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THE UTILITY AND POTENTIAL APPLICATIONS  
OF MICROCOMPUTERS IN  
DATA PROCESSING AND ANALYSIS:  
A REPORT ON  
OPERATIONAL SUPPORT IN RABAT, MOROCCO

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Background

On January 5-9, 1981, Fernando and Sandra Bertoli responded to a request from Gerald Bowers, Population Office, USAID/Rabat, to provide assistance in assessing operational support for microcomputing equipment that had arrived recently. The consultants' major tasks were to install, test, and evaluate the printers, processors, and other peripherals and to provide advice on how the equipment might best be used. A brief introduction to the Interactive Statistical Inquiry System (ISIS), which was developed in connection with a project in Central Tunisia, was given to programmers and systems analysts from the Division de Mecanographie (DM) of the Ministry of Health (MOH) and the Ministry of Planning (MOP). The one-and-one-half-day workshop was successful in demonstrating the utility and potential applications of microcomputers in data processing and analysis.

The consulting report produced after this visit contained several recommendations on desirable system configurations, procurement, documentation, applications software, and utilities. (A copy of the report is attached as Appendix A.)

Scope of Work for March Mission

In January the consultants identified several tasks that had to be done. These constituted the core of the scope of work for the second visit in March. Briefly, the tasks were:

1. To develop some local self-sufficiency in the maintenance and servicing of equipment. In the absence of an Apple computer dealer in Morocco, it was necessary to build up some system redundancy and to develop a capability for "survival maintenance" to avoid interruptions in the work. The most efficient approach to achieving this objective was to provide some elementary training in the DM in system-service and diagnostics and to prepare a small inventory of commonly needed chips and spare parts.

2. To provide the personnel of the DM with some basic utilities required for efficient use of the Apple II microcomputers and to train those personnel to use them. (Utilities are programs that facilitate the development of other programs. They are the tools of the trade, so to speak.) It was clearly demonstrated to the consultants in January that the personnel at the DM were enthusiastic and well trained in systems analysis and programming languages and familiar with microcomputers. What they lacked were the tools--hardware and system utilities--they needed to become familiar with the microcomputers and to use that equipment to full advantage in selected development applications.
3. To demonstrate some "packaged" software applications in word processing, statistics, accounting, and mailings to provide some insight into the potential uses of the Apple microcomputers.
4. To continue exploring areas of need in the MOH data management operations to determine where the microcomputers could be used to best advantage and to advise the mission accordingly.
5. To help the mission to use software to improve record-keeping pertaining to population projects.

### Activities

Fernando Bertoli worked in Rabat, Morocco, from March 19 to March 22. Sandra Bertoli was in the city from March 27 to March 31. The two consultants spent a combined total of nine person-days in the field.

#### A. Equipment

Several days before Fernando Bertoli left for Rabat, M. Hasbi from the DM informed him that two processors were not functioning and that a third was operating only marginally. Dr. Bertoli's first task was to examine these processors. (This was NOT intended to be part of the hands-on survival-maintenance workshop planned for this visit.) The situation was profitably exploited at the DM, where Dr. Bertoli, M. Hasbi, and M. Chebrou cheerfully spent a day troubleshooting the processors and related equipment. "Light surgery" was performed on one of the Apple processors; one of the Autostart ROM chips included in the first-aid kit brought to Rabat was used to correct the problem. The second processor exhibited some chronic, recurrent symptoms that required further laboratory tests

to verify the preliminary diagnosis of problems with the motherboard. (The motherboard is the major circuit board where the chips are plugged in.) Eventually, the processor was hand-carried to North Carolina, where more skilled computer specialists used sophisticated instruments to confirm the initial assessment.

Sandra Bertoli delayed her departure for Rabat by one day to turn the equipment around after it had been repaired and burned-in. An additional power supply and another Autostart ROM chip were also hand-carried by Mrs. Bertoli to repair a third processor. This task was accomplished during her visit.

At the end of the Bertolis' visit, all equipment had been repaired and had become functional.

## B. Training

Given the limited time available for assistance and the need to render the equipment operational, the consultants were able to complete only a modest amount of training. Personnel at the DM were introduced and trained in the following utilities:

- Program Line Editor
- Program Global Editor
- Supercopy
- Applesoft Optimizer.

Systems analysts and programmers will be able to profit immensely from these basic utilities as they apply their new knowledge to their daily developmental work on the Apples.

## C. Applications

An uncommonly large number of pieces of faulty equipment was identified, and it was necessary to address this problem at the outset, and not after concrete applications had been successfully demonstrated and implemented. Equipment has become operational, and new initiatives are being undertaken. Tom Eighmy and Chris Wornum are now inputting all available data at the provincial level that are relevant to population and health planning (contraceptives, supplies, prevalence, infrastructure,

epidemiology, etc.). This effort is expected to facilitate the synthesis and analysis of available data. A true, national Moroccan file is beginning to take shape that could serve as a basis and model for future expansions and enrichment of the data set. Because of the compatibility of the ISIS software, the file can be used at the MOH and at other agencies which use an Apple microcomputer. The file can be used also in training to illustrate the capabilities of the ISIS Apple to manage the information required in day-to-day decisionmaking processes.

### Findings and Recommendations

Initial hardware malfunctions precluded the execution of the important tasks that had to be accomplished. (From the point of view of a service-and-maintenance workshop, conditions in Rabat could not have been better. The consultants had the best choice of dead processors and peripherals they had ever seen!)

At this time, with the exception of the DM, the consultants do not believe they have enough information on other relevant actors and the structure of the MOH information system. They are, however, able to present some tentative conclusions and to suggest some operating principles that might guide the introduction of the microcomputers.

1. The DM has the potential capability to assume a central, and perhaps leading, role in applications software (custom program development for other agencies) based on the Apple. The "wetware" (i.e., personnel) are enthusiastic and technically competent, and the consultants have sought to render them as operational as possible. Personnel could assume central responsibility for the "survival-maintenance" of the microcomputing equipment, should this be identified in the future as a desirable and productive task for the DM in the general Health Information System (HIS). Much discussion and interfacing would be needed to ensure good communications between the software developers at the DM and the ultimate users in other agencies.
2. Other agencies that lack the capacity to produce, process, and analyze relevant data in a timely manner need to be identified. At this time, the consultants envision the rudimentary division of labor, where DM assumes the responsibility for program development and support and other agencies produce, use, and analyze information that is useful in, and that illuminates, decisionmaking.
3. The use of microcomputers to support the HIS should be considered in relation to other data-processing support

activities now under way. Tom Eighmy's work on the installation of the Statistical Package for the Social Sciences (SPSS) will have a definite impact on the allocation of tasks at the DM. Given the generality of SPSS, it is conceivable that it can be applied in areas that require a good deal of programmers' and analysts' time and efforts. The challenge will be to establish new priorities under these new environmental conditions.

Another consideration is the interfacing of the Apples with the Honeywell computer at the Ministry of Planning, where the equipment could perform double-duty: as terminals to the mainframe and as separate processors.

4. The Apples, and microcomputers in general, offer the potential of cheap computer power independent of a large, mainframe computer in the capital city. In some sense, microcomputers offer "democratized computer power" that heretofore has been unavailable. The consultants surmise that microcomputers can be powerful tools for the implementation of a policy of decentralization at at least some levels and in some spheres of decisionmaking. This would be especially true in applications outside the capital, where there is no easy access to computing power, but where timely data on supplies, schedules, project targets, and the like are needed.

### Future Tasks

In the short run (summer 1981), the consultants recommend that the following tasks be undertaken:

1. Review the kinds and volume of data now stored and processed in some key units of the MOH.
2. Examine the possibilities for mechanized processing of existing and potentially available data.
3. Assess the suitability of the Apple microcomputer and the ISIS package (or other software) for these applications. For example, the Epidemiology Division periodically publishes reported cases and the incidence of selected diseases by province. Use of the ISIS Apple could enhance the division's capacity to analyze this

information, for it would permit the incorporation of socioeconomic profile characteristics for each province, as well as "intervention" or "policy"-type variables (e.g., medical inputs, personnel), that are useful in examining the merits of alternative program mixes or strategies. A more holistic approach to health planning may be thoughtful use of the ISIS Apple; it would permit the incorporation and statistical manipulation of other variables to represent the contextual, socioeconomic conditions under which the health system must operate. Another, and no less important, spinoff of improved analytical capacity is the ability to pinpoint data gaps and deficiencies.

4. Establish linkages with the Institut National de Sciences Economiques Appliquées (INSEA) to create a center for training in the use and applications of ISIS Apple.
5. Using the data files created in the summer, lay the groundwork for a general sample presentation in the fall of the potential applications of microcomputers in the day-to-day operations of the MOH. This could be one way to assemble some of the important actors to share common information and to examine the possibilities of implementation. The group of participants could include the minister, M. Alaoui, M. Meshball, M. Ouakrim, M. Boukrisi, and M. Benyadef.
6. Assist the mission in computerizing project participant files and other applications.

## APPENDIX A

TO: Gerald Bowers, Head  
Population, USAID/Morocco

FROM: Fernando and Sandra C. Bertoli

RE: January 5-9 Visit

DATE: January 18, 1981

Upon arrival in Rabat, our initial task was to become acquainted with the local operational capacity of the Ministry of Health. Hardware (equipment), software (programs), and "wetware" (personnel) were examined. A prerequisite to any treatment of the latter two components required, in our assessment, the proper operation of the computing equipment that had already been received. Thus, for the first day and a half, we tested and installed available systems. Our task was made difficult by some equipment malfunctions. In particular, one Centronics printer and at least two parallel interface cards were thought to be defective. After the equipment was rendered operational, we met with M. Ouakrim, M. Hasbi, and others on Tuesday afternoon, January 6, to obtain first-hand knowledge of their interests and needs. It was agreed that a complete system with disk-drives and printer would be installed in the ministry the next day and that an in-house training session would be conducted for the analysts at the Ministry of Health.

On Wednesday, we installed the system and conducted the in-house session to introduce the Apple and its operating system. M. Hasbi and others took part in a "hands-on" introduction to the disk-operating system of the machine and a demonstration of the Interactive Statistical Inquiry System (ISIS) package.

Thursday was devoted to a full session, which included the systems analysts, four or five programmers from the Ministry of Health, and two or three analysts from the Ministry of Planning. The purpose of the training sessions, it should be pointed out, was to provide some ideas about the potential uses of microcomputers to correct common, recurring problems in data handling and data management. The sessions were not intended to be an introduction to the language or disk-operating system of the Apple per se. Given the limited time available, it seemed more productive to discuss and clarify some potential areas of use and to illustrate at least one concrete application than to perfunctorily examine machine-specific characteristics. The session on Thursday included a discussion of applications and involved the creation and retrieval of hypothetical data files using ISIS, the package that we have been developing for a regional planning agency in central Tunisia.

After the Friday meeting with M. Alaoui, M. Ouakrim, M. Hasbi, and their associates, we agreed that the Ministry of Health's efforts should be further supported with equipment, software, and training.

### Findings and Recommendations

We found that personnel in the Ministry of Health are very receptive to the mission's efforts, and we were impressed with the potential for a fruitful and productive relationship. The in-house training sessions were particularly useful for us, for they provided the opportunity to gauge capabilities. Our tentative assessment is that, after an initial period of support, personnel at the Ministry of Health will be able to achieve a self-sustaining operational capacity on solid foundations. Some immediate tasks, which were earlier discussed verbally, are listed below.

1. Five additional disk-drives for the Apple II microcomputers should be provided. Serious computer production and application require the use of disks. We propose that all four processors be equipped with two disk-drives each. There are four disk-drives available at this time. Four more disk-drives would need to be ordered (two with the disk controller card, two without). In addition, we suggest a fifth disk-drive (with controller) for backup.
2. All future orders of computing equipment should include the proviso of "successful completion of a continuous burn-in period, under load, of at least 72 hours, prior to shipment." There are inevitable risks in shipping delicate equipment over long distances, but some can be minimized. For example, assurances can be obtained that the equipment was operational PRIOR to shipment by specifying the above conditions as part of the procurement process. In this business, the best approach is to refuse to accept a sealed carton of equipment shipped straight from the manufacturer.
3. A list of all French documentation on the Apple II known to us is attached to this report. M. Ouakrim and his associates should receive a copy of this list. We will make every effort to stop in Paris next time to pick up copies of the orders. You, however, will have the information needed to acquire these items.

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4. We believe that certain tools are indispensable for the development of programs. The so-called software utilities are programs that facilitate the development of other programs. Because a good number of these utilities come from the Apple Puget Sound Program Library Exchange, and can be obtained only by individuals who are members of the Exchange, we have taken the liberty of ordering these and other commercially distributed utility programs. We hope to have these on hand before our March visit.
  
5. By the time this report reaches you, we hope we will have found a way to order some standard applications packages that we can take with us in March. We think these applications packages are important because they can be used as training vehicles and models for other program development efforts. In addition, they are generally well tested and performance-proven in selected applications. By using them, we can avoid "having to re-invent the wheel," so to speak. These applications include word processing, inventory control, and some general data base management packages. We are also at work on ISIS, and we believe that this could be the "workhorse" for statistical data analysis on the Apples at the Ministry of Health. A version compatible with the Centronics printer and with some enhanced screen and sort routines will be ready for our March visit.

Beyond these immediate tasks, some central concerns need to be addressed. One is the problem of servicing and maintaining the computing equipment.

We have succeeded in gaining access to dealer-service training provided by the Apple Computer Corporation. We will have completed the course before our March visit. Thus, we will be in a position to train the analysts in the Ministry of Health in the standard Apple dealer-service procedures. A small stock of spare parts and Level 1 dealer-service training will go a long way toward local self-sufficiency in equipment maintenance until a dealer is established in the country. If we can obtain them in time for our next visit, we intend to take a small inventory of spare parts to meet current need.

In general terms, a brief visit in March would enable us to accomplish some of the following tasks:

1. Introduce and train the personnel at the Ministry of Health to use the software utilities they need for their own program development.
2. Introduce some of the "packaged" software applications discussed above.
3. Provide some training in elementary troubleshooting of equipment.
4. Continue the discussion and examination of areas of need in data management and attempt to find solutions. One area of interest seems to be the network which the Apple systems have created among themselves and with the Honeywell mainframe computer available in the Ministry of Planning.
5. Help the mission to introduce some available software to facilitate program recordkeeping, use of mailing lists, word processing, and accounting.

The extent and depth of coverage will depend on the time available, contingent upon our commitments in Tunisia.

In the foregoing discussion we have not alluded to what seems to us to be a central, and at times elusive, goal of computerizing information systems: the ability to ferret out data in meaningful ways to improve decision-making (i.e., "wetware support"). We touched on this concern when we visited Rabat in January. At that time we suggested applications of ISIS, new types of analysis of available data and, in general, new methodologies and strategies. This, of course, is a long-range goal. Other concerns must be addressed first to enable us to gain a better understanding of what lies ahead.

It may be possible to pilot-test the Apple outside the capital to bring together the disperse statistics of various programs and to provide a decentralized data analysis capability for regional interests and needs. In another pilot-test the Apple could be used for hospital management (scheduling of staff, patient records, inventory, etc.). These two tests could also be combined with tests of the Apple as a terminal or front-end processor, and the information could be aggregated before it is sent in machine-readable form to a central mainframe computer for further processing.

The Apple could also be used to generate reports. Word processing programs could be combined with the graphics capability of the machine to automate the production of recurrent statistical reports. Mapped data or geographical variations could thus be produced routinely. These and other possibilities can be discussed further in the future.

We would like to close this report with a personal note of thanks to you and all the people with whom we worked at the mission and at the Ministry of Health. The help and hospitality we received made our stay in Rabat particularly pleasant. We hope we will see you in March.

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SOFTWARE AND SPARE PARTS

This is a list of software and spare chips in stock in Rabat as of March 31, 1981.

SOFTWARE

Apple Writer Word Processing Package  
BPI General Ledger Accounting Package  
Apmail II Mailing List System  
DOS 3.3 Disk Operating System (needed to run BPI)

Software Utilities at DM of MOH

Program Line Editor  
Program Global Editor  
Supercopy  
Applesoft Optimizer

SPARE CHIPS

Applesoft ROM Chips

341-0011-D0  
341-0012-D8  
341-0013-E0  
341-0014-E8  
341-0015-F0

Autostart ROM Chip

341-0020-F8

Disk Controller Card

341-0009-01 (2 units)  
341-0028-01 (2 units)

74LS4174N  
74LS74 (2 units)

P5 and P6 chips were taken from disk controller card and replaced by P5A and P6A chips to run DOS 3.3. (Note that these chips are still in good condition.)

Two disk-drive collets were replaced, but they can be kept as spares for emergencies.