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**COMPUTERS FOR
INDUSTRIAL MANAGEMENT IN AFRICA:
THE CASE OF COTE D'IVOIRE**

V.90-83104

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Preface

The Regional and Country Studies Branch of UNIDO is carrying out a study of the use of computers for industrial management in Africa. It focuses on the present levels of computer usage of this kind, and looks at the obstacles to a wider use. The study is intended to contribute to the development of technical assistance programmes and enhanced international co-operation in this field.

The management use of computers encompasses traditional applications such as payroll, accounts, stock keeping, etc. In other countries the computer has proved a useful tool in increasing the efficiency and accuracy of such tasks and contributing to the effectiveness of the management function. Its role in industry in Africa is potentially very important. However, obstacles to a wider use in Africa are many, and include both economic and technical factors. The study attempts to provide an overview of these.

As part of the whole study, several analyses are being made of individual African countries. The present study examines the case of Côte d'Ivoire.

The study has been prepared by Mr. Kouassi Kra of the Secrétariat Général à l'Informatique (SGI) as consultant to the Regional and Country Studies Branch of UNIDO.

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PART ONE: CURRENT COMPUTER USE IN INDUSTRIAL BUSINESS MANAGEMENT

I. INTRODUCTION

I.1 Industry in Côte d'Ivoire

Côte d'Ivoire industrialization strategies

Côte d'Ivoire is one of the most industrialized countries in sub-Saharan Africa (SSA). Industry has contributed over 23 per cent of GDP, and manufactures account for over 10 per cent of total exports - an extraordinary high level for SSA. The country has experienced remarkably high and steady growth of its manufacturing sector during most of the post-Independence period. Thus from 1960 to 1985, the manufacturing sector expanded by an annual average of 9 per cent, amongst the highest in SSA. During the decade of the 1980s, however, the sector has been adversely affected by a series of both internal and external shocks, especially falling international prices for its major exports, cocoa and coffee. As a result, domestic demand for manufactures has fallen sharply, as has demand for processed agricultural exports, upon which the manufacturing sector is critically dependent. Thus, the sector has experienced significant, although atypical, contraction in the post-1987 period.

Industrial expansion during the past three decades has been assisted by a number of key factors. These include a climate of political stability, sustained demand for processed agricultural products, the expansion of a supportive physical and financial infrastructure, and an effective welcoming policy towards private foreign investment. During the late 1960s and 1970s, Côte d'Ivoire was one of the most important countries of SSA in terms of foreign inflow (largely, but not exclusively, from France). Investment levels in manufacturing remained high throughout the period to the mid-1980s, boosted additionally by buoyant levels of government revenue (especially during the end of the 1970s) from the country's agricultural marketing boards.

Recent attempts further to open the economy to international competition, to reduce the country's dependence upon exports from the primary sector, together with yet more encouragement of foreign investment provide the context for significant and expanded potential for computer usage into the 1990s. This should be enhanced by the absence of restrictions on the import of both hardware and software, as well as manpower regulations which allow expatriates to enter the country to engage in computer skills training.

I.2 Level of computing development

In order to assess the development of computing, one must look at Côte d'Ivoire in relation to the rest of the world. By reference to the United Nations classification with four different levels of computing development, namely initial, elementary, operational and advanced, Côte d'Ivoire is clearly well launched into the operational stage.

The countries which have achieved the operational level in computing possess institutions providing education and training in this subject,

some of which grant formal qualifications in certain specialist areas. When this stage has been reached, the Government is not dependent merely on the manufacturer's representatives because the public and private sectors have attained a very high level of understanding of computing and the various departments can be trained by the specialists operating the many small, medium and large computer installations in the country. Apart from commercial applications, computers are used in fields such as science, engineering and medicine. These activities require the design, development and production of software, as well as the manufacture of certain items of hardware.

Computing in Côte d'Ivoire comes under the aegis of the Commission Nationale pour l'Informatique (CNI) and its executive organ, the Secrétariat Général à l'Informatique (SGI).

The role of the CNI is:

- to study and propose to the Government the main lines of a national informatics policy, in conjunction with the National Social and Economic Development Plan (PNDES);
- To give its views, with a statement of reasons, on the national informatics plan and the studies carried out in connection with its implementation;
- To give an opinion on all files, surveys, reports or achievements in the area of informatics;
- To encourage or recommend all projects, surveys and programmes in the area of informatics and associated technologies.

However, the harmonious development of informatics also presupposes the existence of a body which can give impetus to and promote the sector by ensuring proper co-ordination. This is the role of the Secrétariat Général à l'Informatique (SGI):

- To promote the informatics sector and to monitor the coherence of progress achieved by the State and its compliance with the objectives of the plan;
- To assist in the establishment of management and guidance facilities at computer centres;
- To render technical and financial support to pilot projects adopted by the CNI;
- To assure the executive supervision of work connected with interministerial or national projects.

The implementation of this policy, focusing on system decentralization, should make an effective contribution to national development, particularly through better programming of activities and more rational distribution of resources.

II. COMPUTING: INDUSTRIAL MANAGEMENT TOOL

II.1 Form of the survey

A survey was made of about 40 enterprises active in industrial production in Côte d'Ivoire. These 40 industrial enterprises were selected at random in each branch of production.

The survey therefore complied with the terms of reference and the questionnaires received by the consultant from UNIDO.

Some manufacturers and administrators responsible for co-ordinating computing in Côte d'Ivoire were interviewed.

II.2 Hardware

The hardware varies depending on the size and field of activity of the enterprise. The survey distinguished three systems, namely large systems, mini-systems and microcomputers.

II.2.1 Large systems

These are marketed principally by IBM, Bull and Unisys.

Of the sample of 40 industrial enterprises, 23 per cent use large computers. IBM has the largest share of the market with 46 per cent, followed by Bull with 33 per cent and Unisys (Burroughs) with 21 per cent.

This breakdown proves to be justified from all viewpoints - combining all economic and administrative activities. The 1986-1990 National Informatics Plan (PNI) indicates the following figures:

| | |
|--------|-------------|
| IBM | 45 per cent |
| Bull | 26 per cent |
| Unisys | 18 per cent |
| HP | 4 per cent |
| NCR | 2 per cent |
| Others | 5 per cent |

The IBM systems used are the 43 XX range and the top-of-the-range configurations of the IBM 36 and the IBM 38. The Unisys systems used are the B6800 and B2/3900.

II.2.2 Mini-systems

This sector is dominated by three manufacturers, with IBM clearly in the lead. IBM's share of the equipment used by the sample studied is 55 per cent, followed by Unisys with 20 per cent and Bull with 17 per cent.

This category includes the Bull DPS 6 and 7, followed by the IBM compact 36.

II.2.3 Microcomputers

These are mainly 8 bit, 16 bit and 32 bit microprocessors, the majority being in the first two categories. Nearly all (95 per cent) are professional single-station machines and 5 per cent are multi-station facilities (IBM 60 and Sharp 5600A ...).

In our sample, IBM is a long way ahead with 45 per cent, followed by Compaq (15 per cent), Bull (13 per cent), Wang (10 per cent), Goupil (5 per cent) and Olivetti (4 per cent).

Any appraisal of the microprocessing market requires consideration of all sectors of activity. The proportion it represents is currently diminishing appreciably, and is now around 23 per cent for IBM and 11 per cent for Bull. Other manufacturers are penetrating the market and have some good selling points: Goupil-SMT and Macintosh (Apple) have a considerable share of the Ivorian market.

II.2.4 The hardware population

The age of the hardware

Table 1. Age of hardware

| Age | Percentage |
|----------------------|------------|
| Less than five years | 45 |
| Five to 10 years | 42 |
| More than 10 years | 13 |

Source: Current survey data 1989.

The largest proportion of the hardware is less than five years old. This may reflect an enhanced awareness among the administrative departments responsible for the data processing development policy in Côte d'Ivoire, which has led to the purchase of many items of computer hardware in the past five years - particularly microcomputers which are currently experiencing a veritable popularity boom.

Ivorian industrial enterprises use more microcomputers than large- or medium-scale systems, because they are generally concerns of small or medium size. Only the large companies, such as EECI, Blohorn, CIPA/GMA, Textiles de Confreville, Solibra, Sir and others, use large-scale (mainframe) data processing systems.

The current trend in computing, explained in the second part of this document, is focused on microprocessing which is undergoing explosive expansion. As we have said, the size of the hardware depends firstly on the dimensions of the enterprise, and secondly on the enterprise's true activity.

As an indication here are the various key figures in the informatics plan regarding computer hardware for 1985.

Hardware

Table 2.A Sectoral breakdown of computer equipment in Côte d'Ivoire
(number of systems and value as at 1 January 1980)
(value in millions of CFA francs)

| Class of system | Public sector | | Private sector | | Total | |
|--------------------------|---------------|-------|----------------|--------|--------|--------|
| | Number | value | Number | value | Number | value |
| Small and medium systems | 42 | 3,645 | 141 | 9,955 | 193 | 13,600 |
| Large systems | 9 | 2,210 | 21 | 5,250 | 30 | 7,460 |
| Total | 51 | 5,855 | 162 | 15,205 | 213 | 21,060 |

Source: National Informatics Plan 1986-1990.

N.B.: This survey was restricted to computers with a central unit value of more than 15 million CFA francs.

Table 2.B Sectoral breakdown of computer equipment in Côte d'Ivoire
(number of systems as at 1 January 1985)

| Class of system | Public sector | | Private sector | | Total | |
|----------------------------|---------------|------|----------------|------|--------|---|
| | Number | % | Number | % | Number | % |
| Professional micro-systems | 170 | 21.7 | 615 | 78.3 | 785 | |
| Small and medium systems | 45 | 12.3 | 322 | 87.7 | 367 | |
| Large systems | 19 | 26 | 54 | 74 | 73 | |
| Total | 234 | 19.1 | 991 | 80.9 | 1,225 | |

Source: National Informatics Plan 86-90.

Table 2.C Average system values^a
(values in millions of CFA francs)

| Class of system | Public sector | Private sector |
|---------------------------|---------------|----------------|
| Professional microsystems | 5 | 5 |
| Small and medium systems | 75 | 50 |
| Large systems | 250 | 200 |

a/ The cost differences arise primarily in the peripheral units surrounding the computer's central unit.

Source: National Informatics Plan 1986 - 1990.

Table 4. Age of equipment in 1985
(all sectors combined)

| Year of installation | Percentage |
|----------------------|------------|
| 1980 and before | 31 |
| 1981 | 12 |
| 1982 | 18 |
| 1983 | 19 |
| 1984 | 20 |

II.2.5 Maintenance

Maintenance is carried out on a contractual basis. The local distributors maintain the equipment they sell. Most of the subjects approached therefore have no maintenance problem. Even subsidiaries of multinational enterprises that have bought equipment abroad sign maintenance contracts with the local distributors.

It is worth noting that 95 per cent of hardware is bought from computer equipment manufacturers present in Côte d'Ivoire.

II.3 Human resources

II.3.1 Computer personnel in industry

Ninety-seven per cent of the industrial enterprises state that it is easy obtain the staff needed by their data processing departments for their computer centres.

Indeed, 83 per cent indicate that it is a simple matter to recruit a data processing engineer in Côte d'Ivoire.

Regarding programmer analysts, it is clear that these are available when they are required by an enterprise for development purposes. The same applies to operators.

Engineers represent 21 per cent of the population studied. Systems engineers are available because most of them work for the equipment distributors or manufacturers.

Programmer analysts represent only 16 per cent of our sample. The small- and medium-scale industries prefer microcomputing in which there are numerous software packages that can be handled by people who are not data processing experts. Far more programmer analysts are found in the computer engineering service companies.

Operators represent the most numerous category. The big companies practising large-scale data processing are the major employers.

The various personnel strengths are indicated in table 3.

Table 3. Computer personnel in our sample

| Personnel | Number | Percentage |
|---------------------------|--------|------------|
| Design engineers/analysts | 29 | 21 |
| Systems engineers | 1 | 1 |
| Programmer analysts | 22 | 16 |
| Operators | 83 | 62 |
| Total | 135 | 100 |

Source: Current survey data, 1989.

II.3.2 Training received by personnel

The universities and colleges in Côte d'Ivoire and abroad (INSET and INIG in Abidjan) are the principal training centres. Sixty-six per cent of engineers (all categories) are graduates of the universities and colleges.

There are some staff (17 per cent) who have qualified as engineers as a result of in-house training. There are also 17 per cent who have obtained this qualification from the computer hardware manufacturers' training centres.

Fifty-six per cent of programmer analysts are graduates of the universities and colleges. In this category there are slightly higher levels of in-house training and training by manufacturers.

As regards operators, it must be said that the data typists, console operators and even programmers are only trained by the manufacturers and companies (see table 4).

Table 4. Places where the computer staff of industrial enterprises receive training

| Training | In-house | By manufacturer | Universities and colleges |
|---------------------|----------|-----------------|---------------------------|
| Engineers | 17% | 17% | 66% |
| Programmer analysts | 22% | 22% | 56% |
| Operators | 50% | 50% | |

Source: Current survey data, 1989.

All of these points will be covered in the second part of this document which analyses the prospects for and obstacles to computing development.

II.4 Software and applications

The sample studied shows that 13 per cent of industrial enterprises sub-contract their work to computer engineering service companies. Ten per cent of them use no computer processing. These non-computerized companies handle all their data manually.

This therefore leads one to ask the computerized companies about their applications and the software they use to process their data.

II.4.1 Software and software packages

Apart from their "made to measure" applications, most industrial enterprises use data base management systems software packages (INFORMIX, ORACLE, DBASE), integrated software, text processing, spreadsheets and other software on microcomputers to analyse some data which are not included in their large-scale applications.

II.4.2 Applications

The applications developed are highly traditional. Bookkeeping, personnel and payroll management and stock control are widely computerized. They account for 81 per cent, 71 per cent and 74 per cent respectively of all applications in the enterprises in question.

Product quality control applications are developing slowly. They represent 23 per cent in the entire group studied. It is natural that it should be the large companies which use such very costly methods that are beyond the reach of small- and medium-scale concerns - see table summarizing all the computerized applications to be found in industry in Côte d'Ivoire.

Moreover, very few companies use robotics in their production processes.

Table 5. Computerized applications

| Applications | Percentage |
|----------------------------------|------------|
| Personnel and payroll management | 71 |
| Stock control | 74 |
| Invoicing control | 52 |
| Bookkeeping | 81 |
| Production control | 31 |
| Product quality control | 23 |
| Automated production | 11 |

Source: Current survey data, 1989.

The applications sub-contracted to computer engineering service companies involve bookkeeping, invoicing and stock control for non-computerized industrial enterprises.

The following table indicates the mode of development of the applications and the type of processing used.

Table 6. Type of processing used

| Type of processing | Percentage |
|--------------------|------------|
| Batch | 35 |
| Partly on-line | 39 |
| Completely on-line | 26 |

Source: Current survey data, 1989.

The answer to the question whether enterprises prefer to evolve their applications in their own departments or to acquire them from computer engineering service companies (software packages) is given in the following table:

| Applications | In-house (per cent) | Software packages from computer engineering service companies (per cent) |
|---------------|------------------------|---|
| Payroll | 60 | 40 |
| Bookkeeping | 51 | 49 |
| Invoicing | 56 | 44 |
| Stock control | 66 | 34 |
| Other | 58 | 42 |
| Total | 58 | 42 |

Source: Current survey data, 1989.

Fifty-eight per cent of applications are apparently developed by the enterprises' own data processing departments. Enterprises have the necessary people to do this. The large number of enterprises in the sample in favour of having the work done by computer engineering service companies or by purchase of software packages is due to the use of microcomputers by many of these companies.

The following table, relating to the National Informatics Plan 1985-1990, is given by way of example.

Table 7. Mode of development of applications (1985)
National Informatics Plan 1985-1990
 (in per cent)

| Applications | In-house | Purchase (computer engineering service companies - software packages) |
|---------------|----------|---|
| Payroll | 59 | 41 |
| Bookkeeping | 55 | 45 |
| Invoicing | 69 | 31 |
| Stock control | 70 | 30 |
| Other | 69 | 31 |
| Total | 64 | 36 |

Source: Informatics Plan 1986-1990.

The bulk (two thirds) of the applications are apparently developed by the enterprises' own data processing departments.

II.5 Networks

About 9 per cent of the industrial companies questioned used networks. This low level of network use is explained by the fact that the enterprises are of modest size, with only a few dozen staff. In only one case is shared data used. It should also be noted that it is the large industrial enterprises that possess such computing resources.

II.6 Environment

The answers concerning the environment refer to problems connected with the climate, electricity supply and telecommunications.

II.6.1 Climatic problems

The survey revealed that the problems of the physical environment relate essentially to the climate. Many of the subjects questioned mentioned temperature, humidity and dust. They consider that appropriate equipment could help them to eliminate the difficulty. However, this would be more expensive for them.

II.6.2 Electricity supply

More than 39 per cent of the industrial companies believe that the electricity supply is the cause of considerable data losses. The better-endowed, generally the largest, enterprises thus regularly equip themselves with hardware with automatic safeguards. This does not lie within the reach of all enterprises, most of which are rather short of resources.

II.6.3 Telecommunications

Thirty-four per cent of the group studied mentioned telecommunications as an obstacle to the use of distributed or shared data processing. This problem is connected with the telecommunications infrastructure and real time data transmission.

PART TWO: PROSPECTS FOR COMPUTING AND OBSTACLES TO ITS DEVELOPMENT

I. Current trends in the use of computers

The use of data processing reflects two trends:

I.1 Modernization of centralized computing

We are today witnessing the modernization of data processing, reflected in the change-over from batch-type centralized data processing to decentralized on-line processing. In the industrial sector, large-scale enterprises all have batch applications, but they are only just beginning to make partial use of on-line processing. Their aim is to have completely interactive applications. In the administration, the switch from batch-type to totally interactive applications is well under way.

This modernization is encountering some difficulties:

- **Human resources:**
The need to bring Ivorian computer technicians up to the necessary level of expertise because, in the absence of a proper ongoing training policy, they have difficulty in following technological progress in computing.
- **Financial resources:**
Côte d'Ivoire, like all developing countries, is undergoing a serious economic recession, bringing about a reduction in investments that affects the modernization of computing.
- **The technical and economic characteristics of computer users:**
The development of data processing is influenced by the fact that most enterprises are subsidiaries of multinational companies and their data processing systems, directly transplanted by the parent company, do not evolve.

I.2 The boom in microcomputing

I.2.1 The microcomputing market

The development of microcomputing should be examined closely because of its considerable expansion in comparison with large-scale computing.

Development of microcomputing

The microcomputer market is undergoing full commercial, technological and structural development. Any national policy involving the widespread use and a fortiori the production of microcomputers must necessarily be related to the powerful factors which will modify the economic conditions of this market in the coming years.

Microcomputers are data processing systems designed around one component, a microprocessor, which integrates the functions of the central unit of a computer. Their development is closely connected with advances achieved in microprocessors. Such advances have an impact on the microcomputer market, with regard to both the power of the hardware and the types of software.

The success of microcomputers lies in their ability to bring the power of data processing directly within the reach of the end user. In certain applications they can advantageously replace the terminal traditionally connected to a central computer.

The main applications of professional microcomputers are:

- Bookkeeping (particularly for small and medium-scale enterprises);
- Text processing and file management;
- Processing of tables and financial forecasts.

The microcomputer market is undergoing extensive rationalization and concentration of the means of production. Consequently, the optimum minimum level to guarantee the competitiveness of a manufacturer is continuously rising. Manufacturing on a large scale makes it possible to satisfy the cost and reliability requirements of the market.

Increasing the scale of production affords the opportunity to benefit from economies of scale and to render investments in production and testing automation worthwhile - two factors which enhance profitability, reliability and, therefore, competitiveness.

With reference to components, standardization comes into play, as clearly shown by IBM's recourse to external supplies for their PC microprocessors (INTEL) and disk readers (TANDON).

Size of the microcomputer market

The microcomputer market, which was virtually non-existent in 1981, has developed rapidly in the past three years: 1988 deliveries in all categories were more than three times those made in 1983, indicating how the market has really taken off.

Market breakdown by user class

The following features are apparent:

- Predominance of the small and medium-scale enterprise and industry sector;
- Significance of the enterprises which have begun to equip themselves with distributed data processing systems;
- Weakness of the administration which, however, represents considerable potential.

Presence of manufacturers - distribution structure

The presence of the microcomputer manufacturers on the Côte d'Ivoire market is very diversified, even completely haphazard.

More than 35 distributors are present, representing almost as many makes and more than 50 models. Most of them, with little or no technical organization (software and maintenance), have disposed of only a few machines without serious service back-up, and their area of influence barely extends beyond the immediate outskirts of Abidjan.

Table 8 indicates the position of the leaders on each of these markets.

Table 8. Position of the leaders on the national market in all sectors of activity

| Type | Manufacturer | Market share |
|--------------------------------------|---------------------------------------|-------------------|
| Personal | APPLE | 25% |
| | SHARP | 15-20% |
| | TANDY | 15-20% |
| | OTHERS (10 makes) | 40% |
| Professional single-station machines | IBM | 15% |
| | GOUPIL-SMT | 15% |
| | BURROUGHS | 15%* |
| | MACINTOSH | 10% |
| | HP | Between 5 and 10% |
| | WANG | 10% |
| | BULL-MICRAL | Each less than 5% |
| | SHARP | 5% |
| Professional multi-station machines | OTHERS (CROMENCO-NCR OLIVETTI-DG ...) | 5% |
| | BURROUGHS | 30% |
| | THOMSON | 25% |
| | WANG | 15 to 20% |
| | BULL-MICRAL | 15 to 20% |
| OTHERS (ALTOS ...) | 15 to 20% | |

Medium-term market prospects (horizon)

The on-the-spot survey revealed a convergent set of arguments, often specifically related to the situation in Côte d'Ivoire, which make it highly likely that microcomputing will continue to develop at an accelerated rate.

(a) Potential users initially turning to microcomputing because the microcomputer is tailored to the often modest scale of Ivorian economic activity are:

- Large industrial and tertiary sector organizations wishing to achieve administrative dispersion;
- Administrations, which are attracted by the importance of the constituent local or regional decentralized units and by the policy reflected in the National Data Processing Plan.

(b) This natural tendency is reinforced by external factors:

- The dynamism and hard-sell approach of microcomputer salesmen;
- The political decision of the Côte d'Ivoire Government to favour this form of computing in future;

- The absence of a remote data processing or telematics alternative, since the telecommunications network in Côte d'Ivoire does not lend itself to this form of development;
- The favourable reception and the open-mindedness shown by enterprise heads or specialists and employees in Côte d'Ivoire for microcomputing.

Microcomputer deliveries between 1988 and 1990 could be in the region of:

4,300 to 7,000 machines (excluding microcomputers for home use), including:

- * 2,500 to 3,000 in small and medium-scale enterprises and industries
- * 700 to 1,000 in large enterprises
- * 1,100 to 2,500 in the administration and its ancillary departments.

However, considering the plan to introduce data processing in the education system (I2SE), the number of microcomputers could increase by over 1,000 units per annum over a certain period.

Although the "ranges" announced by the enterprises are relatively narrow, the discrepancy in the administrative forecast needs to be explained:

- The "high" hypothesis reflects the political decision of the Government to give strong impetus to the use of microcomputing and to the microcomputer industry, together with the application, as from 1985, of a vigorous equipment acquisition policy;
- The "low" hypothesis reflects, firstly, the initial delay by the administration (compared with other sectors) in the use of microcomputing and, secondly, the fact that the envisaged establishment of a local industry could initially be a delaying factor.

In all, the two hypotheses indicate respectively:

- Annual deliveries in 1990:

- * 1,450 machines (low hypothesis)
- * 2,600 machines (high hypothesis)

- Total number of machines installed by the end of 1990:

- * 5,300 machines (low hypothesis)
- * 11,000 machines (high hypothesis).

Pricing

Microcomputer prices vary depending on their configuration and on the different levels of duty on the import of computer hardware.

(a) Price of a microcomputer for a minimum configuration:

PS - 30 IBM: 1,860,560 CFA francs all inclusive

PS - 70 IBM: 3,806,875 CFA francs

PS - 80 311: 7,038,750 CFA francs.

(b) Price comparison with European countries

The fact that Côte d'Ivoire does not possess a microcomputer assembly industry renders it vulnerable to imported hardware. The prices demanded in France, for example, are generally half those in Côte d'Ivoire. These high prices are the result of the additional charges - delivery, customs duties and value added tax. However, there are no special regulations to prohibit the import of computer hardware. The Ivorian market is open to any manufacturer who wishes to set up shop.

I.2.2 Anticipated trend in the machine population, 1985-1990
(Units)

| Class of system | Public sector | | | Private sector | | | Total sectors public and private | | |
|------------------------------|---------------|------|------|----------------|------|-------|-------------------------------------|------|-------|
| | 1984 | 1985 | 1990 | 1984 | 1985 | 1990 | 1984 | 1985 | 1990 |
| Professional microsystems | 170 | 221 | 1600 | 615 | 1046 | 10000 | 785 | 1267 | 11600 |
| Small and medium systems | 45 | 48 | 115 | 322 | 386 | 960 | 367 | 434 | 1075 |
| Large systems | 19 | 19 | 24 | 54 | 56 | 64 | 73 | 75 | 88 |
| Total | 234 | 288 | 1739 | 991 | 1488 | 11024 | 1225 | 1776 | 12763 |

Source: National Informatics Plan, 1986-1990.

The 1990 projection has therefore been calculated on the following bases:

- Micro-systems + 60 per cent per annum
- Small and medium systems + 20 per cent per annum
- Large systems + 5 per cent per annum (in this category the public sector figures take account of the equipment plans included in the guidelines for each ministerial department).

I.3 Large-scale (mainframe) computing

Analysis of the sample of 40 industrial enterprises studied indicates that the trend is not towards large-scale computing. None the less, it should be noted that only the large enterprises such as CONFREVILLE (Bouaké), EECI (Abidjan), BLOHORN and CAPRAL use mainframe computers, accompanied by microcomputers that are used for specific applications or converted into intelligent terminals.

Furthermore, in view of the needs of the large ministerial departments, the administration will continue to practice large-scale data processing.

As already mentioned, the slowing down in the rate of investment has a considerable impact on the country's industrial activity, a situation which is not conducive to the development of large-scale computing.

With reference to the different market shares of each manufacturer, IBM has the lion's share with nearly 44 per cent, followed by Bull with 32 per cent.

II. Training

Computers have now penetrated all areas of human activity. This penetration, facilitated by the ease with which one can obtain a computer, may be compromised by the complexity of studying and implementing applications.

Consequently, computer systems are becoming more user-friendly, whereas their design requires people with an ever-rising and ever more versatile degree of technical expertise.

The success of computerization in a country therefore depends on the extent to which it possesses the human skills to implement the applications.

However, the unceasing development of data processing in the various sectors of economic and social activity means that computing, for a long time the preserve of experts, is now everyone's concern. Apart from its introduction into the home, it has an appreciable impact on all jobs.

Those who are today embarking on a career will participate in these developments at all levels of the hierarchy.

It is thus to be expected that training in this new discipline will be made available to all in order to alleviate the problems faced by our enterprises and administrations.

Education in computing is provided by the Ministry of Technical Education and Vocational Training, in conjunction with the Secrétariat Général à l'Informatique (SGI).

II.1 Training provided in Côte d'Ivoire

The training courses provided in Côte d'Ivoire are all focused on management.

The categories are:

- Programmer analysts
- Management computing engineers.

II.1.1 Programmer analysts

Programmer analysts are trained by the Higher Computing Institute (ISI), an establishment which forms part of our big National Higher Technical Education Institute (INSET). It offers a three-year course leading to a management computing programmer analyst diploma. There are 30 graduates each year.

II.1.2 Management computing engineers

For the most part, the first management computing engineers were trained by the National Management Computing Institute (INIG) in Paris, under the aegis of the French Institute of Management (IFG), which had been specifically commissioned by the General Data Processing Secretariat for an initial period. This training lasts two academic years and is open to all students holding a master's qualification in any higher education discipline. Considering the needs of the administration and private enterprises, the annual intake is between 16 and 30 designers.

INIG has fulfilled its task and INSET is now responsible for the training of management computing engineers. It admits holders of the DUES or DEUG and trains them for three years to obtain the diploma of management computer engineer.

II.2 Training not provided in Côte d'Ivoire

As can be seen, there is no framework for the training of specialists in the following areas:

II.2.1 Hardware specialists whose job is to keep computers in good operating condition. The lack of such people causes the maintenance problems encountered in many developing countries which have purchased machines. If there are no local and national technicians who are not employed by the manufacturers, enterprises are at the mercy of the manufacturers who make them pay for a service which is not always of adequate quality.

Côte d'Ivoire is aware of this problem and has just begun to train maintenance technicians at INSET. The target is 15 graduates each year.

II.2.2 Systems specialists

Their main role lies with the use of computers. Many data processing centres continue to approach computer manufacturers to implement and update operating systems.

There are some Côte d'Ivoire nationals who possess this qualification and have been trained in American or European schools or sometimes by the manufacturers for their own requirements.

II.2.3 Scientific computer specialists

These are responsible for the development of scientific applications in various areas or operate tools involving forecasting mathematics, the various aspects of operational research, etc.

II.2.4 Industrial computer specialists

Their role is to establish the computerized running of industrial processes. They use the same tools as the scientific data processing specialists and have an important part to play in the operation of certain industries.

It should be noted that the training of console operators and data typists is provided either by the computer manufacturers or by the computer engineering service companies.

However, the annual figure of 30 trained programmer analysts and engineers is not enough to satisfy the requirements of the administration. The African Data Processing Institute (IAI) at Libreville in Gabon, of which Côte d'Ivoire is a member, has agreed to train seven engineers and seven programmer analysts from Côte d'Ivoire each year.

There will also be other specialists trained by schools in America, Canada, France and (elsewhere in) Europe.

In any case, Côte d'Ivoire intends to make arrangements to cope with these various requirements.

II.3 Training structures

II.3.1 Specialists

The essential aim of training is to provide the country with the necessary human resources for the harmonious and effective development of computing.

Although it is difficult to lay down fixed training programmes, it is none the less possible to envisage the main outlines of an organization capable of satisfying all computer training requirements and tailored to the country's data processing objectives and political options.

The policy to be adopted by the partners involved in computer training should make it possible:

- To control the timing and content of training programmes so as to adapt them to the country's quantitative and qualitative needs;
- To ensure the distribution of specialists in accordance with priorities and requirements;
- To render the instruction provided more practical and to bring it closer to the real problems encountered by organizations by promoting contacts between trainers and employers;
- To make savings in resources (financial, material and human).

There are two aspects to the overall structure of training for data processing specialists:

- Initial training;
- Ongoing training.

(a) Initial training

In order to provide Côte d'Ivoire with young specialists at all levels of qualification, the initial training structures will focus on:

- The training of computer engineers;
- the training of analyst engineers;
- the training of senior technicians;
- the training of operating technicians;
- the training of technical and commercial specialists;
- the training of maintenance technicians.

The training structure for computer engineers:

This structure is designed to train the senior engineers needed by the Ivorian computer industry.

It involves two main options:

- Management data processing;
- Industrial and scientific data processing.

The training will be provided by INSET.

The training structure for holders of a master's qualification in computing (analyst engineers):

This structure will be designed to train holders of a master's qualification in computing who wish:

- To pursue their studies with a view to obtaining a doctorate in computing;
- To teach computing in schools and colleges after undergoing teacher training at the National Pedagogical Institute for Technical and Vocational Education (IPNET);
- To be employed immediately as analyst engineers in enterprises and administrations.

The training will involve two options:

- Management data processing;
- Industrial and scientific data processing.

The training structure for senior technicians:

This structure will be designed to train senior computing technicians. It will deal essentially with the training of programmer analysts.

The training cycle will last for two years, in line with that of all senior technicians.

The objective of this training is to provide the computer industry in Côte d'Ivoire with staff who are able to master - and possibly take charge of - computing techniques. The persons concerned must be immediately operational, and at the same time sufficiently flexibly-minded to adapt to developments in their field.

The training structure for operating personnel:

Such a structure must be based on a data processing centre, whose availability would appear to be essential in the national data processing development strategy.

Since the training of this category of personnel is essentially a matter of applied training, it involves constant handling of hardware. Since it would be very expensive to operate machines solely to teach trainees how to handle them and without their producing any actual output, this training must be associated with a data processing centre.

The training structure for technical and commercial specialists:

This structure will be designed to train the technical and commercial specialists needed for the computer industry in Côte d'Ivoire and will have two parts:

- Knowledge of sales techniques;
- Knowledge of computer hardware and software.

The knowledge of sales techniques could be acquired through a business school, whereas the knowledge of computer hardware and software would require the participation of the manufacturers.

The training structure for maintenance specialists:

Despite the difficulties in establishing a full typology of computer maintenance situations, some examples may be given to demonstrate the diversity encountered.

Maintenance of large and medium computers follows two main lines: there is an increasing amount of first-level maintenance, involving the replacement of defective standard components and assisted by the computer itself, and far more complex maintenance involving a knowledge both of the sophisticated operation of the equipment and of the basic software. The latter type of maintenance can only be carried out by a few very high-level specialists not working on the spot (remote maintenance).

the manufacturers and distributors of computer peripherals do not have the resources of the large computer manufacturers and thus cannot invest heavily in the training of maintenance technicians.

The microcomputer and remote processing peripherals market is a mass market. This market is gradually tending to resemble the automobile and domestic electrical appliance markets. Trouble shooting is carried out by technicians who do not necessarily work for the manufacturer and who are capable of working on different types and different makes of equipment.

However, in the case of cheap hardware, it is no longer economic to call out a maintenance technician to deal with a breakdown.

Some 15 years ago, the annual maintenance cost for an item of hardware represented 6 to 8 per cent of its purchase price -today it has risen to 15 per cent.

If this trend continues, the annual maintenance cost for an item of hardware will eventually be greater than the purchase prices. This is why increasing use is made of self-diagnosis techniques to deal with malfunctions and for emergency assistance, with the repair being made subsequently. This implies an approach to maintenance that is completely different from the current one. It would be necessary to secure increased participation by users and to establish multi-level maintenance circuits.

Maintenance technicians are currently trained by INSET in close conjunction with the manufacturers. This arrangement will thus need to be strengthened.

Training structure for instructors and researchers:

It should be remembered that university or college instructors and researchers are computer engineers or analyst engineers who also hold a higher qualification (doctorate).

Teachers in secondary educational establishments hold a master's diploma in data processing and have undergone teacher training at the National Pedagogical Institute for Technical and Vocational Education (IPNETP).

The instructors and researchers in other disciplines are themselves data processing users and their job structure will thus provide them with training.

There is no private centre (private school) competent to provide initial computer training.

Nevertheless, there exists unsupervised training of analysts and engineers by local private centres. The administration is aware of the problem raised by this kind of training and has decided to dissuade parents who wish to have their children trained in such centres.

(b) Ongoing training

The ongoing training structure will offer two types of training - to those wishing to consolidate their knowledge of the computing techniques they currently use, and to those who wish to expand their knowledge of data processing in a field other than that in which they are at present working.

Science and technology are currently developing so fast that it is impossible to cover all aspects in initial training courses. While retaining their traditional characteristics, schools must therefore "learn to learn".

Data processing is not a field in which one can allow one's knowledge to remain static because it can very easily become out of date and ineffective. Moreover, it is not unusual for enterprises to expect their computer experts to devote 10 per cent of their time to ongoing training.

This training covers technical updating, further training and professional advancement.

Ongoing training must:

- Provide Côte d'Ivoire with a permanent supply of national computer experts who are abreast of new technologies and in a position to implement them;

- Enable national computer experts to advance in their careers;
- Enable computer professionals to carry out applied research, submit theses and acquire recognized qualifications;
- Permit specialization in data processing at all levels of qualification, including doctorate level;
- Enable working specialists to develop their knowledge further and enhance their technical expertise.

With regard to specialization at all levels, Côte d'Ivoire must establish a system capable of providing, by appropriate courses, training which leads to recognized qualifications granted under the same conditions as those governing initial training.

The ongoing data processing training structure will be under the aegis of the CNI and the practical arrangements will be the responsibility of the Ministry of Education and Scientific Research.

The training courses will be organized by a centre for ongoing computer training, in association with other partners (enterprises, computer engineering service companies, manufacturers, training organizations, etc.).

III. Actual conditions of use

There are constraints imposed by the physical environment and those imposed by the economic and social structure.

III.1 Geophysical constraints

The physical environment problems are primarily connected with the climate. In Côte d'Ivoire, as in many developing countries, work has to proceed under conditions of temperature, humidity and dust far more severe than those with which we are normally familiar. This aspect has so far received little attention because highly centralized data processing involved large processing centres. The relative cost of equipment for the sites, considered essential in any region of the world, was thus modest compared with the cost of the data processing system itself, even if it had to cope with the most severe conditions. The problem now is generated by the possibilities of dispersion concomitant with the development of products and applications.

All equipment - terminal, data capture unit or microcomputer - put into service without protection is liable very rapidly to break down and suffer serious damage. The comprehensive installation of air-conditioning units not only adds to the overall cost, but also considerably reduces the possibilities for use.

III.2 Electricity supply

An initial difficulty concerns the power supply. In industrialized countries all computer staff are familiar with the problem of minor power failures. However, in virtually all developing countries there are sometimes long-lasting and often frequent power cuts which bring work to a standstill and may cause serious data loss. Hours of operation can thus be nullified,

not to speak of the need to establish thorough safeguards without which a power cut can become a catastrophe for the department concerned.

This is a familiar problem in third world countries and the search for a solution requires much thought and ingenuity.

Another aspect of the power supply problem concerns voltage and frequency instability. The variations sometimes attain ± 50 per cent of the reference value. Users are frequently obliged to purchase very expensive equipment, including batteries and thyristor inverters. The cost may seem reasonable in connection with a fairly big computer or at least with a sufficient concentration of machines, but it is prohibitive for dispersed equipment. The price of an inverter is easily as much as or more than that of a microcomputer. The question of the electricity supply is thus an obstacle to the dissemination of microcomputing in developing countries.

III.3 Maintenance

In the case of microcomputers, the proliferation of suppliers is the cause of many difficulties. In 1984, out of 25 microcomputer suppliers represented at Abidjan, the number of makes for which effective maintenance was provided was no more than five. Such a situation is not merely an obstacle to the proper dissemination of data processing, but may also lead to unsuccessful computerization work and be a hindrance for the future. The Côte d'Ivoire data processing plan specifically includes the concept of a limit on the number of foreign suppliers. Its implementation will involve delay and negotiations which can only come to fruition in the long term. Although it can already be taken into account in public purchases, the proliferation factor still causes an uncontrolled scatter of equipment acquired privately. In conjunction with the users, the computer engineering service companies are able to play a buffer role, aiming through their advice to purchasers to achieve harmony at national level with the policy of the public authorities.

III.4 Security of centres

Data processing security is relevant to all enterprises, regardless of their size or their activities. It provides a technical barrier to the dangers of computerization. The computer has become almost as commonplace as the typewriter, although the risks connected with its use are of quite a different magnitude.

The installation of a computer, be it small or large, necessitates observance of certain rules and the adoption of special precautions. Failure to do this is to run the risk of difficulties which may have serious repercussions. Data processing security is the protection of vital and confidential data and takes two forms:

- Physical security;
- Logical security.

It is absolutely essential to take account of security right from the system design stage and this is the responsibility of all partners in a project: computer experts and users at all levels.

In view of the numerous difficulties facing enterprises, the General Data Processing Secretariat is proposing seminars on security. However, as a general rule it is the public centres which are involved because they are larger.

Private enterprises receive advice from security companies operating in the public and in the private sector. Consequently, with a view to assisting the entire data processing sector in Côte d'Ivoire, one of the departments of the SGI is to operate a security service for data processing centres. Any enterprise may seek relevant information from it.

III.5 The telecommunications network

There is a network devoted exclusively to data transmission. This is the SYTRAN network.

III.5.1 Features of the network

III.5.1.1 Technology

The SYTRAN (Système Transactionnel) network has been open to the public since 1978. It is a data transmission system. It is connected to the French TRANSPAC to form the SYTRANPAC network, enabling Côte d'Ivoire to extend its public data transmission service internationally.

SYTRAN is built around two-stage time-division multiplexers (synchronous and asynchronous), installed in various telecommunications centres in Côte d'Ivoire. These multiplexers are interlinked by specialized telephone-type connections. These are permanent point-to-point connections rented to customers and designed to link at least two remote processing end points.

Between Abidjan and the regional centres (Bouaké and San Pédro) there are connections able to handle a maximum of 9,600 bits/second.

Whereas SYTRAN can only offer permanent connections, SYTRANPAC, a packet assembler switched network offers both connections on request and permanent connections.

III.5.1.2 Tariffs

Establishment of each data transmission connection gives rise to a fixed charge of 120,000 CFA francs.

The monthly rental/maintenance charge is dependent on three parameters:

- The capacity of the connection: 300, 600, 1,200, 2,400, 4,800 or 9,600 bits/second;
- The relative geographical position of the two end points - rental charges for one four-line connection:

Urban: 130,000 CFA francs/month for 600 bauds;
 260,000 CFA francs/month for 9,000 bauds;

Long distance: 300,000 to 600,000 CFA francs depending on the speed.

III.5.1.3 SYTRAN network data transmission problems

The users suffer from the weaknesses in the network. The problems vary, depending on whether a connection between Abidjan and its local districts or between Abidjan and towns in the interior is involved.

(a) Data transmission between Abidjan and its local districts

There are two sources of problems: the modem and the transmission line.

Modem breakdowns are not a cause for alarm, because emergency repairs are quickly effected by the National Telecommunications Office (ONT). The difficulty lies in the inadequate quality of the transmission lines, which causes frequent disturbances.

(b) Data transmission between Abidjan and the interior

Here the problems are more complicated.

Between modem A (located in Abidjan) and modem B (located at San Pédro, for example), the following difficulties are encountered:

- No particular problem worth mentioning, apart from a few breakdowns. If the breakdowns cannot be repaired immediately, the modem is replaced by ONT. This is an important guarantee.

- Concerning the long-distance line and the coaxial lines

The coaxial lines are often old, damaged and of poor quality, a situation that is not conducive to good data transmission quality. They extend from the Plateau exchange to the Abobo exchange. A breakdown affecting these lines is difficult to detect, giving rise to rather lengthy repair times for SYTRAN users.

This leads some users to believe that it is practically impossible to transmit data to the towns in the interior during the rainy season.

- Concerning the radio links

On arrival at the Abobo exchange, the data transmitted from modem A are sent on by radio link to the first exchange at San Pédro.

The signals are sent by the Abobo transmitter. On route to the first exchange at San Pédro they pass through relay centres located at high points (hills, mountains).

In the event of a breakdown during the rainy season, it is practically impossible to reach the relay centres because of the poor condition of the tracks.

The abundance of the vegetation sometimes obstructs the beams, causing disturbances in the data transmitted. The SYTRAN network is not looped and in the event of a breakdown offers no other way to safeguard the transmissions. The ONT is very familiar with all these problems.

III.5.2 Users' views

(a) Extent of use

ONT estimates that there are currently 50 users. This represents 150 effective connections. There are two to three new connections each month. The system is thus far from saturation point.

A communications needs and use survey was carried out in November 1984. Thirteen establishments, both in the banking sector and in the semi-public and public sector, were chosen as a sample group to answer the questionnaire.

NETWORK USE (Survey of one quarter of users)

| Type of processor | (a) SYTRAN network | (b) Local network | Total |
|-------------------|--------------------|-------------------|-------|
| Data capture | 31 | 69 | 100 |
| Data transfer | 23 | 77 | 100 |
| Interrogation | 38 | 62 | 100 |
| Shared time | 23 | 77 | 100 |

Source: National Informatics Plan 1986-1990.

COMMENT: The local network should be understood as being the network inside a production unit.

The survey reveals an average transmission value of 7,007,477 characters per day for the four types of processing on the basis of 13 units or establishments.

With a view to industrial and economic decentralization, it is important to know what type of communication is necessary. The users state that "the point-to-point system no longer satisfies current requirements. It is outmoded."

(b) Users' service expectations

Particular attention must be given to the development of telecommunications in order to offer conditions promoting decentralization and regional balance. That is why it is useful to publicize the results of the survey regarding anticipated use of data transmission.

- Average volume of data transmitted daily by SYTRAN

The volume of data transmitted daily in 1984 was 226 million characters, out of a volume of 700 million characters processed. The users feel that this would increase if the network were reliable.

- Extensions

Six out of the 13 establishments questioned foresee new or extended networks towards the interior. They envisage 20 probable new installations in the coming years (Abidjan districts and the towns in the interior).

III.5.3 Prospects for a packet-switching network (Standard X25)

Implementation of this presupposes, however, that there is a real demand for data packet transmission within the borders of Côte d'Ivoire and, consequently that users install X25 interfaces. ONT is reasonably optimistic about this. Contacts are being made with computer manufacturers represented in Côte d'Ivoire to ask them to include these interfaces in their catalogues, and one large potential user is already acquiring them. The installation of several concentrators distributed over the territory of Côte d'Ivoire will be planned on the basis of the appraisal of foreseeable traffic which may be made by the SGI/ONT co-ordinating committee.

ONT thinks that the increase in demand for data packet transmission is linked to two major factors: the development of decentralized banking or industrial applications and, above all, the implementation of a policy of State management development (particularly of State agents). The transmission of scientific, technical or statistical information represents only a very small volume in comparison with commercial and/or administrative data and will therefore play only a marginal part in the choice of the location of new concentrators. It seems clear that in Côte d'Ivoire the question of data packet transmission is not so much technical as commercial: before making any investment, there must be a demand and this demand is still weak.

III.5.4 Prospects for telecommunications and specialized networks in Côte d'Ivoire

As an accompaniment to and support for the harmonious development of Côte d'Ivoire the Government has equipped the country with modern facilities for running and managing its economy.

Data processing has constantly occupied a prime position among these facilities but, precisely because of the rapid growth in the number of computers, the rational use of the installed capacity has become a major preoccupation over the past few years.

Against this background, the National Telecommunications Office (ONT) is receiving more and more requests for the supply of telecommunications lines for data transmission. It is in response to this demand that the decision was taken to establish a public remote data processing network.

This network is designed to assist managers and specialists who wish to decentralize and decongest the calculation and processing capacities of their data processing centres.

However, apart from this conventional aspect, the network is designed in particular to enable small- and medium-scale enterprises to have access to computers without having to sustain the burden of equipment immobilization or the associated organizational costs, which are almost always prohibitive for them. Furthermore, this logistical infrastructure is designed to make a large contribution to the development of the country by providing the regions, at the lowest possible cost, with the installed data processing capacity located in the capital, in the economic centres or at the development poles.

The proper use of the nation's calculating capacity and the available telecommunications trunk lines, with a view to establishing a "dialogue"

between computers and terminals in a network open and transparent to all the requirements and special features of the users, should be the purpose of the national public remote data processing network.

Since 1986/87, ONT has scheduled the establishment of packet switchers for traffic in Côte d'Ivoire, initially in Abidjan, followed by Bouaké. This installation in Bouaké and subsequently those in San Pedro, Abengourou, Korhogo and other towns will be dependent on the results of the current profitability surveys (number of potential users, concentration points, transfer volumes, etc.).

Alongside the services provided by packet switching, other services are scheduled for users.

It is the aim of ONT to establish itself without delay in the front rank as regards modern data transmission techniques, in order to include the service integration numerical network (RNIS) in its services. Once established, this network will integrate the present telex, telephone and packet transmission networks.

ANNEX

QUESTIONNAIRE

COMPUTER USE IN THE MANAGEMENT OF INDUSTRIAL
ENTERPRISES IN COTE D'IVOIRE

Name of enterprise:

Address:

Head office:

Products manufactured:

Name and functions of the person
completing this questionnaire:

Survey conducted by: Mr. KOUASSI KRA
Engineer in charge of research
Secrétariat Général à l'Informatique
- SGI

1. Did you find all the computing staff you needed for computerization of your enterprise?

| | Easily | With difficulty | No |
|--------------------|--------|-----------------|----|
| Designer/analyst | | | |
| Systems engineer | | | |
| Programmer/analyst | | | |
| Operator | | | |

2. How were your staff trained?

| TRAINING | Within the company | By computer hardware manufacturers | University or college |
|---------------------|--------------------|------------------------------------|-----------------------|
| Engineers | | | |
| Programmer analysts | | | |
| Operators | | | |

4. What type of hardware do you use?

| Type Make | Large system (No.) | Mini-system (No.) | Microcomputer (No.) |
|----------------------|-----------------------|----------------------|------------------------|
| IBM | | | |
| DEC | | | |
| DATA GENERAL | | | |
| HP | | | |
| UNISYS | | | |
| BULL | | | |
| WANG | | | |
| OLIVETTI | | | |
| GOUPIL-SMT | | | |
| OTHERS (indicate) | | | |

5. What type of software do you use?

| | Type | Make |
|---------------------|------|------|
| Data base | | |
| Integrated software | | |
| Text processing | | |
| Spreadsheets | | |
| Others (indicate) | | |

6. How many computer staff do you employ?

| | Number |
|---------------------|--------|
| Design engineers | |
| Analysts | |
| Programmer analysts | |
| Operators | |

7. How did you obtain your hardware?

| | Large system | Mini-system | Micro-system | Printer |
|--|--------------|-------------|--------------|---------|
| From computer hardware dealers | | | | |
| Outside the country (transposed by parent company) | | | | |

8. How did you obtain your software?

| Data base (SGBD) | Integrated software | Spreadsheets | Text processing |
|-----------------------|------------------------|--------------|--------------------|
| From local dealers | | | |

11. What is the lifetime of your data processing hardware?

Less than 5 years

5 to 10 years

More than 10 years

12. How are your applications carried out?

Batch

Partly real time

Only real time

13. What type of environmental problems do you encounter?

| | Often | Sometimes | Never |
|--------------------|-------|-----------|-------|
| Temperature | | | |
| Humidity | | | |
| Dust | | | |
| Electrical supply | | | |
| Telecommunications | | | |
| Others (indicate) | | | |

14. Do you operate in networks? What software do you use?

15. Do you use shared data processing?

16. What do you believe (in connection with data processing) could help you in your various tasks?

17. Do you prefer to develop your own applications or to acquire software packages from computer engineering service companies?