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## Computerization, Aid-Dependency, and Administrative Capacity: A Sudanese Case Study

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### Introduction

From 1983 through 1985 the Sudan was reeling from an influx of nearly a million refugees, having the misfortune to share borders with several of Africa's most unstable states. Its economy was in shambles, having deteriorated fairly steadily since the early 1970s when the OPEC oil bonanza (from which much of the rest of the Arab world benefitted) shot the fertilizer and fuel prices of this agrarian country sky high. Agriculture itself entered a further calamitous decline as the result of one of the modern era's worst droughts, bringing famine to much of the country. Jaafar Numeiri, the Sudan's authoritarian military ruler, was growing increasingly eccentric and unpopular, and sought (ultimately unsuccessfully) to rescue his failing regime by imposing a strict, if poorly thought-out version of Shari'a law. This proved the last straw for Southerners who had been chafing under the gradual retraction of the concessions they had been granted when civil war was brought to an end a decade before; they resumed fighting in an all-out military struggle.

Why, in the midst of all this, did the Government of Sudan contract with USAID for a series of major computerization

projects? Was this another glaring instance of inappropriate development aid, a counterproductive response to the glamour of high technology? We would hardly defend the proposition that computers were what the Sudan needed most, nor do we want to wrestle here with the question of what priority they should be given vis-à-vis other potentially useful goods. We do, however, want to suggest that even under these extraordinary circumstances, the Sudan did (and does) need the information management capacity which computers have to offer. Moreover, and perhaps more importantly, we want to suggest that any adequate understanding of the process of computerization (and on that basis, any really adequate advice for those involved in such a process) must take into account the impact of a range of background factors well beyond those generally addressed in computer manuals or classes on systems analysis.

In a sense, then, we construe our task of examining the relationship between microcomputers and social change in the Sudan as calling for a kind of "deep background" to the concrete process of design and implementation of computer systems. Put another way, while computerization may cause or shape a variety of social changes, it is not the prime mover in any such process. The factors that lead to computerization, the conditions under which it takes place and the specific design decisions of those who implement it are the crucial determinants of its effects. And while our concern is in part with giving advice to those who may design such systems, we would stress that the voluntary decisions of designers are much less influential than the background factors and context.

Computers were and are needed in Sudan primarily because of the information management demands of state administration and economic development. These demands are imposed largely by the structure of the world political economic system—including the capacity of other actors to produce and in turn require massive flows of information. Sudan is in a position to ignore these demands only at very great cost. It does not exaggerate, indeed, to say that the cost

may include an element of national sovereignty. The Sudan is host to a bewildering array of international aid agencies, multilateral and bilateral donors, lenders and operative agencies. In the early to mid-1980s, over 100 foreign or international organizations were involved in refugee relief and famine assistance efforts alone. Without major reforms, the Sudanese government lacked the capacity to monitor the activities of these various actors. This meant, thus, that the government not only risked losing some of the aid donors and lenders offered by failing to comply with their informational demands, but risked losing its own capacity to bring order to both temporary aid efforts and long-term development plans. This is not to say that all foreign actors were inclined to let the Sudanese government exercise full autonomy. Nonetheless, it is significant that even if all foreign and international actors had attempted fully to respect Sudanese decision making, the government lacked the capacity to manage the situation. And beyond management of the various foreign actors working in the Sudan, there was the question of how the government might deal with such challenges as the influx of refugees or the growth and redistribution of its own population. These were (and remain) equally potent challenges to the administrative capacity of the government. Dealing with them also posed massive needs for new capacity to gather, manage and analyze information, and to present it effectively to policy makers.

In the following pages, we will first defend the initial proposition that computerization (financed by foreign aid) can be of value. Then we will describe something of the challenge of information management in the Sudan, focusing on the problems of aid dependency and development planning. From this background, we will turn to issues more closely related to the practical side of computerization efforts, considering some specific challenges of the Sudanese context and offering a number of suggestions for system development in similar settings.

### **A Bad Idea from the Start?**

This chapter is based on our experiences as technical advisors to the Government of Sudan on two USAID-funded projects in which computerization played a major role. One (receiving greater discussion here) involved the design and implementation of systems for financial accounting, developmental budgeting, project monitoring, commodity assistance tracking and donor coordination for the Sudanese Ministry of Finance and Economic Planning. The other involved support for the Sudanese National Population Committee in a program of research, policy formulation and education.<sup>1</sup> The two projects delivered and installed several microcomputers, developed specialized software (as well as supplying off-the-shelf software) and trained users. The systems installed were used for a range of functions from word processing in both Arabic and English through data base management to formal simulation modeling.

A variety of objections may be raised to work of this sort. It is done on behalf of aid agencies whose agendas may not coincide with those of domestic policy makers or be based on any independent verification of the interests of the citizens of the host country. It involves the transplantation of a foreign technology, and the transplant may, moreover, work to enhance the position of indigenous elites or of the state at the expense of subalterns and/or democracy. There are inevitably power relations in all technology transfers, involving not only asymmetries between rich and poor countries but also between international consultants and indigenous users. All these are valid concerns, and each should be borne in mind by those doing this sort of work. Yet none, in our view, invalidates it. For the Sudan to do without computer technology would mean simply for it to be even less able to chart a desirable course in the contemporary world system. Increasingly, it is as unreasonably abstract to ask whether computers are "good" for a country as to ask whether roads or telephones are. All are indispensable parts of the infrastructural basis for economic vitality and effective government. That both of these will be defined in terms of an exploitative international economy or a



system of states of unequal power and arbitrarily imposed boundaries may be unfortunate, even tragic. It is, however, inescapably the way the world is, and even changing the world demands starting where it is.<sup>2</sup>

This said, it should not be thought that our projects went any great way toward reversing the Sudan's long economic decline, ending its civil war, feeding its hungry or otherwise addressing its immediate ills. Moreover, even within their specific scopes, the projects suffered from flaws which we do not propose to minimize. We write not simply to extol their virtues, but to improve work of broadly similar genres and to provide an account of it which can be integrated into more general understandings of both technology and social change and what it means to be among the least "developed" countries of the world.

Though we do not challenge the utility of computers or even the value of many of the projects for which they are used, we do want to challenge the naive view of microcomputer technology as either neutral or automatically beneficial. Such technology always has a politics, as Langdon Winner (1985) has stressed, if for no other reason than that it represents a deployment of resources and is an occasion for struggle over alternative futures. The machines as such determine little, however. Nearly every significant outcome depends on how computer applications, and information systems generally, are designed, implemented and used, not on intrinsic characteristics of the machines. Accordingly, our suggestions will be aimed mainly at the process of system development and implementation. Power relations, larger strategies and highly specific local contexts stand behind and shape each system and its use. This political dimension to "technical assistance" is usually ignored, especially by the staffs of funding agencies and the consultants who make their living by guiding implementations. Ignoring the political and organizational biases and sensitivity of any computerization effort, however, both masks troubling side effects which deserve our attention, and makes for instrumentally less effective implementations.

Implicit in our account is the suggestion that the difficulties of computer use in less developed countries are not due simply to low educational levels or other failings of indigenous users. While a variety of problems stem simply from the lack of support for machines—a shortage of local parts suppliers, for instance, or undependable electrical current—others have to do with the conditions of international domination and self-interested domestic government. Even apparently “purely technical” difficulties often cannot be dealt with effectively unless they are viewed within this political-economic context.

Recognizing this fact necessitates breaking with the notion that the problems of Third World countries are simply a series of “absences” or “underdevelopments” of conditions or goods present in more “advanced” countries. It has been one of the unfortunate features of Western “orientalist” ideology to treat the rest of the world as essentially similar insofar as it was/is non-Western (or non-rich or non-powerful). This point is driven home to those who work in Africa and read development studies texts based on Latin America, or advice to computer consultants based on Southeast Asia. It is crucial to grasp the specificities of any context, of course, but the issue is especially acute in Africa because so much of the literature—even the critical and sensitive literature—on the Third World is rooted in other experiences. So is most of the lore of professional consultants and officials of international agencies. Even within Africa, differences are enormous. In fact, differences are in many ways greater among the less developed societies precisely because their conditions have not been recast in the common mold of the modern world system.

### **Information Management as a Problem in Developing Countries**

Information management is a crucial issue for developing countries. Faced with both domestic and international demands for statistics and record-keeping, many governments find themselves stretched to the limits of their resources. This is especially true of those which attempt any form of central

planning and/or monitoring of development activities. Whether the aims are improved service delivery, economic growth, or more effective monitoring of climatic variation, management of a large volume of information is essential. Trained personnel are at a premium; material facilities are minimal and funds for their improvement usually slight.

Despite the importance and difficulty of information management, the transfer of advanced technology to assist in it has been, until recently, only slight. This is so largely because most versions of this technology prior to about 1980 were (a) expensive both to purchase and to operate, (b) dependent on highly trained personnel, and (c) unreliable in the inescapably harsh operating conditions of many less developed countries. This was particularly true of mainframe computing.

Microcomputers (and in some cases related new communications technologies) offer new potential. They are relatively inexpensive, and moreover can be introduced incrementally so that a whole system need not be procured "up front." Though they require trained operators the number of specialists and the extent of training required is vastly less than on even moderately powered mainframes of a generation ago. Crucially, microcomputers also demand less in the way of environmental control. They do not require air conditioned rooms, for example (though our experience on the edge of the Sahara desert still suggests that air conditioning is advisable, if more for keeping dust out than for keeping machines cool).

As a result, microcomputers have been purchased for a wide variety of uses in Third World countries and prescribed for even more. They are tools which may, we think, improve many services and even support national autonomy. One of the best ways to see the potential usefulness of computers is to examine the information management demands placed on those charged with national economic planning and financial management in the Sudan.<sup>3</sup>

There is an international mandate for Third World countries to engage in national economic development planning and concomitant maintenance of national accounts. It is implicit in the activities of the World Bank and IMF. Evidence

of development planning is sought by both private and public donors—even by the United States, despite the fact that it is one of the few countries in the world to lack its own domestic planning agency. Scholars hold up successful cases of planned development as models for other countries, and their words are backed up by the ability of agencies to deliver billions of dollars in aid. But most economists and government officials in the Third World are already convinced of the merits of planning and national accounts, even where they reject the specific proposals of the IMF and other international agencies. They are graduates of the same university programs as the IMF officials, and they have been trained to believe in development planning. Yet this pursuit of planned development and effective national accounting runs up against severe limits of both political will and bureaucratic capacity (Rondinelli 1983; Robertson 1984), as both serious planning efforts and superficial attempts to meet the requirements of international donors require the management of an enormous range and complexity of information.

The various domestic and international actors who demand development planning (a) may have very little sense of the complexities of data management, (b) may have no intention of doing actual analysis on the data collected, and therefore (c) are often mandating not actual planned development but conformity to a myth concerning the role of planning and centralized monitoring (Robertson 1984). The demands for development plans, ironically, may even be at their most extreme in those cases where they are least likely to be effective—the poorest countries of the world.

In the Sudan, during the drought of the mid-1980s, foreign aid and related activities accounted for the absolute majority of macro-economic activity. Without it, we might reasonably say, there would have been no national-level economy but only local subsistence economies. The Sudan is thus a paradigmatic, even extreme, case of what Abu-Lughod (1984) has provocatively but accurately termed the “charity-economies.” Even in the few good years since 1973, formal sector domestic production has been relatively small in relation to international borrowing and aid. In such a setting, the ideals

of centralized planning and monitoring face the realities of seemingly intractable economic problems, the absence of a transportation and communications infrastructure to knit the country together, and an organizationally weak government. In the Sudan, it should be stressed, the governmental bureaucracy was not always weak, but rather was one of Africa's most efficient. A severe brain drain, increasing political interference with the civil service and dramatic deterioration in educational institutions, as well as simple lack of resources, all contributed to its decline. Moreover, the various external actors (such as USAID and other bilateral donors, the World Bank, UN agencies) which may call for effective central government nonetheless help in many ways to undermine it. Their agents demand constant attention from senior government officials, distracting the latter from their domestic duties.<sup>4</sup> Each international organization imposes its own set of rules and procedures and demands information in its own format; too many also shift constantly from one to another currently fashionable strategy for economic development (Morss 1984). The number of donors and the extent of dependence on them have increased dramatically in the last several years.

These challenges, and the need for solutions which underlie them, were (and are) particularly great in the Sudan. One of the world's poorest countries, the Sudan is nonetheless involved in a wide range of publicly financed development activities. It is the recipient of an enormous volume of foreign aid—a volume recently multiplied in an (only partly successful) effort to cope with Sudan's influx of refugees from Ethiopia and other troubled neighboring states, and its own domestic drought.<sup>5</sup> Sudan's British colonial rulers started a tradition of very large-scale development projects—the most well known of these being the Gezira scheme, a mechanized farming venture focused largely on cotton. After independence, Sudan continued on the same path, hoping (with a good deal of international support) to become "the breadbasket of the Arab world." New agricultural schemes were set up and old ones enlarged; industrial facilities were planned; housing was built to house migrants; shipping facilities were improved.

Ventures of this sort placed increasing demands on the central government's ability to plan and monitor dispersed activities (as well as to finance them). Like most of the countries of the world, the Sudan chose to engage in centralized planning for economic development. A Planning Ministry was created, though later merged with the Ministry of Finance, of which it is now the Planning Section. The planners were charged with (a) planning, but also (b) monitoring activities, and (c) maintaining liaison with foreign and multi-lateral lenders and donors. The last of these responsibilities became, in a sense, the tail which wagged the dog. The scale of activities involved was not the only major issue. Government officials were also working in a very large country (Africa's largest, about the size of the U.S. east of the Mississippi) with a minimal transportation and communications infrastructure.

There were, however, problems in the Ministry as well. First and foremost, there was a lack of effective record-keeping.<sup>6</sup> Though quite a few accountants were employed, procedures were minimal and primitive. No running balance was maintained, for example, of the outstanding lines of credit the country had open with various foreign lenders. No domestic bookkeeping allowed the accounts of foreign donors to be checked; indeed, in most cases the requests for payment from individual contractors were approved without any attempt to verify their claims. To the extent that record-keeping was carried on, it was in a system oriented far more to storage than to retrieval. Though ledgers and binders were filled with numbers and forms, senior officials could not get answers to their requests for information. The Ministry had little ability to use data analytically. Each year's Development Budget, for example, was prepared without knowledge of how much of the previous year's had in fact been spent. Linking past records with future plans was impossible (and alas, we cannot claim that our system has entirely eliminated this problem).

To these internal difficulties foreign donors added a great deal. They demanded frequent reports, drawing on the time and attention of Ministry staff members. Perhaps more

problematically and less necessarily, nearly every foreign and multilateral aid organization and lender insisted—and still insists—upon its own distinctive procedures for recording and reporting data.

### **The Context of Computerization: A System-Poor Environment**

Even in the world's richest, most technologically advanced countries, computer use is still expanding into new applications and new organizational settings. New users can draw, however, on a rich background of experience, training institutions, support organizations and, in general, technological infrastructure. This is of enormous importance in even small applications, but even more so in relatively larger ones. As Kling and Scacchi (1982a) suggest, computer use involves a whole web of activities, relationships and technologies. No one application can well be understood in isolation. This holds a particular import for those countries of the world where computerization is still very limited. These are mostly to be found among the least developed countries. There computerization efforts cannot build on strong foundations from prior computer use, on strong support systems, physical infrastructure, technological familiarity or even, in many cases, a common linguistic basis. Not only foreign exchange and spare parts but such basics as electricity may be in short supply.

In such settings, computing environments are unstable and underdeveloped. Yet computerization makes significant demands on environments. Unfortunately, the planning of many systems presumes settings like the United States, Western Europe or Japan, where a high level of environmental support can be taken for granted. Failure to think through the special challenges of early applications in a "system-poor" environment is an important cause of failure and/or underutilization. Moreover, it is important that early applications foster wherever possible the development of a stronger computing (and, more generally, information management)



environment. Early computerization efforts, thus, ought to be judged in part on whether they make later ones easier. In countries like the Sudan, however, there are serious limits to this. Computers represent a technology which cannot in the foreseeable future be fully "acquired" by the Sudan. While specific machines may be put in place, in other words, the overall process of technology transfer is truncated because the Sudan is not in a position to become a self-sustaining producer as well as a consumer of computer systems (and thus is in a very different situation even from such other less-developed countries as Brazil, Indonesia, China or the Philippines).

It is important also to note the difference between simply introducing computers, and introducing information management with computers as the medium. In planning for computerization in the Sudanese Ministry of Finance we faced, as mentioned above, the problem that no very satisfactory system of paper accounts was in place. The task was not to computerize an existing system, but to create a management information system anew. The computer, we thought (following the work of Pinckney, Cohen, and Leonard in Kenya, 1983), might be something of a catalyst. The glamour attached to new technology might persuade some people to interest themselves in data management who otherwise would not do so.

A variety of other factors also represented barriers to effective system development. The Sudan suffers from an extraordinary brain drain. Until the recent collapse of oil prices, the oil-rich Arab states employed some 45% of Sudan's professionally educated workforce. Any Ministry staff members whom we trained in computer use would become prime candidates for employment abroad or in the Sudanese private sector. In addition, the Government of the Sudan is able to pay its employees--once perhaps the best trained and best organized civil service in Africa--little more than a pittance. Beyond the issue of staff stability, the physical environment posed a problem. Dust is a constant presence, even without the occasional dust storms--haboobs--which sweep over Khartoum from the desert. Few buildings are sealed against the dust; after all the warm, dry climate makes for little need to protect humans (if not computers) from the



elements. Temperatures reach over 130 degrees Fahrenheit. The Ministry did provide a closed and air conditioned room (which, however, encouraged an apparent over-centralization of access to the computers, though a few were dispersed to other offices despite inclement conditions). Electricity was another matter. Supplies are subject to frequent interruption and to wide fluctuation. "Brown-outs" are common, especially during the summer, and black-outs may last for days. Beyond the usual reserve power supplies and line filters, of course, there was little to be done about this.

What was to be done about this range of challenges to any computer system, we thought, was to take an incremental approach. Computerization should proceed through the creation of several more or less self-contained systems rather than one large, centralized one. If some failed, others would continue to function. Moreover, a gradual process of computerization seemed in order. Design, system construction, training and implementation could not be four separate processes in a strict linear arrangement. Rather, each would have to take place simultaneously, at least in part, and influence the others. A "turnkey" system seemed guaranteed to fail in practice whatever its technical merits. An incremental approach would not only allow a high degree of tailoring of the system to the specifications of its actual users and the specifics of its actual situation. It would also allow us to build up the necessary flow of documents, the familiarity and confidence of a wide range of interested and/or essential staff, and the support of senior administrators not just for a system, in the abstract, but for the concrete system being implemented. An incremental approach allowed us to incorporate several layers of administrators in the actual design process, thus simultaneously (a) improving the system, (b) increasing support for it, and (c) giving administrators a clearer idea of what could and could not reasonably be expected from it. If anything, in retrospect, we underestimated the advantages of incrementalism, and overestimated the extent to which "a way could always be found" to implement any technically sound feature of the system.

Microcomputers are a technology particularly well suited to an incremental approach. The unit cost is low, yet systems can be expanded almost indefinitely. Relative levels of centralization or decentralization can be shifted in the field. Computers initially deployed as discrete machines (though linked by common software and transferability of data by disk) can later be linked in a network. New technology (or newly affordable technology) can be added piecemeal; indeed the whole system can gradually be changed over from one brand of computers, say, to another. This is particularly important in a developing country that is dependent on foreign donors for its computer equipment. Donors are fickle; those interested in supporting an MIS system this year may have other priorities next year. A new donor may have a commitment to a different hardware supplier, perhaps because its aid is tied to its own national business interests (as is most US aid). Where a mainframe computer system could become instantly obsolete in the absence of a continuing source of support, and where it may be hard to find new donors willing to cough up the cost of an entire new system, a microcomputer-based system would, we thought, more likely survive the vicissitudes of aid dependence. In a sense, microcomputers are closer to the sort of smaller-scale technology often advocated under the label "appropriate technology."

### **The Finance Ministry Management Information System**

Our system was planned in response to several specific issues and concrete tasks within the Ministry. The first was a need to keep track of expenditures and activities involved in the implementation of foreign loans and grants. This was of interest not only to the Planning Section of the Ministry, which had little ability to monitor physical implementation or plan for fiscal needs, though it bore responsibility for both, but also to the various foreign donors. Assembled as a group in the Joint Monitoring Committee, they recognized (at least gave lip service to) a need for donor coordination and data about each other's activities. It would be helpful, for example, for two

donors offering road-building assistance each to know what the other had in the pipeline. The Project Directory sub-system was designed with this purpose in mind.

Secondly, it developed very quickly in our work that despite the presence of a substantial "official" accounting apparatus, the Ministry had no good financial records system, still less one which could make current data easily available to those charged with establishing and monitoring foreign loan and grant arrangements. A Financial Accounting System became the highest priority for the Ministry, if not for the outside donors.

Thirdly, and at the lowest level of technological sophistication, we worked on spreadsheets to help the Commodity Assistance Committee keep track of the flow of physical imports. Requests from various implementing agencies in both private and public sectors have to be coordinated, and referred to potential donors. Lines of credit must be opened against foreign loan or grant agreements; tenders of goods must be received and approved; shipments monitored, payments made, and delivery vouched for. Time lags may enter at any point and may prove critical (as for example when trucks are not available to move necessary food, which rots at the docks). At the time we began work, only partial paper records were maintained of this chain of activity; the primary data were in the head of the Director of the Committee, and to a lesser extent, the heads of his staff (see Adkins 1988:38 on similar problems in monitoring the even more complex commodity flows of Tanzania). Yet analysis of where delays arise is one of the main means for improving the efficacy of the entire foreign aid operation.

At least in principle, all three of these sets of activities (and the MIS sub-systems tracking them) should contribute to effective budgeting. In fact, budgeting is carried on largely as a separate activity with no systematic relationship to the monitoring of either expenditures or physical implementation, and with no established flow of data about either. As we mentioned earlier, the Development Budget is prepared each year in nearly complete ignorance of the actual expenditures made the year before, let alone of whether those expenditures

were translated into appropriate physical outcomes. We provided computer support for the Development Budget process, though top Ministry officials and USAID staff alike regarded this as a luxury. Regrettably, the budget process remains largely disconnected from the other activities. It appears to lack the political backing to take the central organizational role one might expect (on the other hand, as of 1990, the computerized budget system was the only component of the project still being consistently used). The failure to connect planning to disbursement was not an anomaly, but an indication of a general state of affairs at the Ministry. Indeed, in the absence of a clear relationship of the monitoring and record-keeping activities of the Ministry to its disbursement and planning activities, we felt a lack of organizational sense of purpose on the part of many, at least in the Planning Section of the Ministry. Indeed, staff come into the Ministry with backgrounds wildly unsuited or unrelated to the specific jobs they will hold. Economic planners, for example, may hold degrees in chemical engineering (as did one of the best computer-trainees to pass through our Management Information Systems Unit). Nothing in the organizational structure or the lines of power relations, and nothing in the job descriptions under which individuals work, really suggests very forcefully that planning (or the monitoring of physical implementation) is the central function of the Planning Section. And, in fact, it may not be. As Robertson (1984) suggests, planning is largely a ritual activity, undertaken for the benefit of various domestic and international audiences. In the Sudan, at least, the core function of the Planning Section of the Ministry of Finance seemed to be placating donors. Beyond planning, record-keeping was also apparently largely a matter of ritual, as it involved filing various documents with no attention to the possible purposes for which they might be retrieved, and entering financial transactions chronologically with no effort to reconcile income and expenditure or even to sum columns. There was little notion that data need to be gathered for use in analysis, rather than as mere records. But that is another story.<sup>7</sup>

The main thrust of our approach, and the main insights of our experience, can be revealed through a look at one of the subsystems in the larger management information system we helped to develop. This is the Project Directory of Foreign Loans and Grants.

The Project Directory subsystem was planned to meet two goals. First, it was to provide a database for the use of the Government of Sudan and the foreign donor community in achieving greater coordination of donor activities. Second, it was to enable the Sudanese Ministry of Finance and Economic Planning to maintain its own accounts with regard to foreign loans and grants, rather than depending entirely on the accounts of the donors themselves. The former goal was of interest primarily to donors, including especially the USAID which paid for the project; the latter goal was of much more interest to the Sudanese officials in the Ministry. In both cases, the need was for information on plans themselves, on actual agreements, and on physical implementation. A separate system was developed for financial accounting (see Whittington, Calhoun, and Drummond 1986).

Previous efforts had been made to gather this sort of information; some of it was collated in the course of routine work in various "sectoral" (for example transport, energy, agriculture) offices within the Planning Section of the Ministry. There was, however, no systematic effort to ensure that records existed for every project. Indeed, there was no one who could list all foreign-financed projects underway in the Sudan--even with the aid of a file cabinet of his or her choosing. As a result, project planning was not based on explicit records of past experience--and, given the very high rate of turnover in Sudanese and especially foreign staff, such planning often was not based on any form of experience.

An attempt to enhance collective memory was one of the central reasons why the foreign donors wanted a project directory. Foreign donors, however, tended to see this as primarily a Sudanese problem. An ineffectual Secretariat for the Joint Monitoring Committee had been established; one early view of our project was as an effort to "beef it up." The Ministry tended to proliferate units aimed at improving

administration, but not to attend to the underlying problems. Shortly before our MIS project spawned an MIS Unit, for example, a "Follow-Up Section" had been created to follow-up on the undone data collection work of the other units (perhaps needless to say, it did not do so). While the Ministry was able to offer precious little information management capacity, it has to be said that few donors could do much better. Most information was shared by informal word of mouth, or more formal announcements at meetings of a Joint Monitoring Committee. The UN Development Program office in Khartoum appended a summary of those projects of all donors from whom it could gather data to its annual reports. This was the only real effort to gather data across donors, and it was not only inadequate in contents, it was almost always too late to affect project planning and development. Even within the missions of individual donors, record-keeping was generally conceived of as a necessary evil and was undertaken only to placate the home office, not to aid in planning, analysis, or transfer of responsibilities among the ever-changing field staff.

Given this situation, several kinds of data seemed to us potentially useful. In the first place, it would be helpful simply to know what each donor was doing, so that their activities might be coordinated—at least to the level of avoiding duplication (or, though this was less often mentioned, to avoid leaving gaps when all donors rushed to follow the latest fad in development aid). It was important that such data be current and reflect the actual state of implementation efforts, not merely the existence of an agreement. The political volatility of the Sudan, together with other problems, meant that only a fraction of development projects approved in the early 1980s actually reached completion. Secondly, systematic data on the course of implementation of each project might provide the basis for learning what roadblocks were characteristic and beginning to remove them. A concern for trying to speed the movement of aid was voiced by nearly every donor. Thirdly, data on both Sudanese and expatriate contractors and other personnel might allow for more intelligent choice among candidates for future contracts. Fourthly, it was thought by

the government and foreign assistance agencies that the Project Directory might provide a ready index to all reports or other publications resulting from projects or their evaluations.

We developed the Project Directory as a database using dBASE III software.<sup>a</sup> The design of the database was actually fairly straightforward.<sup>8</sup> Our problems—and these were considerable—arose in implementation.

First, there was the question of designing a form on which to solicit information. Administrators at nearly every level of the Ministry, together with some expatriate advisors, insisted upon putting their own stamp on the form and content of the questionnaire. Many of their suggestions were helpful; the problem was that over a period of more than a year, no end could ever be brought to this process of revision. We never succeeded in persuading the senior officials involved that each revision of the form might mean a considerable delay because it sent us back to redesign the database structure. Waiting for the perfect form, moreover, seemed an excuse for not getting on with data collection.

This raises the second main problem: a difficulty in translating interest in the computer as machine and status symbol into a willingness to do the information gathering work which is the true basis of an effective MIS. Indeed, constant tinkering with forms was only one way in which senior officials coped with the problems that (a) no one in the Ministry wanted to do data collection, and (b) at least unconsciously, many people must have known there was precious little good data to be had. With regard to the first problem, we found that those who were sufficiently senior to be chosen to work with us regarded mere data collection as a form of clerical work and beneath them (this was somewhat less true of women). Moreover, the staff of the Management Information Systems Unit saw themselves as technically trained computer specialists, not researchers or fillers-out of forms. We tried in vain to convince them that the computers could not do the work without good data, that computerization was

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<sup>a</sup> dBase is a trademark of Ashton Tate.



merely the introduction of a tool into an effort which was really about information.

The third difficulty with the Project Directory may hold a less obvious lesson. This is the importance of a relatively transparent system. We chose dBASE III as a powerful tool with which to accomplish the ends listed above, and in technical terms it performs admirably. In practice, however, almost any dBASE III program works as a black box into which ordinary users feed data and from which they receive reports. While the most complicated spreadsheet is at least partly transparent, the simplest data base is usually not. The issue is not just one of training users to a high enough standard that at least some can make innovations in the system. That, indeed, would have been very difficult in the circumstances, but the Financial Accounts System developed in LOTUS 1-2-3 is not easily altered by users of moderate training either. The crucial issue is that it is very hard to show anyone how the database system works. The interest must be in the output, and so the potential role of computer as "catalyst" is reduced. This aggravates the second set of difficulties discussed above. Anyone chosen for such an honorable (and potentially remunerative) job as working with a computer in a very poor country is likely to feel "above" and bored by clerical tasks such as entering data into and requesting reports from a database. One of the best typists we encountered was a young "gaffir"—a sort of porter, almost literally a go-fer in the Ministry. He was personable, would have loved to enter data, and was considered ineligible because he did not have a university degree. It was suggested, by contrast, that we train economists and engineers with master's degrees to do data entry.<sup>9</sup>

All of these problems internal to the Management Information Systems Unit and the Ministry pale before the fourth. Despite their initial support for this effort, voiced officially through the Joint Monitoring Committee, the donors—especially the major Western and multilateral donors—failed to respond to requests for data. We had expected some problems getting data from those donors not active in the Joint Monitoring Committee, such as the Arab donors and the



African Development Bank. On the contrary, these replied promptly and generally quite thoroughly to our requests. It was the World Bank, France, Great Britain, and the EEC which failed to complete our forms, and failed even to respond to follow-up letters from the Under-Secretary of the Ministry (the highest civil service rank in the Sudanese Government and in this case a dynamic and powerful figure, who later was promoted to Minister of Finance). USAID, the agency which funded the project, responded but only after considerable nagging on the part of the project's supporters, including the Chief of Mission, and direct intervention on our part to supervise completion of the forms. It seems worthwhile at least to pose some hypotheses as to why the donors may not have responded. Each of the following is probably true in part for at least some of the donors.

First, there are possible reasons which have to do with the internal affairs of various donor organizations. Then, there are also several likely reasons having to do with donor-representatives' perceptions of the situation outside their own organization.

### *Internal*

1. Data may be in a central office, not in Khartoum. This was voiced as an excuse, and at least some of those voicing it had definitely requested the data from their headquarters. The failure of headquarters staffs to respond presumably has a variety of bases with the common denominators that records are not readily ordered in this fashion there and doing the work to so order them is not a high priority for anyone back in Washington, New York, Geneva or Paris.

2. Donors (and/or their representatives) may simply not care; they may have no interest in donor coordination. Indeed, the latter does seem to be something which everyone claims to want—but with the unvoiced condition that no one else be allowed to coordinate them! Among the hundred-odd organizations trying to alleviate the refugee and drought crises in Sudan, at least half a dozen—from the U.N. High Commissioner for Refugees to Grassroots International and Bob

Geldoff's Live Aid--claimed that their role is to coordinate the others, or at least information about the others.

3. It is likely that even where senior officials gave verbal commitments to participate in this effort (as nearly all did, repeatedly) they did not translate these into incentives for anyone in particular in their organizations to do the work involved. Aid missions are chronically over-worked (and poorly administered); in the absence of a strong inducement to do otherwise, many staffers would let a mere request for information by the host government gather dust. The extreme and urgent problems facing the Sudan even give such decisions a moral cast: "how can I fill out these forms when people are starving?" Of course, the same people who make such statements find time to go on innumerable, generally useless, "familiarization visits" to the scene of hardship. The latter give them a sense of activity which effective administration does not.

### *External*

4. Many donors may have reasoned that others would fail to do their part, and so decided not to waste their own time or energy. This "others won't so why should we?" reasoning is a sort of free-rider problem in reverse (as well as a self-fulfilling prophecy). We think it was an important factor.

5. Many donors seem to have perceived the Ministry of Finance (or at least its Planning Section) as either irrelevant or incompetent or both. They simply chose on that basis not to support its efforts, anticipating that they would amount to nothing.

6. Some donors may have felt quite the same way about the MIS technical advisors—us—or at least the system we appeared to be developing. A number certainly seemed to feel that the MIS system would not work, either because it was impossible to get the Ministry that organized or because they thought a computerized MIS was not a good way to go about it.

7. Privately, at least one donor voiced what may have been a more common sentiment—that this project was too closely

tioned to USAID for their tastes. Rivalries among donors are intense, and the multilateral donor whose agent made the above remark had previously unsuccessfully proposed another approach to many of the same issues. In any case, USAID appeared to some other donors to be encroaching on their turf—in part because it seemed to want to take the active role in promoting (doing) donor coordination.

Whatever the reasons, the non-compliance of the donors with this major effort by the Sudanese Ministry of Finance and Economic Planning to get its records in order must call into question their willingness to support the development of effective government administration in the Sudan. It should be said that we responded not only by expressing our disappointment, but by gaining direct access wherever we could to the files of the donors so that we could gather at least baseline information for the system. It would appear, however, that for the future the Sudan would be well advised to depend on donors for as little information as possible, and to ensure that adequate procedures are developed for its own record keeping and information management. Our efforts can only count as a step or two in that direction.

### **Simpler Applications**

The introduction of microcomputers at the National Population Committee (NPC, part of the National Research Council) involved some other interesting dynamics—partly due to the different functions of the computers, and partly to the very different nature of the organization itself. Computerization at the NPC was part of a larger program of technical assistance in the development of a national population policy. The program (USAID-funded "OPTION for Population Policy") included support for task force research on major population and health issues, preparation of a national conference, development of policy constituencies through educational campaigns and regional seminars, and assistance to sectoral ministries in planning and awareness raising. Initially, one microcomputer and existing software were used

to prepare graphic presentations of population projections. Fairly senior staff were trained on the software. However, quite soon the secretarial staff began to use the computer for word processing of Committee documents and correspondence (in part because of lack of typewriters). Upon the request of the NPC, OPTIONS added more computers and training in word processing in English (Wordstar) and then in Arabic (Multilingual Scholar). At this point, the microcomputers became critical to the function of the office and played a large role in the institutionalization of the organization. The NPC grew from basically a one-person activity to a full-fledged government institution with its own building and staff and with greatly expanded credibility within the government.

As the project went on, the staff (mainly the secretaries) themselves pressed for training in DOS, Lotus, and dBASE; as professional staff came and went, the senior secretary became the office expert in the demographic software as well. This obviously affected office dynamics. Senior staff were keen to maintain status differences (some, by purposely not learning to use the microcomputers), but became dependent on the few lower-level staff for all applications. This led to considerable wrangling over salaries as the computer-expert staff improved their bargaining positions and as their many job offers from the private sector increased their awareness of the economic value of their skills. After a year, it became clear to the leadership that mid-level staff should be developed, and two young economists were trained and placed in charge of the demographic software. The resentment this fostered in the senior secretary was predictable. The economists have since gone on to graduate school; the secretary remains.

The placement and authorization for use of the computers at the NPC were very different from those at the Finance Ministry. Computers were in the open center of the building, accessible to all staff and visitors. The informal tone of the NPC allowed everyone to have a turn on the computers.

A number of graphics programs also were installed for use in creating color graphics for presentation with the population projections. Some staff members were trained to use the application Storyboard, but many others taught themselves

through trial and error. The more entertaining aspects of creating color graphics using a mouse and a system which required little English reading attracted almost all of the staff, from the media officer right down to the tea maker. The senior analysts still remain quite isolated from the actual use of the microcomputers, partially due to lack of time to learn the programs. They are clearly aware of what the microcomputers (and staff) can do, however, and they guide their work.

Computers at the NPC (all Compaqs) were initially chosen for their portability and durability and have lived very hard lives—traveling by plane, train, jeep and truck all over the country for use in regional seminars. Considering their heavy use and the dusty environment, the Compaqs held up fairly well, but there were constant maintenance problems which cost both the project and the NPC considerable energy and money. In fact, the OPTIONS project was plagued by debates over who had responsibility for the maintenance of the machines. Some felt that the project had done its part by providing all of the hardware, software and training, and that the Sudanese government (the NPC) should show its commitment by at least keeping the machines in working order. Others felt that the project should have this responsibility, since the NPC had no budget for such things at the time and there were no spare parts to be had in the local market. Generally, the project provided parts and the NPC paid for the repairs (until USAID pulled out). This presented serious problems, however. The NPC was completely dependent on OPTIONS for hardware and software for almost three years. As the environment for the computers (and printers and other peripherals) was harsh, parts frequently had to be replaced. Whole computers were sometimes brought back to the U.S. for repair or just replaced outright. All support materials had to be shipped as excess baggage with consultants on trips. At \$100 per box for shipping alone, one box of computer paper became extraordinarily expensive. Printer ribbons, fuses, electronic parts and diskettes all had to travel with technical assistance team members from the U.S. to Khartoum, due to a freight embargo by airlines (even before this, shipments would often not arrive at all or would be detained without

notice by customs authorities). During a five month hiatus in 1988 when USAID forbade project staff to travel to Sudan for security reasons after a terrorist bombing, some NPC work came to a halt due to lack of printer ribbons (which were not available on the local market). When USAID pulled out of Sudan for political reasons in December 1989, NPC was left to its own devices to keep things functioning. The financial costs to the organization are astounding. In December 1989, a printer ribbon cost the equivalent of \$10, a box of diskettes \$50—about the same as the annual salary of an office assistant. Paper was unavailable. To complicate the situation, even when the NPC can find these items in the market and has money in the budget to purchase them, it cannot maintain proper accounting procedures because merchants will not provide invoices. Why? Because severe import restrictions (encouraged, even demanded, by the IMF, USAID and others) do not allow for use of hard currency to import these “non-essential” items. Consequently, all computerized projects and offices which need these items have had to develop creative ways to obtain them; often, the items are smuggled in by personnel who travel abroad. So, although the computerization of institutions may be useful, or even necessary, to effective functioning, if it is supported by donors which are unreliable suppliers it may actually result in draining the institution of scarce resources. Until another source is found for hardware and software support, the NPC must use a major part of its finances and staff time just to keep the system working.

As the NPC expanded its activities, got its own building and became institutionalized (and recognized how dependent it was on foreign consultants to bring parts for the Compaqs), there was increasing interest in having more easily serviced but non-portable IBMs for office use. The NPC has recently built a separate, small, air-conditioned, dust-free room for the computers, which will undoubtedly cut down on maintenance problems but which limits access to the machines. In many ways, this is unfortunate, as the computers attracted quite a bit of attention and experimentation from staff and visitors when they were physically more accessible.

An interesting and unexpected result of computerization at the NPC came from the installation of a word-processing program in the indigenous language, Arabic. This was done initially so that conference papers could be produced in both English and Arabic (a "first" in the country), but the Arabic facility created a demand from sectoral ministries all over Khartoum for assistance in their work. This helped the NPC to establish important relationships with other government agencies and made it a meeting place for numbers of other project directors and ministry personnel. It placed great strain on NPC secretarial staff and sometimes delayed the NPC's own work, but it was critical to the development of key relationships. As more and more of NPC's work began to be done in Arabic, eventually the English was used only for reports to USAID or for materials to be presented to an international audience. In order better to reach audiences outside Khartoum, OPTIONS staff also created an Arabic version of the demographic software and graphics programs. (This was only possible because the programmer on the OPTIONS team was also fluent in Arabic.) As far as we know, this project is the only donor-supported project in Sudan to work in both English and Arabic; this was a result of the determination of the OPTIONS staff (even more than our Sudanese counterparts) to work in Arabic whenever possible.<sup>10</sup> We see working in the local language as very important, especially in projects, such as the NPC's, which involve public (or even bureaucratic) awareness raising. But this is very difficult, even impossible in some cases. Luckily, some Arabic word-processing software existed and we knew where to find it, but transforming other software into Arabic was time-consuming and required very specialized skills. Other languages may be even more difficult. Sometimes English (or French or Spanish) may be the common language in business or government, and so computerization will occur in that language by default. The implications of this include limited institutionalization of computing facilities, restriction of computer access to elites, and often dependence on international suppliers (see discussions of these in the chapter on Tanzania).



After three years of support and intermittent training from the OPTIONS project, NPC staff are able to carry on with all the activities originally envisioned for the microcomputers, and they have added new ones. In fact, we believe that a strength of the project was that instead of establishing a set system and training program, it was flexible enough to respond to the needs and interests of the NPC staff who, in time, became enthusiastic and creative users, constantly finding new functions for the computers. The whole project became a common learning experience. We believe that the success of computerization at the NPC (despite sustainability questions) is partly a result of microcomputers filling a real need—in this case for demographic projections, word processing and graphics representations—which was felt by indigenous staff. In addition, the NPC's own organizational style and structure was loose enough to encourage everyone to get involved in the process. Last but not least, the uses at the NPC did not involve the sort of demands for new and continuous data collection which the Finance Ministry systems did.

### Suggestions

Our suggestions, based on our experiences in Sudan, can be summarized as follows:

#### *Equipment: Keep It Simple*

*Reliability is more important than "state-of-the-art" in hardware.* The number of unanticipated problems is multiplied in a physically hostile environment. Of course, in a country like Sudan, with an unreliable electricity supply, alternate power supplies are absolutely necessary. Repair services in the Sudan were extremely limited not only in absolute terms but in the kinds of problems they could solve. This stems from the country's poverty, from the low level of previous computer and other technological system use, and even from its dependence on foreign aid. The last skews equipment choice to those products manufactured in donor



countries, and may introduce problems (for example the availability of hard currency or stable direct relationships with vendors) in securing a ready supply of parts. The issue is not just that technology must be imported from industrial countries—already a problem—but that many donors will give funds only for the purchase of goods manufactured in their own countries. Such conditions impede any rational and coordinated equipment purchasing policy in the governments of aid-dependent countries. Hence, point #2:

*Buy locally if you can.* U.S. government procurement policy systematically undercuts computer vendors in poor, low-technology economies not only by requiring purchases to be made from U.S. manufacturers, but by following lowest bid price rules which eliminate local vendors. Aid is tied to purchases in donor countries in order to ensure that government spending on foreign aid boosts the donor's own economy and (in the case of capitalist countries) the private interests of the donor's manufacturers. Lowest bid price rules simply represent an attempt to manage costs and combat corruption. Unfortunately, keeping initial prices down in this way does not always keep long-term costs down. Moreover, undercutting the position of local vendors is both antithetical to the professed goal of development and damaging to the immediate task of computerization, to the extent that it minimizes the development of support systems. Even where local purchases may be precluded, local maintenance contracts would be helpful; foreign donors characteristically do not make any provision for later maintenance of the goods they provide. Despite our requests, USAID was unwilling to deal with the fledgling computer stores of Khartoum, except for emergency service (and service, moreover, was considered the financial responsibility of the Sudanese government, not being covered in contract arrangements). This is also an argument in favor of "brand name" purchases, insofar as they provide not merely prestige but a much better chance of service in remote settings.

*An easy-to-maintain, simple system is better than an easy-to-use but more complex system.* In the U.S., software development has moved toward increasing internal complexity in an effort to achieve "user-friendliness". User-friendliness is

of course a desirable goal anywhere, but an extremely unstable computing environment (like that in the Sudan) makes flexibility more important. Difficulties in training and retaining employees mean that any system will have to be easily learned. Few highly skilled people will be available to "maintain" or modify extremely complex software. Users will not be able easily to buy a new system or hire new technical advisors as applications change. Turnkey systems which work fine at the start will tend to fail because of lack of software maintenance or a changed organizational environment. Simple applications are also often overlooked by microcomputer advisors who have little real familiarity with the institution they are advising, its staff capabilities, or its needs. For example in the NPC project, microcomputers were originally introduced to facilitate population modeling; but the greatest impact they had on the organization and its work turned out to be in English and Arabic word processing, which allowed for the development of improved record keeping, journal publication, correspondence, etc. In this case, it was important that advisors were familiar with Arabic software in order to select the best system and to provide training.

*Observable, interactive, visually-oriented systems stand a better chance of succeeding than "black box" or batch systems.* The interactive friendliness and visual appeal of microcomputers is an important virtue to be maximized—even at the cost of system power. Shared goals and boss's orders are often insufficient motivations for learning to use a system. We found an ability to see the program do its work to be important not only in teaching new users, but in explaining the workings of our systems to the senior decision makers in both Sudanese government and donor bureaucracies. In the Finance Ministry project, no one ever paid much attention to, really understood or even wished to understand the system based on dBASE III; it will probably not be used very much. Those based on Lotus 1-2-3 caught the attention of all sorts of people during demonstrations and generated an interest that will probably translate into more effective use. The simulation package on population projections—"RAPID"—provided an

initial source of high-level interest in computers, which then made possible a range of other uses.

*Systems with modular, decentralized component parts will be more likely to survive.* Highly integrated systems have undeniable advantages, but not as first (or early) computer implementations in very unstable, poorly developed computing environments. It is important to remember that systems will always fail. In a modular system, the failure of one sub-system will not cripple the whole. Not only are technological reasons not entirely controllable, but there are political/organizational reasons for failure. In the Sudan, the Presidential Palace for a time overruled the Ministry of Finance's authority to enforce development budget allocations. If work on the budget itself (the ultimate unifying system of our project) had to stop, the other information management functions could proceed separately. Moreover, implementing one module at a time allows for an iterative feedback process to inform the whole effort (see #12 below).

### *People: Training and Organization Are Key*

*The success of any computer application will be determined largely by its effect on the career paths (and remuneration) of individuals.* One serious difficulty both projects faced was providing career tracks for the computer personnel we trained. USAID and the Sudanese managers were unable to establish a fair method of additional pay to people who could dramatically increase their salaries by leaving the Ministry of Finance as soon as they were trained. One of our better pupils secured a part-time position paying ten times her government salary. Three years after completion of the project, only a handful of the nearly thirty trainees remained with the Ministry. Such problems could become one of the greatest barriers to further introduction of computer technology within any specific unit, though of course the departed personnel will help to provide a better computing environment for the country as a whole, so long as they do not leave to market their skills abroad.

*Training a few people to very high levels will not be as effective as training many people to lower levels.* The highly trained specialists will, in the absence of very expensive inducements, probably leave. It might make more sense, anyway, for such experts to be trained through the usual educational channels. Only spreading training widely will help the organization as a whole to become a hospitable environment for computer applications. It will make computer training less of a scarce "property" to be controlled by individuals (or their supervisors) for personal advantage, and will encourage many more employees to feel an investment in the new systems rather than a hostility toward them.

*Training must include senior decision makers as well as junior staff specializing in using a particular system.* Senior officials cannot be expected to make good policy decisions regarding computerization efforts without a general knowledge of the equipment and systems in question. Moreover, they will shy away from discussing the crucial questions if they think that junior staff under them will discover them to be ignorant. Special kinds of training are needed for senior officials who need to understand a system but are not expected to use it hands-on. First, the senior officials will very likely consider it "inappropriate" to receive training side by side with the junior staff (even the middle-range managers for whom we designed one course failed to come after the Undersecretary decided that several very junior staff should also attend). In the National Population Committee case, the secretary whose duties initially were filing and occasional typing is now an indispensable part of the organization. Despite the importance of the computer in the committee's daily activities, no higher level staff have become familiar enough with the software to carry on in the secretary's absence.

*Prior technical training and/or use of machines is an important predisposition to success in computer training.* In the advanced economies nearly everyone deals with a sufficient range, variety, and complexity of mechanical and electro-mechanical appliances to be at least superficially familiar with how any specific device, such as a microcomputer, works. All

manner of general information we may take to be obvious is not common currency in a system-poor environment. In a very poor country, even fairly well-educated people may find it hard to grasp the basic, essential information in an orientation to the machine. For example, in the Ministry of Finance and Planning, many people were totally unfamiliar with an English keyboard and lacked typing skills in general. This proved a major obstacle for some individuals. The same problem may occur separately from direct machine use. Progress on our project directory was continually delayed as a series of committees redesigned forms for data gathering. We had failed to communicate both that a database structure need not be precisely a copy of the visual appearance of data on a form, and that changing kinds or definitions of data for various fields would necessitate restructuring the database. As Kaplinsky has noted:

the recognition of the systemic nature of technology is not something that can be left to common sense. It requires a specific recognition in the structure of training programs, right across the skill spectrum (Kaplinsky 1985:435).

People with engineering backgrounds tended to do better in our course than those who studied mathematics or economics. That, however, raises another problem: such people often had little interest in economic planning or financial management and only worked in the Ministry of Finance for lack of a job more appropriate to their training. In the NPC, most staff had already had some exposure to computers or at least an interest in what they could do.

### *Technique: Developing the Computing Environment*

*Technical efficiency in itself is seldom a sufficient reason for adoption of an innovation.* The gains from such efficiency may be spread very thinly through the organization as collective goods not of sufficient benefit to anyone for him or her to sponsor the innovation; may be offset by a loss in personal power on the part of an important decision-maker;

may not be accompanied by a corollary improvement in personal situation in the organization. Generally, every application, no matter how self-evident its benefits may seem, requires an enthusiastic and powerful sponsor within the organization (compare Moris 1977:127). One subsystem that we proposed in the Ministry of Finance and Planning, for example, offered a fairly obvious gain in efficiency. Budget preparation—a task on which half a dozen staff members work for several months each year, and in which burdensome and repetitive clerical and arithmetical work overwhelms policy analysis—was computerized in 50 man-hours, including both system design and data entry. Revisions that previously had necessitated lengthy and error-ridden human re-computing were rendered routine. But the computer system was not fully or enthusiastically implemented, as best we can make out, because no one saw a direct gain. It would probably have cut the staff of an important section head; at the same time (against our advice) the physical computer (the potential reward) would have been located in the centralized MIS Unit, rather than in the section whose work would be computerized.

*Any system which requires a new information flow, however reasonable or efficiently designed, will be more likely to fail than one which does not.* Systems should be designed to make maximum use of existing information flows in order to make data collection as simple as possible. It proved much easier for us to develop software systems than to get the data collection organized to make the systems worthwhile. One should not underestimate the sheer shortage of reliable data, or the difficulty of getting government officials to do research to find data. Indeed, those who possess new computer skills seem particularly prone to feel that they are above searching for or checking data. While professionals may see computers as worthy of their attention, they think of dealing with data as a mere clerical matter (even when, as in our case, clerical assistants able to do this work are not available). Consultants need to build a substantial plan for implementing data collecting and management processes, rather than assuming that these will follow easily from good system design.

*Applications should be computerized incrementally to allow the implementation experience to influence the design and to increase organizational fit and commitment.* Implementation of this principle may run counter to the prevailing emphasis on top-down programming, but as Simon has suggested, ". . . complex systems will evolve from simple systems much more rapidly if there are stable intermediate forms than if there are not" (Simon 1969:209). Within the Ministry of Finance we found little appreciation of the need for accurate paper records. Ministry personnel did not themselves understand the flow of information from donors and within the Ministry. At the beginning of the system development process, virtually no one understood what was being computerized. As a result, it was necessary to design a simple system prototype, partially implement it to show how it worked, then gain the benefit of comments from Ministry staff who began to better understand what was going on and what the range of possibilities were.<sup>11</sup> Verbal explanations are no substitute for seeing the systems at work. Any system which is designed completely in advance will tend to be less well suited to user needs and less accurately understood by users. It is also easier to keep the systems simple when they are developed modularly.

*Implementations should be planned to promote rather than subvert development of a country's support-systems for computing.* Both within a particular organization and in a country as a whole, we think it likely that the biggest gains from early computerization efforts will be contributions to the creation of a stable, supportive computing environment which will allow future implementations to be made at higher and higher levels of sophistication and efficacy. One of the strengths of microcomputer technology as opposed to mainframe computing, of course, is the lower level of infrastructural support it requires. Nonetheless it requires a fair amount, and much of that may be lacking in developing countries. At present, applications tend to undercut the growth of better computing environments by failing to buy from local suppliers, use and support local computer specialists and institutions (such as University computer science



departments or computer centers), and to provide as much training and infrastructural development as they might. Any turnkey system, for example, that is designed to be run by very low-skilled locals with high-skilled contributions coming only from foreigners will make little or no contribution to developing a better local computing environment.

### Conclusion

Computers may in important ways influence or even cause social change. The spread of computers may reshape job markets, for example, and redefine specific jobs. Computerization generally reinforces the power of those bringing the new technology into organizations (Danziger 1985; King and Kraemer 1985), but they may also pose threats to established fiefdoms. Computer implementations may be occasions for needed bureaucratic reorganizations. It is our hope, not least of all, that microcomputers may help to give weak Third World governments the administrative capacity to chart something of their own courses of development even in the face of aid-dependency. Nonetheless, the primary causal arrow runs not from microcomputers to social change, but the other way around.

The basic social changes that have created the need for microcomputer technology in the Sudan and that continue to shape the course of implementations include the creation of a world full of international organizations and the formation of bilateral dependencies, each with their own demands for and challenges to information management capacity. Behind this lies the Sudan's dependence on big-project aid, and the long-standing predilection of the international aid community for such mega-projects (despite frequent exhortations to the contrary). Computerization in Sudan reflects also the influence of an internationalization of culture in which computers are attractively portrayed through the media, in which Sudanese elites receiving education abroad learn of their desirability, and in which various international agencies operate throughout the world as exemplars.



Microcomputers are not, as some of their boosters have proclaimed, a panacea for Third World development, a magic way to overcome the asymmetries of wealth and power which shape world affairs. On the contrary, it is largely those asymmetries that make computerization essential, not optional, as a part of the effort to maintain government administrative capacity in the Third World. This may serve government elites most of all, but weak states in Africa have not really served anyone very well.

There can be little doubt that microcomputers will continue to spread through much of the Third World in the coming years (the symposium in *South*, July 1987). They will do so in large part simply because they are becoming a part of standard operations in an enormous range of organizations and professional activities. The poorest of Third World countries—many of them in Africa—are apt to lag behind this process of computerization, to their considerable disadvantage. This is all the more unfortunate, given the special needs for informational management capacity which aid-dependency forces on them.

In this chapter, we have tried to suggest something of this need. Perhaps more importantly, we have offered a variety of suggestions for how to improve efforts to meet it by computerization in countries like the Sudan. These are based on project experience, not systematic research. No doubt they could be improved upon. But as the brief description of one aspect of one of the projects shows, the problems, the needs, and the challenges they reflect are not altogether idiosyncratic. There are many other settings in which microcomputers are being introduced into bureaucracies with very inadequate paper record-keeping systems. There are many other settings where general infrastructural support for computing is weak. Perhaps the single most distinguishing factor of the Sudanese case is one that it shares with other aid-dependent countries and that is the flip side of their considerable special need for technical support in administration: This is the distortion and difficulty imposed on processes of computer implementation by the preponderance of external pressures in the push for computerization and the decision-making about actual system

forms. This distortion is a reflection of the lack of organizational control and independence from domestic political elites and especially from international and foreign actors, a lack that the computers ought to help overcome yet cannot without the assertion of local initiative by the organization's staff.

In short, in using computers to enhance administration, as well as for other areas of national struggle, countries like the Sudan are apt to encounter a "catch-22." Despite that, struggle will go on, and computerization will play a part in efforts to achieve the state administrative capacity essential to empowering countries in the contemporary world system.

## Notes

1. Calhoun was co-director (with Dale Whittington) of the first project, lasting from 1984 to 1986; from 1986 to 1990, DeLargy worked on and later directed the second (on behalf of The Futures Group and the Carolina Population Center). We learned a great deal from our colleagues, and thank them and the staff members of the USAID mission in Khartoum and of the Ministry of Finance and Economic Planning and the National Population Committee, without whom none of this work would have been done. Needless to say, they bear no responsibility for the present paper which reflects our views alone.

2. Sudan is certainly in no position to opt out of the world system and attempt to follow an autochthonous development strategy by closing its borders, as did China thirty years ago.

3. A more detailed discussion of this issue may be found in Calhoun, Drummond, and Whittington 1987.

4. Even relatively low-level staff of donor agencies demand to conduct their business with very senior Sudanese officials. USAID project officers newly arrived for their first posting, for example, felt entitled to bypass all Sudanese government officials below the rank of under-secretary—even though the odds were that they could not get an appointment with someone of that rank in their own government.

5. The Sudan received nearly a billion dollars of foreign aid in 1988 (according to OECD figures; *The Economist*, 10 February, 1990). 1988 was a relatively good year agriculturally. Nevertheless, the figure might have been higher had several countries not curtailed their support following the intensification of civil war. The Sudan ranked ninth in total foreign aid received in 1988, and on a *per capita* basis, ranked far ahead of such countries as India which received larger absolute amounts. A particularly

high percentage of this was emergency aid, more difficult in many ways to administer than long-term development assistance.

6. See Adkins 1988 for discussion of similar issues in Tanzania.

7. It should be said that there was much discussion in Sudan during the 1980s of the need for a "proper" system of national accounts. A variety of organizations, including both the IMF and USAID were active proponents of this, and brought several expensive missions of short-term consultants to Sudan to consider possibilities. The idea was of course reasonable in the abstract, and effective national accounts would be an important planning and administrative tool. Concretely, though, it was a bit absurd and its popularity was based on complete inattention to the difficulties of data collection and the need to develop intermediate information systems. Proposals to proceed immediately to the construction of national accounts on the basis of individual returns (for example Morrison 1985) owe more to textbooks in economics or public administration than to concrete considerations of the world's least developed countries.

8. See Whittington, Calhoun, and Drummond 1986 and Whittington and Calhoun 1988 for further description.

9. Lest it be thought that this was purely a matter of Sudanese culture, rather than more specifically bureaucratic style, it should be said that the National Population Committee was more flexible. In fact, the secretarial and administrative staff hold almost all the practical expertise in the organization.

10. The unfortunate, but unavoidable, result of Arabicization was that the operations of the project became less and less accessible to the non-Arabic speaking members of the technical assistance team, and that fewer of the written products generated by the NPC (papers, reports, plans, analyses, graphics presentations) could be read or heard and understood by the project monitors in Washington, the USAID staff in Khartoum, or other interested non-Sudanese. Arabic-speaking OPTIONS team members and NPC staff began to spend a large amount of time simply translating for the sake of the donor.

11. See Naumann and Jenkins 1982 on a "prototyping" approach to systems development. In development planning itself, there recently has been renewed recognition of the need for experimentation and pilot projects for similar reasons (see summary in Rondinelli 1983, Chapter 4). Commenting on a microcomputer implementation in a Portuguese development project, Ingle and Connerly (1984:50) express a similar preference for "a participative, iterative process rather than single-minded, blueprint pursuit of planned products."