to be related to more general patterns of response by bureaucratic organizations to pressure for change in reward structures. While individuals can be trained on a more or less ad hoc basis, changes in the structure of rewards, particularly in a bureaucracy, require much more complicated changes in structures of power. Such changes are often difficult and time-consuming to achieve because there are power-holders whose interests lie in maintaining the status quo. Controlling who has access to learning particular skills is an age-old method of maintaining power. When that control is sustained through the reward structure, power holders are likely to resist changing the structure of rewards until they are ensured control over the new skills.

One consequence of this type of phenomenon appears to be limitation of the potential use of microcomputers to expand opportunities for those currently at low skill-reward levels. Because microcomputers are relatively easy to learn to use, they can open opportunities to those with few formal credentials. Using a microcomputer, someone with relatively limited academic background can learn to produce output comparable to what has until recently required extensive technical training. As microcomputers become a more valued part of an information system, control over microcomputer operations will become more important. Those who already have control over information and information processing may be unwilling to relinquish any of that control. One response may be an attempt to limit introduction of microcomputers. Another may be an effort to insure that they maintain control over any microcomputers that are introduced.(4)

One group that seems to be particularly affected by restrictions in access to microcomputer training are women. It seems clear that clerks, who are primarily women, can learn to program and operate microcomputers. Yet in Kenya it appears likely that programmer analysts, the majority of whom are men, will have exclusive access to jobs in microcomputer programming, and the higher status and pay associated with those jobs. Clerks will be

excluded from the opportunities for learning to program microcomputers, improving their job status, and raising their incomes. Computer operators, about half of whom are women, will receive training in basic microcomputer operations, but are likely to be relegated to basic operations rather than more skill-intensive work, and concomitantly lower incomes.

Similarly, in Indonesia only about 10% of microcomputer trainees are women. Their low representation is, according to one officer, due to the generally lower level of education among women. Yet it is unlikely that women's educational levels would make it difficult for them to learn microcomputer programming, and would certainly not bar them from using the menu-driven programs that are to be used by the trainees.

It is far too early to predict the eventual distribution of rewards from microcomputer training in Kenya and Indonesia. It is useful, however, to note that microcomputer adoption has the potential to alter the hierarchy of skills and rewards. It could therefore be used to improve employment prospects for women, who traditionally have very limited opportunities.

Hypothesis 4. Job quality will improve for those who use the microcomputer and/or its products.

Studies of microcomputer use in city governments in the United States indicate that microcomputer operators perceive their job quality to improve with microcomputer use, their influence with respect to others to increase, and time pressure to become intensified, while time pressure eased for those who use microcomputer products (Kraemer and Danziger, 1984) The experience of microcomputer operators in Kenya appears to support those observations. Microcomputer operators, including clerks, secretaries, and planning officers, all reported that microcomputer use has made their jobs more interesting, easier, less tedious.

Most of those who use the microcomputer are doing the same tasks they had been doing manually, only now use the microcomputer. In a few of those cases there is somewhat more work involved, e.g., one may have worked steadily for four hours per day and now must work five or more hours per day. Nevertheless, those operators report that their jobs are more interesting and easier with the microcomputer. For one clerk in MALD and one in MFP, work and responsiblities have increased substantially. Whereas formerly they were doing straightforward clerical tasks, they are now programming the microcomputer and interacting with a much higher level ministry officers. Despite the increase in workload, both clerks report that the quality of their jobs has improved because their work is more interesting. One of those clerks also feels that her influence with respect to others has increased due to her ability to operate the microcomputer.

At the time of this study, microcomputers had been used for only

a short time in MOF, Indonesia, and most microcomputer operators were still training. The secretaries and clerks in MOF who were already using the microcomputers did report effects similar to those in MALD and MFP, Kenya. They felt their work became easier, less tedious, more interesting.(5)

Officers in MALD who use microcomputer products also reported that their jobs have improved due to the availability of that output. Time pressure has eased dramatically for some of those products users, who say that they can now get information within days that once took weeks or months to calculate themselves. They also feel that there are responsibilities they would not be able to fulfill if they did not have access to the microcomputer output.

Hypothesis 5. Microcomputer adoption is associated with labor displacement.

It is obviously far too early to render any judgement about the impact of microcomputer use on employment.(6) It is interesting to note, however, that in Indonesia, where mainframe computers have been used relatively extensively in government, there is little concern about negative impacts of microcomputer use on employment. In fact, MOF officers reported that they expect microcomputer use to generate new work, primarily in the area of information analysis and related tasks. They anticipate that while some typists and clerks may be displaced from their current work, they will easily be retrained to use the microcomputers to meet new demands for information. The ultimate result, they feel, will be more efficient and effective allocation of resources. There is also considerable confidence among the secretaries and clerks now using the microcomputers. Those interviewed for this report are convinced that the microcomputers have actually generated more work, and will continue to do so.

In Kenya, more concern about potential labor displacement was voiced by some planning officers and secretaries. While they noted that there was little chance that anyone would be fired from government jobs, they worried that microcomputers could affect future employment.

Interestingly, however, the divisions that have been using microcomputers most, displayed the least concern about potential labor displacement. In MALD, which has had microcomputers for three years, no one interviewed, including clerks, secretaries, planning and finance officers, felt that microcomputer adoption might lead to unemployment. Transport officers, now using a microcomputer for a transport monitoring system, reported that use of microcomputers substantially cut the effort involved in certain secretarial tasks. The result has been increased output by secretaries who can now keep up with other work that previously had not been done, or had been done late. The perception to date among MALD staff appears to be that microcomputers have led to increased productivity rather than

idle staff.

These observations are not to be construed as evidence that introduction of microcomputers will not be associated with labor displacement. They do raise the likelihood that microcomputer use may be associated with increased productivity rather than decreased employment. Since productivity in the government service is a major problem in Kenya, introduction of a tool that can help increase productivity would be welcome.

It has also been noted by advisors and some ministry officers that labor-intensive methods are not feasible for certain kinds of information systems. There are both managerial constraints and practical difficulties associated with attempting to produce and revise large tables of information rapidly enough to make the information a useful management tool. Time constraints also often make labor-intensive production an infeasible option. That is particularly the case where calculations must be carried out sequentially and within a very short time.(7)

For some of those operations, the microcomputer application used is word processing. Word processing as a generic function is one of the most questionable ways of using microcomputers in developing countries. It has been argued that given the factor proportions in LDCs, microcomputers should not take the place of typists and typewriters. TAP and RPP advisors, and some MALD and MFP finance officers disagree, however. They say that the low level of typing skills among secretaries forces professional staff to allocate excessive time and energy to proofreading typewritten documents. Often, pages must be retyped in their entirety to correct typographical errors, or to make desired changes. The new pages must be completely re-proofread, and frequently have new errors. Production of a document can require many iterations, just to correct typing errors. Such demands on professional staff time decrease the time available for more important decision-making responsibilities. Use of word processing can reduce amount of scarce professional staff resources that must go into routine proofreading tasks.

Hypothesis 6. For some in the organization, the perceived effect of microcomputer use will be negative.

TAP advisors had expected some negative response to MALD's new, computerized monitoring system from local officers threatened by loss of autonomy. Thus far, however, that response has not been forthcoming. Possibly, those whose activities have begun to be better monitored with the microcomputer system do not yet feel the impact of that monitoring, and/or do not know it involves a microcomputer. If monitoring begins to affect the freedom of action of local officers, there may yet be resistence the microcomputer system. The only negative response in MALD appears to have come from Division Chiefs and one administrative officer who perceived their roles to have been bypassed by the

microcomputer system. Once their roles were integrated into the new system, that resistence appeared to have receded.

In MOF, Indonesia, there has been a sharp negative response among local tax and customs officers who perceive the new microcomputer system to impinge on their powers and prerogatives. Since the system was established to do precisely that, it is not surprising that some local officers have reacted negatively. The extent to which that response will persist, and the process by which the conflict will be resolved cannot be predicted.

Hypothesis 7. Use of microcomputers will be associated with greater utilization of information in decision-making than was previously possible.

The phenomena described by this hypothesis are undoubtedly the most difficult to assess. There are actually two issues related to the impact of microcomputer use on decision-making. The first relates to the accessibility of information. The second concerns the application of that information to decision-making processes.

The experience in MALD clearly suggests that microcomputer use can be valuable in organizing large quantities of information so that they are more accessible to decision-makers. For example, microcomputer use makes it possible to manipulate information in order to present useful relationships in the data. It also accelerates the ability to revise information as new data becomes available, or as decisions are made to alter the figures.

These kinds of microcomputer applications provide valuable opportunities to improve various kinds of financial monitoring and budget preparation activities. Even the more mundane microcomputer applications appear to indirectly contribute to improving budget development. Producing budget documents using word processing and machine stencil cutting helps to free senior officers from the time-consuming tasks of proofreading and overseeing production of the physical document, giving them more time for analysis of the budget. With the assistance of the advisors, ministry officers have apparently utilized at least some of that time to prepare a more carefully conceived budget submission, which better reflects considered priorities.

Those efforts were enhanced by other contributing factors. The use of microcomputers to produce expenditure monitoring reports provides a good example of the multiple factors involved in improving the expenditure monitoring system. Use of the microcomputers has made expenditure reports more accurate, more current and more flexible and focused. The result has been reports that are more relevant and easier to apply to the particular needs of the decision-makers. The reports appear to have helped Estimates Officers to limit the extent to which spending stations over-spend their allocations.

Yet other contributing factors have been equally or more

important in producing those effects. The district treasuries' tighter control over the expenditures in their jurisdictions, for example, contributed greatly to limiting the over-spending by spending stations. The assistance of the advisors has been an essential factor in improving use of financial information.

It appears quite clear, then, that use of the microcomputers, in the context of the other contributing factors, helped to improve the more "mechanical" tasks of the finance and budget process, such as record-keeping and expenditure monitoring. What is more problematic is whether the information made available in those records, or through those monitoring exercises, is actually being used to improve policy-related decisions.

Some advisors feel that microcomputer use has helped to improve the quality of decision-making by providing information that otherwise would have taken so much time and effort to produce it would never have been made available. The availability of the information has, in their view, helped them to develop finance officers' analytic skills that contribute to better decision-making. One example of the way microcomputers contribute is in the aggregatation and disaggregation of expenditure information to reveal the real costs of certain expenditures. The result is that expenditure reports have been more used more effectively to address problems of over- and under-expenditure during the fiscal year, and to improve the budget allocation process.(8)

Other advisors, however, feel that application of the microcomputer-produced information to decision-making thus far has been limited. The monitoring information system has been improved: letters go out to project heads when rates of expenditure are over or under acceptable quarterly levels. The letters ask for explanations of the over- or under-expenditure. There is not, however, a system to follow-up on the monitoring information. There are no effective disciplinary measures available if projects continue to over- or underspend. Comparative evaluation of projects, assessment of general trends in over- or under-spending, and evaluation of "problem expenditure items" across projects are not carried out by ministry staff. To the extent that information is used for this kind of analysis, it is through the efforts of TAP advisors.(9)

Nonetheless, there is growing enthusiasm among MALD finance officers for new monitoring systems using the microcomputer. The expectation is that the systems will help improve the efficiency and effectiveness of the allocation of scarce resources. The vehicle monitoring system, provides a good example of such a system. Vehicle monitoring was recently established to help cut transportation operating costs and improve the efficiency of vehicle use. Certainly, trying to monitor 3-5,000 vehicles would be extremely resource-intensive without the microcomputer, and probably could not be done with the available Transport Office staff.

The new microcomputer system tracks the asset and

operating costs of the various ministry vehicles. By identifying the vehicles that are relatively more costly to maintain and operate, it will be possible to target sources of excessive cost. Of course, the availability of the information will not ensure that it is used to change the vehicle operations policies. It merely makes it easier to do so if there are sufficient incentives to induce administrators to make changes.

In the planning division of MALD, analysis does not appear to be an important part of the decision-making system. Certainly microcomputers can facilitate statistical analysis, and are potentially useful tools for planning and project evaluation. Some junior planning officers have used the microcomputers to prepare reports that incorporate statistical analysis. Those reports have been received and acknowledged by senior officers.

The extent to which the reports are used in the decision-making process is difficult to ascertain, however. Many reports seem to be ignored or used only by advisors who provide alternative options to decision-makers. The most important role of the microcomputers in planning has been as a tool to encourage younger planning officers to do more sophisticated analysis than is ordinarily done in the planning division.

The microcomputers are only one factor effecting this change in orientation, however. TAP advisors have put considerable effort into recruiting young economists with good analytic skills and strong academic backgrounds. TAP advisors work closely with those junior officers to encourage their use of the microcomputer as a tool of analysis, and help them to use it effectively. Thus, the microcomputer has been a tool used by TAP and some ministry officers to develop a cadre of younger planning officers with quantitative skills and interest in using them in their work. It is hoped that those abilities will contribute to decision-making processes using the reports prepared by those planning officers. Perhaps more importantly, it is an attempt to instill an improved decision-making approach in officers who may eventually become senior decision-makers.

In MFP, information has thus far been prepared primarily by advisors and a few finance officers, in response to requests from the senior officers of the finance or planning divisions. That sort of ad hoc responsiveness has provided information useful in considering issues at top levels of government, and in organizing certain systems, e.g., the distribution of food to areas hit by famine. While this application of information appears to be extremely valuable, its use is limited to officers at the top level of the ministry, who are experienced in the use of quantitative analysis.

As yet, however, the microcomputers do not appear to be part of any established decision-making system in MFP. If the top leaders in the ministry were to leave, and new officers with a different orientation to come in, use of the microcomputers for decision-making could be cut back significantly.

There are efforts being made in MFP to develop systems that will incorporate microcomputer output as an integral part of the decision-making process. One important application will be in budget production. Microcomputer use is likely to improve the accuracy and rapidity with which the budget can be prepared. Whether it will, as is hoped, induce budget officers to spend more time analyzing the budget submissions and conferring with the officers of other ministries remains unclear.

Another important system is the projects registry, which is expected to enable planning officers to keep better records of the projects for which they are responsible. Whether the planning officers will use that information to improve project evaluation and monitoring is likely to depend on other factors than the microcomputers.

These observations are, of course, based on only short-term evidence. The trend toward greater recognition of the value of using information for decision-making suggests that microcomputers will increasingly become an effective tool in administrators decision-making kit.

One advisor has hypothesized that part of this process is modification of the traditional bureaucratic culture. That style, he suggests, developed in the face of limited access to information. Because decision-makers have traditionally had difficulty enforcing the submission of accurate information that they could not analyze, they have developed a management style that does not rely to any great extent on the use of information. With improved access to accurate information, and the ability to analyze that information, that management style may be changing. The microcomputer system thus creates the possibility for improved approach to decision-making, which did not exist before.

While the availability of information may in itself contribute to modifying the decision-making style, obstacles to using microcomputer-provided information appear to be indicative of more general problems of financial management. Effective use of microcomputers for decision-making will therefore depend on the development of new management systems and structures that incorporate use of the information made available. Thus, incentive systems and structures of responsibility must be devised to better support use of microcomputer-provided information for decision-making.

In MALD, the advisors and some ministry officers are making a concerted effort to provide training and incentives that will stimulate use of microcomputer-produced information in decision-making processes that previously did not utilize such information. Their efforts have been successful most quickly in areas in which the information was already being utilized to some extent. Where decision-makers were almost entirely unaccustomed to analyzing and applying financial or planning information, it has been much more difficult to stimulate use of the information

in decision-making.

Nonetheless, progress has been made. Officers are beginning to understand some fundamentals of analysis, and, more importantly, to value such analysis. The microcomputer appears to have contributed to the training efforts by providing advisors with more accurate information more rapidly, by quickly performing transformations of the data to clarify important issues, and by permitting the advisors to format information in ways that clarified its implications. By doing so, microcomputers have helped TAP advisors to more effectively encourage finance officers to consider the impact and importance of policy decisions. Thus, while microcomputers alone are not likely to improve use of information in decision-making, they proved a valuable tool in a management training effort to do so.

In any context, progress in changing management structures and systems requires considerable time, training and patience. That microcomputers have come to be considered important by ministry officers makes it more likely that they will increasingly contribute to the quality of decision-making.

Even if the decision-making style is modified, however, there are limits to the extent to which a public sector agency will be willing and able to make "rational" decisions entirely on the basis of "objective" information. In all countries and governments, there are other considerations that condition decision-making. The conflict between decision-making on the basis of efficient allocation of resources, and on the basis of other "political" considerations cannot be resolved by the adoption of microcomputers. Some observers even suggest the caveat that information provided by microcomputers could be used merely to help entrench current elites, and to justify policies that policy-makers favor on other bases than efficiency or equity.(10)

It will be important to recognize that those possibilities exist, and to carefully scrutinize the way in which information is used, when it begins to be used by policy-makers in their policy-making activities. Yet it is also clear that an effective information system is necessary to help improve the rational allocation of resources, toward goals of efficiency and equity. Building such a system, and gaining acceptance of the legitimacy of utilizing the information in making decisions that necessarily have a political component, is a crucial first step, and has been taken.

CHAPTER X

SUMMARY AND CONCLUSIONS

SUMMARY

This study began with a simple model of three stages of microcomputer adoption: introduction, use, and institutionalization. The model was than utilized to examine microcomputer adoption in three cases, the Ministry of Agriculture and Livestock Development (MALD) and the Ministry of Finance and Planning (MFP), Kenya, and the Ministry of Finance (MOF), Indonesia.

Microcomputers were introduced into MALD, Kenya, about three years ago.(1) MFP, Kenya, received microcomputers about one year ago. MOF, Indonesia, adopted microcomputers only a few months before the advent of this study. Clearly, the relatively short period during which microcomputers have been used in these cases makes conclusions about microcomputer adoption extremely tentative.

The objective of this chapter is therefore a modest one. It seeks to summarize the observations made about the factors that appear to be important in achieving effective adoption of microcomputers. It offers some preliminary conclusions related to hypotheses that emerged as most useful in capturing the experience of the cases. In doing so, it will, hopefully, provide signposts for future microcomputer adoption efforts, and for future studies of the experience of microcomputer use in developing countries. A brief summary of some key points first serves to orient the following, more detailed discussion.

The Ministry of Agriculture and Livestock Development (MALD) and the Ministry of Finance and Planning (MFP) in Kenya adopted microcomputers as part of a response to tightening macroeconomic constraints. The microcomputers were introduced by external advisors who provided most of the essential resources, training in microcomputer operations and applications, and incentives to encourage officers to learn to use the microcomputers and the microcomputer output.

In the Ministry of Finance, Indonesia, microcomputers were introduced on the initiative of the ministry computer center. The intent was to centralize ministry tax and customs operations in order to increase the accuracy of assessment and collection of fees. Although they received assistance from advisors, the computer center (PAIK) was responsible for most of the training, designing the information system, and ensuring an adequate supply of essential resources.

Certain factors emerged as critical in determining the response to microcomputer adoption in the ministries. The most decisive factors appear to be those related to management systems and structures, rather than to the presence of adequate skill bases. Primary among those factors were the role of government leadership, the ministry incentive system, and the power structure.

The cases in both countries suggest that the initial demand for microcomputer output was generally for information that was already being used, but was needed more rapidly and with greater accuracy. When new kinds of information were provided, or old kinds of information were to be used in new ways, it became evident that training of professional staff in the use of that information was necessary.

The cases also suggest that the way in which microcomputers are used makes it important to distinguish between use of microcomputers and use of microcomputer products. The distribution of skills, and the relative ease of microcomputer use, led to systems in which the microcomputers are operated by clerks, while the output is used by professional staff. A number of conditions emerged from that situation. One of the most important is the possiblity that institutionalization of microcomputer output would not necessarily be accompanied by institutionalized supply of that output. The reverse is also true.

Evidence from the cases supported the hypothesis that institutionalization of microcomputer use requires the support of those with control over essential resources, including staffing and budget allocations. It also appears that the more comprehensive the change in activities related to microcomputer use, the more difficult it is to institutionalize that use.

With regard to the impacts of microcomputer adoption, conclusions were necessarily very tentative. The experiences in Kenya and Indonesia suggest that the impact of microcomputers on decentralization of authority depends largely on the macropolitical trends within the ministry and the country. Microcomputers also appear to be a tool that can support shifts in power within levels of the ministries.

With regard to job quality, the cases suggest that the impact is, at least initially, positive. Although it is too early to predict the impact on job displacement, expectations in the ministries are that the microcomputers are more likely to generate a net increase in jobs than to displace workers.

It is difficult to assess the impact of microcomputer adoption on the quality of decision-making. The cases make it clear, however, that in order for microcomputers to help to improve decision-making, management systems and power structures must support changes in decision-making styles. Training is also likely to be needed to improve skills in analyzing information

and applying it to decision-making.

EXAMINATION OF FACTORS DETERMINING OUTCOMES OF MICROCOMPUTER ADOPTION

Factors Associated With Effective Introduction

The model that guided this research suggests that effective introduction of microcomputers contributes to the receptivity of organizational staff to microcomputers. A number of factors were hypothesized to determine effective introduction: leadership messages, external pressure, advisors' credibility, and a favorable "balance of power."(2)

One tentative conclusion that can be derived from the cases is that support from the leadership is critical to effective introduction of microcomputers. In both Kenya ministries, divisions which had strong leadership support for microcomputer adoption showed greater receptivity and less resistence than divisions in which there was little visible leadership support for microcomputer adoption. To the extent that the professional staff perceived leadership messages to discourage their use of microcomputers, they have resisted learning to operate the microcomputers. In MFP, where leadership messages were most contradictory, there has been considerable confusion on the part of the professional staff regarding the real value of the microcomputers, and more resistence to learning to use them.

In contrast, in MOF, Indonesia, the adoption of microcomputers was spearheaded by the head of the ministry computer center. Leadership messages have been clear and consistently positive, and there appears to be little question among ministry staff that microcomputers are to be a permanent feature of ministry operations.

The literature on organizational change suggests that because organizations generally use "satisficing" rather than "optimizing" strategies, they usually adopt innovations only under pressure.(3) Evidence from the cases suggests that the role of external pressure in inducing microcomputer adoption may be more complicated. When microcomputers are introduced by agents outside the government, very powerful external pressure for change may be necessary to convincing leaders that microcomputer use is worthwhile. That kind of pressure appears to be less important, however, if the initiative comes from within the government.

The Kenya experience exemplifies the first type of experience. In both ministries of Kenya, financial and political pressure made it clear to leaders in the finance divisions that change was essential. Those circumstances made them responsive to advisors' proposals for microcomputer adoption. In the planning divisions of those ministries, there was little pressure for change, and the leaders of those divisions have demonstrated little visible

support for introducing microcomputers into ongoing planning division activities.

The Indonesia experience illustrates the second type of situation. In Indonesia, the impetus for microcomputer adoption came from the head of the ministry computer center. He does not appear to have been responding to critical external pressure for change. Instead, microcomputers apparently were adopted to help resolve what was perceived to be a serious ongoing problem in the ministry.

The cases also suggest, however, that whether the impetus for adoption comes from within or outside the government, microcomputers must meet a fairly explicit perceived need for change, rather than a vague expectation of general improvement. Thus, the "primary need" must already be experienced by the potential adoptors. If microcomputers are able to respond to that need, then a "derived demand" for microcomputers will motivate adoption. The implication is that the introduction of microcomputers as merely a way of generally improving operations is likely to be less successful than introducing them to address a specific problem already of concern to potential adoptors.

The introduction of an innovation is often accompanied by conflict over the value of the innovation. Another tentative conclusion inferred from the cases is that successful introduction requires a "positive balance" of leaders' support for adoption. The probability of successful introduction is further raised, it appears, to the degree that there is consensus among leaders that microcomputers should be adopted.

The study also tentatively concludes that the initiator's experience with the adopting agency is a key factor in successful introduction of microcomputers. Perhaps because it is important that the agency's leaders support adoption, and because the microcomputers should respond to specific perceived needs of the adoptors, it is important that those who introduce microcomputers are known and trusted by the leaders and are familiar with conditions in the adopting agency. In Kenya, TAP and RPP's long and positive association with the adopting ministries appears to have been a critical factor in eliciting a positive response to proposed microcomputer adoption.

Successful introduction also depends on early planning for sufficient resources, including hardware, software, back-up systems, servicing. What the cases made clear, however, is the difficulty with which estimates of a sufficient number of machines are made. Introduction of too many machines can create resistence and are difficult to employ effectively. Introduction of too few machines can impede training, servicing, and prompt response to increasing demand. Those problems can themselves create resentment, and sabotage an effective microcomputer adoption effort.

The Kenya experience suggests that it may be optimal to introduce

a relatively small number of machines, perhaps the minimum reasonable number, with additional machines readily available to permit rapid response to expanding demand. In Indonesia, however, the large number of machines, *per se*, did not create resistence. In fact, the introduction of many machines may have made the change more "real" to MOF staff.

The difference in the experiences of the two countries may relate to the agent of introduction. In Indonesia, the ministry leaders themselves introduced the microcomputers and strongly supported the adoption. In Kenya, the machines were introduced by foreign advisors, with much more limited support from Kenyan leaders. In the latter circumstances, introducing a large number of machines might have engendered resistence to and resentment of a "foreign" innovation. That type of reaction was not apparent in Indonesia. There are, nonetheless, other potential problems associated with the large quantity of microcomputers adopted by Indonesia: the scope of training may be excessively demanding; maintaining the security and integrity of the data across local-central office transfers will be difficult.

Factors Associated With Effective Use

Training is, of course, a key element in establishing effective use of microcomputers. The experience in Kenya, both positive and negative, suggests that even if the microcomputer training approach is primarily one of self-instruction, it is more effective if presented as part of a well organized program rather than with only ad hoc assistance.(4)

An initial oral orientation appears to be valuable in diminishing hesitancy about trying the new equipment. General written guidelines for microcomputer use and summaries of information about the purpose of various kinds of available software can help new users get started quickly without having to repeatedly ask questions of trainers. Where there is reluctance to ask questions, such documentation can particularly useful. Of course, it is important that documents are as clear as possible.

An important component of effective training appears to be direct relevance to the trainee's job. Exercises with applications directly related to the trainee's work are most useful. The best training, according to one trainer, is on-the-job training, receiving real assignments that are within the trainee's level of competence, and "having to struggle with them." The opportunity for self-teaching, with manuals and exercises, appears to be particularly attractive to some trainees. It does seem to be important, however, that someone is readily available to answer questions if the trainee needs help.

The cases also demonstrate that training is most effective if it is designed specifically for the category of microcomputer use that is needed. There appear to be five categories of microcomputer use: 1) Entering data into menu-driven programs; 2)

word processing; 3) use of interactive programming packages and spreadsheets; 4) use of statistical packages; 5) programming "high level" languages, including dBase II.

Each category requires different kinds of basic skills. By identifying those skills, the trainer can ensure that trainees have the requisite skills, or receive corollary training in those skills. The first three categories appear to be easily taught to those with basic reading comprehension skills. Experience in typing is also helpful for the second category, as is experience with spreadsheets for the third category. The fourth category of use requires sophisticated analytic skills. The skills necessary for the fifth category are less clear. The experience in MALD, Kenya, suggested that a certain level of mathematics background (four years of high school math) are essential. In MFP, however, math background did not appear to be an important factor. This remains an open issue.

The difference in skill needs for different categories of use also suggests that it is possible to adjust use to given skill levels. In fact, one of the ways in which microcomputers have revolutionized computer use is in its ease of use, given menu-driven programs. Consequently, if it is difficult to obtain staff with sufficient basic skills to be trained in programming, it is possible to develop menu-driven programs that can be operated by those with little or no technical background.

The experience in Kenya strongly suggests that training in the use of microcomputer products is also likely to be necessary. This aspect of microcomputer adoption highlights a key difference between microcomputers and most other new technologies. The microcomputer is a new technology that can produce new technologies, i.e., new forms and types of information. If the microcomputer is only producing the same information as was produced previously, only faster, more easily and accurately, then training in the use of that information may not be necessary. If, however, microcomputers are used to produce new kinds of information that hadn't been available previously, then it is likely that training in the effective use of that information will be necessary.

Another important issue that emerged from the cases is the appropriate degree of responsiveness of microcomputer output to particular user demands. If microcomputer operators can program in a flexible language like dBase II or BASIC, they can provide products that range in responsiveness from standard, routine documents to individual, customized reports. The experience in Kenya suggests that the more responsive the output to the needs of the output user, the more likely it is that the output will be effectively applied to decision-making.

Constraints related to microcomputer operator time necessarily limit the number of reports that can be produced, however. Therefore, decisions must be made regarding the trade-off between serving greater numbers of output users, and the responsiveness

with which each user is served. Thus, given the same microcomputer staff resources, it will be possible to serve more output users by producing standardized reports than by producing customized reports. There may, of course, be different degrees of responsiveness for different output users, e.g., products may be more responsive to the individual needs of more senior officers.

Early use of customized reports can develop commitment and support among output users. If, however, response to customized requests eventually must be cut back, there may be some resentment among disappointed product users. This issue must be resolved according to the particular needs of each adoption context. It is best considered at the outset, however, rather than emerging from conflict between high expectations and limited operator resources.

The literature also suggests the importance of incentives in inducing acceptance of microcomputer use. The Kenya experience demonstrated some incentives that are inherent in microcomputer use, e.g., use of microcomputers makes the work faster, easier, and/or more interesting. It also made clear the importance of the organization's incentive system in determining the kind and extent of use of microcomputers and microcomputer products. Many kinds of microcomputer use require considerable effort to learn. In MALD and MFP, it became clear that in the absence of incentives beyond those inherent in the use itself, people are unlikely to invest the effort necessary. If the organization's incentive system does not encourage use, it is likely to be difficult to induce people to learn to operate the machine or to use the output.

The incentive systems and the power structure within the Kenyan ministries have deterred positive response, particularly from the professional staff. The formal system offers no positive incentive for learning to use the microcomputers and the information they provide, nor any sanction for not learning to do so. Nor is there any formal incentive for developing the skills necessary to effectively apply the information to decision-making. Some management systems, such as the frequent rotation of senior ministry officers, discourage finance officers from investing the time and energy necessary to learn to utilize the microcomputers and their output.

In contrast, in MOF, Indonesia there is recognition of the importance of positive incentives for learning to use the microcomputers, and there are plans to provide material incentives to those who develop those skills. In one Directorate, selected staff are receiving highly valued training, including training abroad, in various aspects of microcomputer use. These opportunities provide strong incentives for staff to learn to use the microcomputers. There are also, however, strong disincentives which discourage acceptance of the microcomputers among officers of some local tax and customs offices. Resistence from those offices has been considerable.

Effective incentives can also come from outside the formal system. In Kenya, the peception that microcomputer skills expanded employment opportunities outside government was highly effective in encouraging many people in the ministries to learn to operate the microcomputer. If no formal incentives exist, it is possible for external agents introducing the microcomputer system to themselves provide incentives. The incentives need not be material. Providing an appreciative audience and thoughtful feedback can also serve as an effective incentive.

The cases also suggest that, as is true for other innovations, the more radical the change associated with microcomputer or microcomputer product use, the more difficult it is to induce effective use. If microcomputer use demands skills much like those used previously, it is relatively easy to induce use. Similarly, if microcomputer products provide essentially same kinds of information as had been used previously, use of the information will proceed relatively rapidly. If, however, new kinds of skills are necessary, microcomputer use will proceed more slowly.

In the planning divisions of MALD and MFP, Kenya, for example, analytic skills have been little used by most planning officers. Those officers' response to using the microcomputer for analysis has been generally negative. Their response to using the microcomputers for more familiar record-keeping activities has been much more positive. In the finance division of MALD, where microcomputer output provides new kinds of information, it has taken a concerted training effort to develop effective use of the output. Officers in Indonesia's MOF computer center recognize this phenomenon. They are arranging for microcomputers to produce precisely the same documents as had been produced previously, in order to familiarize people with, and increase their confidence in using the machines.

Factors Associated With Effective Institutionalization

To an even greater extent than was true for introduction and use, conclusions about factors encouraging institutionalization are highly speculative. Observations about factors that appear to be associated with achieving institutionalization in Kenya and Indonesia can contribute, however, to our understanding of microcomputer adoption in developing countries.

The observations about many factors associated with effective use of microcomputers and microcomputer products apply to institutionalization as well.(5) Conclusions about training, for example, are likely to apply to both effective use and effective institutionalization of that use. There are some factors, however, for which the effect on use should be differentiated from that on institutionalization. This section will concern itself with those factors.

The experience in Kenya and Indonesia indicate clearly that

microcomputers are not a apolitical tool. There are likely to be those who perceive their interests to be served by microcomputer adoption, and those whose interests are threatened by adoption. In order for use of microcomputers to be institutionalized, distribution of control over critical resources must favor those who support institutionalization.

Although introduction and use of microcomputers also requires the support of those with control over critical resources, it appears that the scale of resources required for institutionalization is quite different. Microcomputers can be introduced and used in a limited way with the support of someone with relatively limited control over critical resources. The scale of resources necessary to institutionalize microcomputer use, however, is likely to much greater. In MALD, for example, microcomputers were introduced with the support of the chief finance officer, who could supply limited staff for training. In order for microcomputer use to be institutionalized in MALD, however, those with control over the government personnel system must support institutionalization.

Conflicts over microcomputer adoption may emerge within a ministry, between ministries, and/or between different levels or branches of government. Wherever it occurs, it appears that if microcomputer use is to become embedded in the system, those conflicts must be recognized and those supporting microcomputer use must hold the balance of power over critical resources, or convince those who do so to join in that support.

Another important factor discussed above is an incentive system that encourages use of microcomputers and microcomputer products. In MALD, for example, professional staff has come to depend on some of the microcomputer products. Yet, aside from the microcomputer advisor, only one clerk is able to produce some of the more complicated output. If that clerk were ill, or left the ministry, there is no institutionalized system to ensure that new operators are trained to produce certain types of output.

Furthermore, in order to achieve institutionalization, the incentive system must not only encourage people to learn to use the microcomputer and its products, it must do so in ways that support ongoing and stable use. In MALD, Kenya, the incentives to use microcomputers were primarily external to the system. Some of those incentives encouraged the development of microcomputer skills in order to get jobs outside the ministry. Clearly, such incentives do not support institutionalization.

In MOF, Indonesia, the microcomputers are also to be largely operated by clerks. The ministry computer center has, however, established a regular training program that is to ensure that skilled microcomputer operators are available. For the more complicated microcomputer applications, teams of "content" and "technical" professional staff are to design useful microcomputer information systems. Experience in those teams is expected to develop understanding of the principles of computer programming

among the finance officers and other "content" professionals.

In contrast, the formal and informal structure of incentives excourages the heads of local MOF offices to resist the institutionalization of microcomputers. Although microcomputers may eventually become institutionalized, due to the power of headquarters, the process would be greatly facilitated by incentives encouraging local offices to accept the microcomputers as a permanent part of the system. In both countries, it appears that changes in the incentive systems would be valuable in institutionalizing microcomputer use.

Another factor associated with ease of developing microcomputer use, the extent to which use represents a comprehensive change in activities, seems to be equally important in determining the ease with which use is institutionalized. Microcomputer use that involves only marginal changes in the use of information is likely to become a regular, stable, valued part of the system relatively quickly. If, however, the microcomputer is used to produce new information, or the information is to be used in a new way, it is much more difficult to integrate the information into a decision-making system. In consequence, institutionalization of those uses will develop more slowly, and remain more tenuous, becoming a stable, valued part of the system with much greater difficulty.

Observations Regarding Impacts of Microcomputer Adoption

Given the nature of the evidence, factors associated with impacts of microcomputer use are, like those associated with institutionalization, the products of speculation. Nonetheless, the impacts of microcomputer use are obviously of central concern, and deserve to be discussed, even within the limited parameters of the evidence.

The impact of microcomputer adoption on centralization or decentralization of authority has been discussed in articles and proposals about microcomputer adoption.(6) Concern has been voiced regarding the assumed "centralizing effect" of microcomputer adoption. Excitement has been expressed about the purported "decentralizing effects" of microcomputer adoption. The evidence from Kenya and Indonesia suggests that the relative accuracy of the two views lies less in nature of microcomputers, *per se*, and more in the context in which microcomputers are adopted. Thus, the microcomputers are not, in themselves, a decentralizing or centralizing tool. They take on political valence depending on the particular distribution of power within the adopting context.

In Indonesia, for example, microcomputers have been introduced specifically to centralize certain kinds of authority. Whether that objective will be attained can not be predicted. What is clear, however, is that the outcome will depend on whether the center has enough power to enforce its policy to reduce the

autonomous decision-making power of the district offices.

In Kenya, the political weight is on the side of decentralization. It appears likely that within that political climate, microcomputers will be used to support decentralization. In MALD, microcomputer use has made it possible to disaggregate expenditures directly to the district level. Improved and accelerated information processing has supported more effective communication between districts and headquarters, raising the opportunities for district officers to participate in the budget allocation process.

The experiences in Kenya and Indonesia also hint at another hypothesis. They suggest that the ability to keep track of data has an allure of its own. In both countries, some agencies have shown interest in monitoring and controlling various activities that have always been of interest to government but only are potentially controllable with the use of microcomputers. One such area is price controls. In Kenya, some government officials have expressed strong interest in using microcomputers to monitor the prices of virtually every item. The hypothesis such experiences suggest is that there may be a "propensity to control" associated with microcomputer use. The idea that there should be criteria for legitimate and illegitimate uses of microcomputers for monitoring has not yet been systematically examined either in the literature or in the field, and requires further investigation.

The cases also suggest a series of hypotheses regarding various forms of conflict. One such conflict is between those who develop new skills and those who control the established structure of rewards. The cases suggest that microcomputer use is likely to be outside any of the existing structures of rewards in LDC governments. One hypothesis that appears to be worthy of examination is that there is likely to be an "adjustment period" during which there will be conflict between those with new skills, who are not being compensated in ways they perceive to be satisfactory, and those controlling the formal structure of rewards.

A corollary of that hypothesis is that failure of the system to adjust to demands of those with new skills is likely to result in the loss of those skills to organizations which are willing to provide greater rewards. A second corollary is that the system may adjust by limiting the opportunity to develop new skills to those who are already compensated by the system for what are perceived to be similar skills. In that case, potential opportunities for lower-level workers to improve their earning power will be limited. The experiences in Kenya and in Indonesia suggest that one group who will be particularly affected by that restriction is women, who tend to be in lower-level positions, but have shown a great deal of interest in learning microcomputer skills.

The cases also suggest that a potential area of confict involves

the central office and local offices. One of the uses of microcomputers in Kenya, for example, is to monitor spending and project progress at the local level. The TAP advisors anticipated some negative response from local officers perceiving the new monitoring system to threaten their power and authority. Thus far, however, there has not been any discernable resistence to the system from local officers. Yet this may be due to the fact that information from the monitoring system is not directly linked to a disciplinary response from headquarters. Local officers may not yet recognize the greater effectiveness of the new monitoring system. It can be hypothesized that if the local officers do perceive the system to establish more effective monitoring, that some resistence will develop, e.g., inaccurate reports, or the failure to submit reports at all.

In Indonesia, resistence to the microcomputer system by local offices has been much more conspicuous. Local officers perceive the system to be designed to undermine their autonomy and authority. Since the microcomputer system is established to do precisely that, it can be hypothesized that some conflict is inevitable.

The cases also suggest a hypothesis concerning another form of potential conflict - between those who master skills of the new technology, and those who do not. A corollary to the hypothesis is that the conflict may take the form of a "generation gap," if those who have developed the skills perceive themselves to be an identifiable group that is differentiated by age from those who do not develop the skills.

The planning divisions in the Kenya ministries appear to be one setting in which there is the potential for such conflict. Interest in using microcomputers for analysis has been limited to younger, junior officers. They perceive the older officers to be unable to understand that analysis and unwilling to encourage the younger officers to use it. Many of the younger officers who have developed, or expect to develop those skills refer to themselves as "the new generation."

One of the impacts of greatest concern to those considering microcomputer adoption in LDCs is impact on employment and job quality. Again, the evidence from the cases is extremely limited and projections highly speculative. Yet the experience in both ministries in Kenya and in MOF, Indonesia, provide some support for the hypothesis that the effects of job quality may be, on balance, positive.

In Kenya, virtually everyone who had learned to operate the microcomputer and was using it in his/her job perceived job quality to have improved. They reported that their jobs were easier, less tedious, more interesting. Most of those who operate the microcomputer do about the same amount of work they had done previously. Two clerks, one in MALD and one in MFP, who learned to program in dBase II, work considerably harder in their new positions, but find the work more interesting and rewarding.

It will be important to avoid being too sanguine about this issue, however, in the light of problems that have developed in the West regarding job quality and microcomputer adoption.(7)

The cases also support the hypothesis that those who utilize microcomputer products experience improved job quality. In both Kenya ministries, officers using the microcomputer reports said that the information has eliminated many of the tedious tasks associated with their work and enabled them to do a better job. In the finance division of MALD, finance officers responsible for expenditure monitoring reported that the microcomputer output freed them of time-consuming calculations and permitted them to spend more time examining the significance of the data. They also say that microcomputer output provides useful calculations that could not have been done manually within a reasonable time, enabling them to monitor projects more effectively. Planning officers in MALD who use the microcomputer for analysis appear to have relatively high morale, and feel that use of microcomputers enables them to provide much more valuable reports to their superior officers.

Conclusions about labor displacing effects of microcomputer adoption are even more tentative than those regarding job quality. In MALD, Kenya, and MOF, Indonesia the dominant expectation is that microcomputers will stimulate an increase in work. In MFP, Kenya, the expectations are much more uncertain. A useful hypothesis for future examination suggests that use of microcomputers will generate a net increase in jobs. Careful consideration of this issue will be necessary in future studies since experience in the West suggests that the impact may be to reduce the rate of expansion of employment rather than to displace workers.(8) A important hypothesis that emerges is that the central concern regarding microcomputer impact will not be with displacement, but with the distribution of access to newly created jobs.

Several advisors have commented that what is at issue is not a trade-off between more labor-intensive methods and microcomputer use. They hold that many tasks for which labor-intensive methods might be feasible would require very high inputs of management skills that are in short supply. As one advisor commented, "[Microcomputers] are much more compatible with the factor proportions in management capacities in LDC's than we initially thought."

For some important operations, the advisors note, there are simply no labor-intensive methods that can satisfactorily accomplish what is necessary. One example is a process in which where calculations must be done sequentially rather than simultaneously, and the entire procedure must be conducted quickly and repeatedly. Using large numbers of people to perform the calculations would not produce the information rapidly enough to serve the needs of decision-makers. These observations suggest the hypothesis that if microcomputers are used for processes that cannot be done sufficiently quickly and accurately

with manual methods, microcomputer use will be appropriate even in nations where factor proportions make labor-intensive methods the preferable alternative.

Another major area of concern regarding impacts is the effect of microcomputer use on decision-making. A primary motivation for microcomputer adoption in Kenya was to provide information that could be used to improve decision-making processes. To what extent do decision-makers appear to utilize the information provided by the microcomputer in making decisions? There is no single or precise answer to that question.

It does seem clear that microcomputer use has improved the availability of useful information to decision-makers. In MALD, microcomputers have made it possible to process large amounts of data in order to provide relevant information in formats useful for decision-makers. Certainly record-keeping and expenditure monitoring have been improved with microcomputer use. In MFP, information which would otherwise be very difficult to obtain, is provided to senior officers on request. In both ministries, more effective projects registry systems are being developed with the use of the microcomputers.

To what extent is the information being made available actually used in the decision-making process? In MALD, there have been instances in which the information has been used to condition policy decisions. In all of these applications, advisor participation appears to have been key. The microcomputers have, for example, been used as a tool by advisors to induce consideration of information that might otherwise have been ignored. Use of microcomputers to provide immediate access to accurate figures during preparation of budget estimates supported a more rational allocation process, again with close involvement of the advisors. In both Kenyan ministries, policy-making committees have used reports prepared by advisors using microcomputers.

According to advisors in MALD, the information provided in the improved monitoring and record-keeping procedures has had little impact on improving policy-making processes. There are three important constraints associated with failure to apply the information to policy-making. One is lack of training among middle and senior officers in using information for financial and policy analysis. The second is management systems and structures that discourage use of information in policy-making. The third is the absence of management structures that incorporate financial or planning information into a decision-making process.

This situation suggests three hypotheses regarding microcomputer adoption in LDCs. First, in order for microcomputers to help improve decision-making, training in the use of the microcomputer output is likely to be necessary. In MALD, one of TAP's tasks is to provide that training. Second, if the information is going to be effectively applied, decision-making systems and structure must support information-based decision-making. Third, the

decision-making structure must explicitly delegate responsibility for gathering the information, analyzing the information, and applying the findings to decision-making. TAP advisors in MALD are helping to develop what they hope will be structures that assign explicit responsibility for analyzing information and presenting it to decision-making bodies. Those structures will also make visible the extent to which the decision-making bodies apply the information in the policy process.

Experience not only in Kenya, but in governments throughout the world demonstrate that there are, however, likely to be limits to the extent to which a government agency is willing and able to make decisions solely on a "rational" basis. The conflict that develops is one between "the technocratic pull" to allocate resources efficiently, and "the bureaucratic pull" to respond to other considerations, including political pressure and personal gain.(9) It is a conflict that is as relevant in the more developed as in the less developed countries.

Advisors who perceive their primary responsibility to be assisting in improving the efficiency with which resources are allocated, may lose sight of contending demands that influence the decisions of bureaucrats in the host country. The basic tasks and objectives of the two groups are, in fact, often quite different. The advisors envision systematic, organized information systems that will provide the basis for allocating resources for maximum efficiency and effectiveness. They long for a system in which senior officers can enforce more efficient processes, have the power to hire and fire, and can control the salaries of those beneath them.

The bureaucrats, on the other hand, work within a system where influence is often based on informal and/or affective ties. They rely on informal information networks, nuance, and impression to make decisions about resource allocation that will sustain cooperative alliances and be perceived as legitimate by powerful members of the bureaucracy and the public.

The extent to which technocrats are influential in policy-making processes varies among governments. Yet whatever the government goals, e.g., equity vs. higher GNP, those with a technocratic orientation are likely to use different measures to assess policy alternatives, than are those with a bureaucratic orientation. Foreign advisors who are wedded to a technocratic perspective without accepting the importance and inevitability of "political" influences may therefore find introducing microcomputers into LDC bureaucracies a frustrating experience.

A final impact that is worth mentioning is the apparent effect of microcomputer adoption on the influence of advisors who introduce the microcomputer system. As the advisors noted, microcomputers are highly visible. Comments of advisors and ministry staff suggest the hypothesis that if government officers perceive an advisor-introduced microcomputer system to be successful, they are more likely to consult with the advisors in other, unrelated,

areas.

The hypothesis appears to be supported by the experience of TAP advisors in MALD. They have experienced a pervasive increase in credibility due to widely perceived success of the microcomputer system. A corollary to the hypothesis is also suggested by the Kenyan experience: If the microcomputer system fails to meet expectations, it can have as disproportionately negative an effect on advisors' influence as success had a positive effect. If these hypotheses are valid, it appears to be extremely important that those who introduce microcomputers ensure that they have access to the resources they will need to meet legitimate expectations.

CHAPTER XI

DIRECTIONS FOR FUTURE RESEARCH

This study was conceived as an early step in improving our understanding of microcomputer adoption in developing countries. One of the objectives of the study has been to identify the issues that seem to be important, consider some approaches for examining those issues, and frame some hypotheses that will provide a useful base for future studies. The success of the effort will not lie in the validity of the particular hypotheses or the immutablility of the analytic framework; it is assumed that those products will be modified considerably as our knowledge of microcomputer adoption develops. Rather, it will lie in the usefulness of this study in designing future studies of microcomputer adoption, and in preparing projects that place microcomputers in LDCs.

This chapter proposes some ways the methodology used in this study may be usefully modified for future studies. It suggests some measurement tools that can be utilized to assess some of the hypotheses presented in chapters VI-IX. The chapter also considers substantive areas of research that merit further investigation.

METHODOLOGICAL ISSUES

The informed inductive method used in this study has been useful in guiding the development of a framework for analyzing microcomputer adoption in developing countries. Using that method, a large number of hypotheses were made available for examination. Field evidence indicated which hypotheses best illuminate microcomputer adoption in LDCs, and suggested the extent to which the hypotheses are valid.

That methodological approach was a valuable first step in analyzing microcomputer adoption. It provided a sufficiently structured base from which to examine the issues that appeared to be most relevant. At the same time, it permitted exploration into areas that emerged as important during the course of the field work. Several insights into microcomputer adoption would have been missed had the study been too wedded to particular issues and hypotheses.

For the next phase of research on microcomputer adoption in LDCs, the most productive analytic approach appears to be one that incorporates a mix of inductive and deductive methods. The hypotheses presented in this study which appear to be most useful in capturing the phenomena associated with the microcomputer adoption can be further refined and examined using a more

rigorous set of tools. At the same time, it will be important for studies of microcomputer adoption to remain open enough to capture phenomena that did not become salient in this study. Thus, what appears to be most useful for the future is a mix of: 1) More sharply defined versions of the hypotheses that emerged from this study, along with a structured survey instrument designed to measure the elements of the hypotheses; 2) New hypotheses that emerge from the literature or from field work, framed in general terms, and examined using open-ended questions and directed discussion.

To evaluate the hypotheses presented in this paper, and to frame new ones, various methodological techniques will be valuable. Longitudinal studies, including cross-national surveys and in-depth case studies, will provide valuable insights. Cross-national surveys can be designed to identify elements affecting particular contexts as well as factors that apply across contexts.

Large surveys must be carefully designed to provide data that are not only statistically significant, but also clarify the actual conditions within which the microcomputers are adopted. All too often in studies of new technologies, the attempt to obtain the largest possible survey population encourages use of survey instruments that are brief and superficial. The resulting data are often not only limited, but misleading. Understanding of the wider social, political, economic, and management conditions within which the microcomputers are used, and the associated factors determining use and institutionalization, is essential to designing valid and useful studies of microcomputer impact.

In-depth case studies of microcomputer adoption in various contexts would improve our understanding of the dynamics of microcomputer adoption, and the factors, both context-specific and effective across contexts, that determine microcomputer impact. Again, a multi-disciplinary approach is likely to be most effective.

SUBSTANTIVE ISSUES

This study examined
the dynamics of adoption, and the factors that determine the impact of microcomputer use. The underlying assumption is that microcomputers, in and of themselves, do not have particular impacts. The various impacts of microcomputers emerge from alternative ways in which the microcomputers are introduced, used, and institutionalized, and from the context in which they are adopted. Attempts to examine microcomputer impacts without careful examination of the adoption process - even if the context is considered - are likely, in the author's view, to miss much of the important story, as well as to provide misleading analysis. The cases examined in this study appear to lend credence to that assumption.(1) Developing more explicit understanding of the linkages between microcomputer introduction, use and

institutionalization, context structure and systems, and various kinds of impacts is an important task for future studies of microcomputer adoption.

Chapters VI-IX use the microcomputer adoption experiences in Kenya and Indonesia to identify and examine some ways in which the three stages of adoption and the impact of microcomputers are related. Two overarching concepts appear to be of particular importance, in part because they are often ignored in discussions and studies of microcomputer adoption in developing countries.

One concept that emerges from the study is the need to alter some traditional dichotomies of thought. Some of the questions raised at the beginning of this paper reflect those dicotomies, e.g., "do microcomputers encourage centralization or decentralization?" "Are microcomputers associated with labor displacement [yes or no]?" The cases suggest that microcomputers can simultaneously support centralization and decentralization, can simultaneously displace labor and create new forms of work for the displaced.(2) It is important for studies of microcomputer adoption to recognize that what are often framed as exclusive alternatives are more likely to be simultaneous effects. Thus, it appears that studies will be better served by attempting to understand and trace the dynamics of various phenomena related to microcomputer adoption, rather than to attempt to elicite narrow cause-and-effect relationships from the data.

The second important concept concerns the need to consider the impact of existing decision-making structures and management systems on microcomputer adoption and impact. The findings of this study suggest that demand for new kinds of information is likely to develop in response to the microcomputer's ability to provide such information. When that kind of demand develops, or where microcomputers are introduced to encourage new ways of using information, decision-making structures and management systems must be carefully scrutinized for their influence on the the way and extent to which information is used.

There are seven sets of issues that will be important areas for future research. One set of issues concerns choice of hardware. It will become increasingly important to develop communication channels between developing countries which will provide better exchange of information about hardware. Particularly useful will be feedback from LDCs using various kinds of hardware. Central concerns include durability, and availability of service for various kinds of hardware, and their appropriateness for different kinds of needs, e.g., single-user systems vs. multi-user systems. Compatibility issues will become increasingly important. There has already been good headway in addressing some of these issues.(3)

A second set of issues concerns software. Useful areas for study will include examination of the basic skills needed to use various kinds of software effectively, assessment of new generations of software, e.g., packages that make data base

management a far easier task. Again, many of these technical issues have begun to be addressed. Several sofware assessments exist in the West, and need to be made available in LDCs. A related issue concerns methods of transferring knowledge of and experience with different kinds of software between LDCs.

A third set of issues concerns data requirements, including ways of identifying the kinds of data and formats needed. This set of issues includes what is usually considered information systems analysis. It will also have to be concerned with ensuring that presentation of the data is responsive to the needs of information users, yet is not so responsive that production is beyond the capacity of the available technical staff.

Central to these concerns is establishing regularized communication and cooperation between "technical" people, i.e., those adept at technical aspects of computer operations, and "substance" people, who work with and will actually use the information. These arose as serious concerns with the introduction of mainframe computers. Although much has been written about the conflict between those groups, more needs to be known about establishing systems for more productive cooperation between them.

The fourth category of issues concerns decision-making structures that affect the way in which available information is applied in decision-making processes. These issues relate to structures of responsibility for developing the information system, providing data, analyzing data, applying data to decisions, and ensuring that decisions are implemented.

An important system involves training. It seems clear that training should fit the applied needs of the user. Thus, users of statistical packages will require different kinds of conceptual training from those using dBase II to produce reports. The study suggests, however, that training in operating microcomputers may be comparatively straightforward. Training in conceptualizing the kinds of data systems needed, and effectively applying data to decision-making is much more complicated.

These issues of structure also incorporate important political considerations, e.g., the extent to which leaders, or other groups within the adapting organization, use information to more effectively allocate resources, or to bolster their own power.(4) It will be important to develop better understanding of the association between different structures and different uses of information.

The fifth set of issues concerns cultural factors that influence the response to microcomputers, to various forms of training, and to potential conflicts that develop related to microcomputer use. Experience with other new technologies suggests that different cultures provide different levels of basic receptivity to various forms of innovation. The kinds of cultural variables that are pertinent to microcomputers, and their influence, would be a

valuable area for future research. The case of Kenya also suggests that cultural characteristics influence the response to certain kinds of training approaches. Better understanding of that association would be valuable in designing effective training systems.

The sixth set of issues concerns wider socio-economic-political issues. A valuable direction for research of such issues will be to develop a model that relates type of structures/systems to types of outcomes of microcomputer use. Developing an approach like Moore's Social Origins of Dictatorship and Democracy, will contribute to a clearer understanding of the ways in which particular structures appear to support various impacts of microcomputer use (Moore, 1966).(5) Questions about who benefits and who suffers loss due to microcomputer adoption, how people respond to the potential for those effects, the ways in which microcomputer use responds to the structure of power, and how microcomputer use can modify or reinforce that structures are vital areas for further examination.

TESTING THE HYPOTHESES

The hypotheses presented in chapters VI-IX were framed on the basis of technology change, technology transfer, and organizational change literature, or emerged from the field work. Those hypotheses suggest useful directions for future research on microcomputer adoption in LDCs. Most of the hypotheses examine complicated variables that need more precise definition. Many of the hypotheses are concerned with assessments that are not susceptible to evaluation using quantitative methods. Rather, assessment of those factors will depend on the qualitative judgements of various members of the project, including government officers, advisors, outside consultants. Values will have to be assigned, formally or informally, to those judgements.

Although quantitative measures can be utilized for some variables, they will continue to be of secondary importance for most hypotheses. This is particularly true because one of the most important impacts is on the quality of decision-making, a difficult outcome to measure. Thus, for example, merely measuring the number of times information is used can be misleading if the information is used inappropriately. Although variables can be constructed to reflect the success of a microcomputer project in terms of quantity of various kinds of output, those variables cannot tell the whole story - perhaps not even the most important part of the story.

Because qualitative assessment will continue to be of primary importance, the following measurement tools are offered only as supporting instruments in the analysis of the complicated issues of microcomputer adoption. The use of qualitative instruments, e.g., assessments by those involved in the projects, field observation, examination of products of manual and computer systems, and scrutiny of decision outcomes, will continue to

provide major contributions to our understanding of microcomputer adoption. Field experience does suggest, however, some measurement tools that would be useful in more rigorous testing of some hypotheses. The following discussion presents those tools, as well as suggestions for refinement of some of the concepts in the hypotheses.

Microcomputer Introduction

Hypothesis: Clear and consistent messages by organizational leadership, in support of microcomputer adoption, will be a critical factor generating acceptance of microcomputers among people in the organization.

Some measurement tools that would be useful in evaluating this hypothesis are:

- the proportion of organizational members who perceive leadership signals to reflect different levels of support (the spectrum from strong negative to strong positive) regarding microcomputer use - associated with:
- the proportion of organizational members with differing perceptions of microcomputer use (strong positive to strong negative) AND/OR
- relative availability of critical resources (never a problem obtaining resources/rarely/sometimes/often).

Hypothesis: Planning for sufficient resources is best done early in the process of introduction.

One of the most interesting aspects of this hypothesis concerns the issue of "how much is enough?" The cases suggest that introducing either too many microcomputers or too few microcomputers can create problems. To examine this hypothesis, the unit of analysis would be the microcomputer adoption project, rather than individuals involved in the project. One set of variables in this hypothesis will be based on qualitative judgements about difficulties associated with too many or too few microcomputers. It will be valuable, however, to begin to build a base of information about the numbers of microcomputers adopted and difficulties associated with adoption. Thus, a measurement tool for the hypothesis is:

- The ratio of the number of microcomputers adopted and the number of people in the adopting organization (which can be defined as a department, a division, a ministry, etc.) associated with:
- the kinds of problems experienced in the project (resentment of "too many" microcomputers/insufficient microcomputers for training needs, etc.)

Microcomputer Use

Hypothesis: The better the training "fit" with organizational needs and operator skills, the more effective the use.

The cases illuminated the importance of training that is directly relevant to the trainee's job. In order to begin sharpening this hypothesis, it will be useful to develop categories of various kinds of training approaches and materials. With the use of such categories, training using different elements can be compared across projects. Some of the categories that appear to useful are:

- o Training approaches:
  - Oral presentations
  - Written overview, summary explanations, introduction
  - Self-teaching, using manuals, exercises, other written materials, interactive disks
  - Audio-visual presentations
  - On-call assistance
  - Direct instruction in a small group
- o Materials
  - Standard manuals and written materials
  - Exercises prepared to be directly relevant to trainee's work
  - Standard interactive disks
  - Customized interactive disks, relevant to trainee's work

Hypothesis: The closer the "fit" between in-place skills and skills necessary for particular microcomputer applications, the more effective the training in those applications.

For this hypothesis it will be useful to develop a typology of basic skills that appear to be critical to permitting effective training in particular microcomputer applications. Chapter VII presents categories of microcomputer use and some basic skills that appear to be necessary to learn them. The categories of microcomputer use and the skill categories must be further considered against the experiences across countries. It increasingly appears that for many, if not most functions of microcomputers, basic reading comprehension skills are sufficient. The other "requirements" may be more closely associated with psychological attitudes, e.g., interest in the microcomputers, than with particular intellectual skills.

One of the most interesting questions will be the kinds of skills that enable trainees to learn to program microcomputers in such

high level languages as dBaseII. There are indications that significant mathematics skills (four years of high school math) may not be essential. Some of those involved in training the United States suggest that the skills most closely akin to programming are those associated with playing chess. It will be valuable to begin to log the kinds of skills trainees have, and their success in training across different microcomputer projects. Getting a clearer understanding of the kinds of skills that are associated with adeptness in programming will be particularly useful for countries where programming skills and resources for training in those skills are extremely limited.

Hypothesis: The more "responsive" the microcomputer products, the more effective the use of the products.

Again, the four categories offered in Chapter VII can be considered against outcomes across projects and countries. Although the following categories must be refined, they can provide a starting point for testing the hypothesis. "Responsiveness" can be defined as the modification of documents in order to meet the needs of the user. Thus, it will be useful to test responsiveness using the following constructs:

- "Responsiveness" levels: 1) Least responsive - Documents are standard and never modified, 2) Somewhat responsive - documents are modified over time in response to feedback from users, 3) Moderately responsive - Documents are regularly modified for different groups of users. 4) Very responsive - Documents are modified on request for each user.

  Responsiveness can be associated with:

- Scope of document usefulness (number of people who receive the document and find it useful) and intensity of usefulness (the extent to which users find the documents very/moderately/somewhat/or not useful)

Institutionalization of Microcomputer Use

Some indicators of institutionalization are presented in Chapter VIII. The hypotheses that relate levels of institutionalization to other variables must rely on assessment of such complicated issues as the incentive-disincentive system, and the extent to which the change in activities due to microcomputers use is marginal or comprehensive.

Development of measurement tools for those phenomena will be a complicated task, which is likely to require considerably more field observation across contexts. The following hypothesis, however, is somewhat more accessible to quantitative measures. While development of precise measures will depend on further evidence from the field, the following measures are an initial

attempt to begin the process of refining the concepts.

Hypothesis: Distribution of control over critical resources must support institutionalization of microcomputer use if that use is to be institutionalized.

Clearly there are various kinds of resources that must be available for microcomputer use. Some of those that appear to be critical include the following.

- o Resources:
  - Personnel with sufficient time to learn to use the microcomputer well enough for its use to add value to the employee's work
  - Work space
  - Hardware
  - Software
  - Collateral supplies (e.g., ribbons, disks)
  - Servicing

The distribution of control over these resources can be identified. While it does not appear to be worthwhile to invest researcher time in precisely quantifying the proportion of different resources controlled by different actors, it will be useful to identify the actors that control sufficient resources to maintain or undermine the microcomputer system. Attitudes of actors who control resources can then be determined through interviews with those actors and other relevant observers, e.g., outside advisors.

Associating relative control over resources and relative support for the microcomputer system with level of institutionalization will continue to require qualitative analysis. Nonetheless, it will be useful to attempt to be as precise as possible about: 1) the kinds of resources that are provided by supporting actors and withheld by non-supporting actors, 2) the relationship of those actors to the microcomputer system, 3) reasons for support and for non-support of the microcomputer system, 4) dynamics of resolving conflict.

These variables can be associated with the outcome of conflict over maintaining the microcomputer system. Understanding those associations will permit more precise understanding of the relationship between control over resources and establishing institutionalization.

Impact of Microcomputers

Although the impact of microcomputer adoption is an extremely complex phenomenon, several of the variables presented in hypotheses concerning impact are susceptible to measurement tools.

Hypothesis: Use of microcomputers and microcomputer products will be associated with increasing decentralization of authority.

The hypothesis, like that concerning the impact on the distribution of power within organizational levels will rely on assigning quantitative values to various essentially qualitative variables. Some of the important measures that can be constructed include the following:

- whether actors at different levels of authority gain or lose influence due to use of microcomputer-produced information
- the degree to which influence was gained or losed (large/medium/small/no gain or loss)
- issue-areas in which various levels of actors gain or lose influence with the use of microcomputer-produced information
- the assessment of the "value of microcomputer-produced information" by different levels of actors (e.g., valuable, somewhat valuable/of little value; largely accurate/somewhat accurate/rarely accurate)
- the assessment of the "value of microcomputers" by different levels of actors

Note that actors may actually gain through the use of microcomputer-produced information, although they themselves do not use the information. Similarly, they may feel that microcomputers have benefited them, although they do not use the microcomputers.

Shifts in authority may occur not only between levels of authority, but along other attributes as well. Thus, actors may be stratified across a number of characteristics, including formal position, level of hierarchy, gender, ethnicity, tribe, membership in another organization (e.g., the army). In examining changes in the distribution of power, it will be important to associate types of power shifts with various kinds of power structures, both within the adopting organization and in the country.

Hypothesis: Use of microcomputers will be associated with greater

utilization of information in decision-making than was previously possible.

Measures for this hypothesis can be developed at two levels. One concerns the extent to which information is used in decision-making. Useful variables include:

- the number of actors at different levels who use microcomputer-produced information
- frequency with which information is used
- perceived value of the information by actors at various levels (very valuable/moderately/slightly/not at all). It is possible for actors to use information often, yet feel it is not really valuable.

The second set of variables measures the way in which the information is used. These variables will rely largely on self-assessment by actors, and observation by those familiar with decision-making within the context. Some useful measures include:

- ways in which information is used by actors, in their own view (e.g., to identify problems/define alternatives/choose among alternatives/gain support for decisions/publicize an issue/support a superior officer/fulfill routine tasks/rote completion of forms perceived to be without value)
- ways in which information is used by actors, in the view of researchers, advisors, other non-participants.

In Kenya and Indonesia, information was to be used in a variety of ways, including monitoring, record keeping, project evaluation, determining budget allocations, projections. In Indonesia, the anticipated applications of information are ambitious; the system is too new to assess whether, and how, those applications actually materialize. In Kenya, information has generally been used for routine bureaucratic tasks rather than in decision-making process, except with the participation of advisors. The system is new, however, and the application of information to decision-making may develop. It will be important, therefore, to continue to accumulate longitudinal observations about the changing applications of information. It will also be important to understand <u>how</u> the information is used with regard to the decision-making process. Thus, information may be used to bolster decision-makers' positions, to gain greater control over various activities in government and in society, or in other ways that do not contribute to more efficient and equitable allocation of resources.

Hypothesis: The use of microcomputers and microcomputer products will be associated with changes in the hierarchy of skills, but not concomitant changes in the hierarchy of rewards.

Although skills in the use of microcomputer products are difficult to assess, the development of skills in microcomputer operation can be measured. For the purposes of this hypothesis, it is sufficient to identify various categories of skills, e.g., ability to enter data into menu-driven programs, word processing skills, elementary dBaseII programming skills, advanced programming skills. These skill variables can be associated with individual characteristics (e.g., job category, age, gender, education) and new rewards for the skills (e.g., promotion, rise in salary, educational opportunities). The resulting portrait of the organizational reward structure vis-a-vis the change in skill structure can reveal potential areas of conflict, groups that are disproportionately denied or given opportunities to advance, and the role of microcomputers within those systems.

Hypothesis: Job quality will improve for those who use the microcomputer and/or its products.

This hypothesis can be directly measured through interviews with microcomputer and microcomputer product users. The questions asked of those respondants can be open-ended, e.g., "Has using the microcomputer changed your job?" They can also be directed, e.g., "Has job-pressure changed with the use of the microcomputer in your job (or in your office)?" The respondants can be stratified along various job categories. By assessing the relationships between different job impacts and different job categories, it will be possible to begin to determine, across contexts, the kinds of jobs that appear to be positively and negatively affected by microcomputer adoption.

In the early stages of examining microcomputer affects on jobs in LDCs it is important not to rely solely on quantitative methods, but to establish clear understanding of: 1) the kinds of tasks involved in different kinds of jobs under examination, 2) expectations about responsibilities associated with those tasks. This kind of understanding is important because what may appear to be similar job categories across nations can actually be very different. It will also be useful to investigate <u>why</u> people feel that microcomputer use has improved or negatively affected their jobs.

Hypothesis: Microcomputer adoption is associated with labor displacement.

Of all the potential impacts of microcomputer adoption, this is the one that engenders most concern. In countries with large populations and limited employment opportunities, new technologies that may eliminate jobs must be carefully scrutinized. This is particularly true of technologies like

microcomputers, which appear to be associated in the West with reduced rates of employment expansion. To assess the impact of microcomputer use on employment opportunities is a complicated task because while it is relatively easy to measure displacement, it is difficult to measure direct and indirect job creation.(6) To assess the extent of job displacement, the following variables are useful:

- Number of people who carried out the computerized process before use of the microcomputer
- Number of people who carry out the process with the use of the microcomputer
- Current positions of those who are no longer involved in the process that has been computerized

We need many longitudinal studies assessing the changes in employment in processes that have been computerized in order to understand job displacing effects of microcomputers. It will also be important to ascertain whether some groups, e.g., women, are disproportionately displaced.

Understanding job creation due to microcomputer adoption within an organization is necessarily more qualitative since it relies on some "what if" questions. Administrators, supervisors, and others in positions that determine employment opportunities can be asked: 1) whether there are new jobs that have emerged since the introduction of the microcomputers, 2) if so, do those jobs depend on the presence of the microcomputers, i.e., could those jobs have developed were microcomputers not used in the organization? Again, it will be important to determine whether there is equitable access by various groups to new job opportunities associated with microcomputer use.(7) If there is not, the research should identify the critical factors creating unequal access.(8) These are issues that are also productively pursued in the developed countries, and will be relevant cross-nationally.

Summary

The hypotheses presented in Chapters VI-IX appear to be of value in further research on the process of microcomputer adoption and its impacts. Although many of those hypotheses must be assessed with qualitative rather than quantitative instruments, their contribution can be substantial. As those hypotheses are examined, however, it will be important to both sharpen their terms in view of the evidence from the field, and to be receptive to new hypotheses suggested by field experience. The increasingly narrowly defined hypotheses can then again be applied in the field.

Thus, the process of research on microcomputer adoption will be an interactive inductive-deductive method. By using such a

method, it will be possible to gain the advantages that the inductive method offers when little is known about a phenomenon, e.g., identification of important elements, improved understanding of the critical relationships and dynamics, establishment of linkages between macro and micro elements that determine outcome. It will also be possible to utilize the advantages of the deductive method, e.g., more precise clarification of our understanding of the critical factors and their relationships. Together, the approaches will permit an integrated understanding of the complicated process and impact of microcomputer adoption. This study has been an attempt to contribute to the early stages of developing that understanding.

FOOTNOTES

CHAPTER I

1. For good overviews of the arguments pro and con, see Wad (1982); Hearings on measures to address the impact of computer technology on lesser developed countries (1982); Friedrichs and Schaff (1982); Shirkie and Fleury (1981); Servan-Schreiber (1980). Some extremely optimistic views are expressed in Norman and Blair (1982) and "Steady Progress in Computer Marketing" (1982). Although not directly concerned with microcomputers, Ford and Ryan (1981) are convinced that third world countries may be able to operate competitively against Western companies in areas of advanced technology.

The literature discussing projected positive and negative impacts is very large. The following footnotes can also provide a small sample of that literature.

2. See, for example, Paul (1982); Montgomery (Monograph #76-6), Wallender (1979); Bryant and White (1982); Solomon (1981); Food and Agriculture Organization (1980); Hunter (1974). The value of explicitly addressing management factors is demonstrated in Ingle and Connerley (1984). The important linkage in the private sector between technological innovation and management that understands the technology is discussed in Cleland and King (1975). Also see Pava(1983) for a good discussion of the sio-technical approach to adoption. The importance of developing analytic skills among decision-makers is discussed in Harsh and Weber (1984).

3. Handling information is, at least, one of the most important activities of governments.

4. A good discussion of the implications on decision-making without sufficient information is Montgomery (Monograph #79-2). The importance of resolving these problems particularly in budgeting, and the difficulties in doing so are well discussed in Caiden and Wildavsky (1974).

5. See United Nations Financing System for Science and Technology for Development (1983, March; 1983a, March). Some possibilities are noted in Kettering ((1982), Griffiths (1981). Some benefits and limitations of microcomputers for improving management skills are discussed in Ingle and Smith (1983). A systematic look at microcomputer applications in management in developing countries is presented in Ingle (1983). An interesting general discussion of the way computers can change management for better or worse is in Wynne (1983).

6. With regard to Kenya, see Saltzman (1984). Also see Young, Bertoli and Bertoli (1981).

7. See, for example, Mann (mimeo). Whether use of microcomputers for planning individual projects validates

microcomputer adoption is questioned by "The USAID/Honduras Contraceptive Social Marketing Project" (mimeo). Potential benefits are discussed in Ayensu and Trachtman; also see Steele. An overly optimistic projection is in O'Sullivan (1982). In the West microcomputers are also expected to help public administrators understand statistics and make better decisions; see, for example, Garson (1983).

8. See a discussion of most of these benefits in Wescott (1983). Also, there are other kinds of decentralization some expect microcomputers to enhance. See, for example, U.N. Centre for Science and Technology for Development (1985); "The USAID/Honduras Contraceptive Social Marketing Project" (undated: 41-42).

9. See Nilsen (1979) who feels most applications are likely to be in areas that are "inappropriate" and will displace clerical staff. Also see Friedrichs and Schaff (1982); "The USAID/Honduras Contraceptive Social Marketing Project;" Shaiken (1984), Hoffman and Rush (1980) regarding industry in LDCs. There is also debate, of course, in the developed countries; see, for example, Evans (1983).

Discounting displacement fears are Sadler (1981); Atkinson (1981). Also see a discussion of the indigenous industry in Rada (1982).

10. There is also the problem that decision-makers may simply want what they perceive to be "most modern," even if it is inapproprate. For a discussion of this kind of problem see Wells (1973). There is also fear that microcomputers may endanger indigenous culture; see, for example, Barry (1984); Dray and Menosky (1983).

11. See "The USAID/Honduras Contraceptive Social Marketing Project" (undated: 42-43) for a projection that microcomputers will help disseminate information; therefore authoritarian governments will try to control microcomputer introduction. A general discussion of the power of information control of all governments is in Converse (1985). Crozier (1983) worries that computer use will make bureaucracies even more inflexible than they already are, and will stifle adaptibility and learning in bureaucracies.

12. See, for example, Ingle and Smith (1983), especially pages 17-18.

13. For a general review of technology assessment, see "Approaches to Technology Assessment," (Lincoln Institute Monograph #79-2).

14. The differences between power, authority and influence will not be examined here. For the purposes of this discussion, the three terms will be used to refer to the potential one has to guide, direct, control or alter material resources.

15. See notes 17, 18, 19, 21.

16. Tomich (1983) notes that "when dealing with fresh research topics, it is often impossible to know in advance what will matter. In such cases, it is necessary for data collection and analysis to be an ongoing interactive process to determine what data will be most valuable. Also see Byerlee, Harrington, and Winkelmann (1982).

17. This obviously includes a large literature. This note refers to only a few of the interesting, although less well known works. The importance of such factors as perceived need is discussed in Sen (1980), Perry and Kraemer (1979). Good discussions of important factors in introduction as well as use and institutionalization are in Leemans (1976); Gawthrop (1969); Zaltman (1973); Guest (1962); Rondinelli (1977). Kaufman (1971) is particularly useful regarding the barriers to change and the need to realize change occurs in small increments.

18. There is a very large literature on technology diffusion. Rather than try to list all relevant materials here, this note mentions some of the less well known references. A useful discussion of factors is in Jedlicka (1977). Although concerned with individuals or private units rather than public sector organizations a useful discussion of technology diffusion is Rogers (1962). Also, regarding the importance of leadership to technological innovation in the private sector, see Cleland (1975).

19. See, for example, Montgomery (1974); Ingle (1983); Asian Productivity Organization (1979); Danziger, Dutton, Kling, and Kraemer (1982). Also useful in indicating important factors, of course, are case studies of microcomputer adoption. See, for example, Ourusoff (1983); Ingle and Connerley (1984); Bertoli and Bertoli (1981); Leonard (1983); Mann (mimeo); Pinckney, Cohen, and Leonard (1982); Pinckney, Cohen, and Leonard (1984).

20. See Otway and Peltu (1983), especially chapters 5-6. Two cases indicate the importance of these factors; see Schware and Trembour (1984). Good discussions of these factors are in Ramakrishnan (Lincoln Institue Monograph #79-6); Wallender (1979); Herbst (1974); Scheirer (1981); Ingle (1983); Gottlieb and Borodin (1973). Of course, useful indicators were suggested by case studies of microcomputer adoption in LDCs. See Leonard (1983); Pinckney, Cohen, and Leonard (1982); Pinckney, Cohen, and Leonard (1984); other citations in note 19. The interaction between LDC bureacratic structures and technological change in producing particular outcomes is examined in several cases in Timmer, Thomas, Wells, and Morawetz (1975). The problems with management systems lagging behind technological innovation is discussed in Evan (1976). Some of these factors emerged in computer adoption in U.S. local governments; see Kraemer and King (1977); Danziger, Dutton, Kling, and Kraemer (1982). For a general discussion of the important factors in organizational operation that also seem relevant to microcomputer use, see Bower

(1983); Jackall; McFarlan and McKinney (1983); Rondinelli (1976); Johnston and Clark (1982). Some cases illustrating the problems of reform in a government agency are useful, see Groves (1973). A qualified success in dealing with some of these problems is discussed in Braibanti (1966). The importance of the political system - discussed in this study with respect to incentive systems - is examined in Riggs (1966). A good discussion of some of these factors in microcomputer adoption in the private sector is in Keen and Woodman (1984). A useful reference regarding general training issues is in White (1984), p 2. Useful comments on management training in LDCs, roles and incentives as well as issues related to introduction (e.g., acceptance of roles necessary for innovation) is Management Development Working Group (1981). The importance of these factors generally in administration in Kenya is discussed in Leonard (1973); and, more generally, Leonard (1977). the importance of developing analytic skills among decision-makers is in Harsh and Weber (1984), although their distinction between "data" and "information" is not helpful, in this author's view. And a wider, but interesting, consideration of the relationship between socio-economic patterns and technological impact is in Dickson (1975).

21. Good discussions of some issues that have arisen in institionalization of microcomputer use in the private sector are in Allen (1982); Keen and Woodman (1984). Otway and Peltu (1983) give very good discussions of the factors as they operate generally in offices of organizations, and some differences between public and private organization adoption of computers (p 97-99). And for an alternative view, ata least regarding managment levels, see Whisler (1970). Some interesting discussions of the process and problems of institutionalization of innovation are presented in Grindle (1980); Walton (1975); Lin and Zaltman. The importance of integrating any new technology into the established system, and the frequency with which it is not done even in the private sector, is discussed in Packer (1984). Also see World Bank (1979). Also see Blakely, Mayer, et al.

22. See Huntington (1968), chapter 1, for a good discussion of the concept of institutionalization.

23. Also true for other developing countries, based on discussions the author has had with those working with microcomputer adoption in other LDCs.

24. See, for example, Solomon (1984).

24. See, for example, Friedrichs and Schaff (1982).

CHAPTER II

1. See Leonard (1983) and Pinckney, Cohen, and Leonard (1982).

2. The TAP project in conducted by the Harvard Institute for

International Development, Harvard University. Background on TAP is discussed in McCalla and Saywell (1983); Pinckney, Cohen, and Leonard (1984), p. 24-25.

3. This is a 64K machine that has since been upgraded by TAP. Pinckney, Cohen, and Leonard (1982) describes the Apple II+ technical components in detail.

4. Pinckney, Cohen, and Leonard (1984) and Pinckney, Cohen, and Leonard (1982) describe in greater detail some aspects of the early microcomputer applications.

5. All quotes not referenced to literature are from the author's conversations with the individual quoted.

6. Those hardware problems are described in Pinckney, Cohen, and Leonard (1982). The hard disk had to be returned to England.

7. See President Moi's speech of September 21, 1982.

CHAPTER III

1. Background on the Development Planning Division (DPD) in MOA and MLD can be found in McCalla and Saywell (1983).

CHAPTER IV

1. An interesting discussion of Rural Development Planning in Kenya is presented in Bethke, Cohen, and Hook (1984).

2. The Rural Planning Project (RPP) is conducted by the Harvard Institute for International Development (HIID).

3. Background on the RPP project is discussed in Ministry of Economic Planning and Development (1983) and Saywell (1983).

4. See, for example, "Computers Are No Longer Luxury Items" (1984), and Irungu (1984).

CHAPTER V

1. Microcomputers are also being introduced elsewhere in government. See, for example, Affandi and Rosengard (1983).

Interviews were also conducted for this study with officers at BULOG. Time constraints made it impossible to include the evidence from those interviews in this paper. A future paper will discuss microcomputer use in the two ministries, Ministry of Finance and BULOG.

2. Where applicable, quotes were translated from Indonesian by the author.

CHAPTER VI

1. There is a large literature, particularly about the private sector, that notes the importance of positive, visible leadership in legitimating innovation. Albricht (1973), for example, describes the importance of top management backing of a new information system through its "ups and downs." Also see Schwartz, Bennigson, and Brodman (forthcoming). A good discussion of the influence of the manager is in Leonard (1977). Also, regarding the importance of leadership, see Vertinsky and Barth (1972); Guest (1962); Walton (1975). McCaleb (1982) gives practical advice in exercising leadership to the head of a business (or any organization) introducing microcomputers.

2. In examining technological innovation in local U.S. governments, Perry and Kraemer (1979: 101) found that leaders' support was relatively less important than other factors, e.g., the general level of professionalism in the organization. Mann (mimeo) suggests that leadership was extremely important in the adoption of microcomputers in MOA, Tunesia.

3. There is much literature to suggest that organizations tend to "satisfice" and therefore ignore innovation unless there is pressure to change. Regarding innovation among U.S. local governments, Perry and Kraemer (1979: 36) hypothesize that a possible determinant of innovation is a "need-based" process in which there are "felt needs." As presented, however, it is a tautology (officials search for innovation because they feel they need it). The discussion of Hypothesis 2 in this paper attempts to describe the idea of felt need more precisely in terms of external pressure rather as contrasted with mere recognition that there is a better way of doing things.

CHAPTER VII

1. Bjorn-Andersen (1983) discusses the need to use computers to "expand" secretarial/clerical jobs and recommends some ways to do so. Also, my conversations with James Taylor, President of Socio-Technical Design Consulting, formerly at the UCLA Center for the Quality of Working Life support this approach. Dr. Taylor's studies demonstrate the importance of communication between secretarial and professional staff in developing effective microcomputer use.

2. Studies of decision-making the U.S. also show the need for training managers in data-based decision-making skills in order for managers to exploit potential MIS contributions. See, for example, Pauley and Cohen (1984).

3. An excellent example of such a course in given by Carl Gotsch at the Food Research Institute, Stanford University, Stanford, CA.

4. Training in management techniques is extremely difficult in the West as well as in LDCs. Any tool which facilitates such training would appear to be valuable. For a discussion of the difficulty in providing effective training in the public sector, see Guyot (1977). Also see Brewer (1974) for the limits of this kind of analysis in government.

5. The problem of responsiveness is persistent in systems using mainframe computers. Albrecht (1973) presents a useful discussion of the issues of resonsiveness, or, in his terms, "centralization-decentralization" of information systems. Kraemer and Danziger (1982) suggest that in U.S. local governments, the determination of control over such issues as responsiveness are largely made by technical computer personnel.

6. Kraemer and Danziger (1982) discuss policy boards in U.S. local governments in which information users and the technical computer staff decide important policies concerning the computer system. They do not function in the way the MOF teams do, however. The teams are aimed at infusing both technical and content professional staff with one another's knowledge.

7. The problem of getting decision-makers to use information effectively as the basis for decisions also occurs in other contexts. See, for example, Evan (1976); Caiden and Wildavsky (1974); Guyot (1977); Danziger and Kling (1982); Pauley and Cohen (1984); Packer (1984). On the other hand, Ingle (1983: 23) found that "once the technology is understood there is a tendency to use it as a solution to every problem encountered, leading in [sic] inefficient use of the machine".

8. There is a large literature that discusses the "politics of bureacratic decision-making." Some of that literature suggests that the character of bureaucracies in developing countries is very different from that of Western bureacracies, making the process of decision-making very different; see, for example, Heeger (1974); Timmer, Thomas, Wells, and Morawetz (1975). Danziger and Kling (1982) argue that in U.S. local governments, decision-makers tend to use information from computer systems to buttress the positions they want to take rather than to help them choose among alternatives.

9. The literature on "the politics of bureaucratic decision-making" (see Note 8) indicates that designing and implementing such information systems is likely to be very difficult.

10. A good statement of this point in in Scheirer (1981).

11. Studies of use of computer information suggest that this pattern holds for other contexts. See, for example, Albrecht (1973). Danziger and Kling (1982) suggest that computer resources in U.S. local governments are often "captured" by finance departments. However, they do little analysis that is applied to decision-making. The cases of MALD and MFP, Kenya are

quite different, of course, since advisors introduced the microcomputers and strongly influenced the direction of microcomputer use. One way in which the situation of LDC microcomputer adoption differs from adoption within the U.S. is in the role of expatriate advisors.

12. The tendency to use computers for only routine operations also characterizes computer use in the West; see, for example, Albrecht (1973); Danziger and Kling (1982).

13. This also true in other countries; see, for example, Albrecht (1973); Guyot (1977); Ingle and Connerley (1984).

14. See, for example, Kotter and Schlesinger (1979); Frost (1974); Walton (1985).

15. They also were reacting to the possible loss of influence over an area in which they have authority. Brodman (1983) discusses the way in which decision-making systems in developing countries tend to prevent the introduction of innovations that might undermine the power status quo. Also see Montgomery (1974); Dicksen (1975). Kraemer and Dutton (1982) find that U.S. local government policy-makers will try to prevent use of information they cannot control. Although the result is similar, the dynamics of the response to innovation by decision-makers in those types of governments appears to differ significantly from decision-makers in national LDC governments. Those differences and similarities must be the topic of another paper

16. See, for example, Kotter and Schlesinger (1979).

CHAPTER VIII

1. See Huntington (1968: chapter 1).

2. See Blakely, Mayer, et al. (undated); Huntington (1968), especially Chapter 1.

3. The compatibility problem may end up being resolved by the technology itself. Although solutions are now expensive, it seems likely that they will decline in price as have other elements of microcomputer systems. See Lambert (1984); Freedman (1984).

4. The proposition that more comprehensive innovation is more difficult to implement is discussed in Grindle (1980).

CHAPTER IX

1. Walton (1985) finds that computer applications can facilitate either centralization or decentralization of decision-making in the workplace.

2. Danziger and Kling (1982) found that in local U.S. governments, policy-makers tend to use information to support the positions they have already decided to take rather than to seriously consider what position to take. While there are some similarities, those findings contrast with the major theme of experiences of MALD and MFP, Kenya. In the latter cases, information has tended to support more rational decision-making. The advisors participation has been an important factor in that outcome.

3. Danziger and Kling (1982) suggest that technocrats do not generally increase their power with computers, but only get control of computers if they already have power. In contrast, the technocrats in MFP and MALD were very weak and are gaining some increased influence due to their access to information. Part of the reason for the apparent difference between the U.S. local government experience and the MFP and MALD experience is Danziger and Kling's use of the term "technocrat." That use is a form of "misplaced aggregation" (see Brodman, 1983: chapter 4). In the planning division of MALD and MFP, the "technocrats" are in fact more than one distinctive group with differing interests. The role of the advisors has also been important in the increasing influence of the planning division. The influence of international organizations has been another factor. Ruttan (1978), and Ruttan and Binswanger (1978) are also useful in understanding how new technologies can lead to a shift in power and the streams of benefits from related activities.

4. There is a great deal of literature that concludes that innovations tend to be "captured" by those with greater power. See, for example, Timmer, Thomas, Wells and Morawetz (1975); Montgomery (1974); Dickson (1975); Brodman (1983); Dutton and Kraemer (1982); McFarlan and McKinney (1983).

5. For a discussion of possible future decline in job quality for clerical and secretarial staff, and the importance of job design, see Bjorn-Andersen (1983).

6. Even in the West, where microcomputers are widely used, evidence regarding displacement is mixed. An interesting review of the impact on women's employment is in Werneke (1983).

7. Some disagree with the argument of limited managerial resources; see, for example, "Hearings on Measures to Address Impact of Computer Technology on Lesser Developed Countries" (1982).

8. See Pinckney, Cohen, and Leonard (1984); Wescott (1983).

9. The problem of inducing administrators or managers to use data for analysis occurs in other contexts; see, for example, Harsh and Weber (1984); Pauley and Cohen (1984). Danziger and Kling (1982) find that in U.S. local governments, policy makers avoid using information for policy evaluation.

10. See Converse (1985); Kraemer and Dutton (1982).

CHAPTER X

1. A microcomputer had been introduced in MALD, Kenya several years earlier, but was used by only one MALD staff person, and had little impact. A few microcomputers had been introduced into MOF, Indonesia, but were scattered throughout the ministry, and were used for limited tasks. Their impact was also negligible.

2. See Chapter VI for citations relevant to the discussion of microcomputer introduction.

3. March and Simon (1958) discuss satisficing.

4. See Chapter VII for citations relevant to the discussion of microcomputer use.

5. See Chapter VIII for citations relevant to the discussion of institutionalization of microcomputer use.

6. See Chapter IX for citations relevant to the discussion of the impacts of microcomputer adoption.

7. See Werneke (1983) for a good overview of these issues.

8. Werneke (1983) provides a good overview of the potential displacement effects for women, and their relatively lower access to new jobs associated with microcomputer adoption.

9. Analysts like Montgomery (1974); Heeger (1974), especially chapter 4; Riggs (1966); Riggs (1970); Braibanti (1969) consider the politics of what I am calling the "bureaucratic pull." Also relevant is an interesting discussion of the conflict between the supposed "efficiency" concerns of businesses vis a vis the "equity" concerns of government (Bower, 1983).

CHAPTER XI

1. Book shelves have been lined with cases in which innovations that clearly could provide "good" impacts, at least in the outsider's view, have failed to be accepted and implemented. Such new technologies transferred to LDCs range from solar stoves to complex integrated rural development projects. It is important, therefore, to understand how the innovations were introduced and used.

2. Other studies support this view. See, for example, Werneke (1983).

3. An important discussion of hardware and software options and implications is in Ingle, Berge, and Teisan (1983). Also useful in its approach is Wood (1984).

4. The importance of the political use of information to strengthen the position of a policy-maker was suggested by the experience of MALD. Danziger and Kling (1982) discuss the use of information in similar ways by policy-makers in U.S. local governments.

5. Kraemer and Dutton (1982) consider the political structure of city governments in examining the use of information. They conclude that computer use serves those who already have power. Where computer use seems to serve those with little power, the situations are considered exceptions. In contrast, in Kenya microcomputers appear to be supporting a shift in power. The crucial issue is what kinds of structures, in Moore's (1966) sense, will be associated with what outcomes.

6. See Werneke (1983) for a good overview of the employment effects of microcomputer adoption on women in the West; also see the discussion in Friedrichs and Schaff (1982).

7. The groups to be considered will, of course, depend on the particular countries studied. For all countries, however, differential impacts on women should be examined.

8. See Werneke (1983) for useful references.

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APPENDIX A

QUESTIONNAIRES

Questions for Users of Microcomputers/Microcomputer Products

1. Name, title, job

2. How did you learn about the ministry's microcomputers?

3. How do you use the microcomputer/product?

4. Has using the microcomputer/product changed your job? How?

5. How often do you use the microcomputer/product?

6. How did you do that job before you used the computer?

7. Are there benefits to using the microcomputer? What are they?

   - Has job pressure changed?

   - Has your influence with respect to others changed?

8. Are there any problems related to using the microcomputer? Explain.

9. Have there been any negative effects from using the microcomputer for yourself or others?

10. Do you think the microcomputers will continue to be used after the advisors go home?

11. How were you trained to use the microcomputer?

    Do you receive training in using the microcomputer product?

12. What were the best parts of the training?

    - Worst parts?

13. Do microcomputers fill your needs? Are there changes in microcomputer use that are necessary?

    - Do microcomputer products fill your needs? Are there changes in products that are necessary?

    - How do you communicate your needs?

14. Who decides how microcomputers/products are used?

15. What exactly does your supervisor expect you to do on your job, now that you're using the microcomputer? How do you

feel about that?

16. Have those who use the microcomputer gotten any reward for learning to use it? What kind of reward?

17. Are there people who don't like the microcomputer being here? Why?

18. Who has benefited most from introduction of the microcomputer? How?

19. Has anyone been hurt because the ministry got the microcomputer? How?

Questions for Decision-makers

1. Title, job, responsibilities

2. Role with regard to the microcomputers

3. How did you learn about the microcomputers? How were you convinced they were useful?

4. Are there some officers who feel the microcomputers are important for the ministry's work? Who?

5. Are there some officers who think the microcomputers are not worthwhile or appropriate for the ministry? Why? Who?

6. Have there been negative effects from the introduction of the microcomputers? For whom?

7. How did you introduce microcomputers to those below you?

   - Did you seek their opinions?

8. How did you choose who should use the microcomputer?

9. To what extent and how are microcomputers used?

   - Identify users of microcomputers and products. Their responsibilities

   - How exactly are microcomputers used? How were those things done before?

   - Have there been any benefits to using the microcomputers?

   - How exactly are products used? How were those things done before? Benefits?

10. What is the most valuable use of the microcomputers? How was that done before? Benefits?

11. Why are microcomputers useful? What problems have they helped solve? Benefits?

12. Are there changes you would like to see made in microcomputer use? Product use?

13. Have there been any effects on job quality for those using microcomputers/products?

    - Change in influence over others?

    - Change in job pressure?

14. How do you obtain microcomputers? Supplies? Software?

15. How are microcomputers allocated? Who decides?

16. Are people rewarded for using the microcomputers? How?

17. Does training in microcomputer/product use meet needs?

18. What have been the costs of the microcomputers? Anticipated costs for the future?

    - Financial costs to government

    - Total costs

    - Negative effects that lead to costs

19. Do you anticipate that the microcomputers will continue to be used after the advisors leave?

20. Have there been any changes in authority due to microcomputer use? Explain.

21. Has there been any conflict between those newly skilled in microcomputer use and the ministry?

    - Were those conflicts resolved? How?

    - Any changes in how people get promotions?

Questions for Advisors

1. How did decision-makers come to perceive the need for change?

   - Pressure? From where?

   - Role of the advisors

   - Other factors

2. How did decision-makers come to believe the microcomputer could help solve the problems?

   - Role of the advisors

   - When did they actually decide to adopt the microcomputers?

3. When did use begin?

4. Who has control over essential resources?

   - Person, title, resources, pro/con microcomputer adoption

   - What is the distribution of control over resources?

5. What activities/messages of decision-makers have there been pro or con microcomputer use

   - Were there clear, consistent messages from supervisors and top officials?

6. How did enough support for microcomputer adoption develop?

   - Convinced those against?

   - Use influence of those pro-adoption?

7. How were those who were to use the microcomputer/products brought to accept it?

   - Problems

   - How resolved?

8. Was there any two-way communication abouta microcomputers before adoption?

   - About contribution of/need for microcomputers

   - Agreement and disagreement? Resolution?

   - How were users chosen?

9. Who was involved in decision-making process?

   - At different stages

10. To what extent and how are microcomputers used?

   - Identify users of micros and products, and division and level of user

   - Explicitly identify how micros used. How those tasks done before

   - Explicitly identify how products used. How done before.

   - To what extent is use value-added? How? For whom?

11. Who does training?

   - How well did trainer know varying levels of skills?

   - How well does training fit particular needs of trainee?

   - Describe training, approach, materials

   - How effective are different aspects of the training?

   - Is applications development used as a training element?

   - How close is the "fit" between in-place skills and microcomputer-related skills

12. How "responsive" is the micro to user needs?

13. How "responsive" are products to user needs?

14. Are there feedback mechanisms related to use of micros and products?

15. Are micro roles and responsibilities agreed on by supervisors and subordinates?

   - Is there two-way communication?

   - Do subordinates understand supervisors' expections?

   - Were (are) there changes in job perspectives by supervisors and subordinates?

16. To what extent does micro use change the way things are done (discuss for each use)?

   - How well are changes accepted (for each use)?

17. Has micro adoption changed job quality? Explain.

18. What is the requisitiion and procurement system? Who runs it?

19. What is the disbursement and allocation system? Who runs it?

20. What is the reward/sanction system as it affects micro use?

    - Compensation

    - Power over resources

    - Intangibles

    - Instrinsic pleasure

21. Do systems support micro use? Product use? Roles and responsiblities associated with micro/product use?

    - If not, effects so far? Anticipated effects?

22. How there been "models" or "heroes" in microcomputer use?

23. Have early users been rewarded?

    - What problems run into? Source? Resolved?

24. Is there resistence to microcomputer/product use? Source?

    - Do systems encourage resistence?

    - How can changes encourage acceptance?

    - Who feels negative effects of micro adoption? Why? Are they interim or long-term effects?

25. What resources are necessary to use micro?

    - Were they ensured early in the process of adoption? If not, why not? Were there consequent problems?

26. To what extent does micro use improve decision-making?

    - did micro use lead to making decisions in a more informed manner? Explain.

    - Do the outcomes of those decisions make more efficient and/or effective use of scarce resources?

    - Do outcomes of decisions better use limited resources in ways that improve the lives of the broad masses of people, directly or indirectly

27. What have been the costs of micro adoption? Anticipated costs for the future?

- Financial costs

  - Real financial costs to the government

  - Total financial costs to all contributers

- Externalities

  - Employment

  - Job quality

28. Are the costs known to government decision-makers? Accepted?

29. Are there those in government with the ability to choose microcomputer systems?

- Alter and develop systems? Solve problems?

30. Do decision-makers anticipate continued micro use?

31. Have there been institutional changes that support continued use?

32. Have there been any micro use effects on decentralization of authority? Explain.

33. Has there been any conflict between those who developed skills related to micro use and the ministry?

- How resolved?

- Have there been changes in the structure of rewards?

34. Is there a "new elite" who brokers between policy-makers and those who provide data?

35. Has influence of micro users changed vis-a-vis others?

36. Is time pressure eased for policy-makers? Micro users?

APPENDIX B

A SAMPLE MICROCOMPUTER REPORT
VEHICLE MONITORING REPORT FROM KENYA

INTERNAL MEMO

From: C. Pinckney - MSU
D. Mutisya - Transport Office

To: D.K. Ole Nasieku - US/F

Ref:

Date: 30 July 1984

MOTOR VEHICLE REPORT FOR MAY

1. Attached find the motor vehicle report for May. The report has been delayed mainly because of problems with the new computer. Those problems have now been solved, and we hope to have the June report ready by August 15, and the July report ready by August 30.

2. The report is eight pages long. The first page is a summary report, giving basic statistics about the vehicles which have been reported on. The second page lists pick-ups, saloons, and kombis which have unusually low figures for km/liter. The next four pages give similar reports for land rovers/range rovers, tractors, lorries & buses, and motorcycles, respectively. The seventh page lists the forty vehicles with the highest cumulative repair bills for this fiscal year. The last page lists the forty vehicles driven the longest distance during May.

3. Note several points:

a: We received reports on 1,554 vehicles. This is about 40 per cent of the vehicles in the Ministry. Letters have been sent to all non-reporters.

b: Over half of the vehicles reported on did not move during May.

c: Over one third of the vehicles are broken but not yet under repair.

d: The vehicle with the largest repair bill is 262U, belonging to DAO Marsabit, Ksh 73,615.

e: The vehicle driven farthest in May is 807W, belonging to AMS Kajiado, 5,714 km.

4. Your comments on this report are most welcome.

cc: Mr. Warui
Ms. Namangala

Summary report for Vehicle Monitoring: May

During this fiscal year we have received reports on 1554 vehicles
Of these, 1554 reports were received for May.

180 reports were unusable because of incorrect reporting.

The vehicles can be broken down into the following types:

Pick-ups/saloons/kombis:	449
Range Rovers/Land Rovers:	514
Tractors:	150
Lorries/Buses:	191
Motorcycles:	191
Return does not say:	59

Of these vehicles, 855 or 55.0 percent did not move during the last reported month.

The vehicles can also be broken down according to condition:

Good Running Condition:	636
Broken, under repair:	76
Broken, not yet under repair:	537
Being boarded:	124
Sold this month:	0

The vehicles being boarded can be broken down according to the most recent approval they have received:

MOTC approval:	103
PS/ALD approval:	3
DC Board of Survey approval:	11
Treasury approval:	7
Auction date set:	0

Of the vehicles which are reported to be in good running condition, 113 or 17.7 percent ~~did not move during~~ the latest reported month.

High Fuel Consumption Vehicles for May Pickups/Saloons/Kombi's

Average Fuel Consumption for this vehicle type: 7.35

Station	G.K. No.	Distance	Km/l
TRANSPORT OFFICER HQS	357U	227	0.52
TRANSPORT OFFICER HQS	358U	1,126	2.78
TRANSPORT OFFICER HQS	770Q	218	0.98
TRANSPORT OFFICER HQS	C032	1,368	3.44
DIR, HORTICULTURAL R.S. THIKA	454K	476	0.78
DIR, HORTICULTURAL R.S. THIKA	984W	219	0.66
FTC NJABINI	B781	390	3.33
AMS NAROMORU	989S	1,849	3.35
AMS MARIAKANI	489U	335	2.64
PDA, EMBU	810S	334	1.46
DAO MACHAKOS	72U	1,210	2.49
DLDO MACHAKOS	436U	1,008	3.51
ARS, KATUMANI	238K	114	0.71
DAO SOUTH NYANZA	797S	567	2.97
DAO NAKURU	E876	203	1.04

High Fuel Consumption Vehicles for May Land Rover/Range Rover

Average Fuel Consumption for this vehicle type: 4.19

Station	G.K. No.	Distance	Km/l
TRANSPORT OFFICER HQS	A646	472	0.76
DIRECTOR, NAL NAIROBI	97Y2	544	2.24
DIRECTOR, NAL NAIROBI	G469	202	0.91
AIC, NAIROBI	B862	1,630	2.10
DAO KIRINYAGA	156U	855	1.41
PDA MOMBASA	E831	1,267	2.45
DLDO KWALE	368Y	663	2.32
DLDO ISIOLO	535R	336	1.53
DAO MACHAKOS	641W	863	2.33
DLDO MACHAKOS	976W	555	1.93
OIC KIBOKO RANGE R.S.	406Y	565	2.25
OIC KIBOKO RANGE R.S.	407Y	1,570	2.42
OIC PASTORAL T.C. GRIFTU	411U	520	1.53
NATIONAL SUGAR RESEARCH, KIBOS	516R	255	0.75
AMS KIPKELION	189U	667	1.94
OIC V.I.L. KERICHO	468Q	380	2.41
OIC V.I.L. KERICHO	B255	1,710	2.16
DAO ELGEYO MARAKWET	413A	354	2.36
DAO KAPENDURIA	643W	160	1.22
DAO BUNGOMA	628W	1,354	2.30
DLDO BUNGOMA	460Y	622	2.36

Fuel Consumption Vehicles for May Tractors

Fuel Consumption for this vehicle type: 0.59

ion	G.K. No.	Distance	Km/l

High Fuel Consumption Vehicles for May Lorries & Buses

Average Fuel Consumption for this vehicle type: 3.65

Station	G.K. No.	Distance	Km/l
DDLD LIVESTOCK MARKETING	679M	2,950	1.18
PDA, CENTRAL PROVINCE	943W	191	0.82
PDA RIFT VALLEY, NAKURU	B273	1,736	1.58
DAO BUNGOMA	5200	984	0.95

High Fuel Consumption Vehicles for May Motorcycles

Average Fuel Consumption for this vehicle type: 24.02

Station	G.K. No.	Distance	Km/l
DLDO KWALE	B297	2,236	6.50
PDA, EMBU	427K	1,297	10.38
DLDO MACHAKOS	879S	548	12.74
DLDO KISII	276U	592	12.08

HIGH REPAIR BILL REPORT FOR May

40 Vehicles With Largest Cumulative Repair Bills This Fiscal Year

Average Repair Bill: 2,377

Station	G.K. No.	Vehicle Type	Repair Bill
DAO NAIROBI	341Y	Land Rover/Range Rover	17,010
PDA, CENTRAL PROVINCE	943W	Lorry/Bus	20,087
PDA MOMBA A	108U	Pickup/Saloon/Kombi	60,292
PDA MOMBASA	518W	Land Rover/Range Rover	47,913
PDA MOMBASA	845S	Pickup/Saloon/Kombi	19,375
PDA MOMBASA	977W	Land Rover/Range Rover	40,795
DAO KWALE	188H	Land Rover/Range Rover	22,922
DAO KWALE	404U	Land Rover/Range Rover	21,535
PDA, EMBU	67Y	Land Rover/Range Rover	19,506
DLDO EMBU	256U	Land Rover/Range Rover	20,054
DLDO EMBU	318U	Lorry/Bus	18,314
DLDO ISIOLO	312K	Lorry/Bus	20,100
DLDO ISIOLO	B581	Pickup/Saloon/Kombi	17,500
AMS KITUI	357Y	Pickup/Saloon/Kombi	33,901
AMS KITUI	B396	Pickup/Saloon/Kombi	35,380
AMS MAKUENI	221Y	Land Rover/Range Rover	23,367
AMS MAKUENI	791S	Lorry/Bus	26,374
DAO MARSABIT	262U	Land Rover/Range Rover	73,615
PDA NORTHEAST, GARISSA	671W	Land Rover/Range Rover	20,100
PDA NORTHEAST, GARISSA	758W	Lorry/Bus	32,363
ARS KISII	614W	Lorry/Bus	38,996
DLDO KAJIADO	766W	Lorry/Bus	31,575
DLDO KAJIADO	858M	Land Rover/Range Rover	61,155
AMS KAJIADO	222Y	Land Rover/Range Rover	21,804
SEED INSPECTION, LANET	C091	Land Rover/Range Rover	54,884
PRINCIPAL DAIRY T.S. NAIVASHA	691R	Land Rover/Range Rover	20,203
DAO KAPENDURIA	B452	Land Rover/Range Rover	25,984
DAO BUNGOMA	520Q	Lorry/Bus	24,853
DAO BUNGOMA	628W	Land Rover/Range Rover	17,667
DAO BUNGOMA	81U	Pickup/Saloon/Kombi	20,955
DAO BUNGOMA	B356	Land Rover/Range Rover	17,174
DAO BUSIA	171U	Land Rover/Range Rover	22,192
DAO BUSIA	207Y	Land Rover/Range Rover	26,731
DAO BUSIA	294Q	Pickup/Saloon/Kombi	29,763
DAO BUSIA	604W	Land Rover/Range Rover	17,302
DAO BUSIA	A511	Pickup/Saloon/Kombi	31,500
DLDO KAKAMEGA	11Y	Pickup/Saloon/Kombi	22,322
DLDO KAKAMEGA	635W	Pickup/Saloon/Kombi	20,748
DLDO KAKAMEGA	840W	Pickup/Saloon/Kombi	17,076
DLDO KAKAMEGA	A681	Pickup/Saloon/Kombi	27,361

40 Vehicles Driven Longest Distance During May

Average Kilometres Driven: 1490

Station	G.K. No.	Vehicle Type	Distance
RANSPORT OFFICER HQS	320Y	Land Rover/Range Rover	4,095
RANSPORT OFFICER HQS	B772	Land Rover/Range Rover	4,208
RANSPORT OFFICER HQS	G330	Pickup/Saloon/Kombi	5,219
RANSPORT OFFICER HQS	G615	Pickup/Saloon/Kombi	4,685
AO MURANGA	405Q	Pickup/Saloon/Kombi	4,486
AO MURANGA	564Q	Pickup/Saloon/Kombi	4,371
AO MURANGA	C185	Pickup/Saloon/Kombi	3,347
TC WAMBUGU	A509	Pickup/Saloon/Kombi	3,321
DA MOMBASA	518W	Land Rover/Range Rover	4,144
DA MOMBASA	977W	Land Rover/Range Rover	4,144
LDO KWALE	F507	Motorcycle	3,410
DA, EMBU	89U	Pickup/Saloon/Kombi	4,341
LDO EMBU	839W	Pickup/Saloon/Kombi	4,849
LDO ISIOLO	E915	Land Rover/Range Rover	3,711
AO KITUI	B347	Land Rover/Range Rover	4,063
AO MACHAKOS	G648	Land Rover/Range Rover	3,639
IC KIBOKO RANGE R.S.	C010	Lorry/Bus	3,476
DA NYANZA, KISUMU	G642	Pickup/Saloon/Kombi	3,371
LDO KISII	B718	Pickup/Saloon/Kombi	4,307
DA RIFT VALLEY, NAKURU	271Y	Land Rover/Range Rover	3,839
DA RIFT VALLEY, NAKURU	62Y	Land Rover/Range Rover	3,259
DA RIFT VALLEY, NAKURU	B791	Pickup/Saloon/Kombi	3,843
DA RIFT VALLEY, NAKURU	E875	Pickup/Saloon/Kombi	4,209
LDO KAJIADO	963M	Land Rover/Range Rover	5,448
MS KAJIADO	807W	Pickup/Saloon/Kombi	5,714
LDO LAIKIPIA	868S	Pickup/Saloon/Kombi	3,934
EED INSPECTION, LANET	180Y	Pickup/Saloon/Kombi	4,814
RINCIPAL DAIRY T.S. NAIVASHA	A795	Pickup/Saloon/Kombi	4,585
AO TRANS NZOIA, KITALE	846S	Pickup/Saloon/Kombi	3,556
LDO TURKANA	G435	Pickup/Saloon/Kombi	5,198
AO BUNGOMA	A512	Pickup/Saloon/Kombi	3,817
LDO BUNGOMA	721R	Pickup/Saloon/Kombi	4,146
LDO BUNGOMA	E854	Pickup/Saloon/Kombi	5,199
AO BUSIA	A511	Pickup/Saloon/Kombi	3,506
LDO BUSIA	494Y	Land Rover/Range Rover	3,347
LDO BUSIA	E828	Pickup/Saloon/Kombi	4,440
UKURA INSTITUTE	335U	Pickup/Saloon/Kombi	4,082
UKURA INSTITUTE	B411	Pickup/Saloon/Kombi	3,542
UKURA INSTITUTE	B788	Pickup/Saloon/Kombi	3,536
UKURA INSTITUTE	E989	Pickup/Saloon/Kombi	3,727