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THE ELECTRONICS INDUSTRY IN THE AFRICAN COUNTRIES:

ZAMBIA*

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* The views expressed in this document are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. This document has not been edited.

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0.0 INTRODUCTION

0.1 Origin of Study

0.1.1 Background

Advances made in the field of electronics, especially in the last three decades have resulted in increasing power and capability of electronic apparatus while at the same time reducing its cost. The applications of such powerful electronic apparatus have spread into all areas of human activity. In households, offices, hospitals, industries, governance, the spread effect of electronics has resulted in better information flow, precise measurements, accurate control, lower waste, higher efficiency, etc

In nation after nation, electronics has become a driving force of modernization, progress and economic advancement. The pertinence of electronics to security, defence, space exploration gives it greater national importance. Per capita consumption (use) of electronics has become a measure of national strength.

Many developing nations have yet to appreciate and utilise the power of electronics for national good. The lesser developed a country is, the more it tends to regard electronics as a luxury and sophistication not pertinent to their development plans. Such nations are finding the technological gap widening not only in electronics but, due to lack of its use in their development, also widening in all other fields --- commerce, industry, communication, defence, etc.

The rapid advances and high investments make technological catching up very difficult for the less developed nations. However, there need be no great barrier to the use and deployment of modern technologies. In the case of electronics especially, developments in advanced countries are making the end-equipment "user friendly", more reliable and better value-for-money. As a result, the applications are becoming widespread in home, industry, health, education, transportation, services, etc

Several nations have used electronics for overall economic advancement through its spread-effect on other industries --- Japan, Korea, Taiwan are well known examples; more recent are the on going efforts of Brazil, India, Malaysia, Thailand, etc

0.1.2 Objectives

This work will address itself to the task of studying ways and means for less developed countries to participate in the electronics age. Main objectives being

- a To appraise the history, status and growth of electronics industry in relation to the policies adopted
- b To identify constraints regarding the judicious use of this technology and its rapid development.
- c To evolve strategies for accelerated usage, increasing capability, enhancing added value where beneficial.
- d To assess the role of software activities in overall electronics development.
- e To suggest improved institutional arrangements for implementation of these strategies.
- f To find suitable niche markets (domestic & export)

The findings of this study will be part of the consultations between nations directed towards faster industrialization of developing countries and finding ways of increasing co-operation between North-South and South-South to that end.

0.1.3 Study Treatment

Due to the highly visible and undoubtedly powerful position of "informatics" and "microelectronics" at the leading edge of technology, there is a general tendency in discussions, conferences and literature to tout these as essential requirements towards which strategies and policies for which electronics should aim. In case of less developed countries, however, there is a lot of ground to be covered prior to that stage and many tasks at a more traditional level that call for prior attention.

This study will try to see how to accomplish these transitional tasks while also deriving maximal benefits from "informatics" and "microelectronics" through their judicious use and spread effect. We will investigate where an increasing role can be locally played and capabilities garnered in the software area for genuine national benefit.

Based on the economic situation and overall policy structure, what initiatives and changes are needed to accelerate electronics growth, create spread-effect through its use, progressively increase value added and participate more actively in the world trends in electronics.

Our attempts at analysis will focus on the key pacesetting segments of the electronics industry --- i.e. telecom, computers, industrial controls & television --- to demonstrate how the country can benefit from accelerated

development of these areas.

0.1.4 Basis of Information.

Besides a review of published data available from various sources (see Annex.A), the study is based on a visit to the country capital for meeting responsible officials, industrialists, academics, and other currently involved in the electronics industry.

The major limitation of this study is the compressed time available, and the very limited data on electronics in these countries. The findings must thus be considered as a start of the process of analysis needing refinement and detailing by further concentrated studies of the many issues highlighted by this work.

0.2 Country Characteristics

0.2.1 Geographic (Ref. Annex.A 1,3)

Zambia is a land-locked country surrounded on all sides by other newly freed African nations --- Zaire, Tanzania, Malawi, Mozambique, Zimbabwe, Angola. Area of over 752,000 sq. Kms. lies between latitudes 9 degrees to 18 degrees south of the equator and spreads between 23 degrees and 34 degrees east longitude.

Much of the terrain is a high plateau lying between 910 and 1370 meters above sea-level with the North-East rising to 1800 meters (the Muchinga Mountains). Rivers Luangwar, and Kafue flow in the valleys to the main Zambezi river. Luapula river drains the Bangweulu Lake in the north while Lake Kariba (one of worlds largest) is formed by the impoundment of Zambezi at the Kariba Dam.

The climate is largely pleasant on the vast plateaus while higher temperatures rule in the river valleys and the shores of the lakes with the peak heat being in October. Rains are spread from November to April --- about 125 cm in the North coming down to 75 cm in the South.

Land is largely open woodland in the north becoming sparser through savannah to grass land and scrubland towards the south. Zambia with its rather low population is still blessed with ample wild-life and has wisely created preserves near its many lakes and rivers where animals and birds abound and attempts are made to preserve them from human depredation.

0.2.2 Regional

Twenty states of "Eastern & Southern Africa" (ESA, 180 million, people) agreed to co-operate in regional development in many spheres. After four years of discussion, in December 1981, a Preferential Tariff Area (PTA) has been formed with 15 nations signed on and five more awaiting signature. Besides increasing

commodities enjoying preferential tariff, recently a PTA traveller's cheque scheme was started enabling use of one country's currency in other countries.

The farthest advanced of sub-saharan regional groups, ESA hopes to create a common market by 1992 and an Economic Community by 2000. ESA has land (8.2 million sq.kms.) blessed with rivers, lakes, forests equalling in size all of North Africa (which is mostly arid); ECA population approaches that of all West Africa (about 175 million); ECA has copious and varied natural and forest resources. However, GDP per capita is lowest in Africa (\$ 275 in 1986) while its inflation rate is high. ESA contains some of the poorest nations on earth.

0.2.3 Demographic (Ref. Annex.A 1, 2, 3, 4, 5)

The population of Zambia is modest for the large and well endowed land --- 7.2 million in 1987. However, the growth-rate has been accelerating with each half-decade --- from 3.1% in 1975-80 to 3.3% in 1980-85 onto 3.4% in 1985-90: urban population at 51.9% in 1987 is also growing at an accelerating rate 5.2% between 1980-85 and 5.8% between 1985-90.

TABLE 1 : Demographic Statistics

	Unit	1980	1986
Population	Million	5.6	6.9
Growth	%	3.1	3.4
Between 15-59 Years	%	48.6	48.7
Urban	%	42.8	50.7
Economically Active	%	23.1	33.6
Urbanisation Rate	% PA.	5.2	5.8
Family Size	Persons	N.A.	5.8

In demographic terms Zambia is a small nation presenting a tiny market. Its geographic size and liberal natural resources should provide the opportunity to enhance the welfare of its people at a rapid rate if properly managed.

In cultural terms, Zambian population is fairly uniform & integrated. Almost the entire population is of Bantu origin as are the five major dialects --- Bemba, Lozi, Luvale, Tonga, Nyanja. However, English has been retained as the official language. Religionwise 72% of the people profess Christianity in various forms. Different versions of Churches coexist (some of them influenced by latent animistic beliefs).

1.0 OVERALL ECONOMIC SITUATION

1.1 Major Resources

1.1.1 Human (Ref Annex.A 3, 4, 5, 16)

Zambia has benefitted from its long history of missionary education. A literacy rate (1986) of 75% for males and 58% for females (1980) has been steadily rising to 86% and 70% respectively (1986).

With its small population, Zambia does not have a large number of schools, colleges and universities. The 1986 scenario of education is summarised in Figure I. Primary (first level) education is free (funded by central, local and missionary organizations) and about 90% of eligible boys and 80% of girls comprise 1.44 million students at the first level in 3185 schools.

Only about 10% of the students proceed for secondary and higher education. Twenty-eight Vocational polytechnics (9700 students) and one university (4860 students) form an even smaller number.

The annual output of natural science and of engineering graduates is placed at 65-70 each while engineering technicians output is around 360. Those of electronic speciality are few and software training practically non-existent. Clearly, higher education (especially technical) needs to be spread wider and augmented if Zambia wishes to participate in the march towards high technology.

Economically active population of 2.3 million displays an activity rate of males at three times that of females. Over 70% are active in some form of agriculture or forestry, only around 10% in industry (including mining) and 20% in services. A great deal of activity in agriculture is of an informal and itinerant nature; less than 20% of the active population are in formal employ, the others being informal workers or marginally self-employed.

1.1.2 Energy (Ref. Annex.A 2,16)

Due to the nature of terrain and endowment of lakes & rivers, almost the whole 1730 Megawatts (1986) of electric capacity comes from hydro-electric plants. Annual potential of 15,000 million KWH is utilised only 67% even though 3000 million KWH are exported.

Petroleum products comprise an imported source of energy and fuel, and varying according to availability of foreign exchange. Coal reserves amounting to 72 million tonnes of which only about half a million tonnes are annually used.

FIGURE - I(A) : EDUCATION SCENARIO IN ZAMBIA (1986).

	Primary	Secondary	Higher Level	Technical & Vocational
No. of Schools	3164	276	1*	28
No. of Teachers	29841	5627	613	1055
No. of Students	1442133	150298	4860	9687
Student:Teacher Ratio	48.3	26.7	7.9	9.2

FIGURE - I(B) : PROJECTED MANPOWER OUTPUT BY CATEGORIES RELATED TO ELEX. INDUSTRY.

(Scale : Nos.)

Category	1989	1990	1991	1992	1993
1. High-Level					
- Natural Sciences	65	72	120	80	80
- Engineering	68	84	93	90	86
2. Upper Middle Level					
- Business Studies	182	182	182	182	182
3. Technical					
- Engineering Technicians	360	380	400	400	420

* No. of Institutions

(Source : Annex. A 16)

Electric energy consumption per capita is about 1000 KWH per year but the figure is misleading because a large part of it is consumed by mining, leaving little for other industries and residences.

1.1.3 Extractive (Ref. Annex.A 3,6,7)

The dominant mineral resource thus far exploited for national benefit has been copper. It is said that, at the present rate of extraction, the known seams may deplete in 20 years.

Some quantities of cobalt zinc, lead, uranium form additional resources as do minor quantities of gold, silver, tin.

1.2 Economic Structure

1.2.1 National Product

Zambian economy in real terms at constant 1977 prices shows negligible growth (after a period of steady decline). For the past few years (1984-1988) GDP is hovering in the range 2011.5 to 2161.8 million Kwacha at 1977 prices. With population rising at 3.5%, this constitutes a decline in GDP per capita. In current dollars, GDP per capita has dropped from a peak of \$ 713.5 in 1981 to \$ 248.6 in 1987. Meanwhile, inflation has flared from 12 - 14% in early eighties to around 50% in recent years.

The structure of GDP in the different sectors shows Agriculture and Manufacturing growing in importance while Mining is declining. Service Sector retains its level at around 45%.

Table 2 : Structure of GDP (1977 prices).

	Unit	1984	1985	1986	1987	1988
Aggregate GDP	Mill. Kwacha	2011.5	2044.5	2069.3	2105.6	2161.8
Primary						
- Agriculture	%	16.52	16.82	18.15	17.36	18.00
- Mining	%	9.94	9.09	8.57	8.75	8.75
Secondary	%	27.28	27.95	28.04	28.02	28.47
Tertiary	%	46.26	46.14	45.24	45.87	44.78

The decline in Mining since the hey day of the 1960's (47% of GDP) to 18% in 1970 to around 9% in 1988 has been dramatic and sums up the basic reason for the problems faced by the Zambian economy --- i.e. past over dependence in one sector for exports.

1.2.2 Infrastructure (Ref. Annex.A 1,8)

For the large land area to be served, Zambian road structure could bear rapid improvement. Excluding urban road networks, Zambia in 1983 had about 6500 kms. of bitumenised roads, 7500 kms of gravelled roads and another 23000 kms of dirt track. Main highways are the Great North Road and the Great East Road helping landlocked Zambia to connect to neighbouring countries and through them to the sea.

Zambian Railway have 1300 kms. of track (meter gauge) connecting mainly to the borders of Zimbabwe, Angola and Tanzania. Effectiveness of the railways is limited by the shortage and maintenance of equipment and track.

Inland waterways cover 2250 km. in the flatter terrain and across the larger lakes. Many other waterways are impeded by cascades and rapids which make navigation difficult.

Zambian Airways runs between 11 internal airports and also links Lusaka with certain major nations with whom a good portion of trade and commerce exists --- London, New York, Frankfurt, Belgrade, Nairobi, Harare, Bombay, etc.

1.2.3 Communication (Ref. Annex.A 1,8,16)

Various modes of communication in Zambia are summarised in Table 3.

Table 3 : Modes of Communications.

	World Average (1983)	Target for Africa (1988)	Zambia (1986)
No. of Persons/P.O.	6660	3000-6000	15, 213
No. of Persons/Telephone	6.8	100	82
No. of Persons/Radio	3.0	5	7
No. of Persons/Television	7.6	20	36

With limitations in transportation infrastructure apparent in section 1.2.2, Zambia plans to step up its electronic communications internally and externally. Telephone and television can put people in touch more easily and effectively at low cost. There is building up a strong regional cooperation in this regard between ESA nations to jointly look at technical and economical issues of communications in the region.

1.2.4 Trade Policies (Ref. Annex A 2,12,14,16)

At the time of independence, copper exports were booming and provided surplus resources to accommodate consumption as well as developmental needs. However, falling copper prices put the squeeze on foreign resources and also made mining

marginally remunerative. It therefore became necessary to control imports more stringently.

Tariff rates in 1975 were designed to protect local industry and encourage progressive import substitution :

Table 4 : Average Tariff Protection(1975)

	Nominal Protection %	Effective Protection %
Capital Goods	7.94	59.71
Heavy Intermediates	16.50	29.77
Light Intermediates	32.42	182.49
Non-food Consumables	36.75	342.45
Food Products	40.99	67.35
Durables	82.11	472.87

(Source : World Bank Study 1984).

Above protection strongly influenced the direction of local production towards non-food consumables. However, this production made little impact on exports while at the same time requiring import content ranging from 23.6% to 85.2% in domestically consumed items.

Due to onset of serious foreign exchange shortage, government in latter half of the 70's began to place quantitative controls on imports through licensing and foreign exchange allocation. Ministry of Commerce and Industry examined each request and issued licences after which Bank of Zambia would take further time in deciding to allocate foreign exchange. These controls (often arbitrarily implemented) overshadowed the tariff regime and affected the structure of the manufacturing sector inclining it towards locally consumable goods at high protected prices.

The objective of broad-basing exports away from sole dependence on mining was not fulfilled --- industry contributed less than 1% of exports while absorbing much of the imported inputs. Reasons for poor export performance could have been a highly overvalued Kwacha, complicated procedures for export benefits schemes, delays in duty drawback, etc.

The deteriorating foreign exchange position and increasing need for foreign resources led to the initiation of a "Structural Adjustment Program" (SAP) along with an "Interim Development Plan" from 1985; it affected trade and exchange policies as below :

- a. Import licensing was abolished

- b. Tariff structure was re-adjusted; minimum import duty at 15% and maximum at 100%
- c. Half the foreign exchange earned could be used by the exporter.
- d. Foreign exchange available on weekly auction.
- e. Export Promotion Board to aid exporters in getting duty drawback, exploring markets, etc.

Under liberalised regime, the Kwacha devalued sharply. It was pegged at K 8 to the dollar for a while and further repegged at K 16 to the dollar in 1989. The free market rate however, was 3 to 5 times the official rate and the government was forced to demonetise by calling in all the old currency notes.

Under these continuing difficulties, the government formulated the Fourth National Development Plan 1989-1993 (FNDP) seeking to counter the difficulties by bringing back certain elements of control.

1.3 Current Approach to Industrial Development

1.3.1 Industrial Structure (Ref. Annex.A 2,16,19)

Proposed investment of K 23 billion in the Fourth National Development Plan (FNDP) would be divided : 27% in private sector, 44% in parastatals, 21% in government projects and 8% for social and administrative services.

Government projects will concentrate on maintaining, improving and extending the infrastructure further out into rural areas. This includes roads, railways, electric supply, telecommunication, banking, etc.

Agriculture will continue to remain largely private while mining will be parastatal. Manufacturing will be parastatal in the heavy sectors and private in the light sectors. Small scale industry will be specially encouraged. The FNDP specifically mentions "Provision of affordable radio and TV receivers" is specifically stated as an objective.

1.3.2 Policy Emphasis (Ref. Annex.A 2,16,19)

The FNDP lays emphasis on encouragement of "Zambian private investments in the small and medium sectors". This could be taken to imply dominance of parastatals in the large and heavy sectors. Certain major policy credos for the private sector can be emphasised :

- a. Encourage foreign investment in "priority and productive" sectors were modern technological

inputs are required.

- b. Give priority to investments which maximise local resources.
- c. Give assistance to projects which generate foreign exchange, or substitute imports especially through non-traditional products having substantial local added value.
- d. In important projects, encourage joint ventures and technical agreements with both parastatals as well as private industry.
- e. Discourage "Non-indigenous franchise and trade holdings".
- f. Institutions must lend 10% of new advances to small scale at concessional terms.
- g. Assistance to parastatals and private firms in establishing technical training programs.
- h. Small scale will be allowed even in extractive sectors
- i. Local consultancies in industrial and research activities will be encouraged.

Electronics industry would be greatly affected by these policy imperatives since it is small-to-medium in size, prone to private investment, requires technological assistance, has substantial import content, etc.

1.3.3 Institutional Framework (Ref. Annex.A 16,19)

The Ministry of Commerce and Industry remains the umbrella organization responsible for promotion, guidance and regulation of enterprise in Zambia. However, depending on various adjustments in policy, a number of other bodies get involved in decisions regarding specific projects and proposals as they come up for implementation.

The Small Scale enterprises, theoretically free from the need for licensing and other controls, have nevertheless to approach Small Industries Development Organization (SIDO) or Village Industry Services (VIS) for location in estates, certification of plans for benefits such as reduced customs duty, removal of Sales Tax on imported equipment, etc.

Large enterprises have to obtain from the Director of Investments (or his Investment Committee and Investment Council) approvals for manufacturing registration, technology transfer, industrial licences, certification for drawing benefits, etc.

The National Commission for Scientific Research enters the picture when agreements for technology imports are to be reviewed. Their mandate is to optimise the use of local research, local materials and labour intensive processes --- a role which is more regulatory than promotional.

Every importer has to approach the Foreign Exchange Management Council (FEMAC) for each requirement of foreign currency --- whether for new machinery or for regular imported inputs. The objective is to supervise and allocate the issue of foreign exchange from time to time according to the rise and fall of foreign exchange availability.

2.0 ROLE OF ELECTRONICS

2.1 Development of Electronic Industry

2.1.1 International Context

Largely due to its small market and accentuated by the internal orientation of its policies, the consumption and use of electronics in Zambia is negligible by international standards. Even compared to its own GDP or MVA, electronics occupies a negligible part (around 1.2%). There is even less contribution to MVA since there is little local manufacturing activity.

The more visible use of electronics is in the telecommunication segment where its own national programs, along with RASCOM and PANAFTEL are laying an appreciable ground work of communications. Activity in computers is limited to a few government departments, parastatals, and multinationals and has hardly begun to make impact on commerce and industry at large.

2.1.2 Historical

As in most countries, use of electronics in Zambia began with the establishment of radio and telephonic communication in the early stages. After independence, the facilities expanded substantially as the earnings from copper export enabled the import of the required equipment. It is presently claimed that there is 100% coverage of radio, 35% of television and about 90,000 telephone connections.

Along with the growth of the above facilities began some local assembly of radios, then TV and later even some telephone instruments. Prominent in these activities were Philips, IIT, and small indigenous assemblers. However, the activities remained linked to SKD/CKD kits imported from technical partners abroad. No local design capability became established and dependence on foreign partners could not be reduced.

During periods of liberalization of foreign currency and before the Kwacha devalued heavily in 1987, government also canalised imports of these items and these were sold through

retail outlets run by government itself. A survey by Trade Development Authority of India put the Zambian demand in 1986 at 70,000 radios : 15,000 TV : 10,000 recorders.

However, with the tightening up of foreign exchange situation and the steep fall in the Kwacha, imports of complete sets have dwindled and inflow of CKD kits have been strictly controlled. Utilization of assembly capacity dropped and several parties including IIT stopped their assembly activities .

Computers have also been imported mostly for government use to enable the establishment of a socio-economic-industrial data base in various Ministries and administrative centres. Parastatals, railways, airlines too have hooked on to computer usage in recent years. But utilization of such imported equipment remains low due to lack of adequate software and of people to skillfully operate and maintain the systems.

The telecommunication network, generally catalysed by the need for better communications has been able to grow substantially through use of multilateral and bilateral funding. Its growth has not been greatly affected by foreign exchange stringency.

2.2 Electronics Promotion

2.2.1 Administrative Structure

The telecom network planning, investments and operation (including private networks for railways, mines, etc.) are guided and regulated by PTC under the wing of Ministry of Power, Transport and Communication. Professional electronics has as major user the numerous companies under the holding company Industrial Development Corporation [INDECO]. A powerful parastatal responsible for over 60% of the MVA of Zambia. Light and small industry requirements are regulated through the various councils under Ministry of Commerce and Industry.

Zambia's major policies and structures are conditioned by the major issues and considerations of other economic sectors. Electronics has not been accorded separate attention and must fit in with the general policies discussed in Sec.1.3.

If anything, there may be negative promotion of electronics as it tends to be viewed as a luxury and a sophistication to be kept for later consideration. By and large the unavoidable needs of government, P & T, railways, airlines, hospitals, etc. are as users : it has been thought appropriate to allow them to import within the framework of policies and external loans from time to time. Such requirements do not annually exceed US \$ 40 million at worst --- a burden considered manageable.

The question of broad-basing and building up modern electronic capabilities has not been addressed as yet by the

policy makers.

2.2.2 Trade Policies (Ref. Annex.A 12,13,14,16)

Trade policies for electronics have been progressively made more stringent. Except for government and infrastructural needs (which are given special consideration), all other users have to obtain permission to import and also queue up for foreign exchange. When combined with high cost of foreign exchange and the rapid inflation of local currency, even sales and service activities do not appear to attract entrepreneurs. This has compounded the difficulties of maintaining the population of existing equipments.

A summary of the tariff structure for certain key electronic items is given below :

TABLE 5 : MAIN TARIFF STRUCTURE

Group	Import value	Customs ad valorum	Import sales tax	Effective landed value	Local sale tax on landed
Radio	100%	75%	25%	200%	15%
Sound Recorders	100%	75%	25%	200%	30%
TV	100%	75%	25%	200%	20%
Elex.Parts	100%	30%	25%	155%	20%
Tapes/Discs					
Unrecorded	100%	15%	25%	140%	15%
Recorded	100%	75%	25%	200%	30%
Data Proc.M/C	100%	30%	25%	155%	10%
Instrumentation	100%	15%	25%	130%	10%
Private Telecom	100%	20%	25%	145%	5%
PTC Telecom	100%	Suspended		100%	5%

(Source : Interview Economic Adviser, Min. of Finance, Lusaka.)

A broad picture of the levels of reported imports of electronics related items can be had from the import statistics shown in Figure II.

2.2.3 Local Taxation

Over and above the duty, an " Import Sales Tax" of 25% is levied on all items which is of the nature of an auxiliary tax. Further, after these items are imported a local sale tax dependent on the type of item is levied on the landed value

FIGURE II: ELECTRONICS RELATED IMPORTS

	(Million Kwacha)	
	1984	1986
Office Machines	1.80	9.60
Automatic Data Processing	1.10	13.00
<u>Parts</u> of Office M/C	0.75	1.50
<u>Parts</u> of Data Processing	2.00	9.40
Consumer Elex.	1.40	4.70
Telephones & Telegraphs	9.10	56.50
Radio, TV, Telep. Transmitting	14.00	12.50
<u>Parts</u> of Radio, TV, Telephone	1.70	3.30
Medical & Surgical Instruments	2.66	16.35
Elex. Measuring Instruments	2.27	47.92
	36.78	164.77
	2.20	4.20
(Exchange Rate : Kwacha/\$)		
Million \$	16.70	39.20

{Source : Ref. Annex. A 12,13,14}

after paying the import levies. This local sales tax varies from 5% to 30% according to whether the item is considered essential or luxury.

3.0 SPREAD OF USE

3.1 Key Sectors

3.1.1 Communication (Ref. Annex. A 22, 24, 25, 26)

As an important infrastructure for the nation, the telecommunications sector receives special treatment in terms of policy, taxation, tariff, external aid, etc. Post and Telecommunications are handled under the Ministry of Power, Transport and Communication. The operative agency for internal and external communication is the parastatal Post and Telecommunication Corporation (PTC) Ltd.

The critical role of telecommunications in socio-economic development and improvement of the efficiency of all national activities has been recognised in Zambia and PTC has been given special support in this regard --- substantial budgets, exchange availability, exemption from duties, etc. Zambia's participation in PANAFTEL, RASCOM and SADCC programs for the U.N. Communications Decade for Africa, have pushed PTC rapidly on the growth path.

Investments in the Telecom Sector have, for a small population, been substantial --- K 96.7 million during TNOP, K 794.4 million between 1985-1988 and a further K 256.7 million during FNOP. The growth of the network and its service are shown in Figure III. Zambia has raised its telephone density from 0.64% in 1984 to 0.75% in 1989. Residential lines are nearly half the connections and come to 1.5 per 100 households.

Connections with the neighbouring countries by way of microwave links (and in few cases satellite) have been recently established. More distant African countries are linked by satellite. Lusaka is also the "satellite connectivity centre" for the region and is linked via Atlantic Satellite to the Western Hemisphere.

Most of the service, however, is still to the Urban centres and main active towns (Lusaka alone claims 32%). The large area of the country with scant population makes a rural service rather uneconomic. However, Multi-Access Rural Radio (MARR) is penetrating into rural areas around major Urban centres, thus gaining access to the national and international network.

3.1.2 Consumer Electronics (Ref. Annex. A 1, 5, 9, 28)

Zambian National Broadcasting Corporation (ZNBC), under the Ministry of Information, is responsible for all broadcast --- internal and external, radio and television. Possessing 43 Radio

FIGURE III : GROWTH OF TELECOMMUNICATIONS

At the end of 31st March of every year

	Unit	1979	1987	1988	1989
Telephones					
No. of exchanges	No.	46	71	77	85
Equipped Capacity	'000 Lines	42.65	84.82	90.46	92.28
Working Lines	'000 No.	30.37	48.49	50.92	58.49
Telephone Stations	'000 No.	59.50	81.36	N.A.	91.58
Registered Waiters	'000 No.	13.65	26.76	28.81	29.10
Faults/Line/Year		N.A.	2.83	2.06	N.A.
Cleared 2 days		N.A.	30.12	44.37	N.A.
Cleared 7 days		N.A.	61.95	68.50	N.A.
Cleared > 7 days		N.A.	100.00	100.00	N.A.
Operating Revenue	Mill. Kwacha	25.12	406.18	483.60	548.40
Telex					
No. of Exchanges	No.	1	1	1	2
Equipped Capacity	No.	1280	2048	2048	4544
Subscriber Lines	No.	877	1473	2048	2520
Registered Waiters	No.	170	595	637	872
Operating Revenue	Mill. Kwacha	6.32	58.25	N.A.	N.A.

(Sources : Annex. A 16,22)

and 17 TV Transmitters. ZNBC claims to cover 90% of the people by way of radio and about 40% by way of TV. Average national programme availability is over 18.8 hours per day for radio (2 programmes) and 6.6 hours per day for TV (single programme).

Reaching rural areas with programmes of their interest has been an ongoing problem. In case of radio, shortwave broadcast including from neighbouring countries, can provide some material. The introduction of relays or transponders to rediffuse programs at local government centres on FM could be a method.

Television has not yet reached the countryside and awaits the exploitation of satellite actuated transponders to retransmit national programs in to rural pockets.

Recorded statistics show the ownership of radios in 1986 at 77 per 1000 and TV at 15 per 1000. There could, however, be many more sets which have gone unrecorded as they came across borders of surrounding countries by illicit means. Despite it all, ownership does appear low.

Audio and video recorder systems and sound equipment are other items of consumer durables commonly desired even in low income bracket families.

In recent years, the devaluation of Kwacha, high inflation, limited FX availability, and the high exchange rate in the "free" dollar market have severely suppressed demand which can only be enlivened when the Zambian economy revitalizes subject to wise management of its resources.

3.1.3 Professional Sector (Ref. Annex.A 20,27,29)

Use of computers, control systems, instrumentation takes place in a limited way in parastatals and government departments. Even so, the level of use is conditioned by availability of foreign exchange or by particular aid programs.

In 1986, a year of liberal policies, about 23 million Kwacha worth of data processing equipments and parts entered the country. So did nearly 50 million Kwacha worth of measuring instruments.

The position however, fluctuates from year to year. The 1984 imports show only 3 million Kwacha worth of computers and parts and only 2.3 million Kwacha worth of instruments.

Clearly then there does not exist, except in telecom, a planned and defined strategy to use electronics as a consistent agent for modernization. Zambia would do well to undertake such a step perhaps with the help of appropriate international agencies.

3.2 TECHNOLOGY STATUS

3.2.1 In Telecom (Ref. Annex. A 16,22)

The Zambian telecom network has been absorbing succeeding generations of technology along its part of growth. Its network of exchanges comprise :

TABLE 6 : EXCHANGE TECHNOLOGY

Exchanges	1989			1988		
	Nos.	Lines	Waiters	Nos.	Lines	Waiters
Manual	5	150	88	5	150	80
Cross Bar	22	32000	24933	22	31000	22511
Analogy Elex.	50	37226	20451	47	36936	18889
Digital	9	23000	13010	9	23000	10003

In towns, transmission is largely by cable (a natural outcome of its copper resource) : over head lines are not preferred due to a high level of pilferage. The PANAFTEL inter-African connections pass through Zambia by Microwave chains. These, along with its own national links, have greatly enhanced the domestic transmission network in capacity and quality.

Internationally, Zambia can access 72 microwave and 105 satellite circuits connecting it with many African countries and capitals of major nations.

3.2.2 In Professional Electronics (Ref. Annex. A 20,27,29)

In 1984, Zambia had the largest number of "large computers" in Subsharan Africa --- 51 just ahead of Nigeria and Algeria. It was far ahead of all on a per capita basis. NCR and IBM now have local offices selling, softwaring and servicing not only large but mini and micro computers. Due to economic stringency, however, the computer use in Zambia has not grown according to its potential.

Industrial and medical instrumentation of which parastatals are the largest users has also gone through the past process of imports during the liberal regime but a slowing down after 1987.

Major constraints include stringency and control of foregin exchange, devaluating Kwacha, inadequate supply of spares, non-localization of software, and limitation of suitable qualified manpower. Result of all this is the slower tempo of activities in all spheres --- airlines, banks, industry, government, etc. --- and consequent missing of opportunities of advancement.

3.2.3 Overall View On Usage

In its attempts to rehabilitate and modernise its economy, Zambia should not hesitate to make selective use of modern technology. While it may reject purely labour displacing applications --- (Viz robotics) -- it can not afford to miss the technological bus where quality, efficiency, yield, energy conservation and cost can be enhanced by use of electronics (Viz. process controls, better telecom, meditronics, etc.).

Expenditure on electronics as proportion of the output realised from an application is but a few percent. The resulting enhancement in quality and efficiency can pay back that small investment many times over.

While making increasing use of electronics in various segments of the economy, Zambia may keep in mind the following :

- a. Minimise the diversity of various equipments so that spares and maintenance become easier.
- b. Generate software pertinent to local needs rather than use imported but inappropriate software.
- c. Initiate a strong programme of manpower development for electronics and software.

3.3 ADDING LOCAL VALUE

3.3.1 Opportunity Created By Digitalization

The movement of Electronic Apparatus from analog to digital has shifted the cost emphasis from hardware to software. While the digital hardware is of lower cost than analog (often with better performance in the same use), digital technology brings about the need for system analysis, programming, debugging, etc.

This provides an opportunity for value to be contributed in the recipient country even when the hardware is imported. Some of the indicators of advantages are :

- a. In many cases, the hardware is reasonably standard and low cost --- for example, well known Personal Computers, well established "add-on" cards, certain mass-produced chips, etc.
- b. Depending on the complexity of the application, these can be put together in various innovative ways without having to go to the step of manufacturing.
- c. There is quite a large complement of system engineering, custom programming, etc. to be done based on user need.

- d. To do all this does not call for a forbiddingly large set up. The main component being "brainpower".
- e. So called readymade solutions through import may be less than optimal for local needs.
- f. Cost of imported software is high and rising fast.

3.3.2 Possible Approches

An approach to achieve added value could be "system house" concept where consulting groups (or representatives of foreign suppliers) are able to locally add the "brainware" value to imported systems. The motivating factor could be the sale of hardware and source codes from which the local system is developed and supplied. The motivation could be further emphasised by raising import duty on the application software component and on-site installation, testing and debugging.

Large public sector plants in other industries (not electronics) may need to insist on the plant supplier to perform maximum of the downstream activities (system integration, software, installation, debugging) in local currency. This could be one of the factors in evaluation of tenders for large plants.

In case of informatics requirements of the government itself (telecom, socio-economic database, railways, etc.) the more difficult option of building up internal expert teams or missions may have to be taken. The requirements would be continuous and substantial; the savings in foreign exchange and real costs could be impressive; building up of internal expertise would lead to long term benefits.

3.3.3 Software Manpower

The above approach will however require competent manpower to undertake these tasks. At present, education in software and system analysis is essentially non-existent. It will be necessary to quickly establish such specialties at all levels --- degree, diploma and short-course certificates.

Fortunately, software training at the applications level requires mainly a background of rational and logical thought process. Electronics is not a pre-requisite. Applications knowledge can be obtained by people from other disciplines and at various levels of sophistication.

Thus, the government needs to generate a well thought out policy in the use of electronics at the earliest. The policy should incorporate the important linkages with other sectors and activities, and the important role of software in making electronics useful and paying.

3.4 Encouraging Manufacture

3.4.1 Market Size

From available data, an optimistic estimate of the level of annual import of electronics in recent years falls in the range US \$ 35-40 million of which almost half is for PTC. Considering the variety of items and different sources of supply, it would be clear that the scale of any single requirement cannot justify in-depth manufacture. Zambia is likely to remain mainly a user of electronics until its economy as a whole re-establishes itself on a growth curve in real terms.

3.4.2 Government Role

However, there does not seem to be much to loose (and there may perhaps be a lot to gain in terms of growing competence) if the government were to completely liberalise the import at negligible duty & taxes of electronic components (not sub-assemblies) and also of software. The advantages would be :

- a. Free flow of components would improve dramatically the level of maintenance and beneficial use of existing electronic apparatus.
- b. Inflow of software would encourage widespread familiarity in the use of computers and other digital industrial apparatus.
- c. Ready availability (at low duty) of all types of components would encourage assembly of simpler equipments since they could be offered competitively to imported equipments (which are at higher levels of duties)
- d. Create local activity and hence growing competence in electronics use and application.

Liberal import of components may burden the import bill by no more than US \$ 10 million. However, value derived through better maintenance and local production of simpler equipments will be several times this amount.

Manpower development through education and training in various levels of electronics design, applications, maintenance and software is a lacuna that needs to be filled at the earliest. The sole degree course in Electronics and Telecommunication is at University of Zambia which puts out no more than a dozen graduates a year. There are two institutions providing electrical diploma (2 year) level training and about four certificate short term courses. The contents of these courses may need to be re-aligned and updated to include systems analysis and software.

4.0 CONSTRAINTS AND PROSPECTS

Zambian economy as a whole is undergoing a phase of rehabilitation and restructuring after troubled times in the 80's. In real terms, GDP per capita, inflation, exchange rate, foreign indebtedness, etc. have shown continuing adverse trends which will take some time for correction and stabilization.

The main thrust of the policy embodied in the Fourth National Development Plan 1989-1993 (FNDP) is directed towards rapidly improving local MVA in resource-based sectors --- agro-industries, wood products, metal manufactures, essential consumer goods, etc. To this end investment policies are being liberalised in areas which can achieve substantial progress in reducing import dependence and/or enhancing value-added exports.

As far as electronics is concerned, the main constraints to wider use/manufacture are :

- a. Other sectors mentioned above are receiving major attention and resources.
- b. It is not clearly realised that electronics has to play an important role in modernising other sectors.
- c. In times of FX stringency, the needs of electronics take second place as it is considered a "luxury".
- d. Due to devaluation of the Kwacha and high duty structure, the high cost of imported electronic items discourages users from utilising them.
- c. Maintenance of electronic equipment is a problem due to difficulty in quickly getting components and spares.
- d. Software capability is not sufficiently developed locally to take full advantage of the power of digital electronics and informatics.
- e. Limited facilities for education and training in electronics, telecommunications and software. Annual output of such people may be a dozen or two.

Wider use of electronics is firstly dependent upon an improvement in the basic economic sectors so as to direct the motivation and resources towards electronics. Even under favourable circumstances the potential electronics market is not large enough to enable local manufacture in depth. For the present, Zambia cannot aspire for export market in electronics until it pays attention towards developing local capabilities first.

To maximise the benefits of use of electronics, the above constraints need to be overcome at least partially. In the interim, liberal and low tariff import of components will be a small price to pay for seeing and catalyzing electronic activities so that they can build up in the short term and be in readiness to be exploited when the economy as a whole grows healthily.

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