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REPORT

on "STATE OF THE ART, REVIEW ON INFORMATICS/MICROELECTRONICS IN THE EASTERN AND SOUTHERN AFRICAN SUBREGION AND IDENTIFICATION OF THE NEEDS WITH REGARD TO SOFTWARE TRAINING" x/

by

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R E P O R T

on "State of the Art, Review on Informatics/Micro-electronics in the Eastern and Southern African Subregion and Identification of the Needs with Regard to Software Training"

The Report consists of five separate part, and it refers to:

I. Tanzania
II. Mauritius
III. Zimbabwe
IV. Zambia
V. Kenya

In the Summary of the Report, there were given:

1. Remarks on:
1.1 Informatics Technology and Education
1.2 Education and Training of DP Staff

and

1.3 Remarks on state of the art of Microelectronics and Informatics Technology for the above mentioned countries in East-South Africa
1.4 Recommendations

I. TANZANIA

STATUS OF INFORMATICS TECHNOLOGY IN TANZANIA

R E P O R T

on "State of the art and Review on informatics/microelectronics in the Tanzania and identification the needs with regard to software training"

1. INTRODUCTION

The use of Modern Electronic Computers in Tanzania dates back to the late sixties. The first modern Electronic Computer was installed in 1968 at the Ministry of Finance to cater for all Government computing requirements. This was an ICL 1901 Magnetic Tape based system. Prior to this, there were electromechanical installations of the Hollerith era in several sites including the Government installation at the Ministry of Finance and one at the then East African Railways and Harbours Regional Headquarters in Dar-es-Salaam, Tanzania.

The then East African Railways Corporation acquired its first computer in 1968 and another one in 1969. The two computers (ICL 1904E and ICL 1905) were installed at the Corporation's Headquarters in Nairobi, Kenya and linked to them were on-line Remote Job Entry Terminals in Dar-es-Salaam, Tanzania, Kampala, Uganda, and one at the Kenya Regional Office in Nairobi. The whole Railways Operations Network of the three former East African Community partner states was controlled through this network.

Tanzania Railways Corporation's experience in the application of computer technology, therefore, dates from that time.

Ever since 1968, Informatics Technology based on the use of modern computers has been expanding gradually though at a rather reduced pace due to various technical and financial constraints.

1.1. IMPACT OF COMPUTERS IN TANZANIA

As would be expected with any new technology, the initial experience brought about mixed feelings among the people at all levels on the relevance and suitability of this technology to our society. This was a result of various reasons including:

(i) The high cost of hardware, software and the requisite technical manpower to run an installation.

(ii) The fear of human redundancy in the wake of increasing automation of the hitherto manual processes.

(iii) The relatively low technical calibre of the systems and programming staff who lacked the necessary experience and knowhow to develop comprehensive, efficient and effective application systems for use at all management levels.

Thus by 1974, to most users the computer had not delivered all the anticipated wonders apart from processing payrolls, skeleton accounts and a couple of other more routine batch processing jobs.

A general policy on the acquisition of computers and related equipment was therefore formulated in 1974 to control the importation of computers in Tanzania. Since then, any aspirant or a computer configuration or related equipment must apply to the Ministry of Finance who may reject or approve such acquisition depending on the recommendation of the Government Ad-hoc Computer Committee.

With time, however the technology expertise has widened, the cost of the equipment has lessened, the application systems are already facilitating meaningful decisions at the relevant management levels, and generally the impact of the computer is now being felt positively. Thus from 1978 there has been a proliferation of all categories of computers put to use in such diversified applications ranging from the more complex procedures like on-line airline passenger reservations and weather forecasting.

Analysts have broadly identified four stages of computer activity development:

(i) Inception Stage: Very little knowledge and understanding of computer technology

(ii) Basic Stage: Reasonable understanding in the use and application of computer at the operational level of management.

(iii) Operational Stage: Wide understanding and application of computer technology in most administrative activities at top management level.

(iv) Advanced Stage: Extensive Managerial dependence on computers for decision making as well as strategic planning.

Tanzania is in stage three - operational stage - of the computer activity development.

1.2. COMPUTER AND SUPPLIERS

The traditional suppliers of Computer Hardware and Software were International Computers Limited (ICL), International Business Machines (IBM) and National Cash Register (NCR) of whom, upto 1980, ICL controlled 100% of the Mainframe

Computer Market while IBM and NCR controlled almost 100% of the mini computer market, with NCR taking the larger share. Since 1981, however, the scene has changed drastically with the arrival onto the market of new suppliers and equipment.

Going by a somewhat outdated report by a research student at the University of Dar-es-Salaam, a fair guess would put the number of computers in the country at around 400 units whose distribution is approximately:

(i)	Micro computers	64.6%
(ii)	Mini computers	22.7%
(iii)	Mainframe Computers	10.0%
(iv)	Other (Terminals etc)	2.7%

Most of these computers, especially the minis and micros have been acquired in the period after 1978. The table below shows the share per period as a percentage of the approximate cumulative computer acquisitions in Tanzania since 1968:

Period	Approximate % Share of Cumulative Total
1968-1974	11%
1975-1982	22%
1983 todate	67%

It is evident here that the proliferation of computers in the country is going at a tremendous pace.

The table below shows approximate supplier's market share based on the report referred to earlier:

Supplier	Product Type	%Micro	%Mini	%Mainframe	%Overall
BML	Olivetti Computers Apple Computers Agents	55.6	-	-	36.8
CCTL	Agents for Wang Computers and Osborne Micros	21.8	14.1	27.3	20.5
ICL	ICL Computers	-	31.5	63.6	14.1
NCR	NCR Computers	7.0	31.5	-	13.2
IBM agents	IBM Computers	7.7	7.0	-	6.8
Others		7.9	15.9	9.1	8.6

Note

* a dash (-) means negligible hence contribution included in others.

* BML = Business Machines Ltd

* CCTL = Computers Corporation of Tanzania Ltd

* ICL = International Computers Limited

1.3. USERS AND APPLICATIONS

The main computer users in Tanzania have traditionally been the government, large government parastatal organisations like Tanzania Railways Corporation, Tanzania Harbours Authority Tanzania Electric Supply Company, Bank of Tanzania, Tanzania Tea Authority and the organisation, Crop Monitoring etc, and large companies in the private or semi-private sector, e.g.; oil companies. This is because they could afford the going high costs of computer systems in the sixties and seventies.

Of late, however, a growing number of small organisations and even individuals are gradually finding ready applications for computers, thanks to the latest impressive technological developments that have made the hardware small and convenient, the software less of a miracle and the price well within reasonable budgets. This is all evident in the acquisition of the less costly micro and mini computer which, between themselves, command more than 85% of the total market share.

The uses to which these computers are put vary from user to user. For the small time user with a micro and mini, the use of ready made software packages is predominant, covering a wide range of applications including word processing, spread sheets, financial modelling and accounting, stock control, games, and such other areas increasingly becoming the domain of the personal computers.

For the mainframe users, the dominant applications still remain the traditional payrolls, stock control, billing and accounting systems. Of late, however, there has been a few revolutionary systems which are way apart from the traditional mode of operation including:

(i) The Fujitsu Fedex 100, installed by the Tanzania Posts and Telecommunications. It is an automatic telex message switching system for the control and routing of all message traffic to, from and via the Tanzania Telecommunications System.

(ii) The on-line traffic control and passenger reservations system operated by Air Tanzania via a hook-up to the International network based in the USA.

(iii) The weather forecasting system in the department of meteorology.

(iv) The on-line wagon control system developed by Tanzania Railways Corporation as phase one of the larger and more complex Railways Traffic Control System. The wagon control system is due for implementation in the second half of 1986.

Even without a mention of such sophisticated systems, there are other impressive applications such as maintenance of patient records at a hospital, census statistics, budget control etc. which are increasingly assisting a manager or administrator in the decision making process.

It is currently not easy to put accurate statistics on the impact of computers and the associated technology on the society as a whole, but the recent developments point to an increasing level of awareness and understanding of computer technology and its corresponding applications.

1.4. TECHNICAL MANPOWER

The computer manpower position in Tanzania is not impressive. There are slightly more than 100 trained and practising Tanzanian Systems Analysts and Programmers in the country today. While it is gratifying to note that Tanzania at least has a base from which to advance, it is also a sad fact that this number is too small for the computer equipment currently available in the country. As a result each installation is understaffed and there is now a rising trend of staff turnovers.

Of course, there are many others who have been in contact with informatics technology through various courses at universities and other higher institutions of learning. But normally these are pursuing other professions and in any case they are not trained for professional practice in the computer field. Most of them, therefore, are only helping the profession in their role as users.

For various reasons, including economic ones, the pace at which the public sector was sponsoring professional training in the sixties and early seventies has now slackened. The rate at which the hardware is proliferating far outpaces the training rate of new recruits into the profession and this is not a healthy situation.

1.5. TRAINING

Tanzania does not have a professional training institution in Informatics Technology. It is the same situation in many other African countries. The only professional training centre in East Africa worth the name is the ICL Training Centre in Nairobi, Kenya which offers part-time and full time courses in all areas of information processing.

The courses, however, are more inclined towards manufacturers' equipment. Other courses can only be attended abroad. With the ever increasing foreign exchange constraints these do not seem to be quick solutions to the current training needs.

Other institutions in the country offering computer courses are:

(i) The University of D'salaam - offering computer courses at undergraduate level and a Master of Computer Science degree at postgraduate lewel.

(ii) Eastern and Southern Africa Management Institute located in Arusha, Tanzania - offering short courses and tailor made courses in all areas of the computer profession.

1.6. PROBLEMS AND NEEDS FOR INFORMATICS DEVELOPMENT

Despite the achievements realised so far, there are various problems still hindering the development of Informatics technology in the country:

(i) Manpower:- As mentioned earlier the manpower level is very low. There is now a necessity, not just a need, to expand the manpower base in line with the increasing acquisition of hardware.

(ii) Training: - Training facilities are still very inadequate in Tanzania and there is no way they can expect to make full utilisation of Informatics Technology even with the little equipment available, while the available training facilities remain short of meeting the growing demand.

(iii) Management Awareness:- General user awareness of Informatics Technology even at the management level is still very low. The Manager or Administrator needs to know what is expected from a computer. This is currently lacking in most institutions today.

(iv) Computer Vendor:- With the diversification of computer products and applications, an increasing number of vendors are now entering the market. Many users can afford computers today.

But some of these vendors do not possess the necessary know-how and provide adequate support for the equipment they sell. Many customers have fallen victims to such vendors and equipment lie as furniture in their premises.

It should now address this as authorities duty to protect institutions and society from such vendors who are out for quick returns rather than the noble course of promoting the technology for the development of societies.

(v) Government Involvement and Policy on Informatics Technolgy:- Hitherto many governments have played a rather passive role in the development of Informatics Technology. In fact the promotion role has been wholly in the hands of computer manufacturers and vendors. But it is now a fact that the technology is here to stay and a growing number of national populations will continue to be affected either directly or indirectly by this technology.

(vi) Up to now there has been no very active professional organization for fostering the application of computers and improvement of public awareness in the field of microelectronics generally and microcomputers in particular. The government has howrver, set up a National Steering Committee on the Application of Computers in the country with the view of drawing up a clear policy on Informatics and Computer Utilization.
In the pipeline is also the formation of "The Computer Association of Tanzania".

(vii) Industrial application of microelectronics in Tanzania is rather limited at the moment with exception of the control systems used in the Southern Paper Mills. Tanzania Electrical Goods Manufacturing Co. Ltd. There are also scanty uses of office electronically controlled systems as well as security systems and consumer electronics.

It is the potential of the new systems of production and services to replace, or upgrade the productivity of old ones that will eventually generate the greatest changes in society. However, technology alone will not account for the appearance of the future society. Social, economic, and political parameters are at least as important determinants as technology itself.

It is high time therefore, for governments to take a deeper look into this technology with a view to harnessing it for effective utilisation.

CONCLUSION

As mentioned earlier, Informatics Technology is now here to stay like the radio is now part of our domestic lives. We have made some progress in its application to some of our day to day needs. Our obligation is to put this technology to the service of our people for development.

This is only possible if we tackle the existing problems before they get out of control.

2. THE UNIVERSITY OF DAR ES SALAAM

The University of D'Salaam: offer computer Courses at undergradnate level and Master of Computer Science degree at postgraduate level.

DEPARTMENT OF ELECTRICAL ENGINEERING
UNDERGRADUATE COURSE PROGRAMME

General

Tanzanian industries require engineers with a broad base education in electrical engineering, and also a good practical experience necessary to supplement the theoretical know ledge acquired. To achieve this, the different fields of electrical engineering are weighted almost equally and the practical experience is obtained through working in industries during the fourth term, laboratory work and project work during the third and fourth year.

The main engineering subjects of the course are electrical networks, engineering electromagnetics, electrical measurements, power transmission and distribution, power plants, electrical machinery, electronics, power electronics, telecommunications, control engineering, electrical materials technology, process managemant, safety and maintenance. There is no specialization in either heavy or light current engineering.

Faculty of Engineering — Department of Electrical Engineering

	Undergraduate Course Programme	1st Year Term				2nd Year Term				3rd Year Term				4th Year Term			
		1	2	3	4*	1	2	3	4*	1	2	3	4*	1	2	3	4
OS 100/200	Development Studies	3	3	3E		3	3	3E									
EM 100/200	Engineering Mathematics	3	3	3E		3	3	3E									
EG 100	Workshop Training	10	10	10													
EG 101	Engineering Drawing	4	4	4													
EG 102	Fundamentals of Engineering	3	-	-													
EG 103	Introduction to Computers and Programming	3	3	3													
EG 106	Engineering Mechanics	4	4	4													
EE 151/152	Fundamentals of Electrical Engineering	-	3	3													
CP 101	Basic Chemistry	1	1	1E													
EE 221	Electrical Power/Transmission and High Voltage Eng.					5	5	5E									
EE 232	Electronics I					2	2	2E									
EE 241	Electrical Measurements					5	5	5E									
EE 252	Electrical Networks					4	4	4E									
EE 254	Engineering Electromagnetics					4	4	4E									
ME 207	Mechanics of Machinery					4	4	4E									
EE 311	Electrical Machines and Drives I									5	5	5E					
EE 321	Electrical Power Systems									3	3	3E					
EE 322	Electrical Power Plants									-	2	2E					
EE 331	Telecommunications I									3	3	3E					
EE 332	Electronics II									4	4	4E					
EE 341	Control Engineering I									4	4	4E					
EE 351	Power Electronics									3	3	3E					
EE 344/370/470	Optionals									3	3	3E		3	3	3E	
EE 399/499	Projects									3	3	3E		5	5	2E	
EE 411	Electrical Machines and Divers II													5	4E	-	
EE 431	Telecommunications II													5	5E	-	
EE 441	Control Engineering II													2	2	-	
ME 417	Electrical Materials Technology													4	4E	-	
ME 443	Process Management													4	4E	-	
ME 451	Safety and Maintenance													2	2E	-	
	Total Number of Hours per Week	31	31	31		30	30	30		28	30	30		30	29	29	

E - University Examinations * Practical Training

/84 hours/

EE 334 introduction to Microcomputer

Fundamental concepts: Number systems, binary arithmetic. Boolean algebra and computer logic. The Memory of the computer. Interpreting the contents of memory words. The microcomputer processing unit /CPU/: Instruction execution, microprogramming and control unit. Logic beyond the CPU: Parallel and serial input/output, direct memory access. Programming microcomputers: Source programs, object programs, asseembly language, memory addressing, the steck. Instruction set of a special microcomputer /e.g. Intel 8080/: Programming exercises using the instruction set.

The University of D'salaam together with other institutions of high learning.

The University of Dar es Salaam, together with other institutions of higher learning form another large group of computer users in the country. Computer installations in these areas, serve a variety of functions including teaching, research and adminiscration. The use of computer has not only helped on solving problem of processing large amounts of data and timely output information, but it has also increased the number of users, thereby enabling the technology to be successfully transferred.

3. EASTER AND SOUTHERN AFRICAN MANAGEMENT INSTITUTE /ESAMI/ ELECTRONIC DATA PROCESSING DIVISION

The Eastern and Southern African Management Institute (ESAMI) was formerly established on 28 February 1980. The membership of the Institute is open to all the States of Eastern and Southern African sub-region, that is to say, Angola, Botswana, Comoros, Djibouti, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Somalia, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.

ESAMI is an inter-governmental body whose objective is to help improve the performance and management effectiveness of public and private enterprises and institutions within the member states of the Eastern and Southern African sub-region.

3.1. EDP DIVISION OF ESAMI

Since the Academic Board of the Eastern and Southern Africa Management Institute /ESAMI/ approved the creation of the Electronic Data Processing Division /EDP/ at its meeting on the 16th September 1987 the Division has worked flat out to fulfill its objectives, which are:

1. To promote the effective use of information technology /computers/ in public and private enterprises and institution within ESAMI service area:

2. To promote the use of computers as a teaching tool.

3.2. EDP DIVISION ACTIVITIES - September 1987 - September 1988

For the past year (September 1987 to September 1988) the EDP division has been involved in the following activities:

Training
Training was the main activity in this period. The following is a summary of the training activities:

SUMMARY OF TRAINING ACTIVITIES
SEPT. 1987 - SEPT. 1988

PROGRAMME TYPE:	NUMBER RUN	NUMBER OF PARTICIPANTS	PARTICIPANT WEEKS	ACTUAL REVENUE US$
OPEN	7	141	500	269,308
SPONSORED	1	20	40	21,200
TAILOR-MADE	0	0	0	0
TOTAL	8	161	540	290,508

Apart from running the above progammes the division took part in the cross teaching by giving 2 to 9 sessions on computers in most of the management development programmes held at the Institute.

3.2.1. CONSULTANCY

During this period the division executed two consultancy projects. The first consultancy was the Assessment of Information Management Training Needs. The client was the International Development Research Centre /IDRC/ of Canada. In executing the project the following countires, Kenya, Malavi, Zambia and Zimbabwe were covered. The second consultancy project was the mapping out of computerization strategy for the Board of Internal Trade of Tanzania.

3.2.2. RESEARCH

In research the main activities were concerned with the development of training materials, including case study which has been published by the management development programme of the Commonwealth Secretariat.

3.3. EDP DIVISION 1989 ACTIVITIES

3.3.1. TRAINING

The following are the training programmes the division plans to run in 1989:

	PROGRAMME NAME	DURATION	VENUE
1.	Management Information Systems	2 weeks	Njiro Hill
2.	Data Base Management Systems	3 weeks	Njiro Hill
3.	Micro Computer Based Systems Development	4 weeks	Njiro Hill
4.	Advanced Issues in Systems Development	4 weeks	Njiro Hill
5.	Management Information Systems	2 weeks	Njiro Hill
6.	End User Information Systems Development	4 weeks	Njiro Hill
7.	Structured Systems Analysis and Design	6 weeks	Njiro Hill
8.	Top Level Seminar on Computer Policy	1 weeks	Swaziland
9.	Structured Programming	3 weeks	Njiro Hill

3.3.2. COMPUTER BASED TRAINING

Apart from running the above courses the division will spearhead the introduction of computer based training, where computers will be one of the teaching tools in a number of courses.

3.3.3. CONSULTANCY

This division will continue offering consultancy services in information technology especially in the following areas:

1. Selection of computer hardware and software
2. Review of information systems
3. Auditing of data processing centres

4. Conducting computerisation feasibility studies

5. Development of strategic information systems master plan.

3.3.4. RESEARCH

Management research will be undertaken in selected areas related to the effective and efficient use of information technology.

The division will continue developing local training materials especially case studies.

3.4. RESOURCE REQUIREMENTS

The effectiveness of the EDP division just like any other division will depend heavily on the availability of resources both human and hardware/software.

Currently the division has installed a total of 15 microcomputers which are adequate for spearheading the computer based training and computer programmes specially designed for computer experts.

On terms of consultants, the division is a one man division. One consultant will not be able to run courses, five sessions on introduction to computers and to lead the computer based training, therefore there is a great need for the Institute to recruit a second consultant. Given the constantly raising number of microcomputers been installed in the region, the consultant to be recruited shold be microcomputer specialist.

Also a Data Base Management Specialist should be recruited as well.

Other requirements are:

a/ Additional microcomputers

b/ Software with emphasis on industrial such as CAD/CAM in food industries, /sugar/, textile industries, electronic equipment factories, transport and telecommunications equipment.

c/ Building of microcomputer laboratory.

d/ Since most organizations have problems with foreign exchange fellowships to enable organizations in the region to take advantage of the programmes offered.

e/ Salary support for two consultans.

f/ One consultant from a developed country.

g/ Funds for preparations of local training materials.

h/ Funds for fellowship for ESAMI consultants to enable them to attend short courses.

i/ Assistance in organizing courses in maintenance of informatic equipment, including:

a/ Digital instruments,

b/ Digital measuring instrument,

c/ Microprocessor DBase instruments,

d/ Microcomputers.

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x/ PROCEEDINGS OF THE SOUTHERN AFRICAN REGIONAL WORKSHOP ON INFORMATICS FOR DEVELOPMENT

Zimbabwe, 1986

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II. MAURITIUS

STATUS INFORMATICS TECHNOLOGY IN MAURITIUS

R E P O R T

on "State of the art and Review on informatics/microelectronics in the Mauritius and identification the needs with regard to software training"

1. INTRODUCTION

Challenged by the surging technology development and the demand for modern information systems, Mauritius introduced its first computers in 1968 both in the public and private sectors. These systems were mainly used for economic benefits in medium and large organisations for the automation of repetitive clerical functions and control reports for management. This situation has not evolved until recently when people started to recognise the potentially major contribution of information technology to productivity gains and financial success. This situation creates conditions for computer manufacturers to implement their business in the country. Parallel to the installation of business systems, there has been a boost in the introduction of associated educational and training materials [illegible]

2. COMPUTER SUPPLIERS

In 1968, only two computer manufacturers were active in Mauritius, namely International Computers Limited (ICL) and National Cash Register (NCR). Around 1980, more than a dozen suppliers were sharing the market. A list of suppliers currently operating is attached in Appendix 1. Other computer peripherals are also distributed by agents and distributors involved in the computing business.

Due to the relatively small size of Mauritius and its business volume, the computer market is limited to the range of mini computers. A recent survey illustrating the Mauritian computer scene is attached in Appendix 2.

The hardware representatives are normally structured to provide the necessary hardware maintenance but there are certain problems concerning the small range of equipment.

3. SOFTWARE SERVICES

The current trend of computer sales, mainly in the area of small business systems has introduced a host of computer software packages, mainly accounting, in the country. The main difficulties reside around the user's skill to evaluate them as support services are non-extant.

The more traditional software houses adopt the approach of systems development and the use of locally available software to promote their business but they are confronted with the pricing structure which are escalating for this type of work.

Small business systems users cannot afford the services of professional data processing personnel or consultants and it is likely that they will not probably develop enough confidence to proceed with extensive computerisation.

4. APPLICATION AREAS

The public sector has instituted a data processing division under the responsibility of the Ministry of Finance to support their needs. In the private sector, those organisations which can justify and afford in-house installations have structured their own data processing units. Bureau services and softwa.e houses have been implemented to provide services to the general Mauritian business. In this respect, most of the large organisations are currently using this type of services. Local development resources during the last ten years have enabled the various economic sectors to set up software applications systems tailored to their respective requirements. The sectors covered are as follows:

- Sugar Industry
- Commercial & Trading Industries
- Manufacturing & Production Industries
- Insurance
- Banking
- Tourist Industry
- Parastatal Organisations
- Textile Industries
- Construction Industries
- Scientific

5. APPLICATION SYSTEMS

In the public sector which includes para-statal bodies, the following applications systems have been developed.

- Personnel e.g. Payroll
- Inland Revenues e.g. Income Tax, Sales Tax
- Statistical Applications e.g. Imports & Exports, Central Statistical Office
- National Pensions Scheme
- Electricity Billing
- Water Billing
- Telephone Billing
- Population & buildings Census Database
- Municipal Rates & Taxes 4 Research
- Sugar Crop Insurance 4 Examination Markings

In the private sector, emphasis has been placed on the computerisation of accounting procedures. The following applications systems are currently in operation.

SUGAR INDUSTRY

- Personnel & Costs Analysis System
- Stores Inventory & Analysis System
- Budgetary Control & Costing System
- Planters & Sugar Allocation System
- Cane Sampling & Laboratory Tests Systems
- On*line Weighing System
- Cane Fields Yield & Analysis System
- Vehicle Costing System
- Accounts Receivable & Payable Systems
- Fixed Assets Register System
- General Accountancy System
- Sugar & Molasses Proceeds System
- Statistical Systems

COMMERCIAL & TRADING INDUSTRIES

- Personnel System
- Orders Entry & Purchasing Systems
- Invoicing System
- Inventory Control & Management System
- Accounts Receivable & Payable System
- Sales Analysis System
- General Accountancy System

MANUFACTURING & PRODUCTION INDUSTRIES

- Personnel & Cost Analysis System
- Stores Inventory & Control System
- Raw Materials Odering System
- Finished Products Costing System
- Manufacturing & Production Costs System
- Work In Progress System
- General Accountancy

INSURANCE

- General Insurance System
- Individual Life Assurance System
- Multiple Stage Endowment Policy Assurance
- Group Temporary Assurance
- Family Protection Scheme
- Decreasing Temporary Assurance
- Medical Scheme
- Pensioners Payments
- Reinsurance Payments
- Evaluation of Funds
- Accounting Application

BANKING

- Current Accounts
- Saving Accounts System
- Deposits Accounts System
- Loans Accounts System
- Exchange Accounts System
- Bill Progressive Ledger System
- General Ledger System
- Statistical System

TOURIST INDUSTRY

- Planning & Reservations System
- Hotel Management System
- Incoming Tourism Services System
- Outgoing Tourism Services System
- Accounting Applications System

TEXTILE INDUSTRIES

Same principals as described under Manufacturing and Production Industries.

CONSTRUCTION INDUSTRIES

- Personnel & Cost Analysis System
- Site Costing System
- Contract Administration System
- Accounting Applications System

SCIENTIFIC

Research work is being carried out by the Mauritius Industry Research Institute.

Other scientific work is being performed by a firm of Consulting Engineers.

6. MANPOWER

It is estimated that 600 persons are directly involved in the Mauritian computing business. There are 25 engineers who provide hardware support and maintenance services and approximately 125 Management & Software persons to support the development and maintenance of software applications systems. It is worth noting that since 1980 the total establishment supporting the computer business in the country have been all nationals i.e.,Mauritians.

7. GENERAL TRENDS

With the breakthrough of Information Technology, computer evolution and the advent of communications networks it is perceived as a drawback to continue with a batch processing mode upon which existing applications systems have been

designed. Desicion makers view with concern the lack of management tools to exercise their functions. It is expected that within the next two years, nearly all installations in the business sector will renew their hardware equipment and will embark in redevelopment of software to avail themselves with the new techniques and facilities. Office automation is being implemented at an increasing rate with the availability of software packages to ease routine work, e.g. word processing, database, spreadsheets.

8. EDUCATION & TRAINING

Most of the management and software personnel in computing are either university graduates from various European or American universities or persons with proven experience in the field. Since past years, about a dozen university graduates have been returning annually to the country to take up the challenge of computing.

8.1. EDUCATION

(1) A computer section exists under the school of Industrial Technology at the University of Mauritius and it gives computer courses at Certificate and Diploma levels.

(2) The Mauritius Institute of Education, a pedagogical Centre, has a computer unit which gives training in Computer Studies/Science to secondary school teachers.

(3) Computer studies has been introduced as a full-fledged subject at secondary level, with effect from January 1987.

(4) Education and trainng are being organised locally to provide people with necessing shils to use computers /Apendix 3/.

(5) About ten private training institutes are giving introductory courses in computer studies.

8.2. CIVIL SERWICE AND PARA-STATAL BODIES

(1) A Civil Service Informatics Plan (CSIP) is under way and the same aims at large scale computerisation of Ministries and Government Departments.

(2) A Data Processing Division exists under the Ministry of Finance and it presently caters for most public service computing needs.

(3) Ministries/Departments having urgent computing needs are equipped with either micro or mini computing equipment.

(4) A large number of para-statal bodies including financial institutions have computer-based systems.

(5) State Informatics Training Centre (SITRAC) for the training of Public Officers is expected to be launched soon.

8.3. INDUSTRY

(1) There exists a number of computer suppliers and they deal with a wide spectrum of computer equipment of different brands - almost all well known computer manufacturers, such as IBM, Digital, NCR, Wang, HP, ICL, BULL, etc. are represented.

(2) With the increasing use of computers in industries and services, a lot of software activities are taking place and are likely to grow very fast.

(3) Some industries have already embarked upon plans to computerise their processes and with the shortage of labour many more are likely to do the same.

8.4. OTHERS

(1) A National Computer Board is expected to come into being and it would act as a coordinating body with regards to all computer activities in the country.

(2) To improve quality of life, there are plans to build Public Information Networks for utilitarion as well as leisure purposes.

8.5. PRESENT TREND:

(1) Telecommunication

To modernise the telecom services a Para-statal company i.e. Mauritius Telecommunications Services (MTS) has been created and it is expected that within two years time main aims of MTS will be achieved.

(2) Some Banks are already using ATM and with further improvement in quality of communication others will be encouraged to provide service at computer speed to its customers.

(3) Establishment of Stock Exchange, Offshore Banking, Medical, Industrial and Technological Data Bases would increase the demand of computerisation and hence software and trained personnel.

(4) Besides, the Government is keen to exploit IT fully to improve productivity and ultimately to develop an export oriented industry in this sector.

9. CONCLUSION

The Mauritian computer business is not as sophisticated as it should be. But the awareness of the progress that can be achieved in all spheres with this technology creates a sound atmosphere for the country to face the challenges of information requirements.

With increasing demand for computerisation in the public as well as private sector, proper base and infrastructure all go in favour of Mauritius being the suitable choice of Informatics Development Center /IDC/.

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x/ PROCEEDINGS OF THE SOUTHERN AFRICAN REGIONAL WORKSHOP ON INFORMATICS FOR DEVELOPMENT
Zimbabwe, 1986

11. LIST OF INSTITUTION VISITED DURING MY STAY IN MAURITIUS AND PERSONS MET AND INTERVIEWED

UNDPFIELD OFFICE

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Mr. J.N. Marchal

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Appendix 1

HARDWARE REPRESENTATION IN MAURITIUS

1. International Computers Limited
2. International Business Machines
3. National Cash Register
4. Wang Incorporation Ltd.
5. Hewlett-Packard
6. Olivetti
7. Digital Equipment Corporation
8. CII Honeywell-Bull
9. Apple
10. Apricot
11. BBC Acorn
12. Commodore
13. Victor Sirius
14. Amstrad
15. Sinclair
16. IBM Compatible Equipment

Appendix 2

MAURITIAN COMPUTING INSTALLATIONS

Mini Computer Systems	20
Micro Computer Systems	40
Personal Computers	100

Apendix 3

The Computer Training Unit of the MCCI

Since its inception in April 1985, there has been a gradual evolution in the services offered at the CTU.

Today 2 types of training are being offered :

1 Diploma in Computer Programming of the MCCI.

It is a one-year professionally oriented course with a daily attendance of 4 hours followed by an eight week training in a private firm.

2 Higher Diploma in Computer in Programming. (BTS French Diploma)

The Higher Diploma is a professionally oriented course of 2 years specially geared towards business management. It includes a 2 month training in a private firm at the end of each year.

The training is organised around a few fundamentals principles.

1 - a thorough training in programming.

2 - a substantial knowledge of quantitative methods of management.

3 - a sound training in Systems analysis and design.

4 - Human relations development as a basic element for harmonious integration in his work.

THE PROJECTS OF THE CHAMBER

- The setting up of a local data bank at the Chamber.

- the computerisation of the different services of the Chamber.

SUGGESTIONS

INFORMATICS is a very fast moving discipline. It would be a good thing to help the professionals of the island to keep abreast with up to date technologies through training.

III. ZIMBABWE

STATUS OF INFORMATICS TECHNOLOGY IN ZIMBABWE

R E P O R T

on "State of the art and Review on informatics/microelectronics in the Zimbabwe and identification the needs with regard to software training"

1. INTRODUCTION

Zimbabwe is the youngest indepedent nation in the Southern African Region. It attained independence on 18th April 1980. Since then there has been a growth in all areas of informatics in the country. The country was lucky to get back a number of Zimbabweans from abroad with education and experience in informatics. In addition, a good number of Zimbabweans have received training/education abroad in information technology since independence. There has also been an increase in training activities in informatics within the country, both in the private and the public sectors by the university, the polytechnics, the computer society, micro users clubs, commercial colleges, vendors, schools, Posts and Telecommunications Corporation and other private organisations. There has been a proliferation of micro computers in small businesses and personal computers are becoming ever increasingly popular. More and more government and private organisations have started using computers, large and small, for a variety of applications, ranging from simple word processing to sophisticated on-line real-time applications using telecommunication facilities.

1.1. Computer and Suppliers

The first computer came into the country in 1961 - an ICL 1202 which was installed in the Covernment Treasury Department. This was befcre UDI - Unilateral Declaration of Independence.

After independence there were still some old, second generation or early third generation machines running batch systems and using tapes as the main mass storage media. At independence there was a sudden change in this situation. Some new vendors started business and these and the old suppliers introduced some of the latest hardware in the market from the supermini ranges of Data General, Digital, ICL, NCR, Olivetti, Perkin-Elmer and Wang using 'state of the art' software with paging and virtual memory concepts, database management systems, and productivity tools like application generators and 4th Generation languages. This has set up a trend in the country and any organisation going for updates of existing equipment and/or new computer system has a difficult time to choose from the different and latest hardware/software options offered by the vendors. A list of current vendors and their machines appears in Appendix I.

There are several reasons for the rapid growth in computerisation in Zimbabwe.

Firstly, despite lack of growth the economy of the country remained relatively vibrant and dynamic despite sanctions during the UDI period. This was largely due to the support of South Africa. The trade embargo made Zimbabwe industry innovative and self-reliant to a large degree. Zimbabwe industry suddenly found itself able to export its goods freely into the world merket with all the competition entailed. Computers and computer related technology were quickly accepted as a means of increasing managerial efficiency and theroby getting a competitive edge.

Secondly, South African industry has had considerable influence on Zimbabwe informatics sector particularly during the UDI era. The South African industry is fairly modernised and well computerised.

Thirdly, most of the current crop of senior and middle level public servants were educated, trained and obtained experience in the west at a time when computers and micro computers were making inroads into every facet of life. These people have already lived, seen, and experienced the benefits of using computers. Therefore, when they got into high office, they were quick to make use of the tools information technology had to offer.

1.2. Major Computer Installations in the Public Sector.

Every Government department and Parastatal in Zimbabwe either has its own computing facilities or it uses those offered by one or both of the two Government bureaus, or it uses a bureau in the private sector. As yet no Government organisation can be said to be fully computerised. However, the number of computer installations in the public sector is impressive for a country of Zimbabwe's size and status. The installations described below are examples of what is in existance at the time of writing. The full list is given in Appendix III.

Scientific Computing Centre (SCC) which is one of two Government Computer centres was established in 1982 with the following primary objectives

(a) The cost effective provision of computing facilities and resources to Government with emphasis on scientific type applications.

(b) The provision of centralised training facilities to SCC personnel, computing staff from user departments, as well as training designed to enhance general appreciation of computing within the Public Service.

(c) The provision of consultancy and advisory services to Government departments in the area of computing.

Three distinct application areas were identified when it was set up. These are (1) National & Socio-Economic Planning Development, (2) Engineering, and (3) Biological applications.

SCC was conceived and designed essentially as an on-line bureau. In fact in its original concept, SCC was more of an information centre than a bureau. User departments were expected to be completely self-reliant as far as programming was concerned. They were to get computing hardware and software from the SCC, as well as expert advice, guidance and training. This concept was jetissoned within two years after start up when it became evident that user departments could not get the required staff.

SCC applications can be grouped into three categories. Category one comprises applications implemented and run by the user departments with little or no input from SCC staff. The second category are applications implemented by SCC staff on behalf of users, and subsequently given to users for running. Maintenance is carried out by SCC staff. In the third category are applications implemented and run by SCC staff on behalf of users. The number of applications in the first category is not known. Those in the second and third categories range from statistical systems to national registries of residents.

The Computer equipment at SCC comprise two Perkin-Elmer model 3254 with 8 mb RAM each, and one Perkin Elmer model 3230 with 4mb RAM. There are a total of about 180 terminals connected to these machines and the total disk capacity of the three systems is 6 gigabytes. The three computers are linked through a micom 600 intelligent communication switch which allows any of the terminals to be connected to any one of three computers. The three computers are also linked by Ethernet. Users can access and transfer data from any of the other two systems while connected to a third system.

TREASURY COMPUTER BUREAU (TCB)

The oldest computer bureau in the country is the Treasury Computer Bureau (TCB) which is the second Government Centralised bureau. As mentioned above TCB was established in 1961. It was set up as a batch oriented installation and has remained so to this day. This is now changing with the

acquisition of new hardware (see below). TCB currently has one Data General MV8000 computer, one NCR criterion and one DG S140. These three computers currently support a user base of some 70 departments. Applications include Payroll, Tax, Government Accounts ecc.

AGRICULTURAL FINANCE CORPORATION (AFC)

AFC has quite a sizeable installation centred around a Perkin-Elmer 3254 computer with 8 mega bytes of memory and about 40 terminals. This installation is used to process loans and other inputs to the agricultural sector. It has terminals in Harare as well as in a number of sites in the two regional centres.

NATIONAL RAILWAYS OF ZIMBABWE (NRZ):

The National Railways of Zimbabwe has a network extending along the main stations on the main line of rail. NRZ has two Perkin-Elmer (now Concurrent Computers) 3230 computers and NCR Criterion and Tower computers. The main applications are wagon inventories and movements.

RECENT ACQUISITIONS:

(a) In the Last years, Air Zimbabwe purchased and installed a Vax cluster comprising two of DEC's 32 bit VAX 11/750s, 24 terminals and other associated peripherals costing around US$2 million dollars which was financed by the American Commodity Aid Programme. A set of Air Zimbabwe software packages like passengers, tickets, cargo, stores and financial packages are expected to be rewritten to run on this new system by the end of this year.

(b) PTC have signed a US$1.5 million contract involving Olivetti. This deal involves 40 M34 mini computers, 135 point of sale terminals and a number of PR 2845 multipurpose passbook printers. The minicomputers, each with 2 mb RAM, 1 mb floppy disk and 14.5mb integrated hard disk, have local processing capabilities and will operate local databases with on-line facilities to be connected to a central mainframe in due time. The ultimate aim is to put all post offices in the country on-line, including rural growth points, to provide efficient banking and post office services in even isolated areas. This should particularly help with the rural cash flow, expediting such matters as transfer of money from financial bodies to small scale farmers and agricultural cooperatives.

(c) Treasury Computer Bureau install two Data General MV20000 Model 1 super mini computers and four MV2000 DC micros, with 40 terminals and 10 gigabytes of disk storage. New application systems which will go on to these machines will include the (i) on-line stock control system

and an on-line Vehicle Fleet and Fuel Control system for the Central Mechanical Equipment Department, (ii) on-line stock control and movement for the Government medical stores, (iii) Patients Records and Drug stock and control, and statistics of laboratory sample tests for the Parirenyatwa Group of Hospitals and (iv) Stock Control and Accounting System for the Printing and Stationary Department.

(d) The Ministry of Education have signed a contract to buy a total of 10 Wang computers, one Wang VS 65 for the head office and a Wang VS 15 for each of the 9 regions. It is intended to have distributed data bases containing regional information about schools, teachers and students on the regional computers each with regional processing capability. However, all the computers will be networked together and linked to the central computer in the Head Office. The latter, in turn, will be linked to the TCB and SCC computers thus allowing transfer of data between computers and data bases. One immediate visible benefit from this type of system will be the quick payment of salaries (maintained from the TCB computer) to teachers in the rural areas.

1.3. Major Private Sector Installations

Some of the major private sector installations are:

(a) C F Tulley bureau
(b) N C R Bureau
(c) I C L Bureau
(d) Chemplex Corporation
(e) CABS
(f) Zimbank
(g) Beverley Building Society
(h) Meikles Computer Services
(i) Old Mutual
(k) SMS Bureau

1.4. Education & Training

In the area of education and training one must start with the University of Zimbabwe which has been running a joint Computer Science programme with other university departments for the last ten years or so and turn out annually about 20 to 30 graduates. This is one of the primary sources of recruitment for the government departments employing programmers. The other tertiary educational institutes in the country are the Harare Polytechnic and the Bulawayo Technical College. The former runs a National Intermediate Diploma (NID) and a National Diploma (ND) course and plan to start a Higher National Diploma (HND) in the near future. Bulawayo Technical College also intends introducing a Higher

National Diploma in Computing by 1987. Vendors like C F Tulley & Associates, NCR, ICL also run courses in Programming and Systems Analysis and other computer related courses from time to time. Some courses worth mentioning are (1) a one year course by ICL for academically qualified students in programming, and (2) a three month COBOL course run by C F Tulley & Associates where participants pay no fees but after successful completion of the course, CF Tulley helps in job placements with other companies from whom the fees are realized and trainees are bonded by the recruiting companies. An independent college in Harare - Speciss College runs Computer courses in Computer Appreciation, Basic programming and more recently have started a Programming Certificate Course of the British Association of Computer Professionals. Other software and hardware vendors also provide training in different word processing, spread sheet and data base packages for micro computers.

TELECOMMUNICATIONS

Zimbabwe, as already mentioned, is well ahead in terms of computer technology used both in hardware and software and is using on-line real-time applications and local and broad area networking and computer to computer communications. Besides those mentioned earlier, there are two other fairly large networks in the private sector - one belonging to a bank and the other to a building society both of which have been discussed in companion papers.

Going into such sophisticated technology has been made possible by the data transmission service provided by the PTC which allow computers to communicate from one site to another both nationally and internationally. PTC currently rents its circuits either on a dedicated basis or as a dial-up service. They are also working on the introduction of the International Packet Switching Service (IPSS). Initially, it is intended to introduce a system based on X.25 and X.28 protocols which will be connected to the British Telecommunications International Packet Switching Service with a node in Zimbabwe. This will facilitate transmission of small quantities of data at high speed, as is the general need, at low cost.

1.4.1. Computer Education in Schools

Computers are slowly being introduced in Zimbabwean schools as well. At present there are about 70 schools throughout the country which provide some computing facilities to their students mainly in the form of hobby clubs. Of these 20 are primary schools. The micro computers being used by these schools are mainly Sinclair ZX81, Spectrum, BBC micro, Commodore, Amstrad and Apple II and others. There are about half a dozen schools offering Computer Science as one of the subjects at 'O' and/or 'A' level to their students. Belvedere Teachers Training College provide training in programming and use of micro computers in school education to

future school teachers. A group of enthusiasts interested in computer education in schools comprising members from the Univesity of Zimbabwe and the Curriculum Development Unit of the Ministry of Education are also investigating how inexpensive micro computers (both in terms of initial buying cost and repair cost) running on car batteries can be introduced in rural areas. The ministry of Education is also looking into the manufacture of BBC micro computer type equipment with the help of some local electronic equipment manufacturer and of introduction of computer aided educational materials which can alleviate shortage of teachers and books particularly in rural areas.

1.4.2. Computer Societies and Clubs

To cater for the fast growing computer community there are a number of associations and clubs in the country. First of all there is the Computer Society which is a joint host at this conference. The society currently has about 400 individual members and 100 institutional members belonging to the three branches in Harare, Bulawayo and the Midlands. Its activities include holding of a Datacom seminar each October to inform the public on a particular aspect of computer industry, an annual summer school for society members to discuss current and future issues related to computing, a Computer Olympiad held biannully to stimulate interest amongst school children, and advising the polytechnic in course developement. The Harare Branch of the Society holds regular seminars on the second Wednesday of each month at a local hotel.

There are also two clubs for micro users in the country- the Harare Green Screen Club and the Bulawayo Micro club. These clubs aim to interest and educate newcomers in the fascinating field of microcomputing. Both clubs have organised very successful computer exhibitions in collaboration with the local Rotary Clubs.

There is also a monthly newspaper called Computer News published in Harare giving news and views on everything related to computers in Zimbabwe and generally circulated to all computer professionals in the country. A newsletter MUZE (microcomputer users in Zimbabwe Education) published by the Curriculum Development Unit of the Ministry of Education is circulated to computer users in schools.

Appendix I

LIST OF COMPUTER VENDORS IN ZIMBABWE:

Vendor Name	Equipment
ABM & M (Pvt) Ltd	IBM mainframes,minis,PC's.
Accounting Equipment Supplies	Olivetti Computers & Microcomputers
Atex	Atex products
Burco Electronic Systems	Burroughs equipment
C F Tulley & Associates	Data General Equipment
Computer Processing Group	Wang Equipment, ACORN,BBC micro
Computer Systems & Packages	PSION PC100 range,Apricot/BBC/ Electron/Sinclair/Spectrum
Computer Technology Group Ltd	Corona
Field Technical Sales	Hewlett-Packard
ICL Zimbabwe	ICL equipment
Memory Computers	Memory microcomputers
Microtech	Apple microcomputers
NCR Zimbabwe	NCR equipment
O M L	Facit microcomputers
Philips Zimbabwe	Philips microcomputers
Philpott and Collins	NCR Decisionmate microcomputers
Pro Micro	OEMTEK micro-computers
Protea Computers	Perkin-Elmer equipment
Realtime	Digital equipment
Shinghai Holdings	Ohio Scientific microcomputers
T A Computer Services (Pvt)Ltd	Nixdorf equipment
TEE Systems	Future Computers
Unlimited Business Machines	AMI and Canon microcomputers

Appendix II

List of user departments of SCC

Agriculture
Agritex
Blair Research
Cancer Registry
Civil Aviation
Cotton Research
Central Statistical Office
Deeds Office
Education
Finance Economic Planning & Development
Forestry
Gelogical Survey
Health
Industry & Technology
Labour Manpower Planning and Social Welfare
Lands
Legal & Parliamentary Affairs
Local Government
Matopos Research
Metallurgy
Meteorological Services
Mines
National Parks
National Archives
National Registration
Parirenyatwa Hospital
Physical Planning
Public Service
Public Construction and National Housing
R & S S (BIOMETRICS)
Registrar General
Reserve Bank
Roads
Surveyor General
Tax Commission
Tsetse Control
Vet Services
Water Development

Appendix III

Government Computer Installations

Installation	Computer	Application
Ministry of Labour Man power Planning and Social Welfare	ICL ME 29 ICL micros	Student and scholarship file.Word processing
Treasury Computer Bureau	NCR Criterion DG MV8000, DGS140 MV9000	Accounting, Payroll etc Police, PC's (wordprocess etc.
Scientific Computing Centre	PE 3254 (2) PE 3230 (1) IBM PC/XTs	Various application for 30 departments, for ex CSO
Prime Minister's Office	Perkin Elmer 3220	
Central Statistics Office	PE-30 (1) micros IBM-PC/XTs	Surveys, word-processing calculations
University of Zimbabwe	NCR Decision Mate micros (13) ICL 2946 NCR Tower ICL ME-29 Digital Vax 11/750	Educational purposes
Harare Polytechnic	ICL ME-29 ICL Micros Bulgarian Computer SM4	Education and training
Agriculture	Perkin Elmer 3230 Hewlett Packard IBM PC/XT	Biometrics Agritex
Zimbabwe Army	Data General C 350	
Surveyor General	H P 1000	Digital Mapping
Economic Planning	HP 150 Data General	Cattle Control
Ministry of Construction and National Housing	Wang OIS Wang PC IBM PC	Stock Control
Forestry Research Forestry College	IBM PC/XTs Data General DC10	research in forestry teaching,wordprocessing

Ministry of Trade and Commerce	Micro	Trade information
Harare Parirenyatwa Hospital	IBM PC/XT	National Cancer registry
Education		
Head Office	Wang VS/65 (on order)	
Regions(9)	Wang VS/15 (on order)	
Exam Branch	IBM PC	
Local Government & Town Planning	Various computers in districts	Accounting, payroll
Ministry of Health	IBM PC/XT	Child spacing
National Parks	H P micros	Game/Poaching statistics
Meteorology	P E 737	weather related data
Transport	Olivetti M29 microcomputer	
Reserve Bank	Wang VS 90 Wang LVP Wang PC's	Banking Salaries,wages statistics,wp,spreadsheet
Taxes	Data General S 140	Collection of taxes
Geological Survey	micros	
Blair Research	IBM PC/XT	survey & research in Bilharzia & other diseases
Physical Planning	Wang PC	

2. Inhouse training

Going into computerisation is a fairly big investment. To obtain the best return on this, organization have to ensure that the people responsible for the day to day rumining and managing the machines are properly trained to be able to maximise benefit with leart cost.

Different types of training are required operator training programm traininig, systems analysis training, user training, computer appreciation training for general management and users, and technology update or adwanced training.

Basic operator training is generally avaitable through the supplier of machine.

Many larger organizations, due to lack of any other alternative, arrange inhouse training for hew recruits which sometimes lasts as long as nine month.

In Zimbabwe, vendors provide such in-country training at user request or for general public from time to time.

For example: NCR Computer Science Institute Harare ofers such training Apendix 2.I

Training course schedule ofers by CF Tully Bureau is given in Apendix 2.II

NCR

COMPUTER SCIENCE INSTITUTE
HARARE

COURSE CATALOGUE
AND
SCHEDULE

INTRODUCTION

This catalogue includes all the courses that are currently available in the NCR education centre, which is situated on the third floor of NCR House, corner of Samora Machel Avenue/First Street, Harare. The schedule includes some courses which are on a demand basis only, and requests for these courses should be made to the education centre, or to your account manager. Unless otherwise specified, all courses commence at 8.30 a.m. and finish at 4.30 p.m.

COURSE PREREQUISITES

To receive maximum benefit from each course, all students should review the pre-requisites listed with the course description and ensure they have been satisfied. In order to assist in establishing that students have the necessary pre-requisites for each course, there is provision on the booking sheets for information on relevant courses or equivalents that the student has already undertaken.

ENROLMENT PROCEDURE

All enrolment correspondence and enquiries should be directed to the Education Centre, NCR Zimbabwe (Pvt) Ltd, P.O. Box 979, Harare. The number of students on each course will be strictly limited to ensure maximum participation of students, and early application is therefore advised. Payment is due with the application form in order to ensure a place on the required course. Additional application forms are available on request.

COURSE CANCELLATION

NCR reserves the right to cancel any class in advance upon seven day's notice to customers with confirmed enrolment. Students who are unable to attend a course must inform the education centre in writing at least eight days before the course is due to start in order to receive a refund of the course fee.

COURSE COSTS

The costs shown in the catalogue are per student and include tuition, materials, computer time where applicable, and tea or coffee, for courses held in Harare.

Where there is a requirement for courses to be run on a customer site, outside Harare, or where there are a number of employees from the same company requiring a particular course, a daily rate may be negotiated with NCR, irrespective of the number of students attending. NCR does, however, reserve the right to restrict numbers on such courses where the course would be less effective with too many students.

TABLE OF CONTENTS

INTRODUCTION TO PERSONAL COMPUTERS - MS-DOS

Course Number 200001
Length 3 days

COURSE DESCRIPTION

This course is designed to give prospective users of Personal Computers an introduction to the capabilities and workings of a typical Micro Computer. The basic concepts and commands of the MS-DOS operating system are explained and practised in a workshop environment which combines lectures and hands-on time.

In addition to the hardware and operating system, the Wordstar and Multiplan application packages will be explained and practised with sufficient time allowed on each to let the attendee 'get started', and to gain an insight into how the Micro computer may be used as a vital personal tool in the performance of technical, managerial and administrative functions.

COURSE OBJECTIVES

Upon successful completion of the course, the student will be able to:-

- Identify PC hardware components and features
- Operate and use all the keys of the machine
- Operate and use the MS-DOS operating system
- Understand different types of application software
- Perform the basic functions of a word processing package and spread-sheet application
- Load, run and execute programs
- Identify the programming languages available on PC's

PRE-REQUISITES

None (Typewriter keyboard knowledge an advantage)

CP/M OPERATING SYSTEM

Course Number A02902
Length Self Instruct

COURSE DESCRIPTION

An operating system is a software program which provides the interface between the computer and the computer user.

This course provides you with the background and practice necessary to use your Decision Mate V and the CP/M Operating System. The CP/M commands and command usage presented in this course include only those required to successfully utilise application PC packages or write programs using MBASIC on the Decision Mate V. This course is designed to be used with the CP/M/80 Version 2.2 Operating System.

COURSE OBJECTIVES

This self-instruct course is designed to teach you how to use the CP/M Operating System on your own Decision Mate V, in your own time.

There is a student manual available, together with a course disk which can be used with any released DMV model that uses the CP/M-80 Operating system.

REQUIREMENTS

Should you require the courseware disk as well as the manual, could you let us have a five and a quarter inch flex disk, and we will provide you with a copy of the software with the manual.

WORDSTAR - WORDPROCESSING IN DEPTH Course number 200002
Length 2 days

COURSE DESCRIPTION

Word processing software is a productivity tool that allows someone to compose, store, revise, edit and print texts. This course is designed to review a working knowledge of the PC operating system and an "in-depth" knowledge of the WORDSTAR package. Besides looking at all the commands within the word-processing package, the course will include tuition on SPELLSTAR and MAILMERGE. This will be an intensive course with a great deal of "hands on", practical work on an NCR DECISION MATE V.

COURSE OBJECTIVES

Upon successful completion of the course, the student will be able to:

- Describe different types of Wordstar files
- Use the different control keys on the keyboard
- Use standard Wordstar commands including insert, delete and modify for words, characters, lines or paragraphs
- Use the search and replace function on a string of characters to change the same word (string) throughout the text
- Use printing control characters
- Perform column moves
- Set margins, page length, indentation, text alignment and line spacing in the printing of a document
- Control the cursor movement to jump from one location to another in a text
- Use SPELLSTAR
- Use MAILMERGE

PRE-REQUISITES

Introduction to PC's (MS-DOS) or equivalent

SUPERCALC SPREADSHEET Course number 200003
Length 2 days

COURSE DESCRIPTION

Spreadsheet programs allow the use of a personal computer for all tasks performed on data analysis sheets and calculators. Supercalc is designed for all levels of personnel who will be using the electronic spreadsheet application. Students will learn how to set up a spreadsheet and use the graphics in Supercalc 3.

COURSE OBJECTIVES

Upon successful completion of the course, the student will be able to:

- Define a spreadsheet and detail how and when it could be used
- Load and activate the spreadsheet program
- Design spreadsheet formats and calculation models for given problems
- Save and reload a spreadsheet, change variables in it and print it
- Try out different "what if" scenarios
- Use "help" "scrolling" and "go to" keys

PRE-REQUISITES

Introduction to PC (MS-DOS) or equivalent

MULTIPLAN SPREADSHEET

Course number 200004
Length 2 days

COURSE DESCRIPTION

The course is designed for all levels of personnel who will be using the MULTIPLAN electronic spreadsheet application. The student will learn the basic concepts and features of MULTIPLAN, in a practical, hands-on environment.

COURSE OBJECTIVES

Upon successful completion of the course, the student will be able to:

- Load and Save Multiplan spreadsheets
- Enter Data in the spreadsheet
- Build and enter formulae
- Format the input
- Perform file transfers
- Print the spreadsheet

PRE-REQUISITES

Introduction to PC (MS-DOS) or equivalent

LOTUS 1-2-3 WORKSHOP

Course Number 200005
Length 2 days

COURSE DESCRIPTION

This course is designed to help understand the overall concepts and application of Lotus 1-2-3 and its facilities. Use of the Lotus spreadsheet, can help solve your common business problems such as forecasting, budgeting, costing, analysis etc. It enables you to achieve improved productivity in the work place by using integrated software to control and access information.

COURSE OBJECTIVES

Upon successful completion of this course the student will be able to:

- Design a spreadsheet: Manual vs Electronic
- Describe the capabilities of Lotus 1-2-3
- Use the various Lotus commands
- Improve the appearance of a spreadsheet
- Use mathematic operations, formulae and financial functions
- Basic file commands such as loading, saving and printing
- Experiment with "What - If" situations
- Use windows and titles
- Perform some consolidations
- Design and print graphs

PRE-REQUISITES

Introduction to PC's (MS-DOS) or equivalent.

DBASE III PROGRAMMING

Course Number 300006
Length 5 days

COURSE DESCRIPTION

The course is aimed at anyone with a knowledge of PC's who wishes to use DBASE III to write data handling programs for use in a business or personal environment. It is an intensive, hands-on course which involves solving a pre-determined problem by creating the necessary Data Base files and command files to run a program.

COURSE OBJECTIVES

On successful completion of the course, the attendee should be able to:

- Describe Data Base concepts
- Create Data Files
- Describe the Six Types of Files
- Use Indexing
- Perform file handling
- Establish command files
- Use the various programming commands
- Write a complete program
- Use external files

PRE-REQUISITES

Familiarity with micro computer operations.

Some experience in flowcharting/programming.

VRX OPERATIONS

Course Number 330905
Length 5 days

COURSE DESCRIPTION

This course presents operating procedures used on an NCR 8000 Series processor using the Virtual Resource Executive (VRX) Operating System. System initialisation, job flow, display responses and unsolicited input are discussed. Hands on workshop allows the student to enter jobs, request displays, and respond to system messages. Utility routines, restart and run book procedures are also discussed and practised.

COURSE OBJECTIVES

Upon successful completion of this course the student will be able to:

- Briefly describe the functions and components of the NCR VRX system
- Initialize an NCR system in a virtual storage mode
- Create the necessary job control language statements to enter jobs to the VRX operating system
- Enter system control functions, system control commands and unsolicited input
- Respond to system messages and request system displays
- Reference publications to complete parameters for basic utility routines, such as copy and initialization routines
- Prepare JCL to run catalogued jobs, piggyback jobs and restart jobs
- Use 'EDIT' or NOTE to display directory, create and run a catalogue job, delete a file and display the status

PRE-REQUISITES

EDP concepts

VRX PROBLEM SOLVING TECHNIQUES

Course Number K07105
Length 5 days

COURSE DESCRIPTION

The course is designed to teach a student the VRX operating system structure and functions with emphasis on the software control table content and interrelationship. The intention of the authors is that the information provided by this course will assist the student in analyzing and solving his VRX program problems. Students will debug NEAT/VS and COBOL programs.

COURSE OBJECTIVES

After successful completion of this course, the student, using available reference materials, will be able to:

- List the functions and explain the associated control table relationship of the following parts of the VRX operating system:
  - Satellite and Kernel tasks
  - IOS modules
  - Task and DSA management
  - Virtual storage system
  - Program loader
  - File management and CAM
  - B-series support logic
- Print and interpret the software update table
- Describe the significance of the IOS module's IOCB chains
- Interpret NEAT/C control table definitions (INCL files)
- Briefly describe the system's interrupt handling and explain the ICF/ISF relationship
- Explain the purpose of the lock, queue and signal headers
- Properly interpret the system control stack and the stack analysis report
- Explain VRX use of the linkage table and user stack for controlling intermodule transfer
  Describe the purpose of the software window and the B-series branch table
- Describe and properly interpret, in a problem-solving environment, the object sections of a VRX Cobol program
- Describe the functions of the three different virtual memory areas used to simulate a system disk for a job
- Successfully analyze and solve a program problem using a CAM indexed file
- Interpret and solve a problem associated with B-series support logic

PRE-REQUISITES

Cobol 74 or Advanced VRX Cobol, or Accelerated NEAT/VS experience
VRX Operating System experience
Systems analysis experience in a VRX environment

VRX INTERNALS

Course Number K52105
Length 5 days

COURSE DESCRIPTION

This course is designed to provide documentation and structures of the modules, tables, techniques and functions of the VRX Operating System.

COURSE OBJECTIVES

Upon successful completion of this course the student will be able to:

- Describe VRX system initialization steps and determine from documentation the order and call of a particular step
- Describe the real and virtual memory tables and files and describe the techniques of address translation
- Relate the elements of VRX linkage mechanism and extract necessary information from a VRX dump
- Define the purpose of and locate elements in the window routine
- Describe the components of global and local DSA pools and ways to decrease the use of these areas by the user
- Relate the IOS tables and lists and locate chains of IOCBs in a memory dump
- CPU Dispatch search chains and interrupt procedures
- Card, printer and magnetic tape spooling techniques and identify spool file formats

PRE-REQUISITES

VRX Problem Solving Techniques course.

Suggested audience is personnel responsible for maintenance and/or support of the VRX Operating System in the capacity of a systems programmer, systems analyst, systems engineer, or software developer

VRX COMMUNICATIONS - MCS

Course Number 389105
Length 5 days

COURSE DESCRIPTION

This course teaches the student to program telecommunication applications using the Network Description Language (NDL) and Message Control system (MCS)

COURSE OBJECTIVES

Upon successful completion of this course the student will be able to:

- Explain the VRX Telecommunication user interface and relationship to the VRX telecommunications task structures
- Create the system initialization and job specifications necessary to define telecommunications resources
- Design, code, compile, link edit, test, and debug telecommunications programs using:
  - Network description language (NDL)
  - Message control system (MCS) single tasking for TTY terminal (VRX Cobol or NEATVS)
  - MCS multitasking for TTY and polled terminals (VRX Cobol and NEATVS)
- Use the TCAID feature to capture information that will be helpful in testing VRX telecommunications programs

PRE-REQUISITES

VRX Operating system knowledge
Accelerated NEATVS or Advanced VRX Cobol
Communication system concepts

IRX/ITX OPERATING SYSTEM

Course Number K21805
Length 5 days

COURSE DESCRIPTION

This course prepares the student to use and to support others who use the Interactive Transaction Executive operating system. Most aspects of the operating system will be covered, with emphasis on normal operating procedures.

COURSE OBJECTIVES

Upon successful completion of the course the student will be able

- Demonstrate an understanding of the concepts and features of the operating system by utilizing the appropriate functions
- Demonstrate proficiency in using selected commands, options
- Demonstrate proficiency in the input of the System command language
- Perform printer operations including using the automatic
- Perform selected system utility programs including Text
- Be prepared to interact with the Error Log Utility, the "Audit Trail" Utility, and System Access Control as they relate to daily operations.
- Construct and use control strings
- Create batch processes using the batch queuing feature
- Perform selected operating system-related programming functions
- Be prepared to install and make basic modifications to the operating system software

PRE-REQUISITES

Some experience with an interactive system e.g. IMOS

IMOS V OPERATING SYSTEM

Course Number K08105
Length 5 days

COURSE DESCRIPTION

This course prepares the student to use and to provide support for the operating system known as the Interactive Multiprogramming Operating System V (IMOS V). Emphasis is placed on system operations, hardware components and configurations, and operating system components. This material is presented through a series of lectures and is reinforced through team environment workshops which permit the student to construct system command files, use the utility features of the operating system, and configure and generate the IMOS V system.

COURSE OBJECTIVES

Upon successful completion of this course the student will be able to:

- Demonstrate proficiency in using IMOS V system commands
- Construct and use system command control strings to employ IMOS V system processors and utility routines
- Use the Text Editor to construct, modify, and store data files on disk and cassette
- Demonstrate a knowledge of the file structures and directories used in IMOS V
- Execute the following utility programs: SSORT, STALLY, SEPAC, SDAP, SMFCC, SFIST, SSCURE, SMINT, SSAL/SALPC, AND STAT
- Operate the hardware system on which the IMOS V is being used in workshop
- Design and generate the IMOS V operating software for a specific configuration based upon hardware and software requirements
- Demonstrate proficiency in establishing and using a secure IMOS V operating system

PRE-REQUISITES

EDP concepts

UNIX OPERATING SYSTEM

Course Number K22405
Length 5 days

COURSE DESCRIPTION

This course details the use of various commands contained in the UNIX Operating System. Use of UNIX commands and the Bourne Shell for [redacted] operations and software development is presented. Emphasis is placed on the areas of system operations, the system [redacted] and various utilities and software tools.

COURSE OBJECTIVES

Upon successful completion of the course, the student will be able [redacted]

- [redacted] system commands in daily information processing
- [redacted] modify and store disk files using one of the available [redacted]
- [redacted] various software tools for program development
- Create and modify file and directory structures using system [redacted]
- Use system commands to complete local and network communication activities
- Describe special features and utilities available with UNIX

PRE-REQUISITES

EDP Concepts

- UNIX is a trade mark of Bell Laboratories Inc.

BASIC PROGRAMMING

Course Number Z00010
Length 5 days

COURSE DESCRIPTION

This course acquaints the student with the fundamental concepts of BASIC programming through a problem-oriented approach. Screen formats and data precision handling are studied in simple applications. Workshop exercises enable the student to write, test and debug programs following classroom examples.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:-

- Code, enter, debug, save, and execute a BASIC program
- Develop a program using the appropriate data types, display instructions, and arithmetic expressions for numeric value
- Write instructions using the basic functions explained during class
- Format a screen display
- Follow the logic of a basic program that includes several for/next loops and subroutines

PRE-REQUISITES

EDP concepts
Some experience with a micro or other computer, or typewriter keyboard experience

ADVANCED BASIC PROGRAMMING

Course Number Z00011
Length 5 days

COURSE DESCRIPTION

This course is designed as a 'follow up' to the Basic course number Z00010. It follows the same format as the previous course, being a combination of lectures and workshops, but goes in to more depth, adding to the number of commands covered, and more complicated programming examples.

COURSE OBJECTIVES

On successful completion of this course, in addition to the objectives met in a 'basic' Basic course, the student will be able to:-

- Design a program
- Do advanced flowcharting
- Perform complex file handling
- Use arrays
- Use string handling and data file storage
- Perform validation routines

PRE-REQUISITES

Basic BASIC programming course (Z00010) or previous Basic programming experience

Knowledge of micro computers

'C' PROGRAMMING LANGUAGE

Course Number N16105
Length 5 days

COURSE DESCRIPTION

This course introduces the student to the high-level language "C". C was developed at Bell Laboratories and was used to write the UNIX Operating System. The course is designed for those who will be developing, maintaining, or modifying C programs. In addition, topics such as C's machine independence and accommodation to structured programming will be discussed.

COURSE OBJECTIVES

Upon successful completion of the course, the student will be able to:

- Briefly describe the history of the C language
- Define the C data types and their use within C programs
- State the use of the Storage Classes available in C and their use
- Parse several terse C expressions using the operator's definition and precedence table
- Use the following correctly within C programs:
  - Control flow statements
  - Simple I/O
  - Arrays
  - Structures
  - Functions
  - Pointers
  - Macros
- Describe the use of the C-Processor
- Define recursion
- Define the standard I/O Library and UNIX interface
- Successfully compile, debug and execute a C program

PRE-REQUISITES

Some experience with the Unix Operating System
Experience in at least two high level languages

INTRODUCTION TO INTERACTIVE COBOL PROGRAMMING

Course Number 364105
Length 20 days

COURSE DESCRIPTION

This course is an introduction to Cobol as it is used in an interactive programming environment. It will provide the student with the concepts useful in diagnosing a problem, designing a programmable solution, and writing application programs in a structured manner.

The course will furnish the student with source level programming techniques based on American National Standards Cobol 1974. The practical work will be carried out under the NCR IMOS, IRX, CP/M or [redacted] operating systems, but is easily adaptable to any interactive operating system.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- List and describe the systems and structures of data representation
- [redacted]
- Describe the types and functions of software
- [redacted]
- Define the file concept, giving advantages and limitations of [redacted] file types
- [redacted]
- List and describe file organizations and access techniques
- [redacted]
- Explain the purpose, advantages, and limitations of various processing modules
- [redacted]
- Identify and use ANSI standard flowcharting symbols
- [redacted]
- Code, compile, debug, and successfully execute Cobol 74 programs that involve:
  - the creation and processing of sequential files
  - the random and dynamic processing of indexed files
  - the creation of printed reports
  - the creation of interactive processes

PRE-REQUISITES

EDP Concepts
Experience with an interactive operating system
A pass in an aptitude test (NCR's personnel division runs these tests and would be happy to accommodate you if you have never sat an aptitude test)

ADVANCED INTERACTIVE COBOL PROGRAMMING

Course Number 320105
Length 5 days

COURSE DESCRIPTION

This course furnishes an experienced Cobol programmer with features and programming techniques associated with NCR Interactive Cobol. Workshop exercises permit the student to code, compile, and test complex Cobol programs using an interactive system. There will be exercises assigned to the students which may require additional work outside the classroom both before and during the course.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- Code, compile and execute Cobol programs
- Describe the different file structures and file processing techniques
- Interpret various sections and error messages
- Explain debugging techniques available
- Successfully use declaratives in the design, coding and implementation of a Cobol program
- Use libraries within a program
- Access and use SCL commands from within a Cobol program

PRE-REQUISITES

Cobol programming experience, or a pass in the Introduction to Interactive Cobol (Course Number 364105)

Experience with an interactive operating system

A pass in an aptitude test

VRX COBOL

Course Number NOB105
Length 5 days

COURSE DESCRIPTION

This course presents the unique features and programming techniques associated with the NCR Virtual Resource Executive (VRX) Cobol. Workshop exercises permit the student to code, compile, and test Cobol programs using NCR VRX Cobol. There will be programming exercises assigned to the students which may require additional work outside the classroom.

COURSE OBJECTIVES

Upon successful completion of this course the student will be able to:

- Code, compile and execute Cobol programs under VRX
- Describe the different file structures and file processing techniques available in VRX Cobol
- Interpret various sections and error messages in compile and link edit reports
- Explain the debugging techniques available in VRX Cobol and ANSI debug and determine when and how such techniques could be used
- Describe Cobol language elements which permit a user program to interface with VRX Message Control System
- Create an ICAM file and access the ICAM file through a Cobol program

PRE-REQUISITES

Experience working with the VRX operating system

Cobol 74 programming experience

NEAT 3 PROGRAMMING CONCEPTS

Course Number 200012
Length 5 days

COURSE DESCRIPTION

This course is designed to give the programmer experience in the concepts of Data File Handling, Flowcharting and documentation. It is intended as an introduction to NEAT 3 level 1 programming.

COURSE OBJECTIVES

Upon successful completion of the course, the programmer will be able to:-

- Flowchart a program
- Handle all the relevant documentation
- Be fully equipped to begin programming in NEAT 3 level 1

PRE-REQUISITES

Some Operating System Experience

NEAT 3 LEVEL 1 PROGRAMMING

Course Number 200013
Length 10 days

COURSE DESCRIPTION

This course provides NEAT 3 Level 1 language capability for experienced magnetic file programmers. The course pace is geared to take advantage of the student's previous EDP knowledge and programming skill. Workshop assignments allow the student to use the language to prepare programs from coding, through compiling and testing.

COURSE OBJECTIVES

Upon successful completion of the course, the programmer will be able to:

- Define data
- Code a NEAT 3 Level 1 program for serial file processing
- Have an appreciation of utility routines, control strings and their uses in a programming environment.

PRE-REQUISITES

NEAT 3 Programming Concepts (Course number 200012)

A pass in an aptitude test (NCR's personnel division run aptitude tests on request and would be happy to assist in this if the student has not previously taken an aptitude test).

NEAT 3 LEVEL 2 PROGRAMMING

Course Number 420200
Length 10 days

COURSE DESCRIPTION

This course is designed to extend the student's knowledge of the NEAT 3 Language enabling him/her to control all machine operations except the direct handling of input/output functions. Workshop assignments provide practice in assigning and accessing index registers, interpreting object commands, coding with machine level instructions and patching object programs.

COURSE OBJECTIVES

On successful completion of the course, the programmer will be able to:-

- Combine the power and simplicity of NEAT 3 with the hardware efficiency of NEAT 3 Level 2
- Effectively use index registers
- Interpret object commands
- Code a level 2 program using:
  - Data definitions
  - Hardware commands
- Describe the relationship of file and buffer tables to an I/O request
- Interpret the extended object listing of a program
- Use temporary and permanent patches
- Interpret a memory dump

PRE-REQUISITES

NEAT 3 Level 1 Programming course/experience

A pass in an aptitude test (see NEAT 3 level 1)

PAYROLL

Course Number [illegible]
Length 2 days

COURSE DESCRIPTION

This course is designed for the new customer who wishes to use the NCR payroll application package, operating on a micro computer, or under the I-series operating system. It introduces the data files, processing considerations, input forms, and output report formats associated with this package.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- State the general purpose of the Payroll application
- List the features and customizable options
- Describe the implementation tasks and basic data files
- List the activities of normal processing
- List the correct sequence of [illegible]

PRE-REQUISITES

EDP concepts

FLEXACCOUNT

Course Number 200021
Length Variable

COURSE DESCRIPTION

This course is designed for the new customer who wishes to use the Flexaccount application package running on a micro computer, or under the i-series or Unix operating systems. The course covers an overview of the whole general accounting system package, including the data files, processing considerations, input forms, output reports and interfaces between the various modules. The modules will then be looked at in more depth, allowing one day for each module, subject to demand for each module.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- Describe the files associated with applicable modules
- Describe the interfaces available in the package
- Prepare the input forms necessary for installation
- Produce the reports required from the system
- Describe the activities performed in normal processing
- Explain the current processing sequences

PRE-REQUISITES

EDP concepts
Knowledge of general accounting principles

INTERACTIVE MANUFACTURING CONTROL SYSTEM

Course Number W18425
Length 5 days

COURSE DESCRIPTION

This course will provide the student with the knowledge to correctly implement and run the IMCS application package. In the initial course four modules are covered, namely Bill of Material, Inventory Control, Routing and Material Requirements Planning. However, further modules may be covered, each taking one day, subject to demand for the remaining modules of Master Production Scheduling, Purchasing and Receiving, Work-in-Process, Capacity Planning, Order Processing and Sales Analysis.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- List and define the files and programs used by the MCS IMCS application package
- State the purpose of the various IMCS modules
- Utilize the CRT displays used throughout the system
- Print and interpret all application reports
- List the steps required for installing IMCS
- Define the start of day, system maintenance and backup procedures
- Successfully complete a series of hands-on workbenches

PRE-REQUISITES

EDP concepts or equivalent knowledge

A detailed understanding of the manufacturing industry

FINANCE FOR NON FINANCIAL MANAGERS

Course Number [illegible]
Length [illegible] days

COURSE DESCRIPTION

As a manager, your need for information increases as the organisation grows and becomes more complex. Most of this information is provided by the finance department. This course is designed to give the non-financial manager a full understanding of financial jargon, concepts and procedures. The aim is to give an insight into the uses and limitations of basic financial information.

COURSE OBJECTIVES

On successful completion of this course, the student will be able to:

- Define accounting concepts and discuss practices
- State the role of accounting as a source of information
- Describe financial ratios and identify financial strength and weakness
- Identify the managerial need for funds flow analysis and value added
- Describe the working capital cycle
- List motives of cash holding
- State cash collection and cash disbursement techniques
- Formulate an inventory policy
- Describe different methods of forecasting revenue
- Prepare a flexible budget
- Prepare a master budget
- Define breakeven and list its uses
- Learn the application of contribution for decision making
- Implement profit planning and control
- Analyse and interpret accounts
- Understand what is involved in managing and controlling Current Assets and Liabilities
- Explain forecasting and budgeting
- Describe variance analysis and control
- Understand profit planning and decision making
- Explain business evaluation

PRE-REQUISITES

There are no pre-requisites, but the course is aimed at managers or other senior levels of personnel outside the [illegible] department of their company.

COMPUTER CONCEPTS FOR MANAGEMENT
(Formerly EDP Executive Seminar)

Course Number 434550
Length 2 1/2 days

COURSE DESCRIPTION

This seminar is designed for senior to top levels of management who want to understand the operation, use and potential of computers in order to make strategic decisions on the integration of the data processing department with other functions of the business. The course provides an understanding of computer concepts and terminology, to improve communications with data processing personnel and to provide an insight into management involvement with data processing functions.

COURSE OBJECTIVES

Upon completion of this course, the participants will have covered:

- The concepts of Data Processing and Computers
- Computer systems - hardware
- Computer systems - software
- The personal computer

  Computer files and file processing
- Office automation
- Application systems planning, design, selection and implementation
- Communications and networking
- Management of the Data Processing function
- Computer systems - personnel

  Computer security
- The computer as a management tool
- Computer service and support

PRE-REQUISITES

None.

EDP CONCEPTS - FUNDAMENTALS OF COMPUTERS AND PROGRAMMING LOGIC

Course Number 680005
Length 4 days

COURSE DESCRIPTION

The course provides the fundamental concepts that should be understood by anyone who intends to become involved with computers and data processing. The structure of computer systems, software concepts, file types and processing considerations are discussed. Programming logic is introduced through the use of flowcharts.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- Identify and define the components of a computer system including input, output and storage devices
- Describe how data is represented within a computer system
- Identify and describe the different types of software available today. Particular attention will be paid to programming languages and operating systems
- Describe the different ways that computer files are organized and processed
- Draw flowcharts of solutions to data processing problems.

PRE-REQUISITES

None.

INFORMATION SYSTEMS MANAGEMENT
(Formerly EDP Planning Seminar)

Course Number 676005
Length 4 days

COURSE DESCRIPTION

This is a seminar for EDP User Management, discussing guidelines for effective management in the EDP environment. The seminar informs the manager of the responsibilities and obligations of the EDP manager, as well as how to achieve success in installations.

This course is aimed at DP personnel who are involved in management, as well as middle or senior management personnel who may not belong to the DP department, but who are heavily involved in DP. It is also very useful as a 'refresher' for established DP managers.

Instruction takes the form of lectures with overheads, video and workshop sessions where groups of students work together on a case study.

COURSE OBJECTIVES

On successful completion of this course, the participants will be able to:

- Explain the organizational role of the EDP manager
- Use planning tools for installation management
- Discuss the advantages and disadvantages of various processing methods in the changing EDP environment
- Discuss the importance of having controls in data processing
- Discuss what is involved in effective staffing, recruiting and training
- Determine what factors influence long-range and short-term planning
- Discuss the need for and techniques of capacity planning

PRE-REQUISITES

A knowledge of basic management skills and EDP terminology.

BASIC SYSTEMS ANALYSIS SKILLS

Course Number 490000
Length 15 days

COURSE DESCRIPTION

This course provides the beginning analyst with a basic framework for analysing existing information processing systems and designing new EDP systems. It follows a proven system development cycle like the one used by NCR for developing its highly successful application software. The portions of this cycle in which the analyst is heavily involved are emphasized. A realistic case study is used to reinforce the concepts that are presented in the course. The course is presented by a combination of lecture, video and workshop sessions.

This course provides the analyst with certain basic skills that are necessary for analysing and designing data processing systems. It is split into three separate sessions so that the student may have time to consolidate each week's work before the next session.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to:

- Define the systems analysis function and indicate the major characteristics that a systems analyst must possess
- Gather and analyze data in order to determine the feasibility of a project
- Prepare a project approval report and present it to management
- Gather and analyze data to formulate a solution to the project
- Complete input/output definitions based on data gathered
- Perform the following design tasks and generate the accompanying documentation
  - Write a system description
  - Prepare a system flow
  - Determine hardware requirements for the system
  - Determine communications considerations
  - Prepare program narratives for the system
  - Document the system run options
  - Document the formats of system files and records
- Indicate the types of tasks and the major areas of a company that are involved in converting from one data processing system to another
- List some guidelines for, and conduct an effective management presentation

PRE-REQUISITES

This course requires an understanding of EDP Concepts, the basic organization of a business and how to prepare system flowcharts.

PROJECT MANAGEMENT TECHNIQUES

Course Number 630000
Length 4 days

COURSE DESCRIPTION

This course is designed for NCR and customer personnel involved in application software development. It is intended for project managers, first line managers, senior programmers or other senior level personnel involved in project planning, supervision, or co-ordination including budget or other related administrative areas.

COURSE OBJECTIVES

Upon completion of the course, the attendee will be able to do the following:-

- Explain how the three management functions relate to project management
- Explain the need for a Standard Software Development Cycle
- Define and explain the six phases in a development cycle
- Using specifications for a software project:
  - determine project deliverables and dependencies
  - network the project and identify the critical path
  - develop bar charts showing time estimates
  - develop a milestone chart showing significant events
  - perform a complete risk analysis
  - recommend appropriate organization structure to implement the project
- Explain the role of management in each phase of the development cycle

PRE-REQUISITES

Involvement in a DP department at middle to senior level.

EFFECTIVE TEACHING WORKSHOP

Course Number 015005
Length 4 days

COURSE DESCRIPTION

This course will enable the instructor to employ effective techniques of presentation within educational programs. The instructor will also apply basic principles of educational technology to the design, development and validation of educational programs. At the end of the course, participants prepare and present sample lessons which are video taped for immediate feedback and student evaluation.

Effective [illegible] Workshop is recommended for all full-time and part-time [illegible] staff of company sponsored education, or for personnel of [illegible] organization which maintains a training function.

COURSE OBJECTIVES

Upon successful completion of the course, the student will be able to:

- Define teaching and learning in behavioural terms
- Overview the course development process
- List and describe feedback methods for achieving interactive instruction
- Identify advantages and limitations of various teaching methods
- Recognize the impact of interpersonal dynamics in the discussion environment
- Recognize varying needs and learning styles of students, and identify ways to adapt instruction to those needs.
- Evaluate own instructional strengths and weaknesses and construct a plan for continuing professional improvement of these skills.

PRE-REQUISITES

None

WINNING THROUGH CUSTOMER SERVICES

Course Number 200040
Length 3 days

COURSE DESCRIPTION

This course is designed to improve relationships with a customer or user in any service situation. WTCS will cover the role of a professional in communication skills, and how to deal with difficult customer or user situations

COURSE OBJECTIVES

On completion of the course the student will have covered the following areas

- How to establish a professional relationship
- How to determine a problem situation
- Performing a service
- Completing a transaction

PRE-REQUISITES

Some experience of dealing with customers/users

COMMUNICATIONS CONCEPTS

Course Number 200050
Length 5 days

COURSE DESCRIPTION

This course is an introduction to telecommunications and will familiarise the student with the elements, functions, features and terminology related to online systems. It will also provide considerable insight into the nature of online system development and design, as well as providing some familiarity with new developments in the telecommunications field. On completion of the course, the student should be able to converse intelligently on related subjects, and it should provide a basis for understanding the flood of information presented in periodicals, technical documents etc.

COURSE OBJECTIVES

After completing the course, the student will be able to:-

- Define terminology related to online systems
- Describe online applications
- Identify and describe online hardware elements and their relationship to the system.
- Describe network characteristics
- Describe online system terminal control procedures
- Describe basic considerations and procedures related to online system development.
- Describe significant developments in the field of teleprocessing.
- Make basic design decisions related to hardware configuration and network requirements.

PRE-REQUISITES

No specific course or experience is necessary other than an understanding of Batch Processing and related EDP terminology.

RELATIONAL DATA BASE CONCEPTS

Course Number
Length

COURSE DESCRIPTION

This course has been requested by a number of users, and details will be announced during 1988

EDP OPERATIONS/MAINTENANCE TECHNIQUES

Course Number 200060
Length 5 days

COURSE DESCRIPTION

This course has been designed specially for anyone who is involved in operating or otherwise using a computer. It will cover the basic functions of computer operations, including both hardware and software considerations.

COURSE OBJECTIVES

On completion of the course, the student will have covered:

- Standard start of day routines
- Standard end of day routines

  Backup considerations
- Computer systems security
- Ideal physical environment
- Documentation procedures
- EDP personnel responsibilities

PRE-REQUISITES

Some experience of working in an EDP environment

COURSE COSTS

PC courses

Introduction to PC's - MS-DOS	$ 270
CP/M operating system	$ 90
Wordstar word processing	$ 180
Supercalc 3	$ 180
Multiplan	$ 180
Lotus 1-2-3	$ 225
Dbase III	$ 360

Operating systems

VAX Operations	$ 540
VAX Problem Solving	$ 720
VAX Internals	$ 720
VAX Communications (DECS)	$ 720
IBX/ITX	$ 540
IMOS V	$ 450
UNIX*	$ 540

Programming languages

Basic programming	$ 540
Advanced Basic	$ 540
'C' programming	$ 540
Introduction to Interactive Cobol	$ 540
Advanced Interactive Cobol	$ 450
VAX Cobol	$ 450
Neat 3 concepts	$ 450
Neat 3 level 1	$ 450
Neat 3 level 2	$ 540

Applications

Payroll	$ 540
Flexaccount	$ 540
IMOS	$ 450

General

Finance for Non-Financial Managers	$ 360
Computer concepts for management	$ 540
EDP concepts	$ 540
Information systems management	$ 450
Basic Systems Analysis Skills	$ 540
Project Management Techniques	$ 450
Effective Teaching Workshop	$ 450
Winning through Customer Service	$ 360
Communications concepts	$ 450
Data Base Concepts	TBA
EDP operations Maintenance techniques	$ 450

All prices are per person per course except (1) and (2) below

(1) Price is per self-instruct manual
(2) Price is per day, variable depending on modules covered

1988 EDUCATION CALENDAR

	MON	TUE	WED	THU	FRI	MON	TUE	WED	THU	FRI	MON	TUE	WED	THU	FRI	MON	TUE	WED	THU	FRI	MON	TUE	WED	THU	FRI
JAN 1																									
JAN 2																									
FEB 1																									
FEB 2																									
MAR 1																									
MAR 2																									
APR 1																									
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MAY 1																									
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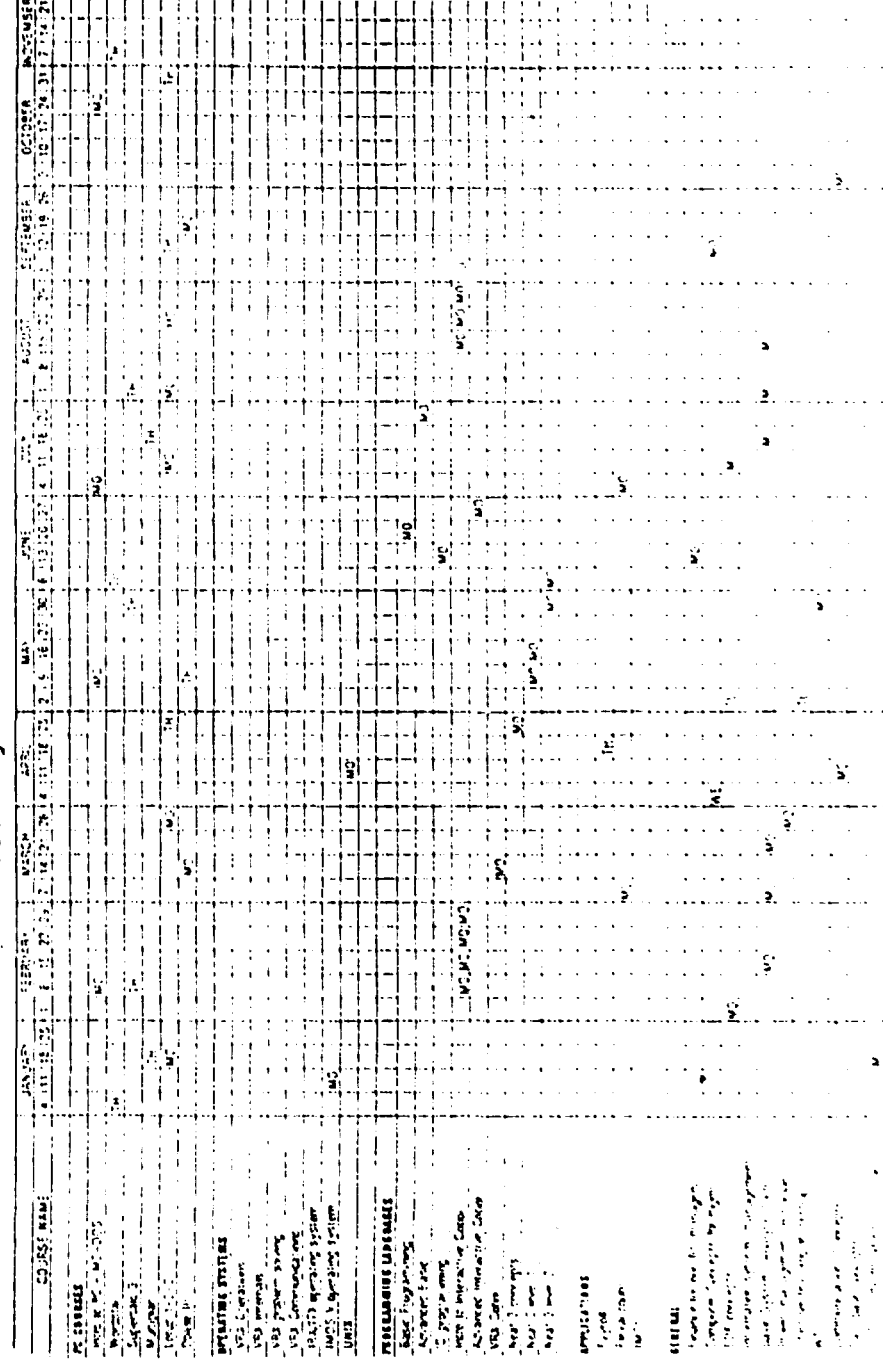
AUG 1																									
AUG 2																									
SEP 1																									
SEP 2																									
OCT 1																									
OCT 2																									
NOV 1																									
NOV 2																									

EDUCATION COURSE SCHEDULE
January–November 1988



TRAINING COURSE SCHEDULE : NOVEMBER 1988 TO SEPTEMBER 1989

COURSE	DURATION	DATES
COBOL PROGRAMMING (CFTGEN6)	12 weeks	13 March - 2 June 1989
COBOL SIX WEEK (CFTGEN7)	6 weeks	17 July - 25 August
INTRODUCTION TO SYSTEMS ANALYSIS (CFTGEN4)	3 mornings	21 - 23 November 1 - 3 March 1989 31 July - 2 August
SYSTEMS ANALYSIS (CFTGEN3)	13 days	23 January - 7 February 12 - 27 June
SYSTEMS DESIGN (CFTGEN3)	10 days	13 - 24 February 1989
WORD PROCESSING (CFTGEN5)	5 mornings	7 - 11 November 21 - 25 November 28 November - 2 December 12 - 16 December 19 - 23 December 9 - 13 January 1989 27 February - 3 March 3 - 7 April 10 - 14 April 24 - 28 April 15 - 19 May 12 - 16 June 10 - 14 July 24 - 28 July 30 July - 4 August 28 August - 1 September
ADVANCED WORD PROCESSING		8 - 10 March 1989 3 - 5 May 26 - 28 June 17 - 19 July 7 - 9 August 11 - 13 September
EXECUTIVE COMPUTER APPRECIATION (CFTGEN2)	2 days	5 - 6 December Further Courses on Request

MICRO-COMPUTER COURSES

MS-DOS (CFTPC1)	2 days	10 - 11 November
		14 - 18 November (5 afternoons)
		12 - 13 December
		21 - 22 December (EEC)
		9 - 10 January 1989
		23 - 27 January (5 afternoons)
		13 - 17 February
		6 - 7 March
		13 - 17 March (5 afternoons)
		10 - 14 March (5 afternoons)
		2 - 3 May
		15 - 16 May
		7 - 8 June
		13 - 14 June
		29 - 30 June
		3 - 7 July
		17 - 21 July
		25 - 26 July
		7 - 8 August
		14 - 18 August (5 afternoons)
		31 August - 1 September
		4 - 8 September
DBASE III+ (CFTPC4)	3 days	23 - 25 November
		13 - 15 December (ZDB)
		28 - 30 December
		23 - 25 January (ZDB)
		6 - 8 February (ZDB)
		13 - 15 February
		8 - 10 March
		3 - 5 April
		24 - 26 April
		29 - 31 May
		26 - 28 June
		24 - 26 July
		21 - 23 August
PROGRAMMING IN DBASE III+		27 February - 3 March (ZDB)
		5 - 9 June
		31 July - 4 August
20/20 (CFTPC2)	2 days	30 November - 1 December
		16 - 17 February
20/20 ADVANCED	1 day	16 December
		20 - 21 March
		20 - 21 April
SUPERCALC 4	2 days	20 - 24 February (4 afternoons)
SUPERCALC 4 ADVANCED (CFTPC3)		21 - 22 June

LOTUS 1-2-3 (CFTPC3)	2 days	7 - 8 November 28 - 29 November 5 - 6 December 8 - 9 December 16 - 17 January (FEC) 19 - 20 January 26 - 27 January (FEC) 6 - 10 March (5 afternoons) 22 - 23 March 9 - 10 May 5 - 6 June 19 - 20 June 10 - 14 July (5 afternoons) 27 - 28 July 24 - 25 August 11 - 12 September
LOTUS 123 ADVANCED (CFTPC9)		9 November 21 - 22 November 12 - 13 December (ZDB) 17 - 18 January 22 - 23 February 28 - 31 March (4 afternoons) 10 - 11 April (ZDB) 24 - 27 April 15 - 16 June 27 - 28 June 1 - 2 August 14 - 15 September
WORD PROCESSING on THE MICRO COMPUTER (CFTPC7)	5 mornings	14 - 18 November 30 November - 2 December (ZDB) 5 - 9 December 23 - 27 January 13 - 17 February 13 - 17 March 29 May - 2 June 19 - 23 June 10 - 14 July 17 - 21 July 14 - 18 August 4 - 8 September 11 - 15 September
ADVANCED WORD PROCESSING		18 - 20 January 1 - 3 February 2 - 4 May 22 - 24 May 3 - 5 July 7 - 9 August 28 - 30 August

INTRODUCTION TO THE MICRO COMPUTER (CFTPC6)		21 November 22 November 30 January 7 April 8 May 22 May 12 June 26 June 24 July 9 August
BASIC PROGRAMMING (CFTPC8)	5 days	19 - 23 December (For schools) $300 9 - 13 January (" ") 30 Jan - 3 Feb $625 3 - 7 July

DATA GENERAL SPECIFIC AND OPERATORS COURSES

AOS/VS USER (CFTDG1)	5 days	20 - 24 February 3 - 7 July
CYBERQUERY USER (CFTDG2)	2 days	8 - 9 December 23 - 24 January 20 - 21 April 19 - 21 June (3 mornings) 14 - 16 August (3 mornings)
CYBERQUERY DESIGNER (CFTDG3)	4 days	On Request
XODIAC (CFTDG4)	3 days	On Request
OPERATORS PART 1 (CFTOPS1)	4 days	30 January - 2 February 5 - 8 June
OPERATORS PART 2	4 days	5 - 7 December 8 - 12 May (5 mornings) 4 - 7 September
INFOS UNDER COBOL	3 days	On Request

3. The needs for training

It is generaly felt that in all South-East Africa contries well established public training institutes are needed. /for example Apendix 2.III/

In all the contries, the major requirement, both in the private sector and the public sector is for solid commercial programmers and shilled systems analysts. Courses for them ay be given at the polytechnics, university, business or commerce departaments and other commercial schools equipped to doso Prospect of Enhancing Computer Studies in Engineering Curricula in University of Zambia was proposed by prof. dr R.K. Appiah /Apendix 2.IV/.

Computer Added Learning Based Courses in Applied Mechanics, Electrical Principles, and Strength of Materials are discribed in Apendix 2.V.

Apendix 2.III

Training needs in CCS

1. Database design techniques

   x Database structures

   x Data analysis

   x Data normalisation

   x SQL Language

2. 4th generation tools

   x Screen designs

   x Menus

   x Report writers

   x Systems Analysis /structured/

   x Systems Software /UNIX and others/

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Apendix 2.IV

3.1. Prospects of Enhancing Computer Studies in Engineering Curricula in University of Zimbabwe

1. Introduction

Advances in microelectronics over the past two decades can only appropriately be described as revolutionary. And this has led inevitably to advances in digital computer hardware and software, spawned new and varied applications of computers and also intensified their applications in traditional areas such as industrial process control, instrumentation and data processing.

In the light of such phenomenal advancements, then, it is only prudent to enquire from time to time how well-prepared are the engineering graduates from the faculties of engineering in African universities and polytechnics for engineering applications of computers in African countries. By engineering applications we mean applications in the productive industries such as mining, manufacturing, telecommunication, power, building and construction, etc. Many engineering graduates in all disciplines require sound knowledge and skill in computers. Without such graduates, and in large numbers, it is argued, African countries will fail to harness the rapidly evolving computer technology to the full benefit of their developing economies.

Basically three approaches are open for producing such engineering graduates:

a) Revision of current undergraduate engineering curricula to increase their computer studies contents -- Integration;

b) Provision of post-graduate degree or diploma courses and/or short continuing education courses for graduate engineers -- Topping up; and

c) Provision of new, joint electrical engineering/computer science degree curricula.

A word on terminology. Informatics and computer science are synonymous. In our usage of the term computer science, it shall subsume software engineering. And computer studies shall embrace computer engineering and computer science.

2. Status quo

Zimbabwe produces graduate engineers from the Faculty of Engineering of its sole university, the University of Zimbabwe (UZ). The UZ Faculty of Engineering has two engineering degree programmes, viz, the BSc(Eng) Honours and the BTech(Eng) programmes.

The BSc(Eng) Honours programme is a 4-year degree programme which started in 1974 with three disciplines: Civil, Electrical and Mechanical Engineering. Mining and Metallurgical Engineering were added in 1985.

The BTech(Eng) programme started in the Polytechnics, ran into difficulties and was taken over by the University in 1988. It is a 5-year sandwich programme. Since the University is still in the process of re-structuring the programme then it will be left out of our present discussion.

2.1 BSc (Eng) Honours degree programme

The structure of this programme is as follows: The first year is common to all the five disciplines. It is only from the second year that students are streamed into the various disciplines of their choice; and even so there is still a certain amount of overlap between mechanical, mining and metallurgy on one hand and mechanical and electrical on the other. The third and fourth years are "specialisation" years. Through the years the curricula of this programme have been reviewed from time to time and tuned to the needs of Zimbabwe while still satisfying the fundamental educational requirements of a professional engineer. The programme is fully accredited by the Zimbabwe Institution of Engineers and recognised by the professional institutions in the U.K.

2.2 Computer Science content

Up to 1985 there were two computer science courses in the programme -- one in each of the first two years -- and they were compulsory courses for all engineering students. From 1986 the second computer science course on Numerical Analysis was abolished and one consolidated course at first year has been given since then. The syllabus for this course is given in Appendix A. This computer science course is nothing more than a FORTRAN programming course!

The abolition of the second computer science course was due to the following facts:

1) the Department of Computer Science was, and still is, not well-staffed;
2) the Department of Computer Science and the Faculty of Engineering were poorly equipped with computers;
3) the Faculty of Engineering did not find the content of the course particularly relevant to the needs of its students as it was too theoretical;
4) due to the above the failure rates in both courses were unacceptably high and tended to throttle down the throughput of the Faculty.

The Department of Computer Science is based in the Faculty of Science and, therefore, outside the direct influence of the Faculty of Engineering.

Departments in the Faculty of Engineering have been supplementing the computer science expertise of their students through the provision at the third and fourth year levels of projects that are software oriented -- either through application of commercially available software packages to the solution of engineering problems or through development of programs ab initio to solve such problems.

In addition to all the above the Department of Electrical Engineering offers the following digital computer oriented courses for its second, third and fourth year students:

- EE205: DIGITAL ELECTRONICS
- EE305: DIGITAL ELECTRONICS
- EE308: MICROPROCESSOR APPLICATIONS
- EE401: COMPUTER ENGINEERING

The syllabi for these courses are given in Appendix B.

2.3 Computing facilities

For teaching and research purposes the Faculty of Engineering has acquired substantial computer facilities since 1986. In all there are some 65 PC's and 3 mini computers with 25 terminals. Some of the machines are in local area networks. Although DOS is by far the widely used operating system in the faculty, UNIX and VMS are also used. Appendix C gives the details by department.

Special mention ought to be made here of the Engineering MicroComputer-Assisted Learning Project. This project funded by UNDP and CIDA provides the facilities for the major student uses of computers in the faculty including the practical component of the computer science course. Its resources are included in Appendix C.

3. Staffing and other problems

The perennial problems facing the Faculty of Engineering, and indeed the whole university, are:

-recruitment and retention of staff;

- lack of textbooks;

-rapidly growing student numbers; and (to a lesser extent in the Faculty of Engineering)

- equipment.

Appendix D summarizes the staffing position in the Faculty of Engineering and the Department of Computer Science as of 1988. It shows a vacancy rate of 36.5% over the six departments. This situation is highly changeable due to the problems of staff retention. The vacancy rate in the Faculty of Engineering has averaged 46% in recent years!

The academic staffing problems are compounded by a shortage of technical and other support staff, e.g. teaching assistants, research assistants and research students.

The staff development scheme is the main provision for training young Zimbabwean graduates to take up lectureship positions. However, some lecturers who have been on the staff for a long time are in need of further training, particularly in the fast-changing electronics and computer science fields.

In view of the sheer volume of computing facilities in the faculty it is a growing concern that there presently exists only one technician in the faculty who has the competence to repair PC's and other sophisticated computing equipment.

4. Who needs more computer science?

In this section they discuss the reactions of the engineering staff to the question: Do students in your discipline require additional computer science teaching, and if so what topics need to be taught?

Although it is only three 's since the scrapping of the second computer science course this question is relevant. It is relevant in that much has happened in the three years, not only in the development of computer applications in general but also in the acquisition and use of computers in the faculty. Virtually all the computer facilities in Appendix C were acquired within that period. The reactions from the staff are discussed below.

4.1 Electrical Engineering

Appendix B shows the digital computer related courses taught in the department. The latest computer course, EE401: Computer Engineering, was introduced in 1986 in response to precisely the perceived need which forms the premise of this paper. It was felt that when this course has been fully instituted, then, there should be no need for an additional computer course for electrical engineering graduates from this department.

However, the department faces the problems of recruiting and retaining a suitably qualified lecturer for the course, as well as the provision of adequate laboratory facilities. It is now appreciated that in due course the hardware and the software contents of the course should be separated into, respectively, a Computer Engineering and a Software Engineering courses, depending on the availability of teaching resources. It ought to be noted that the department offers several optional courses, and that by judicious selection of options a student can come out with a strong computer background, particularly when his third and fourth year project selections are of the computer oriented type. It is felt, with considerable justification, that any further training required of an electrical engineering graduate with such background as can be obtained from the department can be easily provided through the topping-up approach of short postgraduate courses.

4.2 Mechanical Engineering

Practising mechanical engineers use large commercial software packages and a mere knowledge of FORTRAN is not adequate. For proper use of such large packages it is desirable that students are taught something on operating systems, software engineering, etc. The department also requires computer-aided design education

(CADEd) for its third and fourth year students and short courses on the use of commercially available finite element design and analysis software packages. The design needs of the mechanical engineering graduate are considerable even in a developing country like Zimbabwe. It was in response to this need that the department acquired the CAD system described in Appendix C. However, the department lacks a systems manager for its mini computer-based CAD system.

4.3 Civil Engineering

The current computer science content of the programme is adequate for a graduating civil engineer. This, of course, comprises the first year computer science course topped up with project work.

Practising civil engineers in Zimbabwe do use commercially available packages e.g. finite element and spread sheet packages. But these can be mastered by graduates from this department in a short time. There is, therefore, no need to distort the currently well-balanced curriculum with the introduction of another computer science course.

4.4 Mining and Metallurgy

The use of computers in the mining industry is extensive and varied, embracing such applications as process control, operations reasearch, mine design, etc.

Consequently the computer expertise required of a graduating mining or metallurgical engineer goes well beyond the ability to programme in FORTRAN alone. This inadequacy already shows up in, say, the third year course, Computer Applications in Mining, with the result that a substantial fraction of course time has to be given to basic computer science topics at the expense of the actual course syllabus. A computer science course at third year level is definitely required.

4.5 Summary

The investigation reported above brings to light a desire in the majority of departments in the faculty for a well-designed computer science course in addition to the present FORTRAN programming course. Such a course should include topics like computer organisation, operating systems, software engineering, real-time software development, computer communication, local area network and numerical methods.

It also transpired that the strengthening of the computer engineering course in the Department of Electrical Engineering will be much welcome. But the introduction of a joint electrical engineering/computer science degree is frowned upon on the following grounds:

1) Lack of proper market survey to determine even roughly how many such engineers the economy can absorb per annum;
2) Distortion of an existing, suitably balanced engineering degree programme;
3) Cost of staff, computer facilities, library facilities, etc.;
4) less cost-effective than topping up plus integration.

5. Job Opportunities

Engineering graduates from this faculty are all snapped up even before they complete their studies. And this trend is likely to continue for a long time to come.

However, at the present time there are needs in certain areas, e.g. the Post and Telecommunication Corporation (PTC) and the Zimbabwe Electricity Supply Authority (ZESA), for graduate engineers with enhanced computer background. And there are speculations that many such graduates are needed in the country. But this has not been substantiated. One ought to distinguish clearly between the apparently booming data-processing business for commerce and administration, on the one hand, and engineering appplications of computers, on the other. It is for the latter that engineering graduates with enhanced computer background may be required.

Before any exercise is undertaken to produce such graduates in any large numbers, it will be prudent first to conduct a proper market survey to establish how many such graduates can be absorbed by the economy annually. And also the cost-effectiveness of the various modalities for producing such graduates as outlined in section 1.

Specific recommendations are as follows:

Recommendations for UZ

1) Design one optional, proper software engineering course for all engineering disciplines at second or third year level.
2) Strengthen the digital computer engineering thread in the curriculum of the Department of Electrical Engineering.
3) Provide short courses on CAD for staff and students of the Department of Mechanical Engineering, and for practising mechanical engineers.
4) Provide short courses for practising engineers on specific computer science topics, e.g. operating systems, LAN's, etc.

APPENDIX A: SYLLABUS OF UZ COURSE CT130: COMPUTER SCIENCE FOR ENGINEERS

INTRODUCTION TO PROGRAMMING
Computer Concepts and an Introduction to Fortran Language, a historical preview.

BASIC I/O'S
Basic Input/Output in Fortran; Internal storage and Fortran Data. List-Directed Input and output. Program Repetition; Program Style

ARITHMETIC EXPRESSIONS
Fortran constants; arithmetic expressions, arithmetic assignments, statement, integer and real arithmetic.

SUBPROGRAMS
The concept of subprograms, procedures and Intrinsic functions. Additional expressions in list-directed I/O features.

DECISION
Programming for decision; the Block If statement. Nested decision, Case selection.
The Logical If statement.

LOOPS
Programming for repetition; controlling loops. Nested loops, Do loops, Do-loops with real Do-variables, the Do-variable on exit from the loop, and While loops.

SIMPLE I/O's
The Interface with the computer. The format concept, the READ statement.
The WRITE and PRINT statements. More sophisticated format statements. Embedded blanks in numbers.

PROGRAM DEVELOPMENT
Program structure, Program understandability, Program style and program refinement. The programming process.

CHARACTER HANDLING
Characters and character storage units, Character variable and expressions. Intrinsic functions for character handlin

CHARACTER AND LOGICAL DATA
Input and Output of Character Data. Comparing Character Data. Processing Character Data. Logical expressions.

ARRAYS
Arrays and Array Elements. Input and Output of Array Data.

[redacted]LATION
[redacted]n Techniques. Searching and Sorting. Character Data Arrays. Logical Data
[redacted]

[redacted]ONAL ARRAYS
[redacted]nsional Array Concepts The Three-Dimensional Array Concepts. Procession
[redacted]l Arrays.

[redacted]
[redacted]ncepts; Procedures, functions and subroutines.

[redacted]F STORAGE
[redacted]locations. The Common statement.

[redacted]BLE USE OF STORAGE
[redacted]ment. Statement of functions.

[redacted]GRAM DEVELOPMENT
[redacted]pment revisited.

[redacted]
[redacted]Statements for Sequential File Procession. Sequential File Creation and Acc

[redacted]
[redacted]pdating. Direct Files.
[redacted]entation. Survey of other Languages.

APPENDIX B: DIGITAL COMPUTER RELATED COURSES OFFERED BY DEPARTMENT OF ELECTRICAL ENGINEERING, U.Z.

1. EE205: DIGITAL ELECTRONICS

Number systems: Binary, Octal, Hexadecimal, One's and Two's complement system.

Boolean algerbra; Karnaugh maps, gates, combinational logic analysis and design. Sequential circuits, flip flops, registers.

Structure of some SSI & MSI circuits . Half adders and full adders, carry look ahead. Parity checks. Encoders and Decoders, Demultiplexers, Multiplexers. Programmable logic arrays.

Logic families: TTL characteristics. MOS and CMOS devices. Fan in and fan outs.

Bistables: principle of master-slave bistables, shift registers, various applications, digital delay line, sequence generators, ring counters. Asynchronous counters, up down counters, divide by N counters.

A to D and D to A converters, successive approximation and dual slope A/D converters.

Synchronous system design: synchronous counters.

2. EE303: DIGITAL ELECTRONICS

Advanced digital design including SSI-based and MSI-based design. Design of multi-input system controllers and sequencers. Algorithmic State machines, state minimization.

Low power digital circuit design, CMOS devices.
High speed digital circuit design, IIL and ECL devices.

Computer design; CPU, ALU, control, register and 1/0 design.
Register transfer language. Machine language, Instruction format, addressing and execution. Bit-slice elements.
Application to micros, minis and main frames.

Digital transmission techniques:
Error correction and detection; linear, block and cyclic codes.

[redacted]ICROPROCESSOR APPLICATIONS

[redacted]essor organisation: operation, programming, addressing modes, machine [redacted]assembly programming.

[redacted]essor circuit design:
[redacted]its, memory systems. Parallel and serial I/0, Interrupt based I/0. Interfacing [redacted] including A/D and D/A converters. Advanced peripherals. Applications to [redacted]puters, instrumentation and control.

[redacted]essor Architecture; 8-, 16- bit architectures, pipelining, multi-processing, [redacted]memory systems, Virtual memory systems.

[redacted]OMPUTER ENGINEERING

[redacted]si, full custom and semi-custom chips. uncommitted logic arrays. Fault tolerant [redacted]

[redacted]Architecture: non-Von Neumann architectures, supercomputers, transputers, [redacted]niques for high speed computers. Stack computers, parallel processing and ar[redacted]

[redacted]to software engineering:
[redacted]ystems, virtual machines, structured top down design, real-time software [redacted]e studies.

APPENDIX C: COMPUTING FACILITIES IN FACULTY OF ENGINEERING, U.Z.

Dept	Computer	Quantity	Peripherals	Operating Systems
CIVIL ENG.	Hewlett Packard HP 86	1	Plotter Printer Graphics Tablet	HP USCD
	ICL PC15	1		CP/M MS/DOS
	Sirius	1		
	Epson HX20	8	Integral Printers and Tape Drives	
	Portables			
	Compulog	1	Printer	
	Amstrad PC1512	2	Printer	MS/DOS CP/M
	BBC	2	1 Datalogger 3 Printers	
ELEC ENG	VAX 11/750	1	Tape Drive Printer Plotter 22 Monitors 12 Terminals	VMS
	Bristol Single Board Micros	8	3 Printers	
	BBC	4		
	HP 6400 Development Station	1		HP
	TEK 4052A	1	Tape Drives, Plotter	HP
MECH. ENG	HP 86B 1	1	Hard Disk Drive	HP
	IBM MPC XT	3	Plotter Printer	
	Microvax II	1	Printer Collorgraphics Workstation	MS/DOS VMS
	Vax Workstations	4	Plotter Graphics tablets	

De[illegible]ter	Quantity	Peripherals	Opera[illegible] Syste[illegible]s
C[illegible] Work Stations			
P[illegible]XT	24	2 HP ColorPro Plotter 3 Printer	PC-DOS
[illegible] File Server			
[illegible]XT	2		Novell II Netware
[illegible] Publishing:			
[illegible]C XT - 286	1	HP LaserJet Printer	PC-DOS
[illegible]osh	1		
[illegible]P.C.	4	LaserWriter ImageWriter Plus	PC-DOS
[illegible]ment Lab			
[illegible]C XT	1		
[illegible]C AT	5	2 Digitizers 5 mice 4 Printers 1 Plotter	PC-DOS
[illegible]- 350 SPU	1	10 Monochrome terminals 3 Color graphic terminals	UNIX MS-DOS
[illegible]- 330 SPU	1	2 Dot Matrix Printers A1 & A3 plotters Daisy wheel printer LaserJet II printer Tape Drive LAN - 300	
[illegible]TRA	1		MS-DOS

APPENDIX D: ACADEMIC STAFF STRENGTH OF ENGINEERING AND COMPUTER SCIENCE DEPARTMENTS, UZ.

	UZ	
DEPARTMENT	ACADEMIC STAFF ESTABLISHMENT 1988	ACADEMIC STAFF IN POST 1988
Civil	15	9
Chemical	-	-
Electrical	14	10
Geodetic	14	-
Mechanical	14	8
Metallurgical	5	4
Mining	5	3
Computer Science	10	6
TOTAL	63	40

APPENDIX E: COMPUTING FACILITIES IN SCHOOL OF ENGINEERING , UST

DEPARTMENT/SCHOOL	PERIPHERAL	SOFTWARE
Civil		
Chemical		
Electrical	4 Dot-matrix Printers	MS-DOS
Geodetic	1 Dot-matrix Printer	PC - DOS
Mechanical		
SCHOOL		PC-DOS

UNDP–UZ–CIDA Engineering CAL Project

University of Zimbabwe

3.2. CAL–Based Courses in

Applied Mechanics,
Electrical Principles, and
Strength of Materials

An output of a UNESCO sponsored CAL Workshop, August 1988

Contents

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     CIDA/University of Zimbabwe

Introduction

The development of good CAL courseware is not a trivial exercise, demanding considerable effort, time and money. It calls for two things in particular: a thorough pedagogical design for a whole course, and international collaboration

International collaboration means pooling together of resources so that the work involved is distributed, and so also the cost. It also promises a wider market and use of the courseware produced. This is particularly important in Africa where the resources of any single country cannot cope with the workload and student numbers are smallish per country. CAL courseware must be developed for a whole course otherwise it becomes fragmented and loses perspective and impact.

It is with such considerations in mind that a UNESCO–sponsored CAL workshop was organised to bring together some senior university engineering teachers from various African countries to undertake the pedagogical design of CAL courseware for three crucial foundation courses in their engineering curricula. The courses are Applied Mechanics, Electrical Principles and Strength of Materials. This report contains the work of three expert groups for these courses.

The work of the expert groups was modelled on our work on a Control Systems course at the University of Zimbabwe Engineering CAL Project. Our CAL strategy demands courseware comprising a structured textbook tailored to the syllabus, simulation and problem-solving CAL programs for PC's and CAL laboratory notes.

Each expert group produced what it believed to be a core syllabus for its course. From the core syllabi group members then identified, from their vast teaching experience in Africa, the topics that often present conceptual difficulties to students. The lecture and textbook presentations of the course material are to be supplemented with simulation and/or problem–solving CAL programs on the "difficult" topics from which the student can learn at his own pace on a PC or a local area network of PC's.

There already exist CAL programs for some of these topics and with little modifications these programs may be adopted. In most cases, however, the programs have to be developed ab initio.

In bringing the work of the three different expert groups together we have taken editorial liberty to try to strike a degree of uniformity in presentation. We hope that in the process we have not done violence to their work.

Now where do we go from here? Firstly, this document is going to be widely distributed in order to solicit comments and suggestions from many of our colleagues across the Continent. Secondly, we hope to be able to raise funds to bring together the brainpower and other resources required to produce the learning materials.

We believe that the work reported here is significant, and marks the beginning of what could become a wide-scale use of computer–assisted learning in engineering education in Africa.

Finally, we gratefully acknowledge the support given to this work by UNESCO and UNDP.

R. K. Appiah
J. H. Daigle

Chapter 1

Applied Mechanics

1.1 Introduction

The Applied Mechanics Group examined the syllabi from the University of Zimbabwe (UZ) and the University of Ibadan, the latter of which is similar to that of the University of Dar-es-Salaam, and made the following observations:

1. The UZ syllabus contains the usual dynamics topics plus some introductory topics in Strength of Materials;
2. The introductory topics in Strength of Materials are identical to those normally covered in any strength of materials course;
3. The present project is concerned with the development of courseware in Applied Mechanics, Strength of Materials, and Electrical Principles;
4. There is a need to avoid any overlap in courseware development.

In view of the above observations, we recommend that the Applied Mechanics syllabus should consist essentially of dynamics and theory of machines related topics. The syllabus worked out on this basis is given in section 1.3. These topics are expected to be covered in the first two years of an engineering degree programme.

The course structure is given in section 1.2, while the identified CAL topics are outlined in section 1.4.

1.2 Course Structure

The sequence of course topics is listed below. Please refer to figure 1.1.

1. Rigid body dynamics
2. Velocity and acceleration
3. Simple machines
4. Conservation of energy

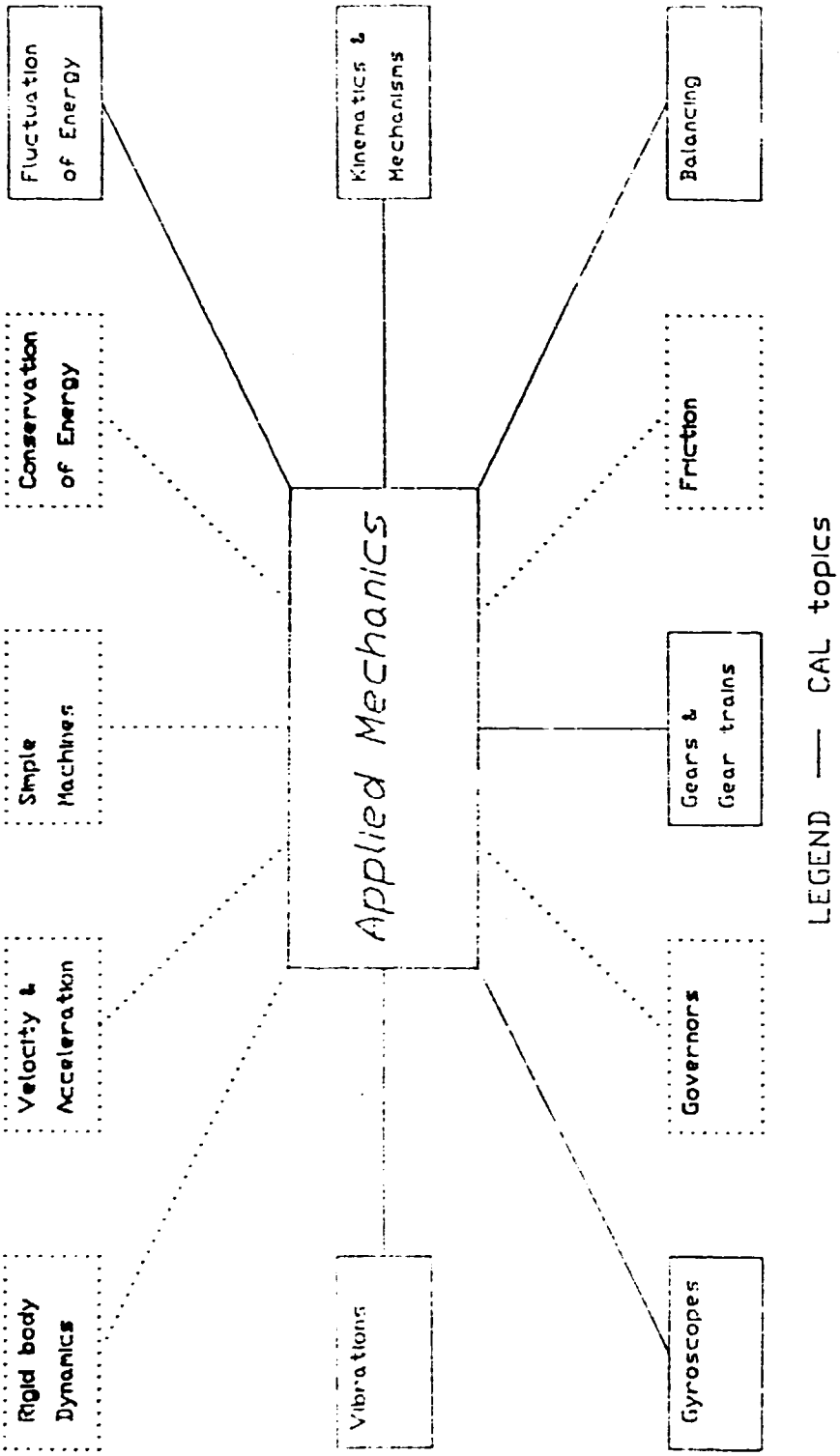


Figure 1.1: Applied Mechanics Course Structure

5. Fluctuation of energy
6. Kinematics and mechanisms
7. Balancing
8. Friction
9. Gears and gear trains
10. Governors
11. Gyroscopes
12. Vibrations

1.3 Course Syllabus

Rigid Body Dynamics

- Displacement, velocity and acceleration.
- Angular displacement, velocity and acceleration equations using constant acceleration and variable acceleration.
- Newton's Laws of Motion.
- Work done by a force and by a torque.
- Power and efficiency.

Velocity and Acceleration

- Displacement vectors, relative velocity, mean acceleration.
- Simple applications of acceleration vectors.
- Velocity images.
- Use of instantaneous centres of rotation.
- Three centres in line theorem.

Simple Machines

- Velocity ratio and Mechanical advantage.
- Real effort, ideal effort, friction effort and efficiency.
- The Law of the Machine.

Conservation of Energy

- Radius of gyration and moment of inertia of typical fly-wheel sections.
- Kinetic energy of translation and rotation.
- Linear and angular momentum.

Fluctuation of Energy

- The purpose of a fly-wheel.
- Graphs of torque against crank angle.
- Typical applications.

Kinematics and Mechanisms

- Pairs and elements.
- Kinematics chains.
- Mechanism and inversion.
- Kinematics of particles and rigid bodies.
- Velocity and acceleration in mechanisms.
- Coriolis acceleration.
- Dynamically equivalent mass systems.
- Inertia forces.
- Cams.

Balancing

- Balancing of rotating masses
- Balancing of reciprocating masses.

Friction

- Screw threads.
- Friction clutches.
- Brakes.
- Belt drives.

Gears and Gear Trains

- Spur gearing, gear tooth shapes.
- Methods of manufacture.
- Gear Trains: Simple, compound and reverted compound trains.
- Efficiency of geared systems

Governors

- Function of governor.
- Dead weight, Watt, Porter, and Proell governors.
- Spring-loaded governors.
- Effort and Power.
- Sensitivity and Friction.
- Controlling force and stability.

Gyroscopes

- One and two degree of freedom gyroscopes.
- Simple applications — motor vehicle dynamics.

Vibrations

- Free vibration of one and two degree of freedom systems.
- Linear and torsional vibrations with viscous damping.
- Periodic disturbing force.

1.4 CAL Topics

From the list of topics in section 1.2 above, several have been identified as being particularly suitable for CAL treatment. They are described below, along with some details of pedagogical objectives and CAL courseware requirements.

5 Fluctuation of Energy

Objectives

1. To gain an understanding of the purpose of a flywheel in an engine.
2. To gain an insight into the basic characteristics of engine cycles, their configuration, and their effect on flywheel design.

Program requirements

1. Display $T - \theta$ characteristics for two and four stroke engine cycles.
2. Display characteristics for 1, 2, 3, 4, 6 and 8 cylinder engines showing for each case the mean torque line.
3. Calculation of energy fluctuations: fluctuations to be displayed on $T - \theta$ diagrams. Student to be asked to evaluate the maximum energy fluctuation. Answer to be provided. Student to interact by providing his own answers.
4. Design: using the answer of 3., student to interactively design the required flywheel.

Time allocation: 2 hours.

6 Kinematics and Mechanisms

Objectives: To gain an appreciation of the motions involved in different mechanisms.

Program requirements

1. For a given mechanism, the software developed must have the capability to (a) display the space diagram for given geometric parameters, and (b) interactively locate points on the velocity and acceleration diagrams.
2. Software to show the trajectories of specific points in the mechanism.

3. Software to have the capability of dynamically displaying the complete motions of the above mechanisms.

Note: One or two mechanisms exhibiting the Coriolis component of acceleration should be included.

Time allocation: 3 hours.

7 Balancing

Objective: To gain an appreciation and understanding of underlying principles of balancing of rotating and reciprocating masses.

Program requirements

Rotating Masses

- Capability of simulating a variable number of masses on a simply supported shaft.
- Interactive input of basic data e.g. masses, positions, angles, radial distances, etc.
- Drawing of the space diagrams, calculation and display of force diagrams with the out–of–balance force clearly shown; the same for couple diagrams plus determination of bearing reactions.
- Student to calculate the bearing reactions.
- Software to balance the system and to provide the answer.

Reciprocating masses

- Capability of balancing a variable number of reciprocating masses in in–line and vee engines.
- Interactive input of basic data.
- Drawing of the space diagrams, calculation and display of primary and secondary force diagrams. Calculation of bearing reactions. Couple diagrams.
- Determination of bearing reactions.
- Software to balance the system and to provide the answer.

Time allocation: 2 hours (1 hour for each program).

9 Gears and Gear Trains

Objectives: To gain appreciation and understanding of gear geometry, properties of meshing gears, motion and torque transmitted in gear trains.

Program requirements

- Simulate involute profile.
- Multiple choice questions on gear geometry — interactive.
- Plot locus of point of contact of two meshing gear teeth.
- Simulate two gears meshing with variable gear ratios — interactive.
- Establish number of gear teeth meshing. Determine interference.
- Simulation of motion and torque transmitted by different types of gear trains.

Time allocation: 2 hours.

11 Gyroscopes

Objectives: For students to appreciate the motions and forces in gyroscopic systems.

Program requirements

- The developed software programs are to consider simple gyroscopes in 1-D and 2-D spaces.
- For each case, students to be interactively drilled in the determination of gyroscopic forces on the body. These forces are to be graphically displayed in such a manner that the physical effect can be easily appreciated or visualized.

Time allocation: 1 hour.

12 Vibrations

Objectives: To relate to one and two degree of freedom systems, linear and torsional vibrations with viscous damping and periodic disturbing forces.

Time allocation: 1 hour

1.5 Concluding Remarks

In addition to the time requirements listed explicitly above, one hour is to be allocated for a general introduction to the CAL system — the hardware and elements of the user interface. This will bring the total number of CAL hours to twelve.

Chapter 2

Electrical Principles

2.1 Introduction

This report proposes a comprehensive syllabus for a first course in electrical engineering. The coverage might be felt to be excessively wide for a single course, and it is intended that certain of the sections could be omitted from a first course selectively and with regard to the character of the target group. It is hoped that service courses for non–electrical students could be mounted by judicious selection of sections of the course outline given in section 2.2. Whilst the majority of the sections are susceptible to CAL application we identify five topics in which CAL would make the greatest impact.

2.2 Course Structure

The sequence of course topics is listed below. Please refer to figure 2.1.

1. Energy: the Systems Viewpoint
2. Electric Fields
3. Magnetic Fields
4. Electrical Circuits
5. Circuit Laws and Theorems
6. Transients
7. Alternating Voltages and Currents
8. Power and Energy
9. Polyphase Systems
10. Magnetic Circuits
11. Measurements

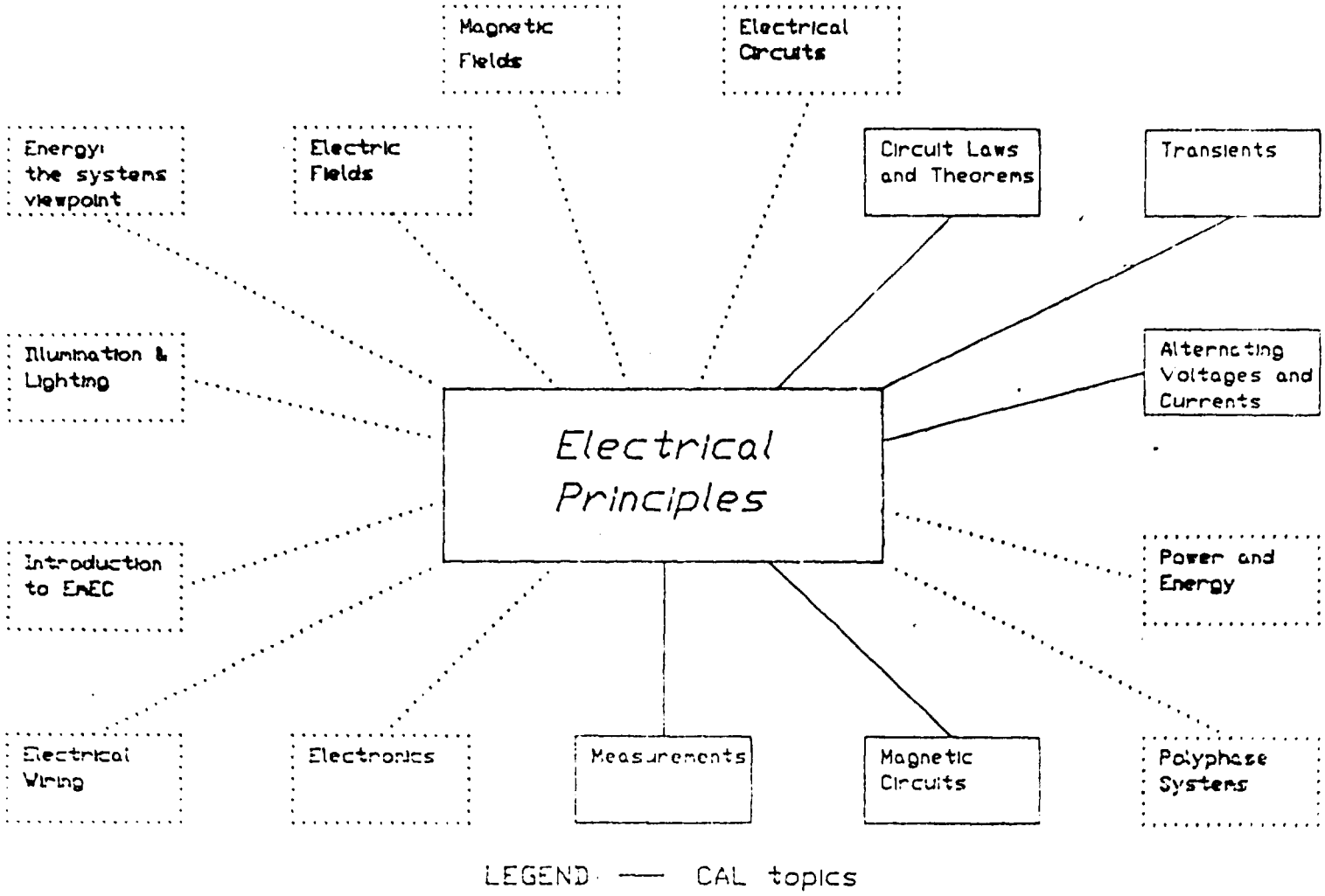


Figure 2.1: Electrical Principles Course Structure

12. Electronics
13. Electrical Wiring
14. Introduction to Electro-Mechanical Energy Conversion
15. Illumination and Lighting

2.3 Course Syllabus

Energy: the Systems Viewpoint

1. Energy Sources
   Distinction between finite and renewable energy resources. Brief review of oil, coal, nuclear, hydro, biomass, solar sources.
2. Energy Conversion and Storage
   Relation between chemical energy and equivalent electrical energy. Derivation of cell emf; watt–hours per kilogram and ampere–hours per kilogram.
   Reversibility of cells. Brief overview of Leclanche cell, LiF; Lead acid and sodium sulphur cells.
   Conversion of mechanical to electrical energy and vice versa.
3. Energy transmission and usage. Methods, costs and efficiencies. Sectoral patterns of energy use.

Electric Fields

1. Electrostatics
   The particulate nature of matter; the electronic structure of atoms. Electrons as current carriers; Current defined as charge past a given point per unit time. $i = dQ/dt$.
   Electric flux density and electric field strength, $D = \epsilon_0 \epsilon_r E$.
2. Electrostatic fields, Coulomb's law; fields due to point, line and sheet charges. Gauss's law. The nature of dielectric materials.
3. Dielectric strength, breakdown mechanisms, corona discharge. Polarisation. Relative permittivity. The behaviour of charges in electrostatic fields.

Magnetic Fields

1. The Biôt–Savart Law. Magnetic fields created by line currents and currents flowing through coils. Magnetic field in a toroid, Ampere's law.
2. Magnetic forces on moving charges and current carrying conductors; Magnetic torques experienced by current loops in a magnetic field. Magnetic materials. Magnetisation and magnetic domains. Relative permeability.

3. Magnetic flux, Electromagnetic induction, Faraday and Lenz's laws, induced emf, self inductance and mutual inductance of simple conductor configurations.

Electrical Circuits

1. Circuit elements

   Resistance $V \propto I$ in linear circuit elements; $V = IR$ (Ohm's Law defining resistance).

   Inductance $V \propto di/dt$ for linear elements; $V = Ldi/dt$ defining inductance.

   Capacitance $V \propto \int i dt$ for linear elements. $V = \frac{1}{C} \int i dt$ defining capacitance.

2. Nature of Circuit Elements

   Resistance Resistivity; $R = \rho l/A$ or $R = l/kA$; Temperature coefficient and use to measure temperature.
   Types of resistor in common use, construction and characteristics of moulded carbon, C film, metal oxide, metal film, wirewound. Power resistors; colour code.

   Inductance L associated with all conductors $L = N\phi/di$ and $L = N^2/S$ where S is the reluctance.
   Inductors in practice: stripline, air core coils, ferrite and iron cores for increased permeability.

   Capacitance $C = q/c$ and $C = \epsilon A/d$ for parallel plate capacitor. $V = \frac{1}{C} \int i dt$.
   Common capacitor types: mica, ceramic, film foil, metallised foil; Power capacitors.
   Capacitors in series and in parallel.

Circuit Laws and Theorems

1. Kirchoff's voltage and current laws. Emphasis on electric circuit having only two degrees of freedom leading to equivalence of circuits.
2. Thévenin and Norton's theorems; simple equivalents by open circuit and short circuit considerations. Superposition. D.C. circuit analysis and reduction.

Transients

1. Transients in simple R-C and R-L circuits. Response under sinusoidal excitation. Concept of phase lead and phase lag, Phasor representation of A.C. quantities. The concepts of impedance and reactance.
2. Differential equations describing R-L-C circuit behaviour. The three types of solutions for undamped, underdamped, critically damped, and overdamped circuits.

3. Phasor diagrams. Simple series and parallel R-L-C circuits. Resonance, resonant frequency, quality factor, bandwidth. Resonant impedance.
4. Analogies between mechanical and electrical systems.

Alternating Voltages and Currents

1. Harmonic motion as projection of circular motion onto a plane: introduce phasors as circular motion to be projected onto an axis.
2. The average and RMS values of A.C. quantities; relation between RMS voltage and current in R–L–C circuits. Phasor diagrams.
3. Concepts of impedance, reactance and admittance. Their use in the solution of A.C. circuits Complex representation: resonance in parallel and series circuits. Resonant frequency and bandwidth.

Power and Energy

1. Derivation of $P = V\,I\cos\theta$ for sinusoidal supplies. Instantaneous, average apparent real and reactive power.
2. Power factor and tariffs; energy and maximum demand. Parallel reactance for power factor correction.
3. Maximum power transfer theorem and its application in electronic systems; Impedance matching.

Polyphase Systems

1. Introduction to 2 and 3-phase circuits. Selection of the 3-phase system for power transmission. Phase and line quantities. Star and mesh connections.
2. Balanced and unbalanced loads. Star and delta connections; relations between V_{ph} and V_l.

Magnetic Circuits

1. Magnetic circuits. $B = \mu_0\mu_r H$ as relation between extensive properties of a medium; concept of reluctance; derivation of S for linear circuits; equivalence with electrical circuits, solution of problems in magnetic circuits. Permanent magnets.
2. Practical characteristics of magnetic materials: saturation and non-linearity of B/H curves; necessity for including B/H curves in magnetic circuit calculations at high values of B. The skin effect.
3. Iron losses. Hysteresis curve and hysteresis losses. Eddy current losses. Separation of the components of iron loss.

Measurements

1. Instruments. Precision, accuracy or repeatability; Calibration; Correction curves; Analogue instruments. Deflecting force, restoring force and damping; common means for their implementation; moving-coil, moving iron, dynamometer and electrostatic instruments.

2. The cathode ray oscilloscope. Its uses, time base, X–Y mode, vertical sensitivity, A.C. and D.C. coupling, alternate and chop modes, dual beam oscilloscopes, triggering deflection sensitivity and post deflection acceleration. Storage oscilloscopes.

3. Measurement techniques. Potentiometers, bridges (both D.C. and A.C.).

Electronics

1. Semiconductors, holes and electrons as charge carriers in semiconductors, electron energy states, electron and hole concentrations, the p–n junction, contact potential and the bipolar transistor. Uses of semiconductor devices.

2. Introduction to thermionic devices; the diode, triode and other valves. The cathode ray tube.

3. Introduction to logic circuits. Boolean Algebra, the truth table, De Morgan's theorems, boolean identities. The principle of duality and its application in CMOS circuits.

Electrical Wiring

1. Typical uses of electricity in commercial and industrial buildings. The wiring regulations.

2. Safety and protection of the installation and the user.

Introduction to Electro-Mechanical Energy Conversion

1. Simple introduction to common types of machinery used in industry. Use of electricity in the Chemical, Manufacturing and other industries.

2. Use of circuit breakers, contactors etc.

Illumination and Lighting

1. Introduction to Lux and Lumen. Lighting requirements in various types of workplace, public roads etc.

2. Types of luminaires, efficiency, lighting economics.

2.4 CAL Topics

Five modules have been selected for CAL treatment. It is anticipated that these will be of two hours duration each.

The modules have been selected to cover those areas which students generally find conceptually difficult, and in which CAL will have the greatest impact on the course. The modules selected are:

- Circuit Theorems and Laws, and their applications.
- Transients.

- Alternating Voltages and Currents.
- Magnetic Circuits.
- Measurement Methods.

The coverage of the course material is expected to be as follows:

Circuit Theorems, Laws, and their applications

Objective: To familiarise students with the calculation of circuit currents, voltages and equivalent sources and impedances.

- Kirchhoff's Laws with examples.
- Thevenin's Theorem.
- Norton's Theorem.

These will be applied to:

- Circuits with resistance only.
- Circuits with resistance, inductance and capacitance.
- Circuits with resistance, inductance, capacitance and mutual inductance.

Transients

Objective: Identification of transient and steady–state components of the complete response; effects of parameter variation.

Step and sinusoidal responses in circuits with:

- R–L and R–C.
- R–L–C.
- R–L–C–M.

Alternating Voltages and Currents

Objective: Familiarisation with average and RMS values, power and power factor in A.C. circuits, concept of resonance, power factor correction and tariffs.

- Alternating signals: square, triangular and sinusoidal signals.
- Average and RMS values.
- Single–phase circuits: current, voltage and power, phase, power factor.
- Resonance in series and parallel R–L–C circuits.
- Three–phase circuits: phase and line quantities, apparent, real and reactive power.
- Power factor correction and its implications.

Magnetic Circuits

Objective: Observation and calculation of flux, flux density, field intensity, reluctance, magnetomotive force. Saturation.

- Circuits with and without iron core.
- Circuits with complex cores, eg. airgaps.
- Circuits with and without saturation.

Measurement Methods

Objective: Illustration of the various measurement methods used in electrical engineering. Sensitivity of detectors. Measurement of non-electrical quantities.

- Potentiometers for the measurement of unknown resistances and voltages.
- Bridges: Wheatstone, Maxwell and Schering for the measurement of resistance, inductance and capacitance.
- Measurement of active and reactive power.

2.5 Concluding Remarks

No specific task allocations have been made to group members for courseware preparation: it is assumed that UZ will take a lead in this respect in view of the CAL Project facilities available.

Chapter 3

Strength of Materials

3.1 Introduction

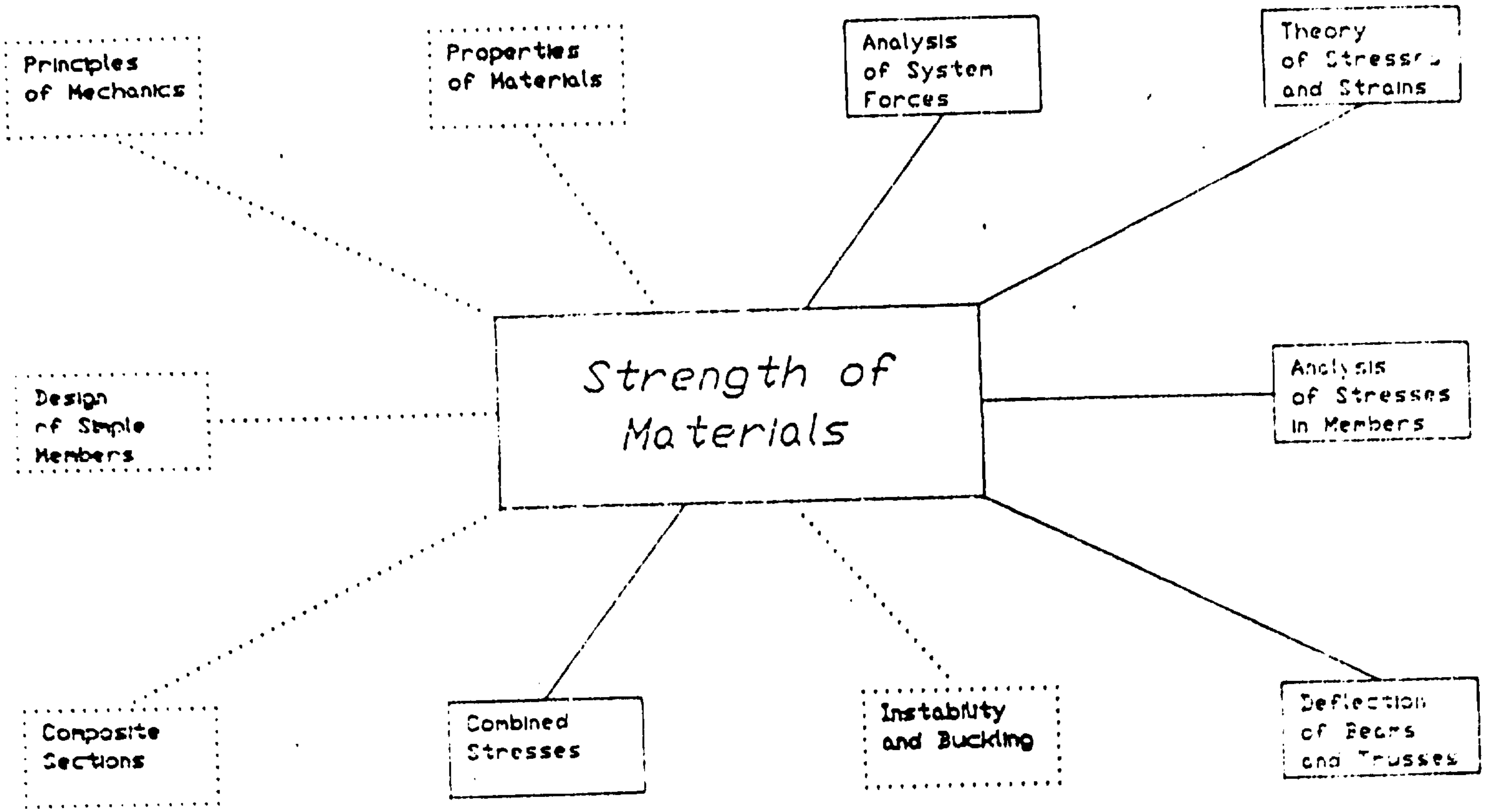
This report presents the Strength of Materials course structure at the University of Zimbabwe in section 3.2. Section 3.3 gives the syllabus. In section 3.4 we set out the topics considered the most appropriate by the group for the first development of CAL in Strength of Materials.

In discussion with the Applied Mechanics group, it was agreed that the topics in section 3.4 were indeed appropriate as core material for Strength of Materials.

3.2 Course Structure

The sequence of course topics is listed below. Please refer to figure 3.1.

1. Principles of Mechanics
2. Properties of Materials
3. Analysis of Systems Forces
4. Theory of Stresses and Strains
5. Analysis of Stresses in Members
6. Deflections of Beams and Trusses
7. Instability and Buckling
8. Combined Stresses
9. Composite Sections
10. Design of Simple Members



LEGEND —— CAL topics

Figure 3.1. Strength of Materials Course Structure

3.3 Course Syllabus

Principles of Mechanics

- Engineering systems, sub–systems, members and elements. Continuity and system relations. Degrees of freedom, Newton's Laws, forces, moments. Types of forces in Engineering.
- Equilibrium. Freedom–restraint relation. Free–body diagrams. Actions, reactions and interactions. Friction. Types of supports and mechanical continuity. Isolation and idealisations in analytical modelling.
- First and second moment of areas. Centre of gravity. Transformation and rotation of axes. Parallel axis theorems.

Properties of Materials

- Engineering materials. Rigid and deformable materials Elasticity, visco–elasticity and plasticity.
- Idealisation of material behaviour. Elastic constants. Effect of temperature. Energy theories.

Analysis of System Forces

- Forces in simple mechanical systems. Discreet member assemblies. Continuum. Trusses. Thin–walled pressure vessels.
- Determinate and indeterminate systems. Geometric compatibility. Superposition.
- Shear force and bending moments. Diagrams. Concentrated, distribution and varying forces.
- Differential relation between force, shear and moment in slender members.

Theory of Stresses and Strains

- Generalised stresses at a point in two and three dimensions. Normal and complementary shear stress. Generalized strain at a point in two and three dimensions. Transformation equations. Mohr's circle of stress.
- Stress, strain and temperature relations. Elastic constants. Poisson's ratio. Bulk modulus. Relation between elastic constants.

Analysis of Stresses in Members

- Bending of beams. Derivation of simple beam equations. Bending stress distribution in hollow sections. Bending beyond elastic limits. Built–up beams.
- Torsion of shafts. Simple torque equation for circular shafts. Hollow shafts. Power transmission. Torsion of non–circular cross sections.
- Shear in beams. Derivation of bending shear equations. Shear flow. Built up sections.

Deflection of Beams and Trusses

- Differential equations for beams. Singularity functions. Superposition. Strain energy in beams
- Deflection of trusses. Influence coefficients.

Instability and Buckling

- Concepts of instability. Stable and neutral equilibrium. Derivation of critical load of simple systems.
- Buckling of axially loaded members under different end conditions. Euler buckling load. Failure of short and long columns.

Combined Stresses

- Behaviour under combined axial and bending forces. Principal stress trajectories.
- Stresses in dams. Retaining walls. Column bases.

Composite Sections

- Composite sections for axial loading.
- Built-up beams of different materials. Reinforced concrete sections.
- Torsion and shear in composite sections.

Design of Simple Members

- Concepts of engineering design. Loads and other destructive actions. Yielding. Modes of failure. Factor of safety.
- Proportioning of sections under different forces. Bending, shear and torsion resistance.
- Connections. Bolted and welded connections.

3.4 CAL Topics

Structural Behaviour

This is recognised as a problem area for all students who study this subject. By studying this topic at the beginning of the application of CAL it should impress upon the student the importance of the physical reality of the structural element or system.

Objectives: To study the relationship between load, displacement, and reactions.

To introduce the concepts of bending moment diagrams and bending deflections

Methods: Student to compare deflected shapes bending moment diagrams and reactions for simple structures under his own loading system with that produced by the program.

CAL software: S1 Planeframe and modification.
The program will be modified to produce a simplified screen presentation to limit the data options and allow the storing of files on a student disk.

Equilibrium

Objectives: To demonstrate that even complex structures produce reactions which can easily be determined by equilibrium of vertical, horizontal and bending forces.

Methods: Loads applied to structural systems are tested against the reactions for $\Sigma V, H, M = 0$. Individual member forces identified and checked for equilibrium as free–body diagrams.

CAL software: S1 Planeframe and modification.

Bending Moments, Shearing Forces, and Reactions in Determinate Beams

Objectives: To explain the relationship between external forces and the internal resistances of bending moments and shear forces.

Methods: Using point and constant or part UD to calculate reactions, vertical equilibrium etc. Use free–body diagrams to explain the concepts of of bending moments and shearing forces.

CAL software: S1 Planeframe and modification.

Section Properties

Objectives: To demonstrate how section properties (e.g. section centroid, first and second moment of area, and section modulus) vary with shape and size of section.

To demonstrate the concept of principle axes.

Methods: Allow the student to construct various shapes from basic rectangles and calculate section properties.

CAL software: Structural Mechanics, Section Properties.

Bending Stresses in Beams

Objectives: To show how strain and stress profiles are developed in a beam and how moment equilibrium is satisfied.

Methods: Diagrams of strain profile and the resulting distribution of longitudinal stress. Calculation of internal moment equilibrium.

CAL software: Structural Mechanics, Stresses in Beams.

Shear Stresses in Beams

Objectives: To show how vertical and horizontal equilibrium is satisfied in the internal forces of a beam and how this leads to the development of shear stresses.

Methods: Calculation of vertical and horizontal stresses, stresses as a function of strain, shear stresses and diagrams for symmetrical and non-symmetrical sections.

CAL software: Structural Mechanics, Stresses in Beams.

Combined Stresses

Objectives: To show how bending, shear, axial and torsion stresses can be combined and how this concept can be applied to simple design examples such as columns and foundations.

Methods: Calculation of bending and axial stresses in columns and foundations.

CAL software: Structural Mechanics, Combined Stresses.

Pin-Jointed Frames

Objectives: To show how the concepts of equilibrium can be applied to nodes as well as part or all of the structure.

Methods: Student to estimate directions and magnitudes of forces in a truss from his own load arrangement and compare with results from program.

CAL software: S2 Planetruss and modification as S1.

3.5 Concluding Remarks

The nine topics above are assumed to require a minimum of two hours for each CAL session, preferably in one hour units. In addition an allocation of a further two hours should be made to ensure that the students are familiar with the operation of the software. The total time for CAL is thus estimated at 18 hours.

The required CAL courseware consists not only of the CAL programs, but also of a structured text (based intimately on the syllabus), and a series of CAL laboratory handouts. The group agreed to prepare the structured text and the handouts.

Of the software detailed in section 3.4, the following are currently available:

- S1 Planeframe
- S2 Planetruss
- Structural Mechanics: Section Properties.

The following are to be commissioned:

- S1 Modification
- S2 Modification
- Structural Mechanics, Stresses in Beams
- Structural Mechanics, Combined Stresses

UNIVERSITY OF ZIMBABWE

ENGINEERING MICROCOMPUTER ASSISTED LEARNING (CAL) PROJECT

COURSEWARE DEVELOPMENT TRAINING WORKSHOP - AUGUST 1988

FINAL REPORT

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1. This was the second international workshop on CAL courseware development to be sponsored by UNESCO in Harare. It addressed the major task identified by the workshop of 1987, viz, the production of courseware for:

   - Applied Mechanics,
   - Electrical Principles, and
   - Strength of Materials

   in accordance with our CAL strategy.

   Our CAL strategy requires the use of the following materials to supplement lectures:

   a) Structured text,

   b) Simulation and problem-solving CAL programs and

   c) CAL lab handouts.

2. The workshop was programmed (see attachment) such that the first week was used for introducing the participants to CAL and to our CAL Project resources and philosphy. In the second week the workshop tackled the design phase of courseware development using the work done here on the Control Systems course as a model. This was done in three smaller groups.

3. The following participants were sponsored by UNESCO:

   a) Professor O. A. Bamiro, Mechanical Engineering (Nigeria)

   b) Dr K. Ansam, Civil Engineering (Ghana)

   c) Dr S. Mulesha, Electrical Engineering (Ethiopia)

   d) Dr J. S. Mohana, Mechanical Engineering (Tanzania)

   The full list of participants, including their curriculum vitae, is attached.

4. A report on the workshop prepared by the UNESCO-sponsored participants is attached. Their recommendations are especially noteworthy.

5. A financial statement, together with supporting documents, is also attached.

6. The output of this workshop is a document (also attached) containing:

a) core syllabi for the three courses,

b) topics from the core syllabi deemed by the expert groups to require CAL treatment, and

c) lists of CAL programs that the expert groups recommended to be produced or acquired.

This document is very important and requires to be further processed and distributed to all ANSTI institutions for comments. I have undertaken to do that with further UNESCO assistance.

7. Problems of CAL intellectual property, production and printing and distribution of courseware, provision of microcomputer facilities at other African faculties of engineering, international collaboration, etc, were discussed at length.

Professor K. D. Srivastava, Vice President of the University of British Columbia, Canada led a lively discussion on these issues.

8. It was generally agreed that the major activities being addressed now by the Harare CAL Project should properly be tackled at an Africa regional level.

An African Engineering CAL Project will have the following advantages:

1. Accessibility;
2. International cooperation required to produce courseware acceptable to most faculties;
3. Cost saving due to economy of scale and no duplication of efforts;
4. Uniformity of standards and quality assurance; etc.

Every effort should, therefore, be made to obtain assistance from UNESCO, UNDP, CIDA, ECA, GTZ, etc for funding for an African Engineering CAL Project.

9. The University of Zimbabwe acknowledges with thanks UNESCO's continued interest in the Engineering CAL Project.

Prof R. K. Appiah

DIRECTOR, ENGINEERING CAL PROJECT

DATE 9/5/98

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UNIVERSITY OF ZIMBABWE

CAL COURSEWARE DEVELOPMENT TRAINING WORKSHOP

15-26 AUGUST 1988

LIST OF PARTICIPANTS

I. Resource persons

1.	Professor R. K. Appiah:	UNDP/University of Zimbabwe
2.	Mr J. H. Daigle:	CIDA/University of Zimbabwe
3.	Dr D. Brohn (Consultant)	Bristol Polytechnic, U.K.

II. Participants

1.	Professor O. A. Bamiro	(Nigeria)	Mechanical Engineering
2.	Dr G. Mulissa	(Ethiopia)	Electrical Engineering
3.	Dr K. Andam	(Ghana)	Civil Engineering
4.	Dr J. S. Mshana	(Tanzania)	Mechanical Engineering
5.	Professor R. M. Harion	(Zimbabwe)	Electrical Engineering
6.	Dr H. C. Parameswar	(Zimbabwe)	Civil Engineering
7.	Mr E. T. Kapuya	(Zimbabwe)	Electrical Engineering
8.	Mr G. Rukweza	(Zimbabwe)	Mechanical Engineering
9.	Dr F. Takawira	(Zimbabwe)	Electrical Engineering

UNIVERSITY OF ZIMBABWE

CAL COURSEWARE DEVELOPMENT TRAINING WORKSHOP

15 -26 AUGUST 1988

Aug 15:-	The UNDP-UZ-CIDA CAL Project
16:-	Introduction to LAN'S
-	The Novell Network
17:-	Desktop Publishing - PCTEX
-	Talk by Prof K D Srivastava Vice President, University of British Columbia, Canada
18:-	Demonstration of simulation CAL programs produced by Dr Bronn
	Demonstration of simulation CAL programs from Queen Mary College, London University
19:-	Demonstration of simulation CAL programs produced by CAL Project, Zimbabwe
22-25: -	Simulation and Problem-Solving CAL program design in groups: Applied Mechanics, Electrical Principles, Strength of Materials
22:-	Core Syllabi
23:-	Text Structuring
24:-	CAL Programs identification
25:-	CAL Intellectual Property, & Courseware Distribution Evaluation
26:-	Evaluation & Closing CAL needs survey Network of CAL Centres Expansion of Core Facilities & their operation

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CAL TRAINING WORKSHOPS

PARTICIPANTS

1987		1988	
NAME	COUNTRY	NAME	COUNTRY
Dr M Sheya*	Tanzania	Professor O A Bamiro*	Nigeria
Dr J D Sakala*	Zambia	Dr G Mulissa*	Ethiopia
Mr E Okure*	Uganda	Dr K Andam*	Ghana
Dr H Ayele	Ethiopia	Dr J S Mshana*	Tanzania
Mr T Munjoma	Zimbabwe	Professor R M Harlen	Zimbabwe
Mr J Daigle	Zimbabwe	Dr H C Parameswar	Zimbabwe
Dr D K Kuwornoo	Zimbabwe	Mr E T Kapuya	Zimbabwe
Dr F Madjzoub	Zimbabwe	Mr G Rukweza	Zimbabwe
Dr K M Siddiqui	Zimbabwe	Dr F Takawira	Zimbabwe
Mr S M Kundishora	Zimbabwe	Resource Persons	
Dr M M El Missiry	Zimbabwe	Dr D Brohn**	U.K.
Dr M Mansell	Zimbabwe	Professor R K Appiah	Zimbabwe
Dr J Blaszczyk	Zimbabwe	Mr J Daigle	Zimbabwe
Prof R K Appiah	Zimbabwe		
Resource Person			
Prof A Bork**	USA		

* = UNESCO SPONSORED

** = UNDP SPONSORED

4. COMPUTER BASED FINANCIAL TRANSACTION PROCESSING

ZIMBANK NETWORK

4.1. Introduction

The main companies in the Zimbank Group are:-

Zimbabwe Banking Corporation Limited
- Registered Commercial Bank
Syfrets Merchant Bank - Registered Accepting House
Scotfin Limited - Registered Financial Institution
Syfrets Trust and Executor Limited
Data Centre (Private) Limited

With the head offices based in Harare, there are now twenty-seven branches of Zimbank and five branches of Scotfin, located in most major centres in the country and some growth point areas. Zimbank is committed to more branches in growth point areas and several are planned to open in the near future. Meanwhile some centers are being served periodically by mobile services, pending the establishment of permanent representation in some of these.

Data Centre (Private) Limited is responsible for the provision of data processing services to the Group as a whole.

4.2. DP History

Zimbank's first computer, an NCR 315 system, was installed about 16 years ago, the initial project being the processing of current accounts for all branches in the Harare area. Two years later the service was extended to Branches in Bulawayo, using Mohawk Data Sciences communications equipment, as described later.

The processing of savings accounts was added at a fairly early stage and gradually the application base was augmented to include investment accounting and general ledger control.

Growth in number of accounts led to the replacement of the mainframe by an NCR Century 151 computer, which also permitted limited online services to be initiated.

It was during this period, that mini computers were introduced into the first rural branches, replacing manual

methods and obsolete letter machinery, and linking these centres to the main system.

The NCR Century 151 has since been replaced by an NCR V8545-11 'Criterion' computer, which now supports online inquiry terminals in all major Harare and Bulawayo branches, and provides account processing for every facet of the Group's operation.

Microcomputers linked to the mainframe are being used by the internal audit and head office accounting divisions and this type of development is expected to increase. The association with Mohawk Data Sciences has continued since the early days of data-recorders, with all batch input being captured on MDS 1200 key-to-disk systems since 1975. Hopefully this equipment will soon give way to MICR input machinery in line with modern banking practice. Also MDS series 21 mini computers have been installed at all Data Centres, the Group Head Offices, Bulawayo and each rural branch.

In selecting suitable hardware and systems in general, the emphasis has been on pragmatic solutions based on available resources and service levels, rather than on sophisticated methods in use elsewhere.

4.3. Main Application Concept

The Group's processing is carried out on an integrated basis incorporating all the various types of accounts in use into one central unitary system. Whilst the computing requirements of so many different accounting functions are very diverse, it has been possible to create a common structure in terms of file storage, input/output and communication handling, which has considerably eased the burden of developing and supporting the system as a whole.

For example, Scottish hire purchase accounts can be captured in the Chinhoyi branch on the same basis as Zimbank's current account data. Similarly, at head office, Syfrets Merchant Bank, Scotfin and Zimbank all use the online inquiry system and share the same telephonic links.

The system which was locally designed and developed, operates daily in batch mode. During the daylight hours input data is received periodically from the Harare key-to-disk systems, and from the mini computers at head office, Bulawayo and the rural branches. During this time, online inquiry terminals at the major branches and head office departments have access to customer and internal data under password control. In keeping with normal commercial banking policy, the information displayed reflects the position up to the close of business on the previous day.

Once all the input is received, automatic entries are generated and the main update takes place. Following this, report data is physically printed in the case of Harare

branches, and transmitted for printing to the remote locations. This report data is fairly voluminous including a full listing of all account balances, managerial exception reports, and customer statements.

With all branches throughout the country being processed centrally an extremely useful feature for selected customers is the ability to automatically transfer funds between accounts, regardless of geographic location, as part of a cash management service.

Like other financial organisations, Zimbank's system requires a daily turnaround of transactions and due to the critical nature of the Group's processing activity, a very high level of security for both the operation and information base is required.

4.4. Communications

Three types of operation are in use:-

Bulawayo leased line
Rural centres dialup links
Harare/Bulawayo local leased lines

Bulawayo

Zimbank's first experience in data transmission dates back to 1972 as the Zimbabwe PTC's first data customer. A system was required to transmit batched transaction data daily from a central point in Bulawayo to the Harare computer centre, and reciprocal transmissions of report data for printing in Bulawayo.

The equipment used in those early days were Mohawk Data Sciences magnetic tape data recorders with communications interfaces in each centre, and an MDS 300 lpm printer in Bulawayo. Asynchronous dial-up modems operating at 600/1200 bauds were provided by the PTC.

As volumes increased it was possible to justify a dedicated leased line, which came into operation in 1979, and was the thirteenth such link provided by the PTC in Zimbabwe at the time.

The next development was the installation of an MDS 2150 mini-computer to replace the data recorders and the existing bank 'waste' machinery. At the same time a further MDS 2150 system was installed at the Harare computer centre and the

leased line was upgraded to operate synchronously at 4800 bauds using standard IBM 3780 protocol.

Lastly, about three years ago, CODEX statistical multi-plexors supplied by NCR were installed to allow four channels on the link. One channel is still used for the MDS to MDS operation, and the other three to support NCR inquiry terminals in the Bulawayo branches.

To summarise, the purpose of the link is firstly to transmit various types of transaction and file maintenance input, including foreign transactions and cheque book requisitions. Secondly, it is to provide a means of transporting data to Bulawayo for the for the printing of branch management reports, customer statements, bank drafts, etc.

Rural Centres

Prior to computerisation, processing of accounts was carried out independently in each branch using ledger card accounting machines. The machines were used to update customer and general ledger records and also to process the 'waste'.

As these machines approached obsolescence, break-downs began occurring more frequently and servicing outside of the main centres became a serious problem. In addition being on a completely different system from the computerised branches in Harare and Bulawayo, transfers of personnel also presented problems.

Following the success of the Bulawayo installation, where waste processing had been integrated with the data capture operation, it was decided to experiment with a similar solution in Gweru, using a smaller version of the MDS 21 series, the 2110 and the programs already developed for Bulawayo.

Some modification was needed, as the proposed units used only flexible diskettes as opposed to hard disk, but basically the operation was, and still is, the same.

So in 1982, the first MDS 2110 comprising 96K byte processor, screen, keyboard, matrix printer and with communications capability, was installed at the Gweru branch. Dial-up modems operating synchronously at 2400/1200 bauds were provided by the PTC and the operation was a great success. Kwekwe followed the same year, and when sufficient foreign currency for the importation of the equipment was available all branches were connected, the last one in February 1985.

Only one mini-computer is required in each branch, replacing up to four accounting machines in some cases. Operators have been drawn from existing branch staff, and with the emphasis on user-friendly software, there have been few problems in this regard. Personnel in Harare are always available to assist by telephone.

In most branches, the computer is left in a ready-to-receive state in the evening, so that using 'auto-answer' the report data can be transmitted late in the evening, for printing the following morning.

Whilst the data transmission service provided by the PTC has not been completely error-free, the level of service available is adequate to serve our daily banking operation, and it is our intention to expand the number of rural branches in the near future, on the same basis.

Harare/Bulawayo local leased lines

Online NCR inquiry screens and printers are provided at most major branches and head office departments. Base band modems are used operating at 9600 baud asynchronous on a polled system allowing several terminals to share one link where required. Response time is good and we have few problems in Harare.

However, in Bulawayo, whilst the inquiry terminal served directly from the statistical multiplexor is equally as good as the Harare branches, where we are using 'tail-links' via further base-band modems to the other Bulawayo branches, we are restricted to certain protocols, for reasons not yet clearly understood, although it is believed that alternative modem types may resolve the problem.

Appendix I

COMPUTER HARDWARE

NCR 8545-II mainframes:

- 3 megabyte main memory
- 6 x 200 Mb removable disk
- 3 x 80 Kb mag tape drives
- Flexible diskette/cassette input/output
- 1200 lpm printer
- 900 lpm printer
- Communications controller
- 9 x VDU (teletype)
- 24 x VDU with printers (polled)

MDS 2150 mini-computers:

- 4 x CPU (128K/256K) with comms
- 2 x 20 Mb disk drives
- 2 x 10 Mb disk drives
- 8 x Flex disk drives
- 18 x operator stations
- 2 x line printers 250 lpm
- 3 x matrix printers
- 2 x daisy wheel printers

MDS 2110 mini-computers:

- 10 x CPU (128K) with comms
- 10 x matrix printers
- 20 x flex diskette drives

MDS key-to-disk systems:

- 2 x 1204 CPU's with disk storage
- 24 x keystations

Microcomputers:

- 3 x NCR DM5
- 1 x IBM XT

Appendix II

ZIMBANK BRANCHES

HARARE	First Street	Birmingham Road
	Angwa Street	Graniteside
	Manica Road West	Avondale
	Samora Machel Avenue	Highlands
	Douglas Road	Borrowdale
	Msasa	Chisipite
BULAWAYO	Abercorn Street	Belmont
	Fife Street	

GWERU
MASVINGO
KWEKWE
KADOMA
SANYATI
CHINHOYI
MARONDERA
MUTARE
MUPANDAWANA (October 1986)
VICTORIA FALLS

AGENCIES

Sheraton Hotel - Harare
Monomatapa Hotel - Harare
Bulawayo Sun Hotel
Nyanga
Montclair Hotel - Juliasdale
Rutenga
Kamativi

MOBILE SERVICES

Neshuro	Lupane
Chivi	Jotscholo
Nyika	Mubaylra
Jerera	Mahusekwa
Rutenga	Mamina
Binga	

Appendix III

STATISTICS

Account Type	No. of Accounts	No. of transactions per annum
Current	20 000	4 800 000
Savings	36 000	530 000
Investments	5 000	80 000
Finance	8 000	290 000
General Ledger	5 000	1 600 000
TOTAL	74 000	7 300 000

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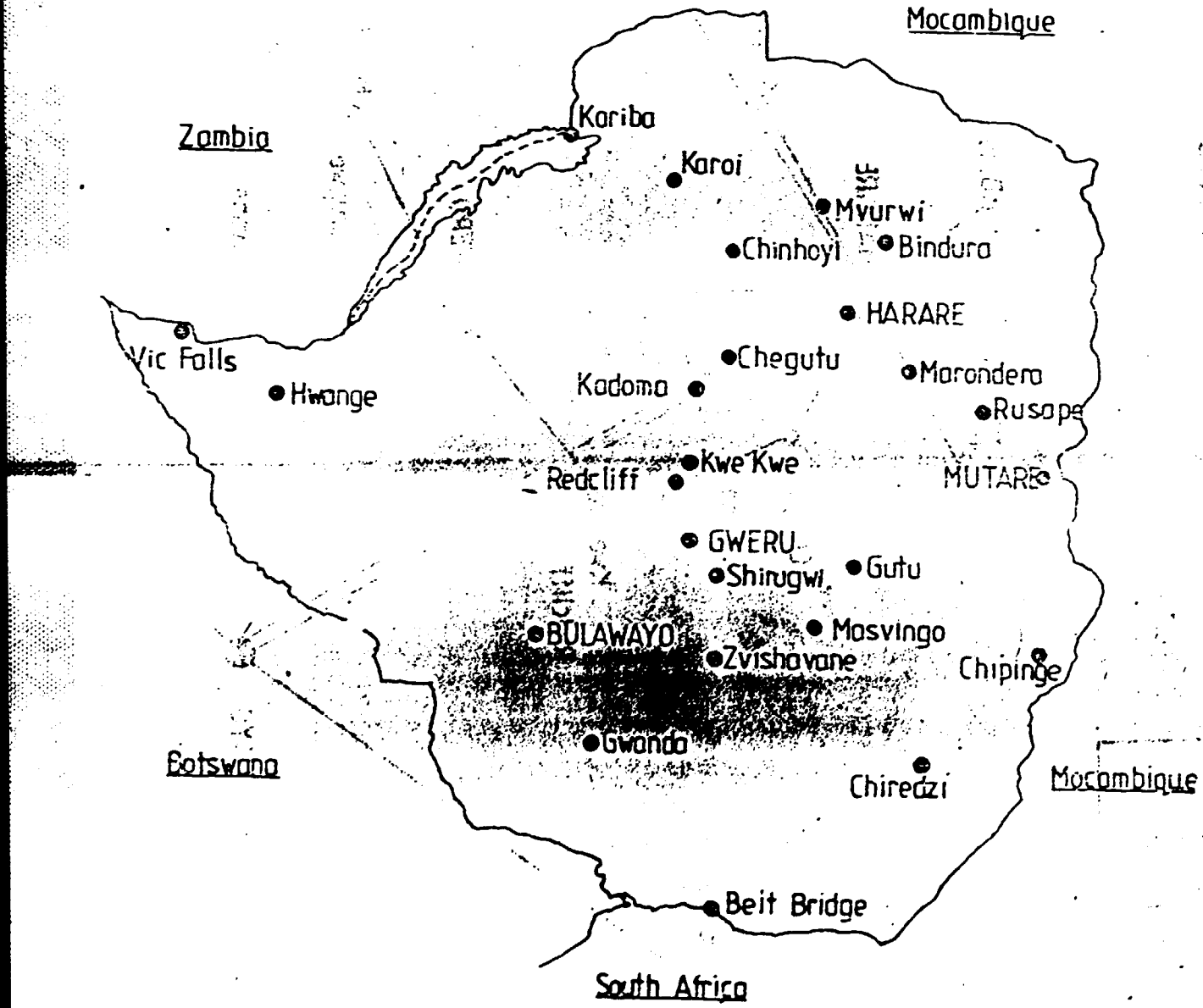
Diagram I



CABS has a multi-drop network, because PTC only provide a point-to-point service, we supply, fit and maintain all equipment /approved by them/, at either end. This will best be illustrated by Diagram III.

The Society's computer in Harare services 250 financial terminals situated in offices countrywide. The terminal population at these offices varies at present from 1 to 24. Because of this varied concentration of financial terminals and the cost of dedicated leased circuits, it has been necessary to employ a multi-drop network.

At present there are 8 protocol converters connected to the mainframe. (Mainframe uses C03 protocol and terminals IBM 3270). From the PC we fan out to 2 Master modems, each of which services a master analog bridge to which are attached 4 slave bridges, with each slave servicing one PTC line from the tag block.

From the tag block CABS's line goes to the PTC exchange and is routed via the PTC network, which could involve a number of exchanges before reaching its destination, i.e., the tag block at each Branch. At the Branch we come off the tag block into a slave modem which might or might not be connected to a digital bridge, dependent upon the number of terminals at the Branch. The digital bridge will handle up to 6 clusters of 8 terminals. Each cluster is controlled by a router terminal which handles all communications between the mainframe and the terminals in that cluster.

Simply, PTC are responsible for the sections between the tag blocks and we are responsible for the sections before and after the tag block.

The Network Control Centre is housed at the Computer Centre. Looking at the network configuration /Diagram III/, the N.C.C. consists of all equipment from the PC's to the PTC tag block. Connected to and forming part of our lines are additional pieces of equipment which are:

1) Distributed network control system - (DNCS).
2) Patch Panel.
3) Data Scope.

1) DNCS

This is a micro-computer used specifically for testing and monitoring lines and modems and is connected to the line at the master modem. It consists of a monitor (CRT) keyboard, and printer, and provides CABS with most of the information

required to manage the network, by reporting all changes in line conditions, etc., and the state of the modems at either end. DNCS is never shut down and reports 24 hours a day.

2) PATCH PANEL

The patch panel is connected in-line before the PC's and after the PC's, i.e., inboard and outboard lines. The patch panel enables us to cross patch lines from a port on one PC to a port on another PC in the event of one going down.

3) DATA SCOPE

Basically used for monitoring data to and from the mainframe and is connected to the patch panel.

CABS' NETWORK

PART 2

CABS are truly proud of the on-line banking systems developed by the organisation. In 1980 the Computer Centre was catapulted in the position where they suddenly found themselves the proud owners of a wonderful new computer, but it was up to them to make it work

Preparations had already begun the previous years intensive training courses were set up and executed. There was a tremendous amount of learning to do in the foreseeable future. Everything was new, not only to CABS but also to Zimbabwe.

Early in the project it was decided that a data-base system would form the basis of the planned system. The ICL version of IDMS (Integrated Data-base Management System) was chosen for this purpose. As CABS were the first users of the IDMS in Zimbabwe, expertise needed to train local staff had to be imported from the United Kingdom. But we learn fast - and in August 1980 the names and addresses of all CABS' clients were loaded into the IDMS data-base on our old ICL 1903A.

service? How would messages be retried? The list of queries goes on and on. The answers came largely from trying different approaches until the best one was discovered.

The difficulty in getting the terminal to 'talk' to the mainframe was due largely, in my opinion, to the fact that the entire development of the terminal was executed by staff at Head Office and not at Computer Centre, and it was to be many years before control of the terminal side of the system was brought under the Computer Centre.

The new Savings banking system was put live, in batch mode, in February 1983. With the exception of a few teething troubles, the system worked well and in June 1983 the Society's new Branch in Central Avenue, Harare opened, on-line realtime. This Branch was chosen as the first obvious reason that the Computer Centre is housed in the same building.

The next step was to put a Branch away from the Computer Centre on-line, and since the First Street Branch, Harare was one of the Society's busiest banking halls, this Branch went on-line in July 1983, and during the latter part of 1983 the Branch on-line network was further expanded in Harare. The next major challenge was to bring a Branch in another town on-line, and subsequently this took place at Bulawayo in February 1984.

After that it was simply a matter of availability of PTC lines. The network has grown to encompass 53 Branches using some 250 terminals, and on an average day the mainframe will process 75 000 message pairs, and during peak periods, up to 10 transactions per second.

The Savings system was a mere beginning. The Computer Users at CABS now had the knowledge and experience to write on-line realtime systems for various departments within the organisation. Permanent and Subscription Shares are now on-line realtime and on-line enquiries can be made into Mortgage and Short Loan accounts.

The obvious question is 'what does an on-line realtime system mean to both the Society and the Society's clients'? Possibly the biggest advantage to the client is that almost every type of transaction can be carried out at any of the Society's Branches countrywide. Money deposited in Masvingo is instantly available anywhere in the country.

From CABS' point of view the advantages lie in the fact that security has improved. Immediately a passbook is reported lost or stolen, access to funds in that account will be blocked and no transactions will be allowed against that account, no matter where in the country an attempt to operate the account is made. Since the introduction of the on-line system, the number of frauds and overdrafts has dropped considerably. Furthermore, any client at any Branch is able

from grass fires, elephants and giraffes. Using these various types of bearers, both audio and data channels have been included in the telecommunications plans, paving the way for computer links for all users.

3. COMPUTER LINKS

Data can be transmitted reliably at speed of up to 9 600 bps over an ordinary telephone line circuit, and higher speeds (typically 800 000 bps) can be achieved using ordinary telephone conductors and special modulation techniques. Owing to the constraints of the cable network, and a relatively low density of subscribers in Zimbabwe, the maximum practicable data transmission rate is 9 600 bps, or 1 000 alphabetic characters/sec. In a number of rural areas the maximum speed is limited to 1 200 bps, and high transmission speeds are unlikely to be required. The PTC offers three types of data transmission services:

(a) Dial-up transmission

(b) Leased circuit (national)

(c) Leased circuit (local)

Subscribers can also use the existing telephone network for data transmission using acoustic couplers - i.e. there is no metallic connection to the telephone network. The human ear and mouth are replaced by a microphone and loud-speaker, and tones are used to transmit the data at speeds of up to 1 200 bps which is the maximum that can be achieved. As far as Zimbabwe is concerned, it is expected that the maximum reliable speed will be 300 bps in the rural areas if this mode is used. Modems using acoustic couplers permitted to use the telephone network

A new service that will be introduced shortly is the Packet Switching Service called ZIMNET

4. DIAL-UP MODEMS

Most remote terminals and VDUs require a full duplex (two way) form of communication. This means that the dial-up modems are restricted in speed to 1 200 bps.

One direction is used for transmitting the data and the reverse direction for either error messages or acknowledgements. Recent developments in computer protocols have meant that half duplex (uni-directional) transmission systems can be used. Since transmission is one direction only it is possible to use the full spectrum of the telephone channel and speeds of up to 9 600 bps can be achieved.

Recent developments in modulation techniques have meant that the data transmission speeds can be increased to 19 200 bps over distances of 6#7 km. The main disadvantage of the baseband modem is the requirements for two pairs of wires for carrying the data. In view of the high demand for cable pairs in Zimbabwe this has often meant that data networks have been difficult to implement.

Investigations have been carried out into the use of line modems making use of the spectrum above the speech band. Line modems use a low#cost but sophisticated phase modulation technique. Investigations in Zimbabwe have shown that these modems can only operate up to 4 km in distance. Since the data frequencies are above the maximum audible frequency, it is possible to combine a telephone and a data circuit over one pair of wires; this represents a major advantage for Zimbabwe.

7. LOCAL DATA TRANSMISSION NETWORKS

Owing to the limited range of the baseband and line modems it is becoming necessary to look at altenative methods of transmitting data for both local and national networks.

PCM data multiplexers have recently been developed which allow a number of low speed data circuits to b combined on to one high speed (2MB/s) circuit. Such links are widely used for telephone circuits and are therefore relatively cheap and readily available. Since Zimbabwe intends introducing either fibre optic or PCM links between most satellite exchanges and the central exchange, it will be possible to introduce a 2 MB/s data network which will cover the entire town and national network with a minimum of problems. Range will no longer be a restriction as all subscribers will only have to be connected to the nearest exchange. Trials are to be conducted using 2MB/s links between exchanges and either line or beseband modems from the exchange to the subscriber's premises. This should enable the PTC to meet the demand in a cost effective manner. Short data circuits connected to a common exchange will not use the 2 MB/s links, but will remain as a direct connection.

8. DIAL-UP SERVICE

Data dial-up service has recently been introduced in Zimbabwe, to meet the demands of companies that have a number of branches throughout the country. The introduction of dial-up services was delayed because of PTC concern over noise interference, particularly impluse noise. However tests have shown, that while impulse noise is a problem, the immunity of the dial#up modems to noise is good.

Tests at 2 400 bps have shown that the error rate is better than 1 in a million. Dial#up modem speeds at 300 bps and 1200 bps are to improve upon this.

11. X.28 SERVICE

There are still many subscribers who do not have the full X.25 software available and yet wish to make use of the X.25 network. For this reason the CCITT defined a PAD (Packet Assembly and Disassembly) protocol which allows ordinary terminals or personal computers to access the Packet Switching Network. The function of the PAD is to break the incoming character sequences into 64 or 128 character blocks and pack them into the correct format for a packet. The PAD also receives an incoming packet and does the necessary protocol and handshaking with the distant PAD or X.25 computer. The received data is then transmitted as a simple sequence of characters in a simple format to the local terminal. To provide the maximum number of subscribers with the service it has been decided to implement a dial-up 300 bps service for Zimbabwe. Dial-up ports will be provided in the major zone centres, namely Harare, Bulawayo, Mutare, Gweru and Masvingo. Subscribers in other centres will dial the nearest zone centre and will then be directly connected to the International Packet Switching System. Subscribers using the X.28 service will only be able to initiate calls and not receive them because the X.28 PAD cannot initiate telephone calls.

12. USE OF TERMINALS

Having established the useful part that on-line computer terminals can play in the role of the rural economy and that the telecommunications network will be able to provide and support the data links, it is worthwhile to see what other benefits could be derived from the presence of computer hardware at remote points, using the Post Office as an example.

A large problem in the telecommunication administration is the timely collection of money owing by the telephone and telex subscribers. Those who have not paid by the expiry of the grace period, must be disconnected. When payments are controlled by computer working in batch mode the batches of information are submitted manually, inevitable delay occurs in processing the results. Disconnection is delayed perchance payments are in the pipeline and debts accumulate.

Tardy movement of mail, transported for economy's sake by rural bus operators, whose vehicles often break down, causes the cash accounts of Post Offices to be reported late with consequent possibilities of thefts not being detected early and with delay in the production of management accounts.

These and other problems can be very much reduced, if not eliminated, if computer hardware at Post Office counters is used as a point-of-sale terminal so that daily balancing is

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x/ PROCEEDINGS OF THE SOUTHERN AFRICAN REGIONAL WORKSHOP ON INFORMATICS FOR DEVELOPMENT
Zimbabwe, 1986

IV. ZAMBIA

STATUS OF INFORMATICS TECHNOLOGY IN THE REPUBLIC OF ZAMBIA

IV.3

R E P O R T

on "State of the art and Review on informatics/microelectronics in the Republic of Zambia and identification the needs with regard to software training"

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1. INTRODUCTION

Computers have been in use in the Republic of Zambia, in both the private and public sectors, for well over twendy years. Major users in the past have been in the government, the mining companies, the Urban District Council, the Provident Fund, the national airline and railways, the Agriculture Marketing Board, and the University of Zambia to mention a few. These have now been joined by the banks, the Electricity Supply Corporation, the building societies, the Post and Telecommunications Corporation, and several private companies. Most of the equipment utilised hitherto has mainly been angaged in serving the accounting departmens of these organisations, payroll being one of the most important systems [redacted]

There are now serious efforts being made towords management information systems. This may have had its impetus from the prevailing economic situation in the country which has necessitated more efficient use of resources, through effective management, in order for enterprises to survive.

The major suppliers of computer equipment are IBM and ICL. Other noteworthy ones are NCR, which has made inroads in the banking sector, COMPUTER SERVICES LTD who are agents for WANG and DATA-CARE who are agents for BURROUGHS and MEMORY SYSTEMS. IBM recently appointed a local company, WOODGATE COMPUTER SYSTEMS, as its re-marketer for all its data processing equipment and products. They however retained the maintenance function as well as marketing of systems larger than the 4361.

[redacted]

There are over ten installation [redacted] of various sizes as well as a number of [redacted] and 2904's, several ME29's are on order. There are several IBM SYSTEM 3's, two IBM SYSTEM 34's one IBM SYSTEM 36 with several on order, one IBM 4341, and one 370/135. The mining group which for years utilised large IBM mainframes switched to NATIONAL ADVANCED SYSTEMS two years ago and now have two AS 8000 series with 16 megabytes each. Most of their peripherals are from Storage Technology. There are three IBM 370/158's and one 145, one 135, and a 125.

At least two 4361's are on order for the University of Zambia and the State Insurance Corporation. All major banks except the Central Bank opted for NCR equipment mainly 9020's and 9300's. The National Saving and Credit Bank (formerly the Post Office Saving Bank) has for years utilised the Government Computer Centre and continues to do so.

and off plans to introduce a Computer Studies course. They have now embarked on a Mathematics course with some Computer Science content.

It has recently been learnt that the College of Commerce and Arts in Lusaka intends introducing a computer studies course soon and several micro-computers in the form of IBM PC/XT's have already been acquired through a donor agency.

In this atmosphere the kind of training has mostly been in-house for most of the installations. The vendors have also organised several successful short courses. ICL, last year, sucessfully conducted a series of courses with instructors flown in from their training centre in the United Kingdom. Due to the foreign exchange auctioning system which has rendered a repeat performance very expensive, ICL are planning on acquiring training aids to train local trainers. NCR has also conducted courses in Cobol Programming and Systems Analysis and Design. IBM, over a year ago, through their Africa Institute concept, conducted a month long course utilising eight PC's which were donated to the participating government and parastatal organisations on the completion of the course. A similar course for another eight government and parastatal organisations commenced on the 29th of April.

The Computer Society of Zambia has also conducted each year for the past three years or so, successful Cobol Programming courses at basic and advanced levels.

It is hoped the institutes of higher learning will take up the challenge and set up a viable formal course in computer studies without undue delay.

4. SUCCESS STORIES

There are a lot of success stories but one that comes to mind immediately is the tremendous [illegible] made in "Zambianisation" in the field. [illegible] installations are now headed by qualified and experienced Zambians and the number of expatriate officers in virtually all installations is now negligible. For a country that had only one hundred university graduates and one thousand school certificate holders at independence in 1964 this is a notable achievement.

Other success stories include the use of computers to process (i) primary school final examinations which last year comprised almost two hundred thousand candidates, (ii) voters registration for 1983 elections as well as the 1980 census. All these are the responsibility of the government data processing department in the Ministry of Finance.

The Zambia National Provident Fund has successfully commissioned regional centres at Ndola and Kitwe and testing the data communications line to its Livingstone center in its

In the banking sector it is envisaged to provide regional computing capabilities which will eventually result in inter-city links. It is also anticipated that this would, in the long run, result in inter-bank links for clearing purposes at least.

Some application-Zambia Goverment Data Processing Unit are given in Appendix 4.I.

6. UNIDO ASISTANCE IN INFORMATION/TECHNOLOGY MANAGEMENT

6.1. One of the prioryty training needs in Zambia has been identyfied to be information technology management. Serval Zambia Industrie have installed computers purchused from varions agencies. Ufortunately due to lack of support services and adequate particulary in software development application and usage these computers are not being utilised.

6.2. ZIMCO INSTITUTE OF MANAGEMENT /Appendix 4.II/

6.3. ESAMI - LUSAKA ZAMBIA /Appendix 4.III/

6.4. THE ZAMBIA STATE INSURANCE CORPORATION Ltd. /Appendix 4.IV/

6.5. THE UNIVERSITY OF ZAMBIA SCHOOL OF ENGINEERING /Appendix 4.V/

Shall be gratefull it UNIDO could assist then in following areas:

1/ Launching og training programmes on software to improve the performance of computer personal in Zambia

2/ Undertake consultancy assignments in companies to improve the utilisation of computers.

The full information on the above subjects are nicluded in Appendix 4.II up to 4.V.

6.6. Zimco Institute of Management has established a Centre for Professional Studies in Lusaka. Details of courses being offered are given in Appendix 4.VI.

6.7. Information regarding to software training organized by Indeco Ltd. Zambia are given in Appendix 4.VII, 4.VIII, 4.IX.

Appendix 4.II

TO: Prof. P. Badzmirowski
UNIDO Consultant

DATE: 16th November, 1988

FROM: G. Musoke-Lwanga,
ESAMI Resident Consultant, Lusaka, Zambia

RE: UNIDO - ESAMI COLLABORATION : ELECTRONICS AND COMPUTER MANAGEMENT IN ZAMBIA

I refer to our discussions, Badzmirowski/Musoke-Lwanga, 15 November, 1988, regarding the above subject.

As you are now already aware, ESAMI is the leading regional management development institution serving 19 countries of Eastern and Southern Africa. ESAMI's business is the improvement of the managerial performance effectiveness in both public and private sector organisations of its member countries.

With a complement of over 35 full-time Consultants, ESAMI identifies management training and development needs, develops, and delivers an average of 100 in-service training programmes both at ESAMI Headquarters in Arusha, Tanzania, and in various capitals of member states. In addition, ESAMI undertakes consultancy assignments on a competitive basis and also conducts applied research. ESAMI training, consultancy and research activities fall into the following broad areas:

1. Business and Operations Management Programmes
2. Accounting and Finance Programmes
3. Electronic Data Processing Programmes
4. Human Resources Management and Development Programmes
5. Transport and Communications Management Programmes
6. Women in Development Programmes
7. Health Systems Management Programmes
8. Library and Documentation Programmes

With reference to ESAMI operations in Zambia and the opportunity for ESAMI - UNIDO collaboration especially in the area of electronics and computer management improvement, the following possibilities would be most welcome:

(a) UNIDO contracting ESAMI to conduct a comprehensive study on the degree to which either the Zambian public (government and parastatal) sector or the private sector have computerized, the type of hard-and-soft-ware employed, the strengths and weaknesses of the current systems and recommendations for improving and strenghening computer applications in Zambia.

Communication should be addressed to the Director

Appendix 4.III

ZIMCO INSTITUTE OF MANAGEMENT

P O Box 31736,
Lusaka,
Zambia.

Telephone: 215867/216002/216248/216404 Lusaka
278575 Chilanga
Telex: ZA 70521

Our Ref: RCD/C/01/ZJN/bm

16th November, 1988

Prof. K. Badzmirowski
c/o U N D P
LUSAKA.

Dear Professor,

RE: UNDP/UNIDO ASSISTANCE IN INFORMATION TECHNOLOGY MANAGEMENT

We refer to the discussions you had with the Deputy Director, Head of Research, Consultancy & Development Department and Consultants at Zimco Institute of Management on 16th November, 1988.

As you are aware, Zimco Institute of Management (ZIM) is the training and consultancy wing of the Zambia Industrial & Mining Corporation Limited (ZIMCO). The latter is the holding company of 123 subsidiary companies employing about 137,000 people. ZIMCO is one of the largest conglomerates in the world.

ZIM is one of the front-line institutions in Africa offering multi-disciplinary professional training programmes, as well as consultancy services. ZIM has undertaken research and consultancy services in several parastatal organisations, Government Departments and international agencies.

2/...

Appendix 4.IV

The Zambia State Insurance Corporation Limited

Premium House – Independence Avenue – P.O. Box 30894 – LUSAKA – Zambia
Telephones: 218888/214527 – Telex: ZA 42521 – Cables: "ZAMSURE"

Our Ref:..... *Your Ref:*.....

15th November, 1988

UNIDO
Corporation Building
Chiparamba Road
LUSAKA.

Attention: Mr K Badzmirowski

Dear Sir,

DEVELOPMENT OF SKILLS IN INFORMATICS

Zambia is a developing country and is situated in Central Africa. In the area of Informatics, she is striving hard to receive great bene[illegible] from the use of Computers in government as well as in industry. She has, and continues to acquire, micro-computers, mini-computers and main frame computers. The development of the human resource i.e. hardware and software skills, has not moved at the same pace as the hardware and sostware acquisitions in the country. There is a requirement for training programmes to be developed in the areas of:-

1) computer Programming s[illegible]
2) Systems Analysis [illegible]
3) Development of [illegible] (Zambians) to meet our on-going staff development requirements.
4) Other specialist skills such as Data Base Management Systems, Data Communications, etc.
5) Development of hardware maintainance engineers.

In my opinion, a systematic approach to solve the above issues, funds permitting, would assist greatly in the further development of Informatics in Zambia both short and long term.

Yours faithfully,

A C MULENGA
DATA PROCESSING MANAGER.

(Chairman - Computer Society of Zambia - Midlands).

Appendix 4.VI

ZIMCO INSTITUTE OF MANAGEMENT

IV.15 / IV.46

PROFESSIONAL COURSES

CENTRE FOR PROFESSIONAL STUDIES
BUYANTANSHI ROAD
P.O. BOX 31735
LUSAKA
ZAMBIA

TEL: 215867, 216002
216248, 216404
TELEX: ZA 70521 ZIM
ZA 40790 ZIMCO

B. MARKETING

The Institute of Cost and Management Accountants — UK. (ICMA), Stages I, II, III and IV.

ENTRY REQUIREMENTS

Candidates wishing to enrol on this course must:—

(i) Be registered students of the Institute;

or

(ii) Possess the necessary entry qualifications to register as students of the Institute. The minimum educational requirements for registration as a student are:—

— A degree of an approved University;

or

— G.C.E. 'O' Level passes in five subjects including two at Advanced Level. Passes must be obtained in Mathematics and English Language.

COURSE DURATION

Each stage will be of six months duration and will be designed to prepare students for the June and December examinations.

COURSE CONTENT

Stage 1

Accounting
Economics
Business Law
Quantitative Methods

Stage 4

MA Decision Making
MA Control and Auditing
MA Strategic Planning and
Marketing
MA Financial Management

EXEMPTIONS:

Accounting Fundamentals
Business Studies

Stage 2

Cost Accounting
Information Technology Management
Financial Accounting Management

Stage 3

Management Accounting Techniques
Advanced Financial Accounting
Company Law

A1. ACCOUNTANCY AND FINANCIAL MANAGEMENT

Levels I, II and III.

ENTRY REQUIREMENTS

Candidates wishing to enrol for this course must:—

(i) Be over 18 years old;

(ii) Possess four G.C.E. 'O' Level passes of which two must be English Language and numerate subject (e.g. Mathematics or Statistics) and any two other subjects provided that only one is a craft subject;

(iii) Three subjects are acceptable if one is at Advanced Level;

or

(iv) Any other qualifications acceptable by the Association as laid down in the manual under 2.1.1 to 2.1.10 and 2.2 to 2.4.2.

COURSE DURATION

Each part will be of six months duration and will be designed to prepare students for the June and December examinations.

COURSE CONTENT

Preliminary Examination	Intermediate Examination
Basic Accounting	Accounting
Communication	Elements of Information Systems
Business Administration	Business Law
Numeracy and Statistics	Economics and Statistics

Final Examination

Route A (Accounting Practice Stream)
Financial Accounting
Cost Accounting and Budgeting
Analysis and Design of Information Systems
Auditing and Taxation

Route B (Industry and Commerce Stream)
Financial Accounting
Cost Accounting and Budgeting
Analysis and Design of Information Systems
Organisation and Financail Control

Route C (Public Sector Stream)
Cost Accounting and Budgeting
Analysis and Design of Information Systems
Public Sector Accounting and Auditing
Public Sector Organisation and Financial Control

F. DATA PROCESSING

Association of Supervisors in Purchasing and Supply (ASPS) — UK.
1st Certificate and 2nd Certificate

ENTRY REQUIREMENTS — 1st Certificate

(i) Registered students of the Institute of Purchasing and Supply;

(ii) Four G.C.E. 'O' Level passes or equivalent;

(iii) Be 21 years old with not less than two years Stores/Purchasing experience.

ENTRY REQUIREMENTS — 2nd Certificate

(i) ASPS First Certificate;

(ii) Institute of Purchasing and Supply Certificate in Stores Supervision.

COURSE DURATION

Each stage will be designed to prepare students for the May and November examinations.

COURSE CONTENT

1st Certificate six months

Effective Communication
Business Procedures and Organisation
And any two of the following:—
Principles of Purchasing
Practice of Purchasing
Stores Administration and Stock Control
Stores Design and Materials Handling

2nd Certificate eleven months

Elements of Costing
Management of Materials
Principles of Supervision
Transport and Distribution
Project Work

G. PURCHASING AND SUPPLY

The Chartered Institute of Transport (C.I.T.) — UK.
Qualifying Examination (QE) Part I
Qualifying Examination (QE) Part II
Qualifying Examination (QE) Part III

ENTRY REQUIREMENTS — Q.E. Part I

(i) A degree from UNZA or of an approved University;

(ii) Five G.C.E. 'O' Level passes of which two must be in English Language and Mathematics.

ENTRY REQUIREMENTS — Q.E. Part II

(i) Pass of Qualifying Examination Part I;

(ii) Exemption from Qualifying Examination Part I.

DURATION

Each Part will be of ten months duration and will be designed to prepare students for the May qualifying examinations.

COURSE CONTENT

Q.E. Part I

(1) Transport Economics and two from the following:—
(2) Law of Business and Carriage
(3) Mangement Accounting and Finance
(4) Quantitative Method

Q.E. Part II

(5) Management and Control of Transport
(6) Manpower and Industrial Relations in Transport
(7) Transport Management Practice I
One of the following
— Air Transport
— Road Freight Transport
— Road Passenger Transport
— Urban Transport
— Marketing

Q.E. Part III

(8) Transport Policy and Planning
(9) Transport Management Practice II
(10) One other paper from (7) in Q.E. Part II
(11) Physical Distribution Management

INDECO LIMITED

SOFTWARE

DEFINITION :

Software is the expression used to describe all programs which are used in a particular computer installation.

TYPES OF SOFTWARE

The two basic types of software are:

a. System Software
b. Application Software

A. SYSTEM SOFTWARE

This is in most cases provided by manufacturers much of it being used in contributing to the control and performance of the computer system.

B. APPLICATION SOFTWARE

This set of programs may be provided by the computer manufacturers or suppliers but in many cases the user produces his own application programs called user programs.

e.g Stock Control, Payroll

A single application program is called a JOB, and this is made up of program and Data.

This can be further divided into:

a. Operating System and Control Programs
b. Translators
c. Utilities and Service Programs
d. Data Base Management Systems (DBMS)

} System Software

e. User Application Programs
f. Application Packages

} Application Software

2/...

c. Real Time Operating System

This is where the input to the computer is processed so fast that the output is able to influence the activity taking place at that time.

EXECUTIVE PROGRAM

Often called the Supervisor program, is the basic control program at the centre of the operating system. It remains permanently in the main store.

COMMAND LANGUAGE

A programming language used for communicating with the system. Statements in this language are directives requiring immediate execution and are handled by the interpreter.

JOB CONTROL LANGUAGE

Special command language used to identify the job and state their requirements to the operating system.

UTILITIES AND SERVICE PROGRAMS

These are system programs which provide a useful service to the user of the computer by providing facilities for performing common tasks of a routine nature. These can be listed as:

a. Sort:
Programs designed to arrange records into a pre-determined sequence.

b. Editor:
Used to provide facilities for creation and/or amendments of programs.

c. File Copy
These copies data from one medium to another.

4/...

INDECO Ltd.

SYSTEM ANALYSIS AND DESIGN

The 1950s saw the introduction of electronic computer into the field of business data processing and the rise of a new breed of specialist called the computer programmer.

At first this was a person who knew the intricacies of the machinery and conducted the whole job of computerising the business procedures. With the spread of machines and the simplification of the job of programming it was found desirable to employ people with a good knowledge of business to design the systems to be computerised. During the same period advances in the discipline of systems theory found a very useful application in the activities of business data processing. In 1960s the term System Analysis was well established as meaning the job performed by the person investigating data processing procedures with a view to transferring the processing of these to the computer. The people doing this job made use of the techniques of work study, organisation study and methods study with specialist techniques developed by the early computer programmers

A definition of a System Analyst employed in EDP might read as "A data processing Systems Analyst [redacted] person also applies his abilities [redacted] system analysis and design methodology and data processing to the scientific investigation, analysis and solution of business system problems. To do this he will design new systems and select optimum processing methods which are firstly the most effective and then the most efficient for the greatest possible overall business productivity.

THE STAGES OF SYSTEMS ANALYSIS AND DESIGN

Having been allocated a systems project, the Analyst must proceed on a series of tasks which will lead him to the solution of the problem in the form of a more effective and efficient data processing syster

Appendix 4.IX

INDECO COMPUTER CENTRE DATABASE MANAGEMENT SYSTEMS

INTRODUCTION:

The organisation, storage and management of vast amounts of information has always created problems. For many years, data management was exclusively theoretical. With the development of large computer systems and mass storage technology, this task became a most important application on main frame computers. The question of maintaining large amounts of information in a central storage location is not difficult. The problem of locating and extracting specific pieces of information from the huge store-house is often difficult. The problem is further compounded when several specific bits of information are needed simultaneously and their relationships to one another explored.

EARLY YEARS OF DATA PROCESSING:

During early years of Data Processing, every application program utilized files that were unique to that particular application. This lead to the storage and manipulation of a great deal of redundant data. Each application created and maintained its own files in the format most suitable for their functional activities.

DATABASE MANAGEMENT APPROACH:

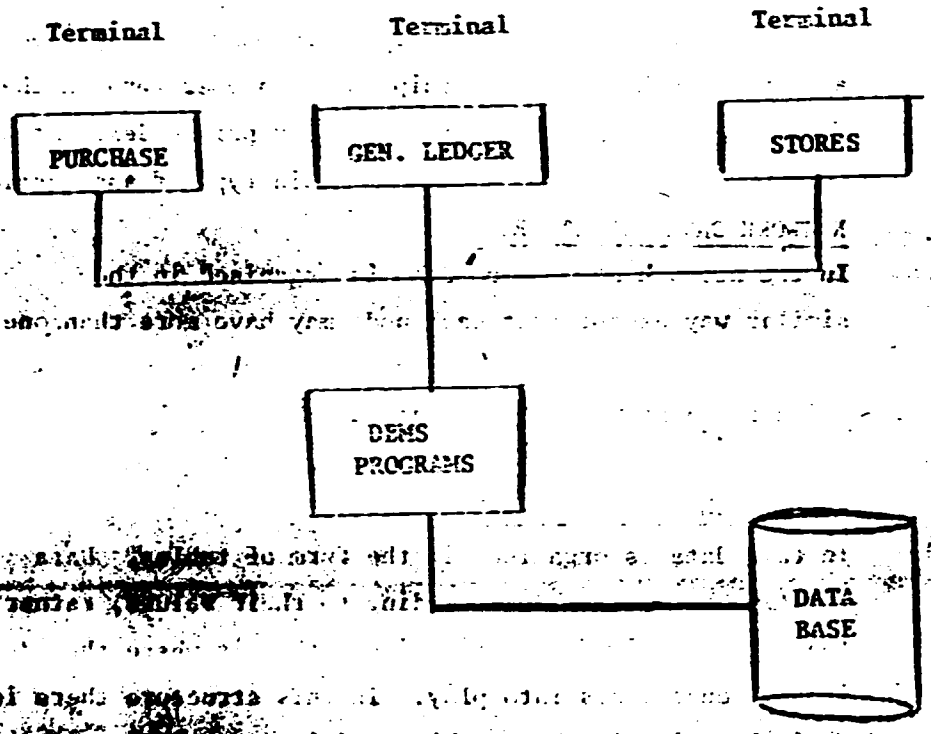
The DBMs approach was introduced (early 1970s) to reduce these redundancies in the data. It also introduced greater efficiency in the storage and usage of information. The key concept employed in DBMs system is that the data can be linked together in such a manner as to allow any application program the ability to access any or all parts of the data, regardless of location, access method or record make-up.

WHAT IS A DATABASE SYSTEM:

What does Database really mean?

A database is an aggregation or grouping of closely connected data. All the parts of such a database are inter-related to each other by means of relationship.

A D B M S ENVIRONMENT:



[redacted] the [redacted] data processing tasks are maintaining and retrieving information. This includes creating, updating and retrieving specific types of data from user-files, manipulating and formatting this information and producing reports from the accumulated data is a major task done by every data processing application. The main purpose of DBMS is to free the user from having to develop detailed programs to handle these routine tasks.

TYPES OF DBMS:

DBM Systems differ according to the data structure they support. There are 3 different (distinct) data structures in which data base can be arranged.

FOR: Prof K. Badzmirowski
UNIDO Consultant

DATE: 15th November, 1988

FROM: G. Musoke-Lwanga,
ESAMI Resident Consultant, Lusaka, Zambia

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6. Women in Development Programmes
7. Health Systems Management Programmes
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Appendix 4.XI

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Telephones: 218888/214527 – Telex: ZA 42521 – Cables: "ZAMSURE"

Our Ref:..... *Your Ref:*.....

15th November, 1988

UNIDO
Corporation Building
Chiparamba Road
LUSAKA.

Attention: Mr K Badzmirowski

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2) Systems Analysis & Design skills
3) Development of Instructors (Trainers) to meet our on-going staff development requirements
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DATA PROCESSING MANAGER.

(Chairman - Computer Society of Zambia - Midlands).

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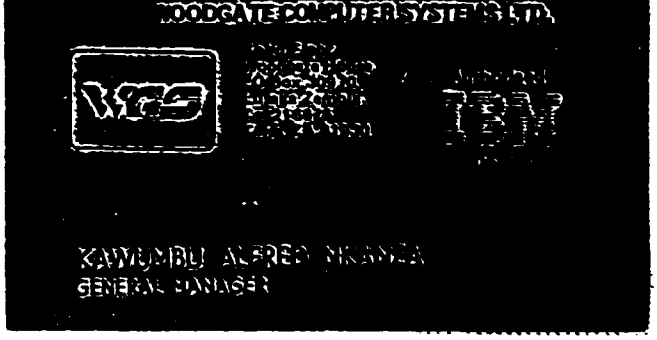
x/ Proceedings of the Southern African Regional Workshop on Informatics for Development
Zambia, 1986



Prabhaka Arole (M. Sc)
Data Processing Manager

INDECO LIMITED

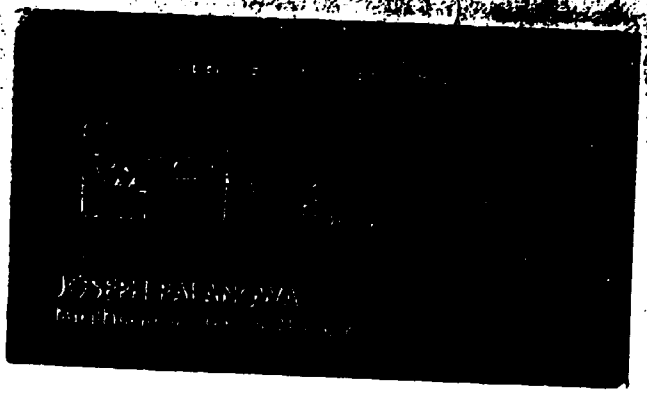
Indeco House, Bunsho Place, P.O. Box 31935, Lusaka,
Tel. 214555, Telegrams "Indeco" Telex ZA 44824, Zambia.
A State Enterprise Incorporating 42 Companies

NCR (ZAMBIA) LIMITED

NCR

THOMAS M. NGOMA
Marketing Manager

P. O. Box 31465 Lusaka Zambia
Telephone: 216772/211917
Cables: Nacareco Lusaka
Telex: NCRZAM ZA 45070



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Tel Office 211928/215743/
219193/4
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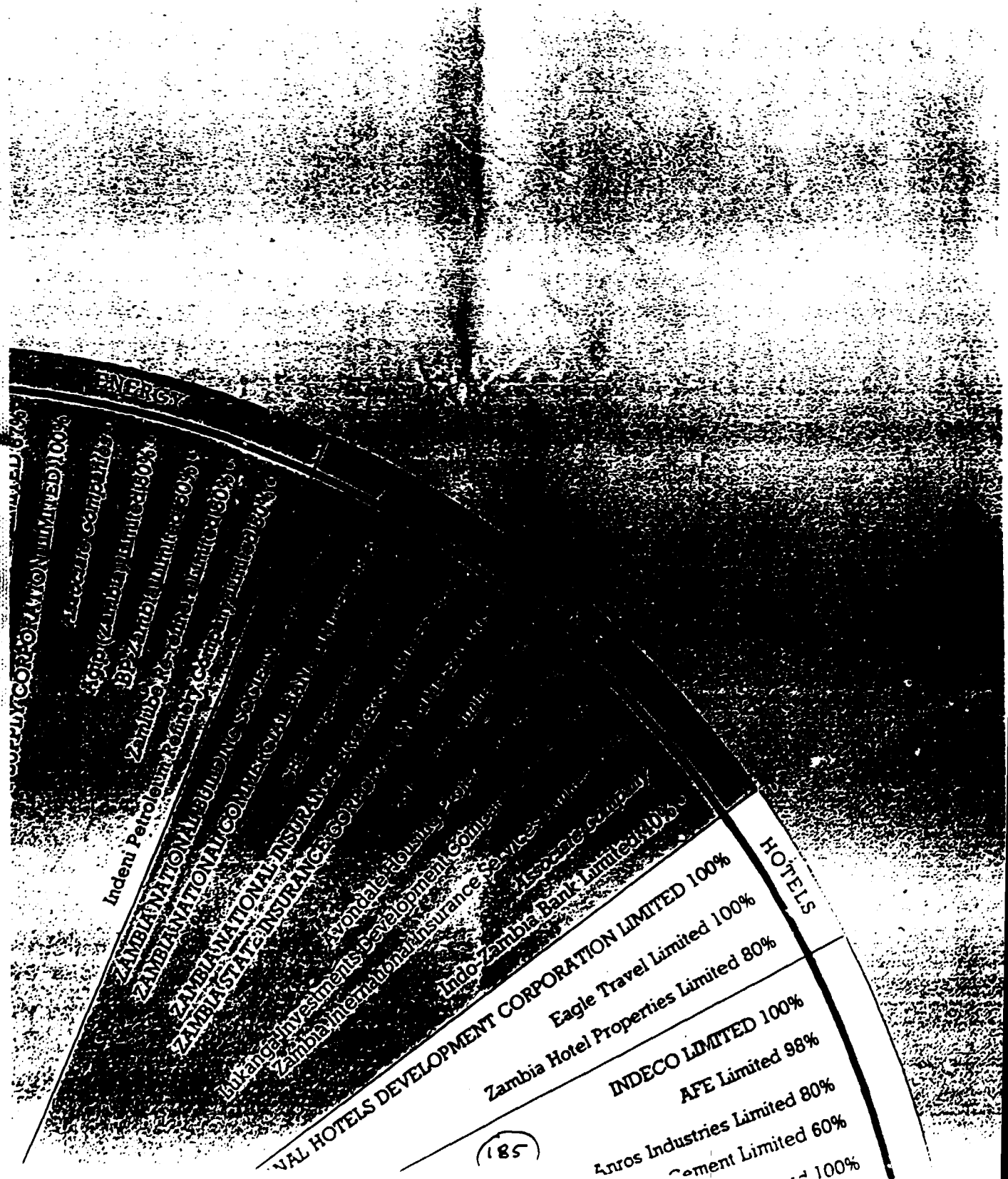

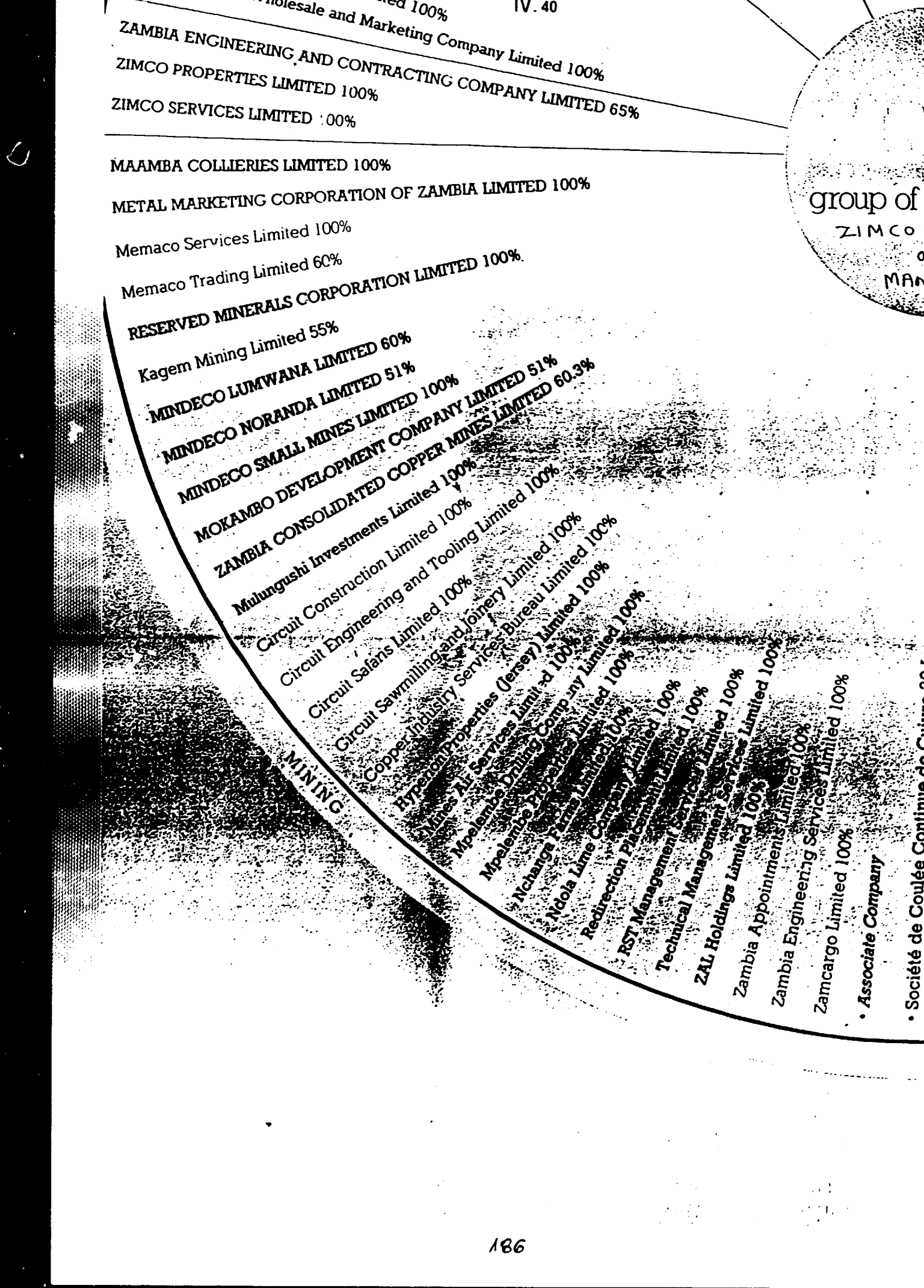
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Wholesale and Marketing Company Limited 100%
ZAMBIA ENGINEERING AND CONTRACTING COMPANY LIMITED 65%
ZIMCO PROPERTIES LIMITED 100%
ZIMCO SERVICES LIMITED 100%
MAAMBA COLLIERIES LIMITED 100%
METAL MARKETING CORPORATION OF ZAMBIA LIMITED 100%
Memaco Services Limited 100%
Memaco Trading Limited 60%
RESERVED MINERALS CORPORATION LIMITED 100%
Kagem Mining Limited 55%
MINDECO LUMWANA LIMITED 60%
MINDECO NORANDA LIMITED 51%
MINDECO SMALL MINES LIMITED 100%
MOKAMBO DEVELOPMENT COMPANY LIMITED 51%
ZAMBIA CONSOLIDATED COPPER MINES LIMITED 60.3%
Mulungushi Investments Limited 100%
Circuit Construction Limited 100%
Circuit Engineering and Tooling Limited 100%
Circuit Safaris Limited 100%
Circuit Sawmilling and Joinery Limited 100%
Copperbelt Industry Services Bureau Limited 100%
Hyperion Properties (Jersey) Limited 100%
Mines Air Services Limited 100%
Mpelembe Drilling Company Limited 100%
Mpelembe Properties Limited 100%
Nchanga Tyres Limited 100%
Ndola Lime Company Limited 100%
Redirection Placement Limited 100%
RST Management Services Limited 100%
Technical Management Services Limited 100%
ZAL Holdings Limited 100%
Zambia Appointments Limited 100%
Zambia Engineering Services Limited 100%
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General Pharmaceuticals Limited 100%

Indeco Milling Limited 100%

Indeconsult Limited 100%

Kabwe Industrial Fabrics Limited 100%

Kafironda Limited 54%

Kafue Textiles of Zambia Limited 55%

Kapiri Glass Products Limited 89%

Livingstone Motor Assemblers Limited 70%

Luangwa Industries Limited 100%

Lusaka Engineering Company Limited 60%

Mansa Batteries Limited 91%

Metal Fabricators of Zambia Limited 81%

Zamefa Sales Limited 100%

Monarch Zambia Limited 100%

Mwinilunga Canneries Limited 100%

National Breweries Limited 51%

National Drum and Can Company Limited 100%

National Milling Company Limited 51%

NITROGEN CHEMICALS OF ZAMBIA LIMITED 100%

Nkwazi Manufacturing Company Limited 85.2%

Norgroup Plastics Limited 100%

Poultry Processing Company Limited 60%

Premium Oil Industries Limited 51%

ROP (1975) Limited 100%

Supa Baking Limited 100%

United Milling Company Limited 100%

Zambezi Saw Mills (1968) Limited 88%

Zambia Breweries Limited 100%

Zambia Ceramics Limited 100%

Zambia Coffee Company Limited 51%

Zambia Oxygen Limited 100%

Welding Electrodes Limited 100%

Zambia Pork Products Limited 100%

Zambia Steel & Building Supplies Limited 78%

Zambia Sugar Company Limited 100%

Nakambala Sugar Estates Limited 100%

• Associate Companies •

Zambia ... Limited 49.7%

INDUSTRIAL

V. KENYA

STATUS OF INFORMATICS TECHNOLOGY IN KENYA

R E P O R T

on "State of the art and Review on informatics/microelectronics in the Kenya and identification the needs with regard to software training"

1. INTRODUCTION

1.1. PRODUCTS AND SUPPLIERS

In the early sixties there were only two suppliers of computers in Kenya, namely IBM and ICT. By 1969 there were 12 computers installed. This number has grown substantially: in 1980 there were 85, and in 1987 there are several hundred centralised mainframe computers and several thousand desktop computers. By 1987, most major Government departments, parastatals, Government-funded corporations and research institutes have their own information processing capability which have been acquired on an individual basis without central co-ordination.

In 1987 there was 12 suppliers of hardware and software in Kenya:

Automated Systems Limited

Hardware: Televideo, IBM [illegible] micros, networks, Gevicom [illegible]

Software: Orchard business systems, accounting packages, wordprocessing and spreadsheet packages, hotel and travel industry packages.

Business Computer Systems

Hardware: Authorised dealer of IBM mainframe and personal computers.

Software: IBM software.

Business Machines (Kenya) Limited

Hardware: Olivetti micros, mini, and mainframe computers.

Software: Multisoft package. MIDAS 2000 general accounting systems, retail banking systems.

Comp-rite Limited

Hardware: Comprite CR7 multiuser mainframes assembled in Kenya; APPLE microcomputers.

Software: Software packages for mainframes, mini and micro computers.

Computer Applications Limited

Hardware: WANG mainframe, mini, and personal computers. Osborne microcomputers. Epson printers and personal computers.

Software: Software for WANG, Osborne and Epson computers.

COPYCAT Limited

Hardware: NCR personal computers, AMSTRAD wordprocessors and personal computers.

Software: NCR and AMSTRAD packages.

Computerland Engineering Limited

Hardware: IBM personal computers.

Software: OMICRON accounting package, wordprocessing and spreadsheet packages.

Data Equipment Limited

Hardware: UNISYS multiuser business computers, mini and mainframe computers. Authorised dealer for KAYPRO personal computers.

Software: Accounting, DBMS, Spreadsheet, wordprocessing, and banking packages.

ICL Kenya Limited

Hardware: ICL mainframe computers, and personal computers.

Software: ICL software.

Kenya Microcomputers Limited

Hardware: Neptune Super Turbo IBM XT and AT compatibles and printers assembled in Kenya.

Software: IBM accounting modules, wordprocessing and spreadsheet packages.

Micro City

Hardware: Authorised dealer for Apricot, Commodore, and Sinclair microcomputers; ARC IBM compatible personal computers and Brother printers.

Software: Business software for Apricot, and IBM microcomputers, games, business, educational softare for Commodore and Sinclair computers. Pegasus business software.

NCR Kenya Limited

Hardware: NCR range of microcomputers, NCR TOWER range of computers, NCR mini and mainframe computers.

Software: Accounting packages, data processing, word processing, spreadsheet packages.

Wordcrunchers Limited

Hardware: IBM PC models XT and AT, WANG and AMSTRAD personal computers, Epson printers.

There are 7 major software houses:

Associated Computer Services

Software: Payroll, stock control, cost management accounting systems.

Data Centre Limited

Software: Package or custom software for mainframes and microcomputers.

Computer Consultants Limited

Software: Package and custom software.

Computer Software Limited

Software: Package or custom software.

Information Processing Consultants

Software: Package and custom software.

Software Applications Limited

Software: Applications software development for banking, financial, hotel and business.

Software House

Software: Package and custom software..

There are the following 9 companies that offer data processing bureau services:

- Abacus Data Limited
- Comp-rite Limited
- Computer Consultants Limited
- Computer Prolific Limited
- Computer Software Limited
- Data Centre Limited
- Datasolv Limited
- Software House
- [redacted] Computer Bureau

There are the following 6 companies that offer wordprocessing services:

- Associated Computer Services
- Comp-rite Limited
- Computer Consultants Limited
- Computer Prolific Limited
- Word Power Limited
- Wordcrunchers Limited

1.2: INFORMATICS MANPOWER

From a report Computers Kenya 1982 [13], it was estimated that in 1981 the following numbers of personnel were employed in Kenya in jobs directly related to information processing:

Data Processing Management	68
Systems Analysis	172
Programming	223
Operations	474
Data Control	190
Data Entry	891
Total	2,018

No figures are available on current numbers but the Institute in Computer Science is compiling an inventory of computers installed in Kenya. From the same report [13], it was estimated that by 1987 the number of personnel in the above categories would not exceed the estimates shown below:

Data Processing Management	214
Systems Analysis	542
Programming	703
Operations	1,496
Data Control	599
Data Entry	2,813
Total	6,369

When these figures were compiled the rapid introduction of desktop computers and direct data entry facilities was not foreseen.

1.3. EDUCATION AND TRAINING

The Institute of Computer Science of the University of Nairobi offers a one-year full-time post graduate diploma in Computer Science which is practical in content and include a 3-month computer systems project that follows 3 terms of academic courses in 9 subjects. To date there has been the following enrolment:

	1980	1981	1983	1984	1985	1986
Applicants	30	32	31	33	70	84
Enrolment	11	13	15	169	22	24
Cumulative	11	24	39	55	77	101

The majority of the participants have been from Kenya and approximately 75% are sponsored by their employees. The Kenya Government Directorate of Personnel Management now regard a pass in the diploma as a prerequisite for promotion to senior posts within the Government Computer Centre. The University of Nairobi has used the diploma as preparation for staff development personnel who then attend Masters degree programmes overseas. [illegible] currently in hand to introduce a 2-year [illegible] Institute also provides service course lectures in Computer Science to approximately 1,200 undergraduates in the faculties of Engineering and Science in two years of their study.

The Kenya Polytechnic in Nairobi runs a diploma course in Computer Science for students who have studied four years of secondary education. It follows closely the Ordinary National Diploma in Computer Studies offered in the U.K., and includes a period of

practical attachment to organisations that undertake information processing. The Mombasa Polytechnic has recently received desk-top computers to enable courses in computing to be given.

A technical teachers college, and six goverqment schools have introduced into their teaching the use of computers but do not teach a course that produces information processing specialists. The majority of private schools utilize computers.

There are at least 18 organisations that offer training course in the field of information processing. Most of these institutions offer short part-time courses that train personnel in a particular skill e.g. wordprocessing. One institution has started a course which will be examined for the award of the I.D.P.M. diploma in U.K. Two of the multi-national vendors have regional training schools situated in Nairobi and are thus able to support full-time training personnel.

1.4. ADVISORY SERVICES

There are at least 14 companies that provide consultancy services, most of whom appear in section [illegible] Supplies and Services. In addition to these, the larger firms of accountants & auditors are now providing computer consultancy. These include: Coopers & Lybrand, Deloittes Haskins & Sells and Price Waterhouse. The Institute of Computer Science of the University of Nairobi provides a consultancy service, and has been able to work closely with UNESCO, UNDP, and IDRC in providing training for professional users of information processing equipment.

1.5. CONCLUSIONS AND RECOMMENDATIONS

1.5.1. NATIONAL POLICY

The Fifth Development Plan [12] states that the Government's efforts to encourage private initiatives throughout the economy should not be interpreted as a laissez-faire policy. In principle, the Government seeks to control the volume of imports by maintaining a realistic exchange rate and, if required, by manipulating the level of tariffs. It states further, that with regard to manpower, Government will discourage labour-saving technology.

It is also noted [illegible] the classic problems associated with the transfer of technology in general. The crux of the matter is Research and Development which is done overseas and imported wholesale thus giving indigenous personnel (engineers, scientists, and technicians) little or no exposure to the process that produces product. Industrial development thus becomes product rather than process oriented, a tendency which enhances further dependency. In the case of Information Technology software development the inherent process involved is well within the capacity of the existing pool of high calibre scientists, engineers and technicians irrespective of their areas of [illegible] specialization.

Recommendation: to resolve the dilemma between industrial development through private enterprise and the problems of ineffective indigenous technological development that arises as a matter of course, it is necessary for concerted action. Judicious steps are necessary to stimulate not only products of Information Technology but also software research and development, hardware assembly and maintenance,

specialized training of software engineers /systems analysts and computer programmers/, communications specialists and end user training all of which implies an integrated organisational capacity for the effective implementation of Information Technology for development. This could ultimately, for example, be in the from of National Research Institute for Information Technology.

2. Review of Computers and Education in Kenya

2.1 Computers installed in the Education Sector in 1987

From a Directory of Educational Computing in Kenya 1987 by SCOTT [1] tables 2.1, 2.2.1 to 2.2.4, 2.3.1 and 2.3.2 have been brought up to date from which the number of educational institutions or departments that have installed computers is as follows:

Level of Education	Government	Private	Totals
Primary	0	5	5
Primary and Secondary	0	4	4
Secondary	7	10	17
Tertiary	6 (21)	2	8 (21)
Totals	13 (21)	21	34 (21)

The numbers in parentheses indicate the number of individual departments within the larger tertiary level institutions like Kenyatta University and the University of Nairobi. These are compared with the 1984 figures from SCOTT [2]:

Level of Education	1984 Total	1987 Total
Primary	3	5
Primary and Secondary	3	4
Secondary	12	17
Tertiary	8 (13)	8 (21)
Totals	26 (13)	34 (21)

The numbers of computers in these categories is as follows:

1987

Level of Education	Government	Private	Totals
Primary	0	31	31
Primary and Secondary	0	21	21
Secondary	63	78	141
Tertiary	248	11	259
Totals	311	141	452

The corresponding 1984 figures for the above from SCOTT [2] are:

1984

Level of Education	Government	Private	Totals
Primary	0	8	8
Primary and Secondary	0	16	16
Secondary	37	66	103
Tertiary	77	1	78
Totals	114	91	205

Some of the numbers for 1984 include the very primative SINCLAIR ZX81 which have now been discarded.

Thus between 1984 and 1987 the number of computers has doubled. What is significant is the large increase of computers installed in the Government funded sector from 114 to 311, a factor of 2.7.

An alphabetical list of educational institutions showing the number of computers within the four categories of institution follows.

Educational Institutions with Computers

Type/ Level	Name of Institution	Name of Department	Number
P P	Greengates Kindergarten	.	. 6
P P	Kenton College	.Mathematics	. 6
P P	Pembroke House School, Gilgil	.	. 6
P P	Riverside Farm Nursery School	.	. 2
P P	St. Andrew's School, Turi	.	. 11
P R	Banda School	.	. 9
P R	Isani School	.Maths. & Computing	. 3
P R	Mount Kenya School,Nyeri	.	. 2
P R	St. Austin's Academy	.	. 6
P R	Tigoni Academy for Girls	.	. 3
P S	Aga Khan Academy,Nairobi	.	. 13
P S	Aga Khan Education Services	.Computers in Education Project.	6
G S	Aga Khan High School,Mombasa	.	. 2
G S	Aga Khan High School,Nairobi	.	. 2
P S	Aga Khan Kenya Secondary School	.	. 5
P S	Braeburn High School	.Computer Science	. 8
G S	Coast Girls High School	.	. 5
P S	Greensteds Independent School	.	. 4
P S	Hillcrest Secondary School	.Computer Department	. 8
P S	International School of Kenya	.	. 15
G S	Kabarak High School	.	. 5
P S	Nairobi Academy	.Maths.& Computing	. 14
G S	Ofafa Jericho Secondary School	.	. 5
P S	Rosslyn Academy	.	. 3
G S	Starehe Boys Centre	.School Computer Educ. Project	. 39
G S	State House Road Girls School	.	. 5

Level Key: P = Primary; R = Primary and Secondary;
S = Secondary; I = Tertiary

Type Key: G = Government; P = Private

Table 1.1: Computers in Educational Institutions in Kenya in October 1987 Page 1

Educational Institutions with Computers

Type/ Level	Name of Institution	Name of Department	Number
G T	Kenya Polytechnic	.Maths.,Statistics & Computing	52
G T	Kenya Technical Teachers College	.	14
G T	Egerton University	.Central Administration	1
G T	Kenyatta University	.Appropriate Technology	3
G T	Kenyatta University	.Bureau of Educational Research	1
G T	Kenyatta University	.Mathematics	2
G T	Kenyatta University	.Physics	14
G T	Moi Teachers College, Eldoret	.Mathematics	20
G T	Mombasa Polytechnic	.	29
P T	Strathmore College	.Quantitative Methods	3
P T	US International University Africa	.	8
G T	University of Nairobi	.Administration & Finance	7
G T	University of Nairobi	.Animal Physiology	1
G T	University of Nairobi	.Botany	1
G T	University of Nairobi	.Chemistry	3
G T	University of Nairobi	.Electrical Engineering	17
G T	University of Nairobi	.Faculty of Agriculture	29
G T	University of Nairobi	.Faculty of Engineering	1
G T	University of Nairobi	.Institute of Computer Science	9
G T	University of Nairobi	.Mechanical Engineering	1
G T	University of Nairobi	.Nuclear Centre	17
G T	University of Nairobi	.Physics	1
G T	University of Nairobi	.Population Stud.& Res. Inst	2

Level Key: P = Primary; R = Primary and Secondary;
S = Secondary; T = Tertiary
Type Key: G = Government; P = Private

Indicated estimated number

Number of Institutions: 49 Number of Computers: 452

Table 1.1: Computers in Educational Institutions in Kenya in October 1987 Page 2

2.2. Makes of Computers

From updating the tables 4.1.1 to 4.1.8 in [1] the educational institutions or departments (when more than one) that have installed at least one computer of the makes shown are as follows by educational level:

Make	Primary	Secondary	Primary & Secondary	Tertiary	Totals
APPLE		1	14	4	19
SPECTRUM	4	3	3	3	13
BBC	2	1	4	6	13
IBM			1	7	8
WANG				6	6
COMMODORE			1	3	4
EPSON			1	3	4
KAYPRO		1		2	3
RML				2	2

Other makes of computer that are installed in educational institutions are as follows: CAMBERRA, COMART, COMPRITE, DEC, JAEA, ICL, KIM, MICROPROFESSOR, MULTITECH, NASCOM. NCR. NEPTUNE. OLIVETTI, OSBORNE, RAIR, TANDY and TRANSAM.

There are 25 different makes of computers and over 35 different models. In 1987 the first locally assembled desktop computers entered the educational market in the form of the IBM compatible NEPTUNE.

From updating the tables 4.1.1 to 4.1.8 in [1] the educational institutions (when more than one) that have installed at least one computer of the makes shown are as follows by type of institution:

Make	Government Funded	Private Funded	Totals
APPLE	10	9	19
SPECTRUM	3	10	13
BBC	7	6	13
IBM	6	2	8
WANG	5	1	6
COMMODORE	3	1	4
EPSON	3	1	4
KAYPRO	1	2	3
RM	2	0	2

There appears to be no significant difference in the distribution of choice of makes of computers in Government Funded or Private Funded educational institutions. There is a problem of compatibility when a donor insists that a particular make of computer must be supplied even when there are no other installations of such computers in the country. This has occurred at several tertiary level institutions of the Government Funded type.

From updating the tables 4.1.1 to 4.1.8 in [1] the number of computers of the makes shown above by educational level are as follows:

Make	Primary	Primary & Secondary	Secondary	Secondary, Tertiary	Totals
APPLE		3	95	7	105
SPECTRUM	24	14	24	14	76
RML				68	68
MULTITECH				40	40
BBC	6	4	12	7	29
KAYPRO		2		15	17
COMMODORE			1	12	13
IBM			1	11	12
WANG				5	5

The predominance of APPLE computers the Secondary level and IBM compatibles at the Tertiary level is apparent.

The number of computers of the makes shown above by type of institution is as follows:

Make	Government Funded	Private Funded	Totals
APPLE	38	67	105
SPECTRUM	21	55	76
RML	68		68
MULTITECH	40		40
BBC	15	14	29
EPSON	23	1	24
KAYPRO	14	1	15
COMMODORE	12	1	13
IBM	9	3	12
WANG	4	1	5

2.3. Programming Languages Used

From the tables 4.2.1 to 4.2.7 in [1] the number of educational institutions that use different programming languages is as follows:

Make	Primary	Secondary	Primary & Secondary	Tertiary	Totals
BASIC	4	3	9	15	31
PASCAL			10	7	17
LOGO	1	2	12	2	17
PILOT			9		9
FORTRAN				5	5
COBOL			1	3	4
PROLOG				2	2

The emergence of the newer well-structured langauges like PASCAL and those for logic programming like PILOT and PROLOG is apparent. However, BASIC is still widespread being used by over 75% of the educational institutions and departments.

2.4. Software Packages Used

From the tables 4.3.1 to 4.3.4 in [1] over 30 software packages are used on different makes of computers. It is significant to note how the use of spreadsheets, databases, and wordprocessing has increased since 1984 with integrated packages like APPLEWORKS or the individuals packages like LOTUS 123 and dBASE.

From the questionnaire used in [1] the details of the levels of activity with different types of software was requested. The number of of respondents out of 45 was as follows:

Wordprocessing	18
Graphics	15
Database	16
Spreadsheets	14

2.5 Staff Involved in Computer Education

From the tables 9.1.1 to 9.1.4 in [1] the numbers the number of staff employed in computer education and the amount of time spents are multiplied to produce a full-time staff equivalents (FTSE) which is shown on the table below:

Level	FTSE	Number
Primary	2.23	4
Primary and Secondary	1.58	3
Secondary	12.50	5
Tertiary	19.46	8
Totals	36.17	20

* the number of staff for the Institute of Computer Science has been reduced from 50 to 6 to reflect the number of full-time academic staff.

This indicates that there are at least the equivalent of 36 full-time staff involved in Computing in the educational institutions in the 20 that have responded to the questionnaire used in [1].

2.6 Formal Courses in Computer Science

2.6.1 Institute of Computer Sceince, University of Nairobi

The Institute of Computer Science of the University of Nairobi was established as a Computer Centre in 1969 in the Faculty of Engineering, and commenced teaching a one-year full-time postgraduate diploma in Computer Science in 1980. The number of participants to date is as follows:

Year	Number	Cumulative
1980	11	11
1981	13	24
1983	15	39
1984	13	52
1985	22	74
1986	19	93
1987	16	109

Each year over 75% of the participants (who usually do not have degree in the subject) are employer-sponsored for training.

Organizations and employers that have sponsored participants (from Columbia, Ethiopia, Kenya, Malawai, Tanzania, Uganda and Zambia) to date include:

All Africa Council of Churches Scholarship
E.A.Engineering Consultants
Gordon Melvin & Partners
Kenya Agricultural Research Institute
Kenya Industrial Estates
Kenya Government Computer Services
Kenya National Assurance
Kenya Power & Lighting Coapany
Kenya Polytechnic
Ministry of Agriculture
Ministry of Transport
Mombasa Polytechnic
Nairobi City Council
University of Nairobi Scholarships
DAAD Scholarships
Food Supply & Monitoring
Industrial Development Bank
Kenya Commercial Bank
Kenya Institute of Administration
Kenya Meteorology Department
Kenya Posts & Telecommunications
Kenya Technical Teachers college
Kenyatta University
Ministry of Energy
Ministry of Water Development
Private Sponsorship
University of Nairobi Departments
UNESCO Scholarships

The one-year programme of study comprises:

First Term: Four compulsory courses are:

Foundations of Computers Systems	Information Processing
Programming Methodology	Software Systems

Second Term: Three optional courses from:

Principles of Accounting and Management	
Business Systems Analysis and Design	
Assembler Language Programming	Operating Systems
Computer Technology	Scientific and Engineering Computing

Third Term: Two optional courses from:

Computer Management	Database Management II
Advanced Programming	Simulation
Advanced Computer Technology	Computational Statistics
Mathematical Programming	Computer Assisted Engineering Design

Fourth Term: Computer Systems Project

Candidiate undertake a practical individual computer systems project for a period of 12 weeks. Sponsored participants usually undertake a project from an area of application of use to their employer.

The Institute also provides the undergraduate service courses in computer science/information processing to undergraduates as part of their normal degree courses. There is no undergraduate degree in Computer Science.

2.6.2 The Kenya Polytechnic

The Kenya Polytechnic has introduced a two-year full-time diploma which is practical in orientation and includes an industrial attachment. The syllabus was devised by a curriculum subcommittee under the Kenya Institute of Education (K.I.E.) on which industry is represented. This programme is geared to the production of programmers and analysts in industry.

3. Problems of Computer and Education in Kenya

3.1 Current Problems Sited:

In [1] twenty institutions responded by describing the problems that they are encountering which are summarised (actual extracts) as follows:

3.1.1 Maintenance:

Cost of maintenance. Cost and availability of power packs for SPECTRUMS. Repairs of SPECTRUMS. Cannot find a Kenyan facility for repairs/maintenance of our equipment. Support systems for APPLE scarce and extreeely expensive when available. Lack of competent maintenance engineers for hardware. Expensive maintenance for timesharing central computer and desktop computers. Maintenance of the large number and variety of computers is becoming an increasing problem.

3.1.2 Power Supply:

Maintenance and fluctuating power supply. Power surges rendering a suite of COBOL (Student Record System) inoperable. Interruption in electrical power and fluctuations can be a problem.

3.1.3 Availability of Software:

Difficulty in buying suitable programs even with oversees finance. Dearth of good software in Kenya.

3.1.4 Staff:

Not enough teachers conversant with computing. Persuading teachers that it is worth their investment of time in learning the systems, both for their own and their pupils benefit.

3.1.5 Cost of Computers in Kenya

Government taxion computing [illegible] resources in Kenya prohibitive. Still reluctance to [illegible] toward software and hardware base because of excessive cost, and lack of software available in Kenya. High costs of computer hardware in Kenya. High import duties on computers.

3.1.6 Lack of Resources:

Lack of sufficient haroware and software to meet the needs of the rapidly increasing numbers of pupils taking Computer Science and Computer Studies. Lack of adequate resources. More people still need to be convinced to give support in areas like furnishing the laboratory and provision of consumables: eg the University admininstration. Lack of local funds to keep computing equipment up-to-date, over reliance on donor funds for purchases. Lack of space.

3.1.7 Telecommunications:

Not enough computers and support technology, eg telecommunications links.

3.2 Attrition of Well-qualified Kenyan Staff

There is the serious problem of the attrition of well-qualified Kenyan staff from the education sector to the private sector which in many ways is worse than in the industrialised countries because of the proliferation of desktop computers in Kenya today into organizations that have not used computers before.

3.3 Import Duty and Sales Tax on Computers

As stated earlier between 1984 and 1987 the number of computers in educational institutions in the country have increased by a factor of 2.7 and the number of educational establishments with computers has increased by 50%.

This can be an explanation for the lack of computers up to the Tertiary level of educational institutions in the Government funded sector apart from those at the Secondary level that have been sponsored by the Aga Khan Education Services. Even at the Tertiary level in the Government funded sector the majority of the computers acquired have been purchased with donor funds and in many of these cases they have been exempted from sales tax and duty by virtue of a bilateral aid agreement.

3.4 Propensity of Models and Maintenance of Computers

It has been found that there are over 35 different models of computers in the educational sector [1]. This gives rise to the dual problem of software compatibility with other institutions and hardware maintenance in the country. Were there to be a concerted effort towards standardization of hardware acquisition a number of benefits would accrue. The most significant would be the ability of some of the Tertiary level institutions to provide hardware maintenance.

4. The Benefits of Computers in Education

4.1 Stated Achievements To Date:

In [1] nineteen institutions responded by describing the achievements to date which are summarised (actual extracts) as follows:

Greengates kindergarten: Still very useful and motivating. Good results with Mathematics and Spelling.

Kenton College: Since 1984 a purpose-built Computer Room has been set aside. All pupils aged 10 to 13.5 follow an introductory course in Computer Education/Information Technology.

Riverside Farm Nursery School: The top class aged 6 to 7 has access to computer everyday in the classroom.

St. Andrew's School, Turi: We are a primary school with pupils aged 6 to 13 and have a purpose-built Computer Room, with computer/screen facility using two children to a unit. This facility caters for one class at a time. A 3-year course has been arranged for the Senior Boys to undertake Computer Studies.

Banda School: Building of separate Computer Room. Teaching of BASIC and LOGO to pupils aged 9 to 11. Use of computers with appropriate software as an educational tool to pupils aged 6 to 11. Gradual build up of software by purchase, donation, and tailor-made programs.

Iqbal School: An 'O' level course now established. Courses in computer appreciation established for younger students. A course in word processing developed for form V & VI students. LOGO taught to primary school pupils.

Aga Khan Education Computers in Education Project: Project expanded to another 7 schools (6 of which are Government maintained) in Phase II which started in July 1988. Equipment from ACT & APPLE.

Braeburn High School Computer Science Department: Launching of 'A' level Computer Science as a successful teaching subject in the school. Use of computers in school administration.

Coast Girls High School: At the initial stage. Some programs have been written for classroom use as teaching aids.

Hillcrest Secondary School Computer Department: [illegible] word processing on a computer. Computers are used to help in school [illegible]

Starehe Boys Centre School Computer Education [illegible] part-time diploma at Kenya Polytechnic having [illegible] (Computer Operations Specialist-2 Week full-time COBOL course in holidays on CR7. Computerisation of [illegible] accounts, staff, training. Initial work begun on library system.

Kenya Technical Teachers College: Too early to make any grand claims. Courses in Data Processing and Computer Applications well established. Student marks record system functioning. In-service course participation for College lecturers has reached 50%.

Mombasa Polytechnic: A chain network of 28 CP/M-based RML 480Z computers served by a NIMBUS server and 16M byte disk. Ample educational software available.

Strathmore College Quantitative Methods Department: Courses in Computer Programming in BASIC for Secondary School students and Accountancy students. Hands-on experience using spreadsheets and dBASE II for Accountancy students.

University of Nairobi Chemistry Department: Introduced and institutionalized computer methods in Chemistry. Numerous projects are now carried out in 6 areas. Appointed Regional Distribution Centre for Project SERAPHIM Educational software. The Computer Laboratory is a nucleus for computer appreciation.

University of Nairobi Institute of Computer Science: Provision of 1-year Postgraduate Diploma in Computer Science for 100 graduates over past 7 years. Provision of service courses in Computer Programming to undergraduate students in Engineering, Science, Commerce. Provision of University computer service, and administrative systems development and support.

University of Nairobi Physics Department: Establishment of link with University of York (UK) has expanded microcomputer facility. Primarily a hardware facility: students have designed and built data acquisition and control systems for a wide variety of applications: eg solar power.

University of Nairobi Population Studies & Research Institute: Use by graduate students for computation of data on Demography. Analysis of demographic data.

4.2 Stated Long Term Objectives

In [1] eighteen institutions responded by describing the long term objectives which are summarised (actual extracts) as follows:

Greengates Kindergarten: We are building our software programs into our teaching [illegible] with good results. Given access to further suitable programs. This could be a very interesting educational scheme.

Kenton College: All pupils aged 10 to 13.5 should have acquired interest and confidence in using a computer; be able to recognize and understand the applications, implications and limitations of computers. Junior boys aged 6 to 9 will use suitable packages.

Riverside Farm Nursery School: A computer in every class?

St. Andrew's School, Turi: That each child leaving Turi at the age of 13 shall be familiar and comfortable with a computer keyboard. To understand the uses and potential of the equipment. To be able to write and use simple programs.

Banda School: To convert to a network system whereby all computers may load software easily and quickly at all times from a 'cold' start.

Aga Khan Education Services Computers in Education Project: Clearly stated in the original project document.

Braeburn High School Computer Science Department: Expand the role of computers through the school. Introduce other programming languages; [illegible]

Coast Girls High School: To use as teaching aid. [illegible]

Starehe Boys Centre School Computer Education Project: To continue giving training to boys in the school in both General Computer Literacy, specific programming languages, applications packages. To develop staff awareness of computers into how they can be used as tools. To develop software. To improve administrative systems.

State House Road Girls School: Teachers to be able to write programs in their various subjects. Resource material writing.

Kenya Technical Teachers College: Modest. For Business Education students: a basic understanding of the role and operation of computers. For Industrial Education students: a very limited group of the fundamental concepts. For staff: to use computers as tools. For administration: selected automated systems.

Kenyatta University Mathematics Department: To establish a Master's degree in Computer Science.

Mombasa Polytechnic: To start a formal computing course and upgrade it to the status of a Computing Department, manned by qualified teaching staff.

Strathmore College Quantitative Methods Department: Establishment of a Computer Centre. Training in computers for Accountancy students in coordination with their CPA and ACCA studies.

University of Nairobi Chemistry Department: Acquisition of at least 10 computers: to run full scale CAL; offer course in Computer Applications in Chemistry; setting up chemical information processing centre; connecting our computers to larger ones, locally and abroad; training chemists with familiarity of computers.

University of Nairobi Institute of Computer Science: Higher degrees in Computer Science/Information Processing. Development oriented research. Computerised university administrative systems. Library computerisation. Extension training in computer applications inside and outside University. Liason with Government agencies on Information Technology for Development.

University of Nairobi Physics Department: To build on this facility to continue to provided a service to the department and other departments: eg Department of Crop Science.

University of Nairobi Population Studies & Research Institute: Develop the unit to serve as an analysis centre for socio-demographic researchers.

4.3 Areas of Application in Education

From the questionnaire used in [1] details of the areas of application of computers in education was requested. The number of respondents out of 45 was as follows:

As A Tool for Teaching	21
Awareness Activity/Computer Club	15
Computers as Subject Content for Computer Literacy	17
Subject Content for Computer Science as an Autonomous Subject	12
Subject Associated with Other Disciplines	16
Administrative of Management Tool	16

From the above it can be seen that there are 6 broad categories in which benefits can accrue from the use of computers in education. The above does not include the computer as the centre of the information services provided by the library of today.

With existing software on existing computers there are areas of application in the classroom that need to be evaluated which are discussed by SCOTT [5]. These include:

Word Processing	CAL in Mathematics
Language Vocabulary Skills	Adventure Games
Arcade Games	Schools Database Applications
Art and Drawing	

Once computers are acquired the teachers and lecturers are going to have to make decisions of the use of such software without having the understanding of the educational implications.

4.4 The Future

Information Technology is firmly established as a core activity in the education field. The use of telecommunications will play an increasing part in providing both local area networks and national networks, quite apart from access to international databases using international networks. New techniques of interactive video will be used in the classroom in conjunction within the computer of today.

It is clear from the what has been described in this paper that a great deal of individual initiatives have been underway in the past 10 years throughout the country, both within the Government funded and private funded sectors of education. What needs to be undertaken is proper planning on a national basis and co-ordination for the future in the following areas: staff development, equipment acquisition, equipment maintenance, software production, curriculum development at all levels, access to research databases, access to scientific computing facilites. This should take into account the anomolies that have been highlighted arising from fragmented and unco-ordinated aid from numerous sources for computers and education in the past.

5. INFORMATIC TRAINING

5.1. Kenya Goverment through the Ministry of Industry appreciates trainings offered by Unido .

The offer is welcome to come and train Ministry personal in this computer field to enable the personnel in upgrading inorder to mantain the computers. The software training is very necessary /Appendix 5.I/

5.2. Kenya Industrial Research and Development Institute stell need a support in setting up an Electronics Research and Development Centre.

They would appreciate any help which Unido can provide. /Appendix 5.II/

5.3. Institute of Computer Science of Kenya Technical University is very active in the science field and aplication of computers.

They would appreciates an assistance from Unido to train on high level the personel of Institute. /Appendix 5.III/

MINISTRY OF INDUSTRY

Appendix 5.I

Telegram: "INDMIN", Nairobi
Telephone: Nairobi 24261
When replying please quote
Ref. No. MI 4/2/4
and date
When telephoning or calling
please ask for .....

P.O. Box 30418
NAIROBI

17th November, 1988

UNIDO
Geneva H/Q.

Dear

RE: INFORMATIC TRAINING

Kenya Government through the Ministry of Industry appreciates trainings offered by UNIDO on the above. Therefore the offer is welcome to come and train our personnel in this computer field to enable the personnel in upgrading inorder to maintain the computers. The software training is very necessary.

Sincerely,

A.H. OGADA
For: PERMANENT SECRETARY

AHO/CTB.

UNIDO ONUDI

Appendix 5.II

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
ORGANISATION DES NATIONS UNIES POUR LE DEVELOPPEMENT INDUSTRIEL

VIENNA INTERNATIONAL CENTRE
P.O. BOX 300, A-1400 VIENNA, AUSTRIA
TELEPHONE: 26 310
TELEGRAPHIC ADDRESS: UNIDO VIENNA TELEX: 135612

CENTRE INTERNATIONAL DE VIENNE
B.P. 300, A-1400 VIENNE (AUTRICHE)
TELEPHONE : 26 310
ADRESSE TELEGRAPHIQUE : UNIDO VIENNE TELEX : 135612

JC/th

REFERENCE: 453/20

DATE: 25 May 1983

Dear Mr. Arunga,

Please refer to your letter of 18 January 1983 concerning the establishment of an Electronics Research and Development Centre. I regret that it has taken such a long time before I responded to your request for assistance.

We have taken the viewpoint that UNIDO assistance to the establishment of such a research centre should be within the framework of a broader electronic industry development project. I believe that this is also in line with your views as observed in your letter of 1 March 1983 to Professor Mike Radnor.

Having this in mind we discussed with our collegues from the Planning Section the possibility to utilize the reports of Mr. Subramanian, related to the development of a Kenyan Electronics Industry, prepared in the context of a UNDP financed project, DP/KEN/80/001 - Assistance to the Ministry of Industry, as a basis for a national seminar on this subject. Financial support for such a seminar could be made available from the project DP/KEN/80/001.

The main purpose of such a seminar is to discuss in detail the various projects mentioned in Mr. Subramanian's report and to prepare the basis for various interrelated development assistance projects. Within such a context, we were most willing to contact potential financial resources for the proposed Electronics Research and Development Centre.

Mr. R.C. Arunga
Director
Kenya Industrial Research and Development Institute
P.O. Box 30650
Nairobi, Kenya

UNITED NATIONS NATIONS UNIES

Along these lines we have requested by telex the UNDP office in Kenya to discuss with the Kenyan Government officials concerned, the feasibility of such an approach. A copy of that telex was directed to you but in case you did not receive it, I have enclosed another copy. We were informed by Mr. Eckert, a UNIDO staff member of the Planning Section who visited Kenya in relation with project DP/KEN/80/001, that no policy decision has been taken with respect to the development of an electronics industry. We were also informed that Mr. S. Shafgat Ali, a UNIDO team leader contacted various senior government officials concerned and was informed that in due course such a decision may be made. It was therefore decided that it is premature to organize a seminar of the nature proposed. Furthermore, only limited funds are available for seminars in project DP/KEN/80/001 and other priority sectors like agriculture products may be preferred by the government.

Since it appears that an integrated approach towards the development of an electronics industry development project is not yet feasable, I would like to seek your advice with respect to your proposal for technical assistance. If you would like us to pursue the matter, despite the absence of an integrated approach, a more thorough formulated document should be prepared. If requested we will make detailed comments which should assist you in the preparation of a self sustained project document. In particular we feel that within the framework of the Electronics Research and Development Centre, a software component should be included as the development of a microelectronic industry should go parallel with the development of a properly chosen software self-reliance. Needless to say that such a document should be prepared in close co-operation with the UNDP office in Nairobi and our SIDFA, Mr. Bekele.

Yours sincerely,

G.S. Gouri
Director
Division for Industrial Studies

Prof Badzmirowski 4th November,

The project for setting-up an Electronics Research and Development Centre at the Kenya Industrial Research and Development Institute never took off. We still need such a cent and would appreciate any help which UNID can provide. The need is now more urgent in view of developments in industry local institutions.

(210) Director (KIRDI)

.vienna (unido) 5/5 0952

30415 pennacchio info eckert, unido staff member on mission info arunga kirdi from latortue ref ken/80/001 aaa unido has been informally requested by arunga kirdi to appraise project proposal for estaolishment on electronics research lab at kirdi bbb project was included in terminal report subramanian dp/ken/80/001/11-55/312a ccc unido cannot appraise project and indentify potentional financing sources without taking account all recommendations subramanian related to integrated development electronics industry kenya. therefore proposing to be included in project activities dp/ken/80/001 national seminar electronics industry development ddd objectives seminar primo establishment of clearly defined development objectives secundo elaboration of detailed project proposed for international financing tertio priority ranking interlinkage of projects quarto identification of potential financing institutions eee unido input seminar micro electronics application and production consultants (two) one staff member two weeks preparation one week seminar estimated cost [redacted] terms of reference could be worked out later fff follow-up on incentified priority projects joint responsibility kenyan government, unido outside context project ken/80/001 ggg appreciate including seminar proposal agenda tripartite meeting regards (butaev unido vienna)

cct ckd

83 MAY 5 10 :5

nnnn

IRDI/64A/2/28

18th January 83

Dr. G.S. Gouri
Director
Division for Industrial Studies
UNIDO
P.O. Box 300
A-1400 VIENNA
AUSTRIA

Dear Sir,

ELECTRONICS RESEARCH AND DEVELOPMENT CENTRE:

May I take this opportunity to apologise for the delay in replying to your letter KF/CS of 3rd September, 1982. I was away from the Institute most of the last quarter of 1982 and our electronics engineers were just being recruited and introduced to the Institute.

I am happy to report that at last we have what I consider as a draft project proposal for your consideration. Please find enclosed two copies of the project which should be read in conjuction with other reports by UNIDO consultants relating to the development of the electronics industry in Kenya.

Notwithstanding the budget contained in the proposal, may I state that we request UNIDO to help us by indicating areas which it could finance and help us obtain finances from other donors, preferably, Japan or USA especially for construction of buildings (laboratories) equipment and experts.

The enclosed document is indicative of our thinking and only provides a basis for what we consider should be a dynamic process to produce a document acceptable to UNIDO, an identified donor and KIRDI. Please keep us informed of any developments in this exercise. The Kenya Government considers this as a pricrity project in its five year development plan (1983-1988).

I look forward to future fruitful cooperation on this important project.

Yours sincerely,

R.O. Arunga
Director

Encl:

INSTITUTE OF COMPUTER SCIENCE

Appendix 5.III

SCIENTIFIC CONTRIBUTIONS TO NATIONAL DEVELOPMENT

RESEARCH PUBLICATIONS

COMPUTATIONAL MATHEMATICS

1. "Properties of constants for a quadrature formula to evaluate Bromwich's integral". Journal of the Institute of Mathematics and its Applications (1976) 18, 49-56. Rodrigues A.J.

2. "An error analysis and convergence of a quadrature formula to invert Laplace Transforms". J. Inst. Math. Appl. (1977), 20, 21-32. Rodrigues A.J.

3. "On the Accuracy of quadrature Laplace Transform inversion and the solution of state-space equations". J. Inst. Math. Appl. (1978), 22, 283-296, Rodrigues A.J.

4. "Convergence of Pade Kernel approximants to the delayed Dirac Function". J. Inst. Math. Appl. (1980), 25, 17-27, Rodrigues A.J.

5. "Patterns in Square Numbers". Mathl. Gaz. (1976) 60, 203-204. Scott R.J.P.

NATIONAL DEVELOPMENT RESEARCH PROJECTS/TECHNICAL REPORTS

INFORMATICS

1. COMPUTERS KENYA 1981 - IDRC report which includes staff projection to the year 1990 for the Kenya data processing industry, July 1983. Scott R.J.P.

2. Directory of Computer Installation in Kenya 1986 - in preparation. Scott R.J.P.

3. "The Role of Informatics Technology in Development". 1986. Rodrigues, A.J. Paper commissioned by Kenya National Academy of Sciences. Technical Report AJR/1/86.

4. "State of the Art Computer Science in East and Central Africa". 1986. Rodrigues, A.J. and Getao, K.W., T.R. No AJR-KWG/1/86.

5. "Informatics Training and Education in Kenya" 1986. Rodrigues, A.J. and Opiyo, J.C. T.R. No AJR-JCO/1/86

AGRICULTURE: (in conjunction with National Agricultural Laboratories)

1. "Dynamical models in Plant-Pathogen Epidermiology". Rodrigues, A.J. Technical Report No. AJR/2/83.

2. "Accurate Holistic Dynamical Models in Epidermiology". Rodrigues, A.J., Ramos, A. Technical Report No. AJR-AR/1/83.

3. Implications of Holistic Dynamical Models in Epidemiology" in preparation.

TRANSPORT: (Kenya-Railways)

1. "Appraisal of the availability of Motive power with special attention to design and maintenance factors". AJR-ALU/1/84. (This work was used to prepare a report for World Bank project) Rodrigues, A.J-Uboldy.

HEALTH-CARE: (Kenya Medical Research Institute)

1. "Intestinal Parasitoses - Community Health Diagnosis: Case Study Awendo 1984". Technical Report No. KMR/1/86. Rodrigues A.J.

2. "Some Aspects of Health Care Management Information Systems. Case Study: Intestinal Parasitoses in a Large Agricultural Industry". Technical Report No KMR/2/86. Rodrigues, Kamunyi, Minawa.

TECHNICAL DEVELOPMENT

1. Financial Modelling for Development - in preparation. Scott R.J.P.

2. Models for Technological development and forecasting: An insight into the futility of the 'catch-up' concept of development. Communication sent to Interdisciplinary Center for Technological Analysis and Forecasting. Rodrigues A.J.

DEMOGRAPHY

1. An integrated model approach to the generation of Life Tables. A position paper (1985). Rodrigues A.J.

ON-GOING RESEARCH

1. Health-Care: Kenya Lung Function Analysis. University of Nairobi in collaboration with KEMRI.

2. Community Health Surveillance and Control: Intestinal Parasitoses (University of Nairobi in collaboration with Vector Biology and Control Research Centre (KEMRI).

3. Agriculture: Mathematical Model for optimum tea growing altitude in Kenya with respect to yield (in collaboration with Tea Research Foundation of Kenya).

WORKSHOPS - TRAINING

IDRC WORKSHOP ON MICRO-COMPUTERS IN RESEARCH ORGANIZATIONS. 17-27th March 1986. Result of this will be a network of research organisations in the East, Central and Southern African region which may be able to produce software for exchange. 20 participants from 9 East and Central African Countries.

UNFP DATA PROCESSING SEMINAR FOR MANAGERS. June, August 1986. Comprised an 8 module seminar package together with 3 sessions of hands on training for software packages such as Lotus 1-2-3. Mandatory seminar attendance for all UNFP management staff (120).

CONFERENCE PAPERS

1. Computer Science/information Processing for Development K.A.A.S., 1978 Nairobi (Scott).

2. The Problems of a Computer Installation in a Developing Country. Cairo 1979 (Scott).

3. Implications of Computer Use in African Socio-Economic Development. K.A.A.S., Nairobi 1979 (Scott).

4. Educational Training in Informatics in Kenya, Dublin 1981. (Scott)

5. The problems of Establishing and Running an Institute of Computer Science in a Developing Country. Geneva 1984 (Scott).

6. Uniform Derivative convergence of diagnal Pade approximants to exp(Z) on unbounded sets. 1st E.A.S. Nairobi, 1981. Rodrigues, A.J.

7. On IMT and Dirac Kernel Approximants, 2nd Conf. Computation Modelling; Penin-City 1986. Rodrigues, A.J.

RESEARCH-REVIEWS

Mathematical Reviews - American Mathematical Society.

ORGANIZATIONS CONSULTING I.C.S.

East African Institute of Management, UNESCO/POSTA, Kenya Posts and Telecommunications, Bamburi Portland Cement Company, East and Southern African Management Institute, Kenya Commercial Bank Ltd., National Cereals & Produce Board, National Council for Science and Technology, Kenya Airways, UNEP.

MAN-POWER-PRODUCTION

INTAKES OF POST-GRADUATE DIPLOMA STUDENTS

1980/81 intake (11) participants from (30) applicants.

Kenya Government Computer Centre
K.P.T.C.
Industrial Development Bank
University of Nairobi - Institute of Computer Science
Gordon Melvin and Partners
One Private sponsorship
One University of Nairobi scholarship
One DAAD Uganda scholarship

1981/82/83 intake (13) participants from (30) applicants

Kenya Government Computer Centre
Kenya Posts & Telecommunications Corporation
University of Nairobi - Institute of Computer Science
University of Nairobi - Geography Department
Meteorology Department
E.A. Engineering Consultants
One Private sponsorship
One University of Nairobi scholarship
Two All African Council of Churches scholarships

1983/84 intake (15) participants from (30) applicants

Kenya Government Computer Centre
University of Nairobi - University Library
Kenya Institute of Administration - Kabete
Kenya Agricultural Research Institute - Muguga
Ministry of Water Development
One OAU to One Private sponsorship from Uganda
Five University of Nairobi scholarships (of which 2 were DAAD)

1984/85 intake (13) participants from (30) applicants

Kenya Government Computer Centre
Kenyatta University College
Ministry of Agriculture
Kenya Technical Teachers College
Food Supply & Monitoring Unit, Ministry of Finance
Mombasa Polytechnic
University of Nairobi scholarship
DAAD scholarship
UNESCO scholarship from Tanzania

1985/86 intake (22) participants from (70) applicants

University of Nairobi
DAAD
Malawi Government
Self/University of Nairobi
Self
Unesco
Ministry of Finance
Ministry of Water Development
Ministry of Transport (Aerodromes)
Kenya Power and Lighting Company
Nairobi City Commission
Kenya Technical Teachers College
Kenyatta University
Kenya Commercial Bank

1986/87 intake (24) participants from (84) applicants

DAAD - (Non-Kenyan)
DAAD
Unesco
KNAC
Self
Ministry of Agriculture
Ministry of Water Development
Kenya Technical Teachers College
Kenya Cargo handling
World University Service
University of Nairobi
Government Computer Centre
Central Bureau of Statistics
Ministry of Energy/GTZ
Ministry of Co-operative/NORAD
Kenya Polytechnic
World Lutheran Federation

APPLICATION AREAS OF COMPUTER PROJECTS

1980/81 intake

Financial Modelling in University Administration
Library Automation
Computer Usage Invoice System
Structured BASIC Preprocessor
Overview of ICL 1900 series Virtual Operating System
Budgetting Systems for a Development Bank
Computerised Reference Library for Ministry of Finance
An Application of GLIM system to the Analysis of intra-urban Mobility in Nairobi.

1981/82/83 intake:

Contour Mapping Program
Microcomputer Payroll System
Database Management Routines in COBOL
Financial Modelling in the Oil Industry
Allocation of Radio Frequencies in K.P.T.C.
User Guide for PERT Package
Statistical Comparison of Memory Control Algorithms
Importer/Exporter Report System
Data Structure precompiler for FORTRAN
Management Information Systems used in Kenya

1983/84 intake:

Financial Modelling - Exams Council
Financial Modelling - Cereals & Produce Board
DAAD Admin. Office Microcomputer System
Information Processing for Research
Computers & Unemployment
Computer Forms Processor
University Systems Analysis of Library Computerization
Financial Systems for Commercial Company
Research activities reporting system
Capital formation reporting

1984/85 intake:

Sales Analysis of Commodities
K.U.C. Payroll System Documentation
Development of Teaching Materials for BASIC
Computerisation of Members for Customs & Excise Workers (CUFW)
Cooperative Savings and Credit Society
Computerisation of Telephone Number Allocation
Computerisation of Kenya Agricultural Documentation Centre
Microcomputers as Teaching Aids
Computerisation of Appropriation Accounts and other public account documents
Computerisation of Maize Yield Forecast Survey
Directory of Computers in Kenya
Computerisation of Transport Records at University of Nairobi
Computer Education in Schools in Kenya
Computerisation of the Votebook of the Ministry of Finance and Planning

1985/86 intake:

Financial Model - K.P.L.C.
Health Statistics - MMEF
University Students Health Centre System
Kenya Commercial Bank - Financial Models
Spare Parts Tender System - University of Nairobi
Microcomputer System for the University Bookshop
Microcomputer Control Interface for a Desk Top Motor
Home Computer Education Package
Evaluation of alternative Charging Algorithms for the Institute of Computer Science
College Budget & Accounting System on Microcomputer
University Budget System on Microcomputer
Errors and Precision of Floating Point Representation of Numbers in Computer System.
Information Technology in Kenya - a Database
Interfacing Microcomputers
Feasibility Study of Computerisation of University of Nairobi Financial System.

REGIONAL ACTIVITIES

UNESCO SPONSORED SCHOLARSHIPS

1984/85	(2)	Ethiopia, Tanzania
1985/86	(2)	Somalia, Tanzania
1986/87	(1)	Zambia

SELF SPONSORED APPLICANTS

1980/81	1 Ugandan
1981/82	2 Ugandan
1982/83	1 Colombian, 1 Ethiopian
1986/87	1 Botswana

IDRC WORKSHOP 1986

The participants were drawn from the following countries:

Country	Number
Botswana	1
Ethiopia	1
Kenya	6*
Malawi	3
Swaziland	1
Tanzania	3
Uganda	1*
Zaire	1
Zambia	3
Total	20

1986/87 POSTGRADUATE DIPLOMA APPLICANTS

	NAME	NATIONALITY	SPONSOR	DEGREE	CLASS	YEAR	COMP. EXPERIENCE	CURRENT EMPLOYER
1.	Musoke, P.N.	Ugandan	DAAD	B.Sc.	2nd(U)	1980	Yes	Teachers Serv. Comm.
2.	Pongole, F.M.	Ugandan	Non	B.Sc.	Pass	1982	No	" " "
3.	Ssegawa-Kaggwa, J.	Ugandan	DAAD/UNESCO	B.Sc.	2nd(U)	1982		" " "
4.	Kariuki, E.M.	Kenyan	Self	B.Sc./M.Sc.		1975	Yes	Kenya Inst. of Educ
5.	Mairegi, G.F.	Kenyan	USAID	B.Sc.(Poor app)		1977		Kenya Poly.
6.	Owiti, C.A.	Kenyan	K.Poly.	B.Sc.	2nd(L)	1985	Yes	Kenya Poly.
7.	Kirui, J. K.	Kenyan	K.Poly	B.Sc.	2nd(U)	1984	Yes	Kenya Poly
8.	Karanja, J.G.	Kenyan	NORAD(to conf.)	M.Sc.		1978		Min. of Co-op.
9.	Imbuye, J.A.	Kenyan	M.o H.	B.Com.	Pass	1981		Min. of Health
10.	Ngure, D. Kabugi	Kenyan	GTZ	B.S.(Met)	2nd(L)	1977		Min. of Energy
11	Maina, K.	Kenyan	UoN	B.Sc.	2nd(U)	1985	Yes	CTC
12.	Awach, J.O.	Kenyan	Govt.	B.Ed.	2nd(L)	1983		Kabarak High School
13.	Njuguna, J.N.	Kenyan	UoN	B.Ed.	2nd(L)	1983		
14.	Miyago, T.O.	Kenyan	UoN	B.Sc.	2nd(L)	1985	Yes	Teachers Serv. Comm.
15.	Kirigwi, J.M.	Kenyan		M.Sc.	2nd(U)	1982		CBC
16.	Koech, I.K.	Kenyan	Govt.	B.Sc.	2nd(L)	1981	Yes	Govt. Comp. Centre
17.	Omurwa, T.M.	Kenyan	Govt./UoN	B.Sc.	PASS	1983		Min. of Health
18.	Anjili, B.A.	Kenyan	UoN	B.Ed.	2nd(L)	1983	Yes	KGSC
19.	Ngure, K.K.	Kenyan	UoN	B.A.	2nd(L)	1983		Kenya Railways
20.	Bett, K.A.K.	Kenyan	UoN	B.Com.	2nd(U)	1984	Yes	Central Bank
21.	Kiarie, J.K.	Kenyan	KCE	B.A.	2nd(L)	1978	No	Kenya Comm. Bank
22.	Kariuki, G.M.	Kenyan	DAAD	B.Sc.	III	1981		Kenya Marine Fish.
23.	Njihia, P.M.	Kenyan	Govt.	B.Sc.	2nd(L)	1984	Yes	Civil Service
24.	Mwaura, W.	Kenyan	Govt.	B.Sc.	Pass	1985		Min. of Commerce
25.	Okello, K.	Kenyan	UoN	B.Sc.	2nd(L)	1981	Yes	Univ. of Nairobi
26.	Azoru-ra, C.A.	Ugandan	DAAD	B.Sc.	2nd(L)	1978		Teachers Serv. Comm.
27.	Mbengei, J.S.	Kenyan	UoN	B.Com.	2nd(U)	1984		Accountant
28.	Magare, J.G.	Kenyan	UoN	B.Com.	No result	1986	Yes	MINFT ICDC
29.	Muthee, P.W.	Kenyan	UoN	B.Ed.	2nd(U)	1983		
30.	Woldemariam, S.K.	Ethiopian	WOS (UK)	M.A.	2nd(U)	1971		
31.	Shalkhnag, A.H.	Kenyan	UoN	B.Sc.	2nd(U)	1983	Yes	Min. of Water
32.	Adalla, C.A.	Kenyan	UoN	B.A.	2nd(L)	1984	Yes	Min. of Energy

	NAME	NATIONALITY	SPONSOR	DEGREE	CLASS	YEAR	COMP. EXPERIENCE	CURRENT EMPLOYER
33.	Mbogori, D.K.	Kenyan	Cargo	B.Sc.	2nd(L)	1981	Yes	Kenya Cargo
34.	Mwea, K.E.	Kenyan	Min.Ed.	B.Ed.	2nd(L)	1985		Kianyaga H.Sc.
35.	Amukonyi, S.A.	Kenyan	Govt.	B.Ed.	2nd(L)	1984	Yes	
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37.	Kinyanjui, C.K.	Kenyan	GK/KP&TC	B.Ed.	2nd(U)	1985	Yes	G.E.D.
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43.	Ombura, E.O.,	Kenyan	UoN	B.Sc.	2nd(L)	1985	Yes	Mombasa Poly.
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50.	Temu, J.J.	Tanzanian	Self	P.Sc.	2nd(L)	1984		
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57.	Mwai, P.M.	Kenyan	UoN	B.Ed.	2nd(L)	1984	Yes	Nyeri H.Sch.
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61.	Manjichi, M.	Kenyan	UoN	P.Sc.	2nd(U)	1985	Yes	Govt. Computer Centre.
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67.	Kabanga, E.M.	Kenyan	K.N.A.C.	B.Sc.		1983			K.N.A.C.Ltd.
68.	Njoe, S.K.	Kenyan	UoN	B.Sc.	2nd(U)	1986	Yes		
69.	Nzioka, F.K.	Kenyan	UoN	B.Sc.	1st	1986	Yes		N/A
70.	Mucai, S.M.	Kenyan	UoN	B.Sc.	2nd(U)	1986	Yes		N/A
71.	Kamau, L.M.	Kenyan	UoN	B.Sc.	1st	1986	Yes		N/A
72.	Mongare, N.P.	Kenyan	UoN	B.Sc.	2nd(U)	1986	Yes		N/A
73.	Mureithi, D.M.	Kenyan	UoN	B.Sc.(Eng)	2nd(U)	1986	Yes		N/A
74.	Juma, K.	Kenyan	UoN	B.Sc.	2nd(U)	1986	Yes		N/A
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76.	Omega, R.	Kenyan	UoN	B..Sc.	Pass	1986	Yes		N/A
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78.	Kisinzah, H.R.	Tanzanian	UNESCO	B.Sc.	2nd(L)	1985	Yes		Min. of Finance
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80.	Sambo, M.A.	Malawian	UNESCO	B.Sc.	Pass	1984	Yes		Malawi Railways
81.	Matemba, D.D.	Mawaian	UNESCO	B.Sc.	Dist.			Yes	Malawi Railways
82.	Chimutu, I.M.C.	Malawian	UNESCO	B.Sc.		1983	Yes		Malawi Railways
83.	Simuyi, J.S.	Zambian	UNESCO	B.Sc.		1985	Yes		Min. of Finance
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SUMMARY

1. SUMMARY

1.1. INFORMATICS TECHNOLOGY AND EDUCATION

Introduction

The process of development is defined as the effective integration of economic and social changes into the sociocultural patterns of society. The effectiveness of integration depends on numerous factors that have come into focus:

- Economic growth measured by improvements in the life of the entire population;
- Scientific advances in research;
- Technological strength based on indigenous productivity rather than on the continuous importation of foreign goods and processes;
- Physical, institutional and communication infrastructures based on a assessment of national requirements;
- Policies that anticipate future conditions and need in natural, human and physical resources;
- A view of development as a learning process that allows the simultaneous creation of new knowledge, dissemination mechanisms and applications;
- Strategies designed to build national capacity for international cooperation rather than for depending on other countries.

In each country, the relationship of informatics technology and development is defined either by information policies or by the lack of them. The establishment of productive links between informatics technology and development plans is based on political intellectual perceptions. This is the conceptual domain of policy making. How these links are forged and maintained, is a question of strategies. This is the organizational domain. The concepts and strategies of infromation development can be brought together only by ongoing communication between scientists, information practitioners and policy makers.

Information as commodity

Information may be perceived in many ways, but currently the two main interpretations of its role in economic growth and technology development are information as a commodity and information as a culturally determined process.

Policy makers and managers came to recognize the content of information as the "core of technology", whether the concerned content is scientific, technological, marked related or social intelligence.

The rise and convergence of computation and telecommunication industries vastly increased the commercial value of this core.

The imbalance in technology and knowledge production between the developing and the industrialized areas of the world led to an intensifying political struggle concerning the flows of electronic data and information across national borders as well as the barriers erected by protectionist measures. These events signalled to many governments in developing countries the need for investment in human resources, research and development, efforts towards the establishment of indigenous computer and telecommunication industries.

Information as process

The assumption underlying the second major aspect of information planing is that information becomes useful when it is accessible in the form, quantity and communication mode most appropriate to the user.

One can see that information as a commodity is a key element in development. However, information must be organised for use and transmitted by an informing process that depends on, among other factors, communication and trust.

Research on informatics

One of the capabilities that is said to contribute to the development process significantly is indigenous research. If informatics technology is expected to accelerate progress, applied research on its characteristics, its relationship to educational and communication technology and its potential social impact, is an essential activity.

In research on new informatics technology, the need for taking the social and cultural environment of users into account is further heightened to the dominant role of the informing process.

We are thus led to the conclusion that investigations of informatics related questions in a developing country should be conducted by indigenous researchers. National information policies must take this necessity into consideration and support resource allocations for the development of domestic research capability.

Informatics technologies imported from industrial countries constitute one of the most controversial tools of development. Problems associated with both the "quick fix" approach which overestimates the benefits of technology, and the practice of "dumping" which pushes near obsolete technology on developing countries, have been repeatedly described and illustrated by examples. Three interrelated processes make the technology transfer dilemma in informatics especially complicated. Few governments and international donor agencies would find the investment in research justified without a persuasive identification of the problem and of the benefits expected from the study. The three processes one needs to distinguish, together with their relationships, are:

- Hardware transfer /discs, tapes, microcomputers, library shelving etc./,
- Information transfer /documentation, computer software, standards, policy statements, etc.
- Konwledge transfer /an understanding of the original purpose of the technology, the ability to plan and manage applications, technical skills, training programs, demonstrations etc./.

The shortage of high-quality researchers might threaten all efforts to get a project underway. However, the point is that without recognising that research on the impact of informatics technology is a national resource, and without dealing with research-related problems, informatics technology may not become integrated with the country's overall development goals.

Education for informatics

Creativity is the most precious resource for development without which a society can become neither productive nor self-reliant. Leadership and policies are needed to recognise and nurture creative talent and to apply it to national needs in order to achieve that elusive phenomenon called progress. It is equally important to remember that creactivity is at work at the grass-root level as much as, and may be more than, in the educated classes.

One must ask: what is the balance between risk-taking by responsiveness to new ideas and reasonable continuity essential for the stability of society? Probably the only answer, upon which humani-

stic and technocratic thinkers can agree, is education and training. Konwledge may be defined as the fusion of new information, intuition and experience in the human mind.

Learning and informatics are inseparable human activites. But it has been stated that "in no other area is the dependency of the Third World as great as in that of information; and in no other field is the concept of self-reliance so neglected". It is well known also that non-industrialized countries suffer from shortages in cognitive, analytic and technical skills. Not surprisingly, education together with indigenous research, has risen to join economic/technological growth as national policy for most nations. Moreover, it is necessary "to relate the whole system of education at all levels to the concrete problems of the country".

With the assistance of intergovernment agencies and non-governmental organisations /NGOs/, curriculum revision and the development of new programs are underway in many countries.

Activities in this regard include the assessment of manpower requirements, the design of new programs; the training of information workers at different levels through workshops; the formulation of new standards for qualification and testing; coordination for resource sharing; and the organisation of regional conferences. Professional level preparation is being planned for several roles in the information workforce simultaneously with para professional training:

- Researchers in information science, informatics and telematics
- Planners and managers
- Systems analysts
- Data processors
- Intermediaries for information retieval, analysis and reference
- Intermediaries for repackaging information for popular diffusion
- Educators and trainers
- Educational administrators
- Paraprofessionals
- Specialised technicians.

Continuing education is of utmost importance to enable current information personnel to deal competently with increasing managerial and technological responsibilities.

Information policies

Recognising that the scope and objectives of national information policies vary from country to country and are a matter of internal development needs, these points represent more reflections on a large number of international statements and documents rather than suggestions.

Generally, information policies aim to

- coordinate or integrate information and data transfer, informatics and telecommunication /telematics/ policies;
- guide national informatics and telematics plans which are based on current and anticipated economic and social objectives as well as on cultural heritage;
- provide resources for research on information related needs and problems and for education and training at all levels;
- develop a framework for the economic valuation of information and information work and for the transfer and indigenous production of informatics technologies;
- create mechanisms for the assessment of different informatics technologies in the context of the country's requirements; develop priorities for technology selection use and popularisation;
- establish a framework, based on economic, cultural and legal considerations, for participation in international informatics relationships.

1.2. EDUCATION AND TRAINING OF DP STAFF

Any country or region in a comparatively early stage of computing development is in something of a vicious circle so far as human resources are concerned. There is insufficient experience or skill to expand usage effectively and efficiently, and there is insufficient practical application or theoretical training to grow the needed expertise.

If matters are left to their own devising, the process of evolution will eventually create an appropriate education and training infrastructure. Industry itself will respond to the market demands and commercial training facilities will become established. The public education sector will, under the influence of industry and governmental pressures, gradually change its priorities and hence increase its investment in computing. Users themselves will place greater emphasis upon the need for training their own staff. As the industry grows, career prospects for individuals will become more stable and users will be able to anticipate more employment loyalty.

But all this is going to take too much time. We could well anticipate ten or more years of frustration and delay until an infrastructure could become established. Is there a short cut? How can we work towards the development of human resources in a more sensible time scale? Obviously there are no easy solutions, but there are some fundamental issues which need to be understood before action can be taken:

1. The problem is too widespread for it to be treated at local level. It is a matter for action at a national /or regional/ level, and that means commitment on the part of government. Appropriate direction and resources must be forthcoming within a policy that recognises that "computers are essential for they future prosperity".

2. The problem must be tackled across the whole spectrum of education and training. It is not enough just to provide high level academic education, for example.

3. The problem must be solved by the indigenous population. Outside advice and help will undoutedly be of great assistance, but it must not be allowed to dominate or dictate solutions in a foreign environment.

All these lead to the inescapable conclusion. In order to move forward at a reasonable pace, there must be some kind of national strategy for education and training in computing. This strategy should address itself to the following areas:

- A level of general education which will fit the population to participate in a system based culture. Sooner or later, directly or indirectly, all citizens will be in contact with the spreading implementation of computer technology and will be intimately involved and affected by its application.

- A level of higher education which will mature the nation's computer scientists, computer professionals and teachers, and which will provide a level of execellence to which the computer professionals may aspire.

- A level of management education and training which will create business, commercial and government environment where computer methods can be introduced effectively.

- A level of technical education and training which will create and mature the systems analysts, programmers, operators and engineers who are necessary to develop, maintain and support the growth of applications.

The strategy may well include provision for rationalisation of university level education; for setting up a dedicated polytechnic level institution or enhancing exsisting facilities for establishing

technical college level training for provision of computer training in professional and business courses for developing school computing; for arranging a National Information Technology Training Institute, and so on.

To formulate such a strategy, there first needs to be a thorough study of existing education and training facilities and an examination of future needs. Only when this gap is properly defined can decisions be taken regarding development of the education and training infrastructure and the resources needed.

1.3. REMARKS:

Basing on information acquired in discussions with the representatives of the managerial staff of Ministries, Scientific Institutions, and Production Works it can be stated that:

a/ the development of microelectronics and its application in all countries of the South-Eastern African subregion are in the preliminary stage;

b/ the development of informatics is based on imported equipment and software.

1.4. RECOMMENDATIONS

In order to have the informatics equipment fully and appropriately used it is indispensable for the governments to elaborate the plans of action and supervise its carrying out. The plans of action in this scope should be the part of development plans of separate countries. The basic condition of carrying out these endeavours should be the programme of staff training in the field of microelectronics and informatics.

1.4.1. The separate countiers have submitted the proposals of cooperation with UNIDO.

These informations are included in parts of Report which regard to:

III. Zimbabwe	- page III - 42;	Appendix 2.III
	- page III - 43;	Appendix 2.IV
	- page III - 59;	Appendix 2.V
IV. Zambia	- page IV - 9;	Appendix 4.II
	- page IV - 11;	Appendix 4.III
	- page IV - 13;	Appendix 4.IV
	- page IV - 14;	Appendix 4.V
	- page IV - 33;	Appendix 4.XI
V. Kenya	- page V - 30;	Appendix 5.I
	- page V - 31;	Appendix 5.II
	- page V - 32;	
	- page V - 35; up to V - 44;	Appendix 5.III

1.4.2 The commencing of discussions with institutions interested in this cooperation should enable the elaboration of a programme, concrete and possible to be carried out, of assistance of UNIDO to the above mentioned countries.

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