

INFORMATICS AND TUNISIAN DEVELOPMENT

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Table of Contents

| | Page |
|-------------------------------------------------------------------------------------------|------|
| Acknowledgements | ii |
| 1. The Government of Tunisia Proposal for Informatics Cooperation | 1 |
| 2. The Tunisian Informatics Environment | 2 |
| 3. The Potential of the Micro-computer Revolution for Assisting Development in Tunisia | 6 |
| 4. Findings and Comments of the Mission | 8 |
| 5. Recommendations for Areas for Donor Support | 12 |
| 6. Potential Areas for Additional Future Cooperation; U.S. - Tunisia | 15 |
| <u>Appendixes</u> | |
| A. Mission Terms of Reference | 16 |
| B. List of Abbreviations | 17 |
| C. Mission Visits- Organizations and Personnel | 18 |
| D. List of "Junior Colleges" for micro-computer diffusion. | 19 |

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We take from our visit not only an exceedingly high impression of the competence and diligence of the Tunisian informatics community, but also a wonderful memory of the hospitality and friendship of the many people we met.

Finally, it should be understood that this document expresses the findings and recommendations of the authors only-- the publication of this report does not imply official concurrence of the sponsoring agency with the views and opinions expressed therein.

William Lawless and Sidney Passman
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INFORMATICS AND TUNISIAN DEVELOPMENT

1. The Government of Tunisia Proposal for Informatics Cooperation

This report represents the findings and recommendations resulting from our three week mission to Tunisia for "Project Development and Support Assessment of Tunisia Science and Technology Proposal". The terms of reference of our assignment, under USAID Work Order 298-0035, are given in Appendix A.

The Government of Tunisia (GOT) proposal for informatics cooperation under A.I.D. development assistance was first raised, and then only briefly listed, under paragraphs 4 and 5 of the 7 November letter from the Tunisian Secretary of State in charge of International Cooperation, to the A.I.D. Director in Tunisia, Mr. J. Phippard:

"4. Financial contribution to the construction and equipment of
I.R.S.I.T.*--- \$2 Million

5. Financing of studies carried out by the Universities and
experts and all technical assistance required to establish
C.I.T. --- \$1.5 Million "

Subsequent discussion with Tunisian authorities, confirmed in the meeting with Mr. H. Bourguiba, Jr. (special advisor to the President) indicated that this request included support for the C.B.M.I.'s major effort of diffusion of micro-computers to the secondary schools and "junior colleges".

In our final meeting, after our extensive visits to the various facilities and institutions, Mr. Bourguiba, Jr. stated that they were open to our suggestions for cooperation in the whole range of informatics development as explored in our review.

Accordingly, we present here a review of the full spectrum of Tunisian activities in informatics as we were able to see them, together with our findings and recommendations for priority projects for donor investment within the GOT proposal framework.

*See Appendix B for a list of abbreviations.

2. The Government of Tunisia Informatics* Environment

We were able to visit the principal Tunisian institutions which deal with policy, coordination, applications, research, education and private sector issues involving informatics in Tunisia and met many of the key participants in the system. We will try to provide below a functional description of these various elements and of their interactions and coordination, leaving our comments, conclusions and recommendations for subsequent sections of the report.

One must start by recognizing that there is clearly a widespread and sincere expression of enthusiasm for Tunisian mastery of the entire field of informatics based upon a recognition of its indispensability for future development of almost all sectors of Tunisian society. This is expressed at all levels of the structure from the highest government levels on down, so that one observes a very high priority attached to informatics developments and applications and a desire to make real progress and to do so with all deliberate speed.

While Tunisia has given high level government support to informatics developments in the past, as witnessed by their active participation in international forums such as the Intergovernmental Bureau for Informatics (IBI), Unesco and the joint IBI-Unesco SPIN Conference (Strategies and Policies for Informatics, 1978) and their creation of such important national institutions as the CNI and the National Commission for Informatics (c. 1974), it is fundamental to this discussion that a new impulse of interest and a high level decision to attach real priority to this area has been underway for approximately the last two years. This impulse emanates from the prime movers in the government who clearly support the innovative efforts now underway. The recent political and structural changes and priorities reflect their desire to accelerate Tunisia's progress and position in the world scene, employing informatics as a vector in development.

In parallel with this commitment is the realization that the so-called "new" informatics, exploiting recent technological developments in hardware and software, namely the "micro-computer revolution", require new approaches to fully realize the micro-computer potential for society. The creation of a number of new institutions and the thrust of the GOT proposals for support reflect this innovative impulse.

The C.B.M.I.** directed by Mr. M. Latiri, is an impressive new development active since November 1984. It is endeavoring to expose the broadest possible community to the potential of micro-computers for a range of popular applications in which education has a privileged central place. Operated under the aegis of the Minister of Secondary Education, it has rapidly acquired an eclectic collection of "micros" contributed by many sources and of many types from the U.K., France, Japan and the U.S., together with the well-known popular software packages from primarily U.S. origin modified enroute in France, including dBase II, Lotus 1-2-3, Multiplan, Framework, etc.

1/4/84
* The term informatics, widely used in Tunisia as it is in Europe, has not yet achieved widespread recognition in the U.S. Adapted from the French "Informatique", it means not only the subject of computer science and technology but encompasses the broad area of information processing applications as well. It easily lends itself to further qualification such as telematics where computer-communication interfaces are concerned.

** A list of all organizations visited and their key personnel is given in Appendix C.

Through Affiliations with the two pilot Lycees (Bourguiba and Ariana *) and supported by an active Task Force drawn from various levels of the education community, C.B.M.I. has been able to introduce a small but growing number of secondary students to hand-on familiarity with the micro-computers (literacy) as well as introducing computer assisted instruction (CAI) in certain limited areas of curricula. Open access of the Center to youth and the "grande public" is another important hallmark of the effort, aided by the central location in downtown Tunis.

C.B.M.I. is now embarked on "Project 500 micros" (already overtaken by events so as to aspire to 1,500 micros) which involves the diffusion of its pilot activities to some 45 other sites in the country involving 15 lycees (out of 300 in the country), 15 junior colleges or other institutes of higher education, and 15 clubs for young people.

In the field of higher education, the GOT has had a long standing focus on informatics training at the University in the Faculty of Science's Department of Computer Sciences (Science de l'Informatique). The full 6 year cycle of this department, leading to a master's level degree provides a classical training in computer sciences and many of the graduates of this program now occupy important posts throughout the structures of the government and the private sector often going on for doctoral work in the U.S. or France.

However, concern regarding the growing demand for informatics specialists** and impatience with the relatively small output from this department, as well as with the curricula and organizational structure, have led the government authorities to create new institutes to accelerate this training along more technological and practical lines. ENSI in Tunis and MIT in Monastir are two of these new "stand alone" institutes, the latter in the process of transition from the Faculty of Science in Monastir. All of these institutions are experimenting with the introduction of micro-computers in their instruction, research, and laboratory work as are several other institutes such as those dealing with public administration (gestion), teacher technical training and the engineering school, ENIT.

Serving the entire higher education community is the University Computing Center (Centre de Calcul) which has a substantial capacity mainframe (VAX/780) which provides access on-line to a broad community of users via 30-odd terminals.

The above mentioned institutes, together with several others serving to train people in other technical career tracks (viz. agriculture, architecture, commercial studies, etc.) are also candidates to receive micro-computers for their training needs in the overall diffusion effort of C.B.M.I.

* These two lycees are exceptional and merit approbation. The students for both are the highest scoring students aggregated from all of Tunisia after an examination to all 6th grade students. In addition to the emphasis on science and technology both lycees are introducing micro-computer equipped classrooms. Ariana Lycee is further distinguished because all technical subjects are taught in English and CAI programs from BBC/Acorn are being used to teach Math and English grammar, with apparent success.

**Although we inquired widely regarding data on the supply-demand aspects of informatics manpower, we received only anecdotal information pointing to a felt need for well trained professionals on the one hand and a broadly literate base in many professions familiar with computer applications. Some stated their capacity to utilize all the highly trained people currently available.

The CNI is the formal governmental structure representing informatics in the more traditional sense including large scale data processing, although it does have a flexible administrative structure as a para-statal corporation headed by a President-Director-General. In addition to assisting government bureaus to manage their data-processing tasks until they have their own facilities and providing advice to other agencies for procurement, CNI serves as the secretariat for the National Commission of Informatics and its various committees and is also designated as the official focal point for GOT adherence to international programs and organizations such as IBI and Unesco's new Intergovernmental Program on Informatics. Further, it exercises an important reviewing function for the general acquisition of computers in the country. This latter function, originally created to assist organizations to avoid making possible errors in computer purchases, has, we learned from several critics, recently contributed to a bottleneck delaying the timely provision of micro-computers by vendors to customers in the private sector.* The CNI has an additional building besides its main computer center which houses facilities for all levels and sizes of training courses of short and medium term duration. They apparently carry out a similar decentralized program at facilities in other parts of the country. Maintenance of computer hardware is one of the key areas for training in this program and a recent regional activity on this subject supported by IBI was completed at CNI during our stay. Finally, some efforts of CNI are underway in development and standardization, especially in Arabization and telecommunications. Some contact with U.S. institutions (e.g. UCLA) exist, based primarily on personal contacts.

As for national coordination, there are a number of long standing and effective elements. Those institutions reporting to the Minister of Higher Education and Scientific Research achieve their coordination via a committee of that ministry. The CNI is well placed for coordination with other agencies since its charter places it under the office of the Prime Minister and they staff the National Commission for Informatics which he chairs. The Prime Minister's annual report to that commission provides a remarkably thorough national state of informatics statement on problems, accomplishments and future directions desired and plans and priorities. In addition, the National Commission has also coordinated a 5 year informatics plan (1981-1985) and is working on the second plan which we understand will be integrated with the 7th National Development Plan, under the supervision of the Ministry of Planning.

Nevertheless there has been a concern that the above mentioned mechanisms have not been sufficiently timely and coherent to respond to the rapid dynamics of the informatics developments. Consequently, the same recent impulse of priority and modernization referred to earlier, has led to the establishment of a more action-oriented ministerial committee known as CIPIT, chaired by the Prime Minister, with Mr. Bourguiba Jr. as spokesman, which meets frequently and oversees progress in coordination and implementation of informatics plans.

Within the last year, based upon activities led by Mr. H. Bourguiba, Jr., and with a supporting team of senior advisers, a new and promising institution has emerged which is expected to play a key role in bringing the overall Tunisian informatics environment into prominence. This is IRSIT, which is the French acronym for the Regional Institute for Informatics and Telecommunications.

* In general, the government is alert to the need for greater flexibility in this area and has already made large reductions in custom duties on micro-computers and is working on easing other regulations. Nevertheless, financial restrictions do apply to acquisitions in order to conform to policy of central bank foreign currency quotas.

IRSIT, while still in a formative stage of development, is being designed for an already acquired attractive 7 acre site on the outskirts of Tunis at LeSucre. The basic objectives for IRSIT include:

- o Providing a regional framework so as to achieve informatics cooperation in the Arab, African, and Islamic regions.
- o Arabization of informatics and the promotion of the Arabic language via informatics.
- o Develop informatics in all sectors where its impact is expected to be significant such as education, communications, information and industry.
- o Promotion of the informatics industry in the region.
- o Provide a center of excellence, where relevant information is collected, selected and diffused, and provide databanks on technology, research, etc. for the regional community.
- o Provide a forum for exchange of ideas.
- o Assist in norms and standards.
- o Provide a post-university research and training center and otherwise stimulate research.
- o Develop a telecommunications network to link research facilities in Tunisia and in the regional countries, and via satellite research facilities and data banks in the U.S. and Europe.

Regional and international contacts have been made on behalf of IRSIT and efforts are underway in a number of areas of cooperation. In line with the ultimate aim of having IRSIT serve as the main catalyst of Tunisian Informatics, there are links with the other institutional elements described above including C.B.M.I., ENSI, ENIT, CNI and close coordination with CIPIT.

Finally, in describing the overall Tunisian informatics scene one should not ignore the private sector. This includes the vendors of hardware and software as well as the increasing population of professionals working in informatics and applying it in commerce, industry and the professions. Efforts are underway to stimulate these areas in line with broad government policy, including encouragement of investment through many incentives sparked by the Investment Promotion Agency (API). The limiting factor constraining demand growth of informatics applications and acquisitions is, of course, the cost, exacerbated by import restrictions determined by fiscal policy.

3. Potential of the "Micro-computer Revolution" for Assisting Development in Turisia

It is widely recognized that the technological development of micro-computers (i.e. powerful computers based on high speed micro-processors with large internal memories, rapid-access, high -capacity disk storage and with costs a fraction of earlier comparable capacity computers) represents the first significant technological advance which a developing country can assimilate and exploit with a relatively low capital investment and without extensive prior knowledge or involvement in prior technologies. As stated by a senior A.I.D. official, "...Our experience has been that developing countries are able to use very advanced technologies (e.g. micro-computers) and, in effect, skip over the years of learning process." *

This opportunity for LDCs to utilize information at the same level as in developed countries is the basis for numerous initiatives by donor organizations to LDCs and by LDCs themselves. (1/)

Unfortunately, this new technology represents not only an opportunity, if properly exploited, but a threat, if ignored. The widespread and increasing incorporation of micro-computers in commerce, industry, and even the social fabric of developed countries represents a major technological advance and an inevitable social change. If an LDC fails to take advantage of the opportunity that micro-computer technology represents, its level of development in relation to developed countries will be significantly lowered. (2)

The Director-General of Unesco, Mr. A. M. M'Bow, has stated: "Informatics opened up such tremendous vistas for modern societies that any failure to master it would mean a life of permanent subordination. For informatics is more than a form of power; it is a power system. The technology which it involves is not just one form of technology among others, but an ability to make use of other techniques, to give or to refuse access to a whole range of scientific data and knowledge and thus to design new models of development." (3)

Dr. Mohan Munasinghe, Chairman of the Sri Lanka Computer Technology Council and Senior Energy Advisor to the President of Sri Lanka included the following comments in his welcoming address at the First International Symposium on Micro-computer applications in Developing Countries**held in Colombo, Sri Lanka, November 1984:

"... If we examine the evolution of human society, the spear is the nomadic hunter's implement, the plough symbolizes the farmer, and the lathe represents the industrial worker. In the same vein the computer is the tool of the thinker, because it will greatly enhance human brain-power, just as machines now amplify our muscle power. In the highly competitive world marketplace of the future, knowledge will increasingly become the basis of national power and prestige--more so than arms, or natural resource. The power of the microchip will outweigh the power that grows out the gunbarrel. Therefore mastery of the computer is vital for us...Let me now briefly turn to our own hopes and expectations for computer development in Sri Lanka. These aspirations have much in common with those of other developing countries. We in Sri Lanka hope to rapidly modernize and transform our society, and help this nation stride confidently into the 21st century, by using the computer to enhance the thinking power of our richest resource, a well educated and youthful population. ...Working level operational efficiency and quality of work will also improve. Better application of computers to science and technology will enable the intellectual community to enhance their contribution to national development. "

*Mr. Curt Farrar, former Deputy Administrator for Research, A.I.D., in a hearing before the House Sub-committee on Scientific Research, 1982.

**This Symposium was jointly sponsored by the Government of Sri Lanka and the NRC's Board on Science and Technology for Development supported by A.I.D.'s Bureau for S&T

The contribution to development that would result from computer literacy and widespread use of micro-computers in Tunisia can only be projected based upon experience in the developed countries (the programs in informatics in LDCs are relatively new.) One of the unique characteristics of micro-computers is that they are "stand alone" devices. The user must learn to solve computer problems independently. This encourages the development of independent thinking, problem solving attitudes and entrepreneurship. (4) "Therefore, it is important that in the developing countries: (a) the analysis and systemization that occur when computerization takes place be recognized in itself as a most significant contribution in accelerating the rate of their economic and social development. " (5)

Based on results in developing countries, a broadly computer-literate population should stimulate wide improvements in the administrative and technical procedures utilized in government, commerce and industry. It should result in the establishment of numerous new enterprises, increase the efficiency of existing establishments and produce an important increase in the growth of the economy. Foreign investment should be attracted by growth in new enterprises, the increased general efficiency and relatively low wage rates in Tunisia. (6)

Tunisia is currently manufacturing a number of components and products for export. In an informatics-oriented environment, manufacturing for export should be one of the faster growing segments of the economy. One of the by-products of a rapidly growing economy is a shortage of trained manpower, which in turn stimulates training of the "less employable".

There would not seem to be a single area of development in Tunisia that would not be impacted by widespread use of micro-computers. They are currently being used in developing countries to improve and advance programs in health, agriculture, energy, education--in fact in every sector. Unfortunately today the extent of use in LDCs is still very limited.

Quoting again from Mr. Farrar's congressional testimony, " A more complex issue is micro-computer training and institutionalization of micro-computer use. Very often a micro-computer will be built into a project to solve a particular problem and then be left without adequate attention. We need to think about long-term use, training people in its use, and the institutional structure in which the computers can be more fully used. We are aware of this problem, and we expect to pay more attention to it in the future."

Our conclusions in regard to the potential of a broad program in computer literacy in Tunisia are that such a program would be highly desirable in any LDC, that Tunisia is an appropriate country for establishing such a program (given the infrastructure and pre-requisites already in place as described in Section 2.), that the socio-economic impact on Tunisia would be strong and favorable and that Tunisia would be an appropriate model for demonstrating the advantages and the necessity of broad-based informatics programs in LDCs.

Summing up, we believe that the Tunisian authorities are on the right track in having recognized the potential which informatics offers to their development and we believe that AID could be helpful in providing the resources to encourage them in this endeavor.

References

- (1) Among the LDCs with current programs for broad-based introduction of micro-computers are: Brazil, Chile, Mexico, Sri Lanka and Thailand. All of these programs are relatively new.
- (2) F.K.A. Allotey (Ghana), "Some Thoughts on TDF in the Developing Countries". AGORA, IEI, Vol.3, 1984
- (3) Mathai, J. "Computers: The Time for Action", Science Age, March 1984
- (4) Bennett, I, and Kalman, R.E. "Computers in Developing Countries". IFIP Proc. Pub. by North Holland Publishing Co., 1980
- (5) Peter C. Newman, "Oracle of the Computer Age". McLean's, August 8, 1983
- (6) National Research Council of the U.S. National Academy of Science. Seminar on Micro-computers for Agriculture, Energy and Health in Developing Countries, Sri Lanka, 1984

4. Findings and Comments of the Mission

The mission spent three weeks (April-May, 1985) immersed in the Tunisian informatics environment, attempting to make the widest possible contacts with all the relevant institutions in the government and private sectors, in order to satisfy its terms of reference. (A list of places visited and individuals contacted is given in Appendix C.) We have been accorded the utmost cooperation, for which we are grateful.

We have the following general comments:

1. The interest in informatics at all levels and the expressed desire for its mastery and utilization in Tunisian development is very evident and quite remarkable. High priority for this area of effort is clearly recognized. Furthermore, we came away from our various institutional visits with a great impression of competence, industriousness, energy and enthusiasm on the part of all concerned.
2. There evidently is a widespread belief that Tunisia must accelerate its utilization of informatics by all phases of society or it will not be able to compete and will fall further behind in the development process. As stated, they have no choice but to move in this direction or to miss the train of development.
3. The extraordinary dedication and commitment of Tunisia to the education of its youth and to its specialization in science and technology is remarkable. The fraction of GNP devoted to all phases of education must rank in the upper level for all developing countries.
4. In spite of these great efforts expended to provide and improve education, the demands are so great that inadequate conditions often apply, due to the shortage of school rooms, teachers, teaching equipment (especially involving modern educational technology), etc. Also, dissatisfaction with certain long-standing overly conservative methods is evident and suggests the need for modern innovations.
5. Tunisia looks to the U.S. for leadership in the science and technology area, especially concerning informatics. It further admires the progressive image of U.S. educational methods and the general flexibility and innovativeness in our society. Links with the U.S. in all phases of such programs are sincerely welcomed. The wider use of English in instruction and research would also be welcomed and is currently being encouraged. New research and higher education institutions modeled after U.S. approaches are very much desired, as are other modern approaches such as greater inter-institutional relations with industry and extended opportunities of the initiatives of the private sector. Opportunities for cooperation in all these areas are promising.

We have the following specific comments on the informatics efforts:

1. Tunisian authorities and education and technical personnel truly believe that expanded informatics activities in diffusing micro-computer literacy, computer assisted instruction as well as other applications are vital to their development efforts and that time is of the essence in taking major steps in this direction. They respect U.S. achievements in this broad area and would like to profit from increased cooperation and further individual and institutional contacts.
2. The efforts of C.B.M.I. in generally stimulating the secondary education system to utilize micro-computers is impressive and commendable. They have moved rapidly to utilize effectively their limited supply of hardware and software in the center and in assisting the 2 pilot lycees (Bourguiba and Ariana). Their dedicated task force, meeting weekly, follows their progress and problems closely and can provide some of the pedagogical and curriculum context for backstopping the limited initial efforts. However, further efforts in diffusion must proceed in harmony

with the training and preparation of teachers to effectively introduce computers to achieve literacy and to employ computer assisted instruction (CAI) in a significant contribution to the secondary school curriculum. Reference to other countries' efforts as reviewed by Unesco* as well as U.S. experience shows that considerable prior efforts must be expended in the preparation of "courseware" so as to provide significant tutorial material and accomplish more than simple drill exercises on the micro-computers at their introduction into the system. For this reason, we believe that the proposed U.S. cooperation in micro-computer diffusion should not just consist of the provision of X number of computers--but must include a comprehensive program of cooperation to include exposure of teaching personnel to the universe of software so far developed for various subjects, together with training and arrangements for indigenous program development appropriate to the Tunisian conditions, all to be accomplished in cooperation with the responsible authorities in the Ministry of Secondary Education. As this ground is prepared, the acquisition of the appropriate micro-computers and peripherals, chosen to satisfy the necessary specifications, can be accomplished and efficiently phased into the previously prepared institutions. Furthermore, we believe that this effort should all be considered as an experiment with the associated evaluation procedures so as to provide opportunities for learning and improvement in subsequent adaptation if this should prove desirable.

3. The introduction of micro-computers into "clubs" for general use including games and special programs to achieve literacy, etc. seems like a useful direction in which to proceed. It would be worthwhile, however, to obtain evaluation results from the C.B.M.I. experience as to how well this really works and determine its specific value for, and impact on young people, before it is widely replicated. We believe that this aspect of the proposed cooperation might therefore be factored out from the above detailed secondary school effort for the time being.

4. The diffusion of micro-computers to the various, so-called junior colleges (the first cycle in higher education carried out in their associated technical institutes or faculties) would appear to us distinct and separate from the secondary and popular education responsibilities of C.B.M.I. (other than their general concern for the widest possible diffusion of informatics literacy and their success as a general "animateur".) The usefulness of computers in the higher education experience depends upon the technical context in the curriculum and the programming applications ability of the teaching staff. Greater familiarity with other efforts so as to profit from the specialized developments of comparable higher education institutions in other countries would also be warranted. We believe that each of the candidate recipient institutions should be assisted in developing a program, under the supervision of the Ministry of Higher Education and Scientific Research, for the effective utilization of micro-computers in their programs, and that hardware provision should not commence until such a utilization program is developed and the required technical specifications and characteristics of the equipment is determined. Access to equipment by professors should be provided during this design period.

5. On our visits to the various specialized higher education institutions we observed some pioneering uses of micro-computers in the research and engineering efforts under way. However, there is clearly a need for a greater supply and utilization of these valuable tools in the overall higher education environment. This part of the overall effort in the diffusion of informatics capacity ought to be

*See for example the Unesco summary reports on micro-computers and education available from the Education Sector's Division of Structures, Content, Methods and Techniques of Education, recently prepared by Jacques Hebenstreit.

addressed to this more sophisticated use which should be able to employ indigenous programming skills in addition to exploiting available software.

6. In connection with the various approaches to higher education, although we were exposed to some of the pro and con arguments in the course of our visits, we are not able to "take sides" on the relative merits of the University Faculty or Department structure vs. the special technical institute or "grandes ecoles" approach. Frankly, we were impressed with the good efforts we saw underway at both types of institutions. We encourage the Higher Education authorities to continue to make use of both approaches. Furthermore we counsel caution on making abrupt changes since the turbulence introduced may undo the gains sought in the conversion. In the plans for such changes and especially in the organization of radically new institutions, detailed consideration must be given to the availability of resources, both human and financial including recurring elements of the budget. (M)

It is important to provide real opportunity for research and innovation to proceed in all the appropriate institutions. This effort is not a privilege to be reserved only for special new elite organizations. The relationship between faculty teaching and research is of proven value and the involvement of bright creative students is an excellent stimulus to the advancement of research.

7. IRSIT

In order to have a full and broadly balanced program of informatics in Tunisia, computer-literacy must become a part of the secondary school curriculum; university level institutes must teach students to utilize computers appropriately in every field of study and must have the requisite equipment; there must be effective departments in computer science and computer technology and engineering; and all must conduct research; and finally, a doctorate/ post doctorate-level program and research facility must be provided in order to ensure a growing cadre of highest level professionals conducting advanced research in Tunisia. Such a doctoral program and research facility does not exist at present and although it might be justified on a national basis, it might be more feasible and certainly cost-effective for such a facility to serve a larger regional base.

The GOT is planning a regional center, IRSIT, for this latter purpose and the current plans have been described in section 2. The target year for the inauguration of this new facility is 1990, and a major planning and implementation task remains. Thus, it is essential that the several existing institutes of technology and the faculties of the University be incorporated into a phased plan of implementation of the research and applications program. These schools all have research programs. In most cases they lack adequate equipment (especially micro-computers), have insufficient research budgets and are impeded by lack of support resources, e.g. communications with others working in their fields, difficulties in obtaining reference data, programs, etc. IRSIT, as the overall informatics stimulator or catalyst must provide for strengthening and supporting these existing centers. Thus, one important function of IRSIT might be to fund specific research projects at the University-level institutions in Tunisia as well as comparable institutes in the Region. GOT Budget

During the IRSIT plan phases, the technical institutes and the University must provide the professional manpower and Tunisian counterparts for developing and implementing the plan. For example, in order to have in place a telecommunications network linking the research facilities in Tunisia and the regional countries, plus satellite communication to related research centers and data banks in U.S., Europe and elsewhere, assistance in planning and implementation will need to be provided by the above institutes. As another example, the Arabization informatics research planned at IRSIT requires considerable preparatory work, regional coordination, etc. in order to be viable as an important focus when that institute commences. The above mentioned institutions including ENIT, CNI, and ENSI are already involved in such research efforts and should be involved in providing expertise and assisting in the elaboration of the IRSIT program. In this area as in most of the programs to be undertaken we believe that productive links with industry and the private sector should be developed along innovative and flexible lines.

8. C.I.T.

The GOT has proposed a new innovative institution, an English language, Western oriented University level school to be named the Carthage Institute of Technology (C.I.T.). One principal purpose of the school would be to provide a higher level educational facility for the graduates from the elite Ariana Lycee which specializes in science and technology and will emphasize informatics and where instruction is being carried out in English for all technical subjects. Because the students at Ariana are selected based on test scores from all 6th grade graduates in Tunisia (150 of top 300 out of approximately 180,000 each year), it can be assumed that a high percentage of these students will qualify for and desire higher education. It might be feasible to incorporate an English language curriculum in an existing higher level science and technology school by the fall of 1989, when the first Ariana Lycee graduates will be ready to enter University. By that same time, however, there may be justification for an additional technical institute in Tunisia which requirement can be integrated with that above.

The plans for C.I.T. also contemplate utilizing advanced techniques in informatics consistent with the credentials which advanced Lycee leavers will be expected to have in the future. Additional innovations in educational technology and curriculum and methods should all be explored in planning this higher education facility of the future which may also aspire to regional prominence.

5. Recommendations for Areas for Donor Support

Informatics and Development

For the reasons discussed above, we believe that it would be highly appropriate for A.I.D. to consider support for and cooperation with Tunisia in the following areas pertaining to "Micro-Computers for Development" and related efforts in educational applications and research and institutional support.

A. Support for an experiment to introduce micro-computers more broadly in the secondary education system in Tunisia for the purposes of improving the effectiveness of instruction and to diffuse computer literacy at a formative stage of the general education process.

Under the supervision of the Ministry of Secondary Education and with the assistance of the C.B.M.I.*, the project could involve the following components:

An AID contract with a U.S. institution (e.g. a University Teachers' College) to work with the appropriate Tunisian authorities:

- 1) to see that the candidate schools prepare the teachers with the requisite training for computer assisted instruction and computer literacy efforts.
- 2) to provide access to the relevant experiences in the U.S. and elsewhere in "courseware" development.**
- 3) to advise Tunisian authorities concerning appropriate facilities for effective utilization of micro-computers in instruction.
- 4) to identify the appropriate computers, peripherals, and other related educational technology and to assist with the procurement, distribution, set-up and appropriate maintenance.
- 5) to arrange for an evaluation of the experiment in C.A.I. and a process of identification of recommendations for future improvements in any subsequent efforts.

The number of schools involved and the facilities for them will have to be reviewed jointly; from preliminary plans of C.B.M.I. we have considered a level of effort involving 10 schools (lycees) and approximately 30 micro-computers per school, however, a final decision should be made during project design.

Summing up, this proposal should include the following elements:

- Technical assistance from an appropriate U.S. institution
(support and services)
- Training for teachers including visits to schools using C.A.I.
- Hardware and software provision
- Program evaluation

The project is expected to take at least 2 years to complete. Although donor and GOT costs would be finalized during project design, it is anticipated that the donor contribution would be approximately \$1.1 Million.

B. Support for the introduction of micro-computers into selected higher education institutions.

Under the supervision of the Ministry of Higher Education and Scientific Research and with the assistance of the C.B.M.I.*, it is recommended that A.I.D. contract with one or more U.S. Universities with technical strengths in the appropriate disciplinary areas to assist in the introduction of micro-computer applications into selected Tunisian higher education institutions.

The effort will:

- 1) assist candidate institutions (junior colleges, etc.) to prepare their faculty with training for the incorporation of micro-computers into the curriculum of their subject disciplines.

* We see the C.B.M.I. role primarily in the early catalytic phase of the effort.

** In cooperation with the Department of Education and the National Science Foundation in the U.S. and Unesco and IBI internationally.

2) provide access to the relevant experiences in the U.S. and Europe in suitably appropriate "courseware" development.

3) assist with the identification and procurement of the hardware and peripherals appropriate to the agreed applications.

4) arrange for an evaluation of the utility of the computers in the higher education applications.

Our preliminary estimate is that some 6 institutes would be involved with this effort, chosen from the larger roster considered by C.B.M.I. (see Appendix D). It is estimated that this component to assist in the diffusion of micro-computers to these institutions would require \$900 thousand in donor funding.

C. Support for IRSIT

We recommend that A.I.D. contract for the services of a U.S. non-profit research institution* with expertise in the computer/communication fields to assist the GOT in developing a detailed, phased plan for the creation of a new regional informatics research institute in Tunisia (IRSIIT). We recommend that if capital equipment is required for implementation of a phase, that equipment be considered as a separate candidate activity when required. (The GOT may wish to finance such equipment itself or to seek other donors.)

The contractor should assist the existing research efforts underway at related institutions and IRSIT in establishing cooperative activities in conjunction with appropriate U.S. Universities and research institutions. The contractor should be responsible for identifying needs and recommending candidates for technology exchange with the U.S. subject to approval of the GOT and A.I.D.

The project should involve the following components:

1) A review of present structure and any planned changes of relevant research in higher education institutes and departments as they relate to IRSIT. A review of the relevant research underway and the areas of expertise of researchers.

2) Preparation, with GOT counterparts, of a statement of purposes of IRSIT together with a review of existing plans.

3) Development, with GOT counterparts, of a plan by phases for IRSIT and assistance in the implementation of the phases.

4) Recommendation to GOT and A.I.D. of appropriate technology exchange visits with the U.S.

5) Recommendations to A.I.D. and GOT of specific U.S. University links for cooperation.

The major elements of donor support for development of IRSIT include a technical assistance team of three professionals, international exchanges of professionals and procurement of selected equipment. It is estimated that this effort would require approximately \$1 Million of donor funding.

D. Support for C.I.T.

We recommend that the scope of work for the contractor for the IRSIT project be extended to include a thorough study of the feasibility and advisability of an initially small C.I.T. If the contractor concludes that it is feasible and advisable, and GOT and A.I.D. concur, the contractor will assist in preparing detailed plans, cost estimates and schedules for establishing C.I.T.

The project will involve the following components:

1) Review of the Ariana Lycee program and any other programs that will prepare students for training at C.I.T.

2) Study the feasibility and advisability of establishing C.I.T. and report.

3) If it is determined that C.I.T. is feasible and advisable, assist GOT counterparts in preparing detailed, phased plans, schedules and cost estimates considering a fall 1989 opening. Plans should include requirements for facilities, equipment, support resources, etc.

*Battelle Memorial Institute and SRI International are examples of non-profit research institutes that have been involved in assisting developing countries establish similar structures.

4) Assistance in developing ties between C.I.T. and U.S. Universities.

It is estimated that this effort involving two professionals and associated travel for a period of one year would require approximately \$200 thousand of donor funding.

In connection with the IRSIT and C.I.T. efforts it is important for the GOT authorities to be aware of the significant recurrent costs involved above and beyond the early initial contributions which the donor may provide.

6. Potential Areas for Future Cooperation: U.S.-Tunisia

In the course of our visits and discussions it became evident that the Tunisians would like to have more and closer connections with their counterparts in the U.S. We have therefore identified some pertinent areas; many of these links of cooperation may be beyond the scope of A.I.D.; however, it is felt worth mentioning in that some future opportunities for cooperation may arise.

1) The work of C.N.I. is analogous to that of the National Bureau of Standards' Institute for Computer Science and Technology in the U.S. The Bureau has made a review of Federal Agency Experiences with Micro-computers which should be of interest. (500-102) The Bureau might also be helpful in considering the standards issues relating to the Arabization of informatics project.

2) Efforts in education involving micro-computers are of interest to the Department of Education and the National Science Foundation. The former maintains an information system (ERIC) which has a clearinghouse on computer applications.

3) IRSIT interests in research should relate to the NSF and NBS. The Department of Commerce's N.T.I.S. maintains a data base on current research efforts which includes computer science and other elements of informatics.

4) Contacts with the informatics industry and some of their cooperative research consortia would be useful and should be encouraged (e.g. IEM's scientific research institutes).

5) Professional societies should be encouraged to give preferential rates to students in developing countries so that they may be able to interact professionally.

6) Tunisia's high interest in informatics will be of great interest to the National Research Council of the U.S. National Academy of Sciences. The NRC has underway a program of seminars and publications on the subject of Micro-computers for Developing Countries. Seminars on specific topics are being held in appropriate LDCs. W.L., one of the authors of this paper, is Chairman of the advisory panel on this project and will serve as contact for Tunisia.

It is possible that all these areas can be integrated into a general S -T bilateral agreement between the U.S. and Tunisia, when the two Presidents meet in June 1985.

Terms of Reference of the Mission

A. Recommend to AID whether a donor investment in the GOT proposal is appropriate at this time in relation to the development needs, socioeconomic benefits, cost effectiveness, and human and other resources available. If the recommendation is positive, they will identify what elements of the GOT's proposed program are appropriate for donor support.

B. As appropriate, identify key constraints which must be satisfactorily resolved or addressed by the GOT before donor investment.

C. Provide an overview of GOT plans (in public and private sectors) for national and regional computer technology adaptation including CEMI and CAI pilot activities, IRSIT and C.I.T.

D) Identify key issues/information the GOT must address in development of this capability and current status toward these issues with particular attention to institutional, economic, financial and educational issues.

E. To the extent possible in a brief overview, prepare comments directed to the GOT on feasibility of their approach, directions to consider and pitfalls to avoid based on other experiences.

Prior to departure, the two Educational Technologists will provide USAID senior staff with a detailed verbal briefing of their findings and submit a final report covering the above points.

List of abbreviations

| | |
|-------------------|-----------------------------------------------------------------------------|
| <u>A.P.I.</u> | Agence de Promotion des Investissements (Investment Promotion Agency) |
| <u>C.I.P.I.T.</u> | Comité Ministériel Permanent de l'Informatique et des Télécommunications |
| <u>C.I.T.</u> | Carthage Institut de Technologie (Carthage Institute of Technology) |
| <u>C.B.M.I.</u> | Centre Bourguiba de Micro-Informatique |
| <u>C.N.I.</u> | Centre Nationale d'Informatique |
| <u>Co.N.I.</u> | Commission Nationale d'Informatique |
| <u>E.N.I.T.</u> | Ecole National d'Ingénieurs de Turis |
| <u>E.N.S.E.T.</u> | Ecole Normale Supérieure de l'Enseignement Technique |
| <u>E.N.S.I.</u> | Ecole Nationale des Sciences Informatiques |
| <u>I.S.G.</u> | Institut Supérieur de Gestion |
| <u>I.R.S.I.T.</u> | Institut Regional des Sciences Informatique et Télécommunications |
| <u>M.I.T.</u> | Monastir Institut de Technologie |
| <u>S.C.E.T.</u> | Société Centrale d'Équipement Terrains |
| <u>U.C.C.</u> | Université Centre de Calcul (El Khawarizme) |

Mission Visits

| | |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C.R.M.I. | Director, Mr. M. Latiri; Mrs. C.H. Hila and staff Task Force (Representatives of Lycees, Institutes and Ministry of Secondary Education) A group of 30 suppliers of computer hardware and software active in Tunisia and rendering assistance to the Center |
| Ministry of Higher Education and Scientific Research | Minister M. Ben Dhia and senior staff |
| Ministry of Secondary Education | Minister M. Chedly and senior staff |
| Ministry of Foreign Affairs (International Cooperation) | Minister M. A. Ben Arfa and senior staff |
| The Mayor of Tunis | M. Zakaria Ben Mustufa and senior staff |
| The Governor of Monastir | |
| Lycee Bourguiba (Tunis) | Principal Mme. Souad Boulahya and teachers |
| Lycee Ariana (Ariana) | Principal Mme. Habiba Soua and teachers |
| Lycee Bourguiba (Monastir) | Principal and teachers |
| A.P.I. | P.-D.G. M. Ali Heda and senior staff |
| I.R.S.I.T. | Mr. H. Bourguiba, Jr. ,President Mr. M. Latiri, Co-ordinator Advisory Committee (Directors of CNI, ENSI, Fac. of Science, Univ. of Tunis, E.N.I.T., Bank, etc.) |
| C.I.P.I.T. | Mr. M. Latiri, adviser to the Prime Minister |
| E.N.S.I. | Mr. M. Ben Ahmed, Director |
| E.N.I.T. | Mr. A. Marrakechi, Director Mr. N. Ellouze, Prof. of Informatics |
| Ministry of Plans | Mr. Y. CHAouachi, co-ordinator of Informatics Plan |
| E.N.S.E.T. | Director and Prof. of Informatic, Mr. Annati |
| University of Tunis | |
| Faculte des Sciences-Tunis | Dean Mohamed Moalla |
| Faculte des Sciences-Monastir | Dean K. Harzallah |
| U.C.C.(El Khawarizmi) | Director M. Anara |
| C.N.I. | P.-D.G. Dr. Farouk Kamoun |
| National Assoc. of Engineers and Research Bureaus | Ch. Mr. Slah Ben Said (Pres. S.C.E.T.) Mr. El Aouari Cherif, rep. Informatics Engineers |
| The Parliament of Tunisia | Secretary-General Pasha |

annexe 3 recapitulatif

| | effectif | | h y p o t h e s e s | | |
|---------------|-----------------|-----|---------------------|--------------------|--------------------|
| | 2 etud. / micro | | hyp. 3 50 micro | hyp. 2 30 micro | hyp. 1 15 micro |
| * E.N.I.T. | f1 | 252 | 170 h./an | 113 h./an | 56 h./an |
| | fm | 270 | 5.5 h.hebdo | 3.5 h.hebdo | 1.5 h.hebdo |
| * E.N.I.G. | f1 | 136 | 327 h./an | 218 h./an | 109 h./an |
| | fm | 136 | 10 h.hebdo | 7 h.hebdo | 3.5 h.hebdo |
| E.N.I.S. | f1 | 134 | 246 h./an | 164 h./an | 82 h./an |
| | fm | 228 | 8 h.hebdo | 5.5 h.hebdo | 2.5 h.hebdo |
| * E.N.I.M. | f1 | 212 | 253 h./an | 168 h./an | 84 h./an |
| | fm | 140 | 8.5 h.hebdo | 5.5 h.hebdo | 2.5 h.hebdo |
| * Fac.Sc.Inf. | inf | 124 | 109 h./an | 72 h./an | 36 h./an |
| | ler | 690 | 3.5 h.hebdo | 2 h.hebdo | 1 h.hebdo |
| Ac.Mil. | f1 | 100 | 891 h./an | 594 h./an | 297 h./an |
| | | | 10 h.hebdo | 10 h.hebdo | 10 h.hebdo |
| * E.N.S.E.T. | ler | 388 | 229 h./an | 153 h./an | 76 h./an |
| | | | 7.5 h.hebdo | 5 h.hebdo | 2.5 h.hebdo |
| * I.S.G. | f1 | 505 | 176 h./an | 117 h./an | 58 h./an |
| | fm | ? | 5.5 h.hebdo | 3.5 h.hebdo | 1.5 h.hebdo |
| I.H.E.C. | f1 | 175 | 285 h./an | 190 h./an | 95 h./an |
| | fm | 137 | 9.5 h.hebdo | 6 h.hebdo | 3 h.hebdo |
| E.N.A. | c.s. | 34 | 281 h./an | 187 h./an | 93 h./an |
| | c.m. | 283 | 9 h.hebdo | 6 h.hebdo | 3 h.hebdo |
| I.T.A.A.U.T. | f1 | 280 | 318 h./an | 212 h./an | 106 h./an |
| | | | 10 h.hebdo | 7 h.hebdo | 3.5 h.hebdo |
| I.S.T. Gabes | ts | 280 | 318 h./an | 212 h./an | 106 h./an |
| | | | 10 h.hebdo | 7 h.hebdo | 3.5 h.hebdo |