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Joint ECWA/UNIDO Industry Division

Mission Report on  
"Micro - Electronics in the ECWA Region - III  
5 - 16 December 1983  
Tunis, Casablanca and Rabat

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\* The opinions expressed in this report are those of the author and do not necessarily reflect the views of the United Nations Economic Commission for Western Asia

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MISSION REPORT ON  
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The third part of the mission was to cover all North African countries; but due to delay in obtaining clearance, the mission did not visit Algeria. Members of mission were the same as in part II and objectives were the same as in parts I and II. The overall mission was terminated in Baghdad on the 20th of December 1983 with discussion of draft reports and provisional agenda of Kuwait Meeting in the presence of Mr. G. Soni.



## TUNISIA

Tunisia is a relatively small country without any important natural resource, except for the educated manpower. That is why Tunisia is moving slowly into the industrial age and much faster into the Computer age.

In Electronic industries Tunisia had very few workshops, manufacturing basically passive components, with a work force of less than twenty persons each. It had also a few assembly lines for several electronic systems; TV, Radios, telephone exchanges, etc., the most important was "El Athir" with a work force of more than 500 persons, productional TV for the Tunisian market (50,000 sets/year). It is worth mentioning at this point that a "Maghrebian Symposium on Informatics, held in Tunis, passed a very important resolution, under the patronage of the three north African leaders, calling for the creation of a "Regional Institute on Informatics and related technologies".

### 1. Centre National de Recherche Scientifique: CNRS

The meeting was on 5 December with Mr. Donkona, Chairman. The name of the centre was misleading, for it was a branch of CNRS - France, and not a Tunisian Institute, aiming at co-ordinating joint activities between different Tunisian research Institutes, and the CNRS of France.

It was noted however that NO joint research was undertaken in the field of microelectronics.

### 2. Ministry of National Economy - Industry Department

The meeting was with Mr. Laroussi on 6 December 1983.

- The Government was pushing computerization of all public offices, down to the level of municipalities.
- Tunisia was seeking regional co-ordination in north Africa, and was to lead a regional group working on arabization in informatics.

- Tunisia was benefiting, in the field of informatics, from French technical assistance: training maintenance research and development of software etc.
- Government was encouraging all new industrialization projects, but had no special incentives for electronics industries.

### 3. Centre National des Etudes Industrielles CNEI

The meeting was on 6 December, with M. Bouche'ala, assistant Director General.

The centre had 2 objectives:

1. Identification of viable industrialization projects.
2. Undertaking feasibility studies of identified projects.

Centre was undertaking sectoral studies, including one on Electrical industries, to identify most urgent projects. It had moved towards giving priority to manufacturing of electronics components.

Mr. Bouchea'la was very interested in ECWA methodology, in identification of industrial projects and was interested in participating in future identification studies of potential microelectronics industries, particularly in software engineering.

As for microprocessor-based applications, they were being diffused slowly into large industries, with newly purchased systems, mostly supplied turn-key by vendors, with one year guarantee, and further maintenance contracts. It was estimated that for large industries integrated controls were costing 10 per cent of total investment and up to 15 per cent, for smaller industries.

There was in Tunisia a tendency to establish good maintenance industry, including improving on missing and expensive spareparts with substitutes manufactured locally.

4. Ecole Nationale Supérieure de l'Enseignement Technique "ENSET"

The meeting was on 6 December with Dean, Mr. M. Annabi, and staff.

The school was a national education centre, of engineers and technical instructors. It had a 4 years BSc programme in Engineering and a 6 years (troisième Cycle and DEA) programme for technical instructors education, the specialization in Electronics was available in the 6 years programme only.

The Institute offered advanced courses in controls, sequential command situation etc., with special courses on microprocessors and microinformatics in the "DEA" programme.

They had undertaken the development of many micro-processor-based application at the lab scale, such as process controllers, data acquisition systems etc. In these applications the researcher used to develop, algorithms, interface modules, including all needed software and hardware. But industrialization was not attempted.

One operational prototype was a model for buses circulation for the "Société Nationale de transport". The model displayed, at a push button, circulation of buses between any two stations in the city.

The school had moderate equipment for control labs, including a micro-processor and a micro-computer labs, they were working on the design and implementation of a micro-computer model for educational purposes.

In most of these applications, the microprocessor used was the Intel - 8085; they had difficulties procuring the microprocessor and the needed parts for their research.

The school had very limited contact with industry because "industrialists were not of the daring type and they preferred to adapt proven technologies bought outside". A few industries were starting to call on the school for technical assistance. e.g. "Aéroport flight control authorities" were asking for the development and implementation of a software application, "to optimize the use of available runways and avoid planes collision, using data of incoming flights processed on available micro-computer".

Data was to be fed provisionally, via telexes, by pilots of incoming flights; the system was to choose, among data fed, important information to optimize air traffic control.

The school had moderate capabilities in terms of equipment and human resources but did not have "the critical mass" to undertake serious effort in R & D, to the degree of identification of fruitful applications and developments of operational prototypes ready for industrializations.

The school had wide contacts with western universities in France, UK, Germany and lately USA; contacts included technical assistance, joint research, exchange of instructors etc.

In the field of informatics the school had a computer centre, used as a tool for education and in administrative functions, but had no computer science department.

The school had some "Computer aided Instruction, "CAI", equipment in the lab and very limited "CAD" equipment, used in Engineering design even by offices outside the school.

The school showed great interest to participate at Kuwait meeting. They expressed urgent needs in:

- assistance in procurement of components and parts, they even recommended a "regional procurement agency".
- Co-ordination of research efforts among universities and research Institutions in the Arab countries and with advanced universities.
- Up-to-date informative seminars and training programmes.

Mr. Annabi was kind enough to give the following remarks:

- Many seminars were being organized in Tunisia on Informatics and microprocessor-based applications including an annual meeting in May.
- Among fruitful applications in Tunisia he mentioned: 1) controllers to optimize drip irrigation systems, using data acquisition from installed sensors for temperature and humidity. 2) system to optimize mixing of fertilizers, and automatic distribution in irrigation water. Controllers to optimize timing, quantity and quality.



## 5. Tuniso-Emirate Investment Bank

The meeting was on 7 December with Mr. Moncef Kaouach, president.

The bank was newly established, seeking investment mostly in manufacturing industries. It was undertaking studies to identify promising industrial projects.

The bank had special interest in electronics industries due to:

1) availability of human resources. Their assessment was that the "Educational programme" in Tunisia had special stresses on electronics; in this respect the bank was developing a file of available human resources in the fields of electronics and software engineering in the country and in Europe. 2) the special characteristics of the electronics industry summarized as follows:

- it was considered as a developing industry with future characteristics.
- it was not a "Mature industry", hence it was not, as yet, totally monopolised by "T.N.C" and there were still chances for developing countries to have a serious "switch" of the market.
- Investment in electronic industries had smaller requirement, in "Financial and human diversification of expertise", as compared to mechanically based industries.

The bank had signed a joint venture contract, to assemble private PABX electronic telephone exchanges, with Jomo Schneider of France.

The project would produce 10,000 lines/year, but was capable of future extension. The bank was also looking into possible assembly of large public exchanges and related accessories such as transmission equipment, distribution means etc.

The bank would look into suitable "product mix" to satisfy industrialization projects in the "Maghreb Countries" and to co-ordinate with other projects in the Arab East.

The project had a total investment of \$4 million, production was to start in 1985 with all Tunisian personnel. Prices were to be competitive on international markets.

Future projects would be assembly of arabized microcomputers and computer terminals, manufacturing of hybrid circuit boards as feeder to telephone exchange assembly etc.

Bank was to send "Electronic Missions" to:

1. Advanced countries to find out about the state of the art.
2. Industrialized developing countries (Greece, Turkey, S. Korea and Taiwan) to study experiences, problems, capabilities, etc.
3. Lesser developed countries to secure potential markets.

Bank was considering "acquiring a window" in silicon valley through purchase of a small components company in California.

The Bank was very interested in ECWA similar activities, in participating in the Kuwait meeting and in co-ordinating future activities.

6. Ecole Nationale d'Ingenieur de Tunis", ENIT

"Tunis School of Engineering". The meeting was on 7 December with Dean Mr. Marakchi and prof. N. Allouze director of micro-electronics and informatics research.

The school was 15 years old, with more than 1500 students. It had 3 programmes after secondary education.

1. High Technician (T.S) education, a 2 years programme, or first cycle.
2. A Bsc engineering, a 4 years programme, or second cycle.
3. An MSc equivalent programme (6 years), or third cycle.

The school offered electrical option at the BSc level with electronic subspecialization, electronics or control specialization at the third cycle, and a biomedical electronic technology at the first cycle level. A programme of Computer technology, for operation and maintenance of computers' hardware and software was introduced lately, with assistance from IBI, to enhance National computerization programme. Hardware aspects were taught to all engineering students, to acquaint them with capabilities and limitations of Computer. The Computer Centre was serving all needs of University including Computing and management tasks as well as scientific research of students and staff.

School was carrying a wide research programme in informatics and microelectronics.

In informatic, research covered artificial intelligence, recognition and processing of sound and visual signals etc.

The school was undertaking an Arabization programme, in co-operation with CNI. It was undertaking some industrial applications development such as the simulation of national telephone network.

In microelectronics, the research was covering computer aided design of chips and systems, development of bilingual terminals and wordprocessors, that included Arabization within the hardware itself etc.

The school was recipient of DIELI assistance: provision of components, equipment, technical know-how etc.

School was using the microprocessor Intel 8085 to develop some industrial controls, e.g. management of electric dispatching networks, using sensors to measure flow characteristics, and processors for the phosphate industry.

Due to limitation in available human capability, most applications were developed at the lab scale, with no production of operational prototypes.

School was in the process of enlarging the informatics department to respond to fast growing diffusion of computer application. Programmes were designed from "End user" point of view, instructions were given at every department to use informatics with direct applications related to field of specialization.

7. Centre National 'al' Informatique, CNI

"National Computer Centre". The meeting was on 7 December with, Chairman Mr. Kamoume, director of development Mr. Cherif and Consultant from ENIT prof. Allouze.

The Centre was the "national informatics institution" attached to the Prime Minister's Office, entrusted with the following tasks:

- develop needed capabilities, and capacities, for data processing at the Prime Minister's office.
- Acquisition of Computer hardware and software for all public services, and the development of needed software for these offices.
- Training of personnel and "know-how" development.
- Research and development into the processing of the Arabic language into Computer and communication.

In Arabization: R & D was undertaken with assistance from DIELI and IBI.

They had developed the following:

1. An Arabized system (hardware and software) for storage and retrieval of information, using MITRA 225 Computer, called HAMIM.
2. A bilingual terminal and necessary interface accessories for bilingual I/O.
3. A "bilingual data-base system" as modification of the Latin system called TRIBUT, for legal documentation.

Above mentioned applications were developed using "SEMS" hardware, (integrated into Bull), with interactive capabilities, using ASMO, CODAR, and V standards.

Mr. Kamoun offered to bring their "Terminal and applications to be displayed at Kuwait meeting if compatible facilities were provided i.e. either a telephone connection or a MITRA computer.

Centre was working on extending developed applications to be compatible to other available machines.

Centre was working, with BULL of France, to develop a new bilingual documentation system of MISTRAL. It was noted however that serious Arabic words and text processing were still semi-manual, with data entry focused on processing of most-frequent-words only.

In microinformatics: the centre estimated the Tunisian market to have absorbed some 600 machines by end 1983, mostly for administrative tasks; management accounting, payroll, inventories etc.; as well as for "CAI" in high schools, a la French model.

The centre was feeling the need to develop Arabized software for schools "CAI".

They felt there was a lack of awareness of the public, on capabilities and limitations of micros, though there were efforts, to sensitize public sector through providing of training, consultancy and needed software.

There were few private software houses with capability to develop customer - tailors software, (i.e. with more than 10 software engineers), most software used were ready packages.

#### Centre Bourguiba Pour le Micro-Informatique (CBMI)

The Tunisian government had entrusted CNI to establish, with assistance from different vendors, a public entre for microcomputer due to open in February 1984. CBMI would aim at increasing the public awareness on subjects of microcomputer, providing elementary information and instruction on the use of machines, and allowing capable clients to use the micros for their own use.

CNI had several other tasks and applications, among them:

- Computerization of different public services including, taxes, boarder security, custom-duty services, budget and finance of finance ministry, personnel management etc.

- Hospital management.

- Management of industries, large supermarkets etc.

- Many other applications were being developed.

CNI had a total of 120 people, with many highly qualified, recruited after acquiring long experience at famous European software houses.

The basic needs were: high level training, state of the art informative seminars, training in CAD, networking, communication etc.

8. Centre d'Etudes Techniques des Industries Mechaniques et Electrique (CETIME)

Centre of Technical Studies for Mechanical and Electrical Industries.

The meeting was with Mr. N. Chaouch, director, on 8 December 1983.

It was a public technical centre, established to assist private industries in consultancy, studies and training.

The Director stated that there were very few automated industries except for a few numerically controlled machine tools.

Many industries had started computerization of "traditional administrative" tasks, such as management, accounting, personnel, inventories etc.

Most industries were suffering from shortage of software personnel to develop own systems, and were resorting to ready packages.

Some large industries were starting acquaintance with CAD/CAM techniques, but were needing serious guidance and assistance.

To enhance development of human capability at educational level, every student had to present at graduation the design of at least one project using computer.

The needs in informatics and microelectronics applications were the same as everywhere else i.e., training and up-to-date information.

9. Agence pour la Promotion de l'Investissement API

"Agency for the promotion of investment". The meeting was on 8 December with Mr. Ahmed Lamine, Assistant Director-General.

The agency was a public institution to promote industrialization. It was undertaking feasibility studies, identification of project, proposals for incentives, technological assistance and provision of technical and financial information. No investment was done by agency itself.

Agency was considering manufacturing of electronics components, as joint ventures with foreign partners, starting with passive components and may be extended later into active components and I.C.

Agency was receiving technical assistance from UNIDO, and was asking for more technical assistance, specially in the domain of up-to-date information.

Agency requested possibility of placing personnel in advanced industries, to gain experience in assessment and choice among available advanced technologies.

Agency was interested in ECWA identification to manufacturing industries, in attending Kuwait meeting and future informative seminars on the "state of the art" in informatics and microelectronics applications.

10. Mr. Sukumar: UNDP Expert at the Prime Minister's Office

The meeting was on the 8th of December 1983.

The main task of Mr. Sukumar was to promote computerization of public services through seminars, training etc.

The stated policy of the Government was to computerize all public offices nation wide starting with the Prime Minister's office and centrale ministries covering later on governments and municipalities.

The most felt need was in development of human capabilities. There were serious need to up-grade quality of available personnel and to provide more qualified people as well. There was a need for training materials of all kinds.

11. Societe Tunisienne de l'Electricite et du Gaz: STEG

"National society for distribution of gas and electricity: The meeting was on 9 December with director and staff of technical production department.

There was little automation for gas production. There was a plan to modernize plant with installation of micro-processor-based controls.

However, the Society was introducing important automation in power generation and dispatching, and there were computerization of all administrative functions.

There was one thermic power plant with dual boilers, 150 Mwc/ea. at Rabes, being constructed by Hitashi, who was supplying the integrated control system that would include the following:

- Automated start-up and operation of the power plant.
- Regulation of power generation and power flow.
- Protection and security controls for all parts of plant.

The plants would have totally computerized data-processing.

There was another automated plant at Souse already operational, built by Siemens of Austria, that included an integrated control system as well.

In both plants, contract included training of Tunisian personnel for operation and maintenance of automated system. It was the established policy of the society to have all maintenance and operation tasks carried out by own personnel, after first year of guarantee.

Society was planning to acquire in the future the know-how to set up own plants, including controls, from stage of conception to implementation, by Tunisian personnel. They expressed serious need for high level training programme on automated controls in this respect. It was estimated that cost of control in plants was 5-7 per cent of the total contract (each \$100 m).



Society was gaining experience in many aspects of control, including reprogramming of set processors, in co-operation with ENIT and ENSET.

In dispatching, the society had constructed a complete national loop networks, at high and medium transmission voltage, where micro-processor-based controls, developed in many cases at ENIT or ENSET, were optimizing all flow parameters.

The flow parameters were collected automatically at every node and post, and were transmitted from secondary posts towards 2 regional centres, for processing and optimization, one in Tunis in the North and the other one in Gabes for the South. The 2 Centres were computer-linked to a main national centre in Tunis. All controls and computers in the system were interactive. The system hardware were provided by CETD (a European subsidiary of DEC). The estimated cost of control system was at 20 per cent of the total loop cost.

Morocco

The visit to Morocco was a very fruitful one. It revealed very instructive facts about that Arab country, that is remote from ECWA region but related to it in many ways.

Most instructive contacts were established with Arabization centre, and with the only electronic components packaging factory which was visited, preliminary contacts were also established with a well developed aviation maintenance centre and a printed circuits factory.

It was important to note there the impact of switching to electronic telephone exchanges on the assembly of electro mechanical exchanges used before.

A. Casablanca: The largest city and the "economic capital where most industries and businesses were established.

1. Apple micro-computer service

The visit was on 12 December the meeting was with Mr. A.M. Housni general manager.

Micro-computers were being slowly diffused into the Moroccan market, 200-300 were installed by end 1983 (one-fourth were Apple) other makes were: IBM, TOSHIBA, DEC, BULL etc.

Main users of micros were for small and medium business purposes and liberal professions.

Import taxes (70 per cent) were making micros very expensive for Moroccan market, added to it the difficulty in maintenance and non-availability of spare parts.

Apple like other agencies, offered preliminary operation instruction only and limited after sale services. The Agency had a maintenance tester to diagnose defects but spare parts were not stored in place and boards were dispatched to France for repair.

2. "Compagnie General de Construction de Telephone", CGCT

The meeting was on 12 December with Mr. Belabdi Abderrahman, Director-General.

The company was a joint venture, with 50 per cent state owned assets and 50 per cent partnership with CGCT of France. It had 2 functions at the service of PTT Morocco:

- Installation of telephone networks (i.e., exchanges and lines).
- Assembly of E.M. telephone exchanges.

In 1982 the company introduced complete electronic exchanges purchased at "Meta Conta" of France.

- Moroccan PTT was switching to Ericson and CIT-Alcatel electronic system; the Company was threatened to stop all operations and to release an already well trained workforce of more than 150 people including 10 engineers.

In 1982 CGCT started assembling private intercome under licence from "PICART-LEBAS" of France, and was negotiating assembly of single telephone sets for PTT customers.

No manufacturing components was undertaken or planned.

3. IMEG: "Informatique et Methodes de Gestion" - Centre de Calcul Cesa (informatics and Management Methods).

The meeting in Casablanca was on 12th December with Mr. Tbarki director of the "Computer Centre".

It was a "private" company established in 1973 among ex-employees of IBM, it became the leading and largest private house for consultancy and software development, with strong support from the Government, and wide services to the public sector, it was offering consultancy, computing services, studies, training, implementation of systems, software development, and lately industrialization.

It was serving as substitute for a Moroccan NCC, and was working in co-operation with ODI and UNIDO on the development of "Centre National l'Informatique et micro-informatique", (National Centre for informatics and micro-informatics), a training and sensitizing centre open to the public, similar in functions to U.K. "informatic community centres", aiming at training drop out youth on computer expertise.

Their computing power was small but being upgraded in early 1984.

- Company developed "software generating" system for micros using main frame facilities.
- IMEG developed a teleprocessing system using dedicated public telephone lines.
- They were not undertaking any Arabization effort, for most applications were in French.

However, there was a plan to develop an Arabic compiler in co-operation with the School of Engineering in Rabbat.

Company was spending on "human capabilities" development for its own and for the public offices, it organized seminars, training programmes and fellowships to more advanced countries, particularly on: networking, data-processing and transmission, data-base techniques etc.

IMEG was extremely well spoken of at every institution visited.

#### 4. "Societe Nationale de Produits Petrolier", SNPP

(National Society for Petroleum Products), the meeting was with Mr. Mourad Bouzid, Director of Computer Services, on 13 December 1983.

It was a holding company established in 1974, as part of Moroconization efforts, to manage the 50 per cent public share of petroleum products distribution industries, covering 85 per cent of Moroccan market.

Computerization of company went in three phases:

1. 1976-1978 aimed to take over computing facilities that were available at affiliate companies and to provide them with substitute, but similar services on a commonly procured IBM 370/115-1.
2. 1978-1980 aimed to develop slowly a unified system to be implemented in all affiliates. There was extension of available computer power: IBM 370/115-2 with 256K, 4 disc drives, 2 band drives, a fast printer etc. and a COBOL generator of software.
3. 1980- being implemented, aiming at the provision of telemetry and data-base systems to all affiliates.

A new system was installed with IBM 4331, 1 on bytes memory and several peripheral satellite minis (IBM 5280) at every affiliate Co.

All satellites to be linked on-line to centre by dedicated lines (2 lines, 2400 bits band as of 1984).

All needed software was being developed locally while hardware maintenance was undertaken by IBM.

The Company expressed the need for training of personnel, they were sponsoring many training seminars in co-operation with IMEG.

5. Bull - Morocco

The meeting was on 13 December with Mr. P. Alain, branch director. It aimed to acquire an assessment of the Moroccan informatic market from a vendor's point of view, following were his remarks:

- There was a "public consultative" body in Rabat to advise on computerization, CETI, at the Ministry of Planning Statistical Department, but it was not effective and did not have computers.

There were about 250 systems installed in Morocco by the end of 1983, excluding micros. The cost was limiting further development specially with new import restrictions imposed by March 1983.

- Public was not aware of capabilities and limitations of micros, and there was serious shortage of software and maintenance services Bull was establishing a well equipped maintenance centre with a large store of spare parts in Casablanca.

Low salaries in Morocco, as compared to Europe could present a good incentive for a growing software and components industries.

Computerization in Algeria and Tunisia was moving much faster than in Morocco.

#### 6. Office Cherifien de Phosphate, OCP

The meeting was with Mr. A. Daoudi of the "Informatics Centre" on 15 December 1983.

OCP was a state owned large conglomerate of companies that handled all aspects of phosphate exploitation, from extraction to export and to downstream processing and industrialization. OCP income made up to 15 per cent, in value, of the total Moroccan export. OCP had its own autonomy with 30,000 employees.

There was no micro-processor-based applications introduced except - what was being diffused with newly purchased equipment.

#### The Informatics Centre

An old division established for financial tasks as early as 1947, and was growing to reach 120 persons by end 1983, many of its personnel were recruited after long experience in established software houses abroad.

Centre was undertaking all data-processing at OCP central office and affiliate companies, including management, personnel, payroll, accounting, budgeting, inventory, production management etc.

it had an IBM 370-135 being updated to cope with growing demands: the new system was to consist of a central IBM 4341 at Casablanca (2x2 Meg Memory) and four IBM 4331 regional stations distributed to geographic regions.

Regional stations will be linked on-line to centre via dedicated lines. The region would handle most of local tasks dispatching end results to centre for historical and overall control.

A data-base was being developed for all operations of OCP.

Informatic centre was supervising the introduction of all bureautic facilities, including word-processing, facsimiles, electronic mail etc. as well as automated management and secretarial services. A video text would be provided by IBM to include a latin dictionary of 10,000 words/working language.

All software was being developed by well equipped experienced personnel updating was carried out through seminars, special courses, fellowships OCP expressed needs for intensive training for maintenance personnel on micro-processor-based controls in preparation for further exploitation of such systems. They also expressed interest in participating in high levels training activity in software mainly: networking, CAD, control etc.

7. "Societe de Fabrication Radioelectrique Marocaine", SFRM  
affiliate of Thomson CSF of France.

The meeting was with Mrrs Menwille and Sousa of the administration on 15 December 1983.

SFRM was a joint venture, with Thomson of France having 49 per cent and 51 per cent for Moroccan private and public shares.

SFRM had 2 factories. The Bouskoura factory, with a workforce of 500 persons, was limited to assembly of systems and subsystems. The Ein Sba'a factory was specialized in packaging and encapsulating of semi-conductor components and had a work force of 1000 persons.

Thomson had another affiliate in Morocco, SADA, specialized in assembly of colour and B & W, TV sets for the local market with a capacity of 100 sets/day. Philips had an affiliate in Morocco assembling 30 TV sets/day.



SFRM represented a special type of "joint venture" where all technical know-how was supplied and controlled by Thomson France. No design, engineering or modification of any kind was undertaken in Morocco, the justification was "prohibitive cost". Morocco was supplying the locality and cheap labour force.

No where the name SFRM appeared on the product, whether it was a system, a subsystem or a component, except for products sold on the local market, and the administration was practically all French while the labour force was in totality morocconized.

There were many European Companies such as IBM of France contracting the assembly of their subsystems to SFRM, the European company would supply all design, components, parts and even machines, SFRM supplying only the locality and the labour force.

Thomson explained the "raison d'etre: of FSRM in the comparative advantage in Morocco "of proximity" to Europe and the relatively cheap "labour force".

It is important to consider seriously and in depth the experience of FSRM, for it was the only place, in the region, except may be in military complexes, where semi-conductor components were produced though under the "special" conditions described above.

Another important aspect that ought to be considered was that FSRM, along with CGCT represented, a case where the introduction of electronic telephone exchanges resulted in the dismissal of a large and experience work force that was employed in assembling electro-mechanical exchanges.

A. The Bouskoura factory: had several sections among them were:

1. Assembly of electromagnetic telephone exchanges for PTT Morocco, the section was to be closed (150 employees) because client was switching to electronic exchanges.

2. Subcontracting assembly to European companies, including electronic subsystems assembly, wiring, cabling etc.

3. Assembly of systems for Thomson - France including, Transceivers, professional communication electronics, navigation aids etc.

4. Assembly of subsystems for Thomson - France including ferromagnetic core memories, hybrid circuits, active filters, miniroping wiring for computers, demagnetizing nodes for colour TV etc.

B. The Ein Sba'a Factory: specialized in packaging and incapsulating semi-conductor components including analogue I.C., transistors diodes, rectifiers, thyristors etc.

The production capacity of the factory in 1982 was:

77,000,000 semi-conductors

13,000,000 relays

900,000 hybrid circuits

20,000 cable for computers

All of it was "exported back" to Thomson - France.

Assessment of Comparative advantage of SFRM: as contrasted with Far East countries and as seen by European companies and by FSRM French management.

1. Final cost in Morocco was much less than can be achieved in Europe and only slightly higher than in Far East.

2. Proximity to Europe, direct and always available and cheap telephone, telex etc. link with designer and customer in Europe, add to it the "common" language, since French was commonly spoken in Morocco.

3. Cheap, direct and always available transport means, even by land via Gibraltar to Europe.

4. Manpower was capable of acquiring important qualifications: trained in short time, disciplined and docile, capable of sustaining European demands in endurance and productivity, though not as much as in the Far East where traditional obedience was overwhelming.

The assessment of the management was that the factory was keeping high standards, even when compared to European factories, in cleanliness, order, organization, efficiency etc.

Assembly of Electronic Systems: The assessment was against having such assembly when contrasted to the Far east.

In systems assembly the quantity was the single major factor in cost, and the Far East had the lead in the market worldwide, on the other hand the Far East had established a tradition of expertise in all levels and types needed for different electronic systems, including the presence of design facilities and components manufacturing within the proximity, which was lacking in Morocco, in the Far East there was a real electronic industrial base where in Morocco almost everything was to be imported.

#### Important remarks

Mission had to note in addition to above-mentioned remarks the following:

Thomson CSF was not packaging micro-processors in Morocco, incapsulating digital and logical I.C. was done in Far East.

The absence of design in SFRM was justified by lack of personnel, (company had been operating since the 1940s)!! and because the economy of operation would not allow it!

Regional co-operation was desired but not practical among the major North African countries though there was an exemption from duty taxes for import between these countries.

### Printed circuits

Mr. Manville mentioned the existence of an advanced lab for manufacturing high quality double faced printed circuits, using thick film technology and metallised holes contacts.

His assessment was that the lab was well equiped up to European standards manufacturing high quality product.

There was no time to visit the lab and he did not have the address either.

#### 8. "Royal Air Maroc" technical service department

The meeting was on December with Mr. Zneiber. The meeting was short due to short notice and occupation of Mr. Zneiber.

Air Maroc had a complete Aircraft Maintenance service facilities not only for own crafts but was contracting the maintenance of European aircrafts also including Air France.

Maintenance Service covered the maintenance of all control systems of crafts, including micro-processors, sensors, micro-computers etc.

The assessment was that RAM had the qualified personnel and the needed equipment. Most qualified personnel were recruited after long experience in Europe and were upgraded in know-how regularly with training programmes locally and abroad.

#### B. Rabat

All visits were on 14 December 1983, they included UNDP, "Institut d'Etude et de Recherche pour l'arabization" (IERA); "Office de developpment industriel" (ODI), IMEG - Rabat, "Centre National de co-ordination scientifique et technologique", (CNCST) and the Ministry of Industry.

##### 1. IERA: the "Institute of Studies and Research for Arabization"

The meeting was with Dr. Safwan Ben Jelloun, head of Computer development at Institute, Consultant to ALECSO on Arabization and Professor of Mathematics and Informatics at the University of Rabat.

The Institute was carrying two programmes on Arabization.

1. Standardization of .entree codes to all types of machines, (computers and transmission of Data), based on simplification of representation of Arabic characters.

2. Terminology, unification of Arabic technical terms, project undertaken in co-operation with Arab League "Office de Co-ordination pour l'Arabization" located in Rabat.

The Institute started its effort as part of Moroccan effort to arabize education and public services, it was a Moroccan Institute part of Rabat University.

The Institute had an on-line link with ESA Computer (European Space Agency) and was acquiring an IBM 4341 to be installed in January 1984.

The Institute was developing a "Data-base" for arabization to be implemented on their computer.

The Institute developed its first bilingual computer terminal in the late seventies, in co-operation with SERTEL of France and with special support from ESA.

IERA was working on a new more advanced bilingual terminal that would include part of the arabization within its hardware, the project was supported by UNESCO, ALECSO, EEC and King of Morocco Fund for Arabization. Expected terminal cost was about \$1,000.

IERA was also developing an Arabized documentation storage and retrieval system, using a bilingual data-base, and the 1976 CODAR-U code.

Institute was reluctant to adopt new "Versions" of ASMO standards before they were finalized and adopted universally.

Institute was also arabizing IRS (Information Retrieval and Storage) of ESA, a "mini ISIS" developed in CANADA using PASCAL.

Institute work on Arabic text treatment and processing was still very preliminary, further effort would have to wait development of preceding steps in hardware and Arabization.

IERA was also developing an Arabic system of "Computer for highschools" supported by IBI to introduce informatics into education.

Mr. Ben Jalloum accepted ECWA's invitation to participate at Kuwait meeting, if expenses were paid, he would present a paper on Institute effort in Arabization and on problem and difficulties faced.

He stated that most difficulties faced in their development efforts were related to procurement of parts, components, catalogues and references, mostly due to Moroccan bureaucracy and restrictions.

2. Office de Developpment Industriel: ODI

The meeting was with Mr. M. Bel-Khayat, director.

Mr. Bel-Khayat mentioned that Mrs Stones and Webster of USA went to his office earlier "to study possible comparative advantage of electronics industry in Morocco" as compared to other countries.

He assumed that Morocco had a good "Technical Team" in Micro-processor-based applications et Rabat University; the team had just started a journal called "Moroccan Journal of Control Computer Science and Signal Processing". Editor was Mr. M. Najim. The Team was undertaking fundamental research with no development of prototype for industrialization.

Morocco had no "National Plan" for Electronics Industries. However, many projects were under consideration, in particular an assembly of Telephone exchanges with Ericsson - Sweden and/or CIT-ALCATEL-France, and assembly of micro-computer with IMEG.

### Role of ODI

To provide economic and marketing studies, incentives for new industries, partial participation in financing (e.g. computer assembly project with IMEG).

Mr. BEL-Khayat mentioned an industrialist of Moroccan origin called Boutaleb Jouti, who had developed in Canada his own computer industry "PROTEC". He was a university prof. and was publishing a book, in French: "Elements de Micro-ordinateurs et du transistors".

### 3. IMEG - RABAT

The meeting was with Mr. Ben Mukhtar, manager and cofounder.

Besides the information collected at IMEG - Casablanca, important information was collected from Mr. Ben Mukhtar.

IMEG was developing "integrated management systems", hardware and software, for many medium and large size industries, e.g. Morocco refinery SAMIR, however they had not gone into computerized process control, or micro-processor-based systems.

It was using system approach to management and informatics and was starting introducing data-base techniques.

It was stressing improved performance and quality control to develop confidence of clients.

IMEG had 2 projects joint with ODI:

1. To develop a public "Computer assistance Centre" in Casablanca in co-operation with UNIDO, aiming, (like centres in UK), to train school drop-outs and to offer consultancy and services for small enterprises. There was a provision of 700,000 Md for the project to start, using IMEG facilities.

2. Assembly of micro-computers for schools, IMEG was looking for a European partner. The expected micro would have to be cheap to serve (a) schools at 82 k bytes RAM with floppy disc drive, costing around 2000 MD, and (b) business at 512 k bytes RAM, with hard disc drive, costing about 40,000 MD. 100 micro/year production was expected for the high level and 300/year for education. Feasibility and technical studies were to be undertaken in 1984.

IMEG was looking to include in their micros capabilities in arabization, bilingual word-processor, sound and form recognition etc.

The project would start procuring all components from abroad with possible manufacturing of certain components later. Expected investment was MD 6 million (\$ 500,000).

4. Centre National de Co-ordination Scientifique et Technique

The meeting was with Mr. D. Bensari and staff.

The centre was supervising about 70 research projects, including many projects in micro-electronics related fields, many of these projects were carried out on premises.

Centre had adequate computing facilities, developing own software, for such applications as management, accounting and scientific research. Centre was developing a scientific and technical data-base for Morocco.

Centre succeeded in recruiting and "harboring" a large pool of qualified scientists and researchers in microelectronics and informatics many had long experience in advanced institutions abroad.

Centre was having difficulties in:

- procuring equipment
- providing finance
- procuring components, cataloging and references.





5. Ministry of Industry

The meeting was with Mr. M. Hilia assistant director at the "Direction de l'industrie" of Electricity and mechanical services.

The meeting was a short review of electronics industries in Morocco. Information provided did not add to what was stated elsewhere. No special incentives were provided for electronics industries but some encouragement for all newly established industrial projects.