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# 14788

GALITAM SONI

Kenya.

STATE OF THE ART OF MICROELECTRONICS APPLICATIONS  
AND SOFTWARE DEVELOPMENT IN KENYA

INTRODUCTION

The paper is based on a survey of the state of the art of microelectronic applications and software development in Kenya, through visits and discussions with relevant agencies of the Government, R & D, academic and industrial organisations. In view of the short time available in which this survey had to be conducted, namely, 31st January, 1985 to 14th February, 1985, useful background information has been obtained from certain earlier studies, in particular, the reports of Subramanian prepared in 1982, for an earlier UNIDO mission to study the development of electronics in Kenya. The scope of the present paper, however, is more specific since it is restricted to the development of 'microelectronics'. A list of persons met and organisations visited is given in Appendix I. The characteristics and activities of each of these organisations is summarised in Appendix II. The author would like to put on record his appreciation to the National Council for Science and Technology (NCST) for providing him office space and a base from which to operate in Nairobi. Such an arrangement considerably facilitated the total involvement of the author in the planning and preparation of the meeting. Thanks in particular are due to Dr. F. Wangati, Secretary, NCST and Mr A. Onyango, Science Secretary, NCST for their complete support and co-operation. Finally, the author would like to thank the sponsoring organisation for making the trip possible and UNDP officials in Nairobi for their assistance and help.

Background Information

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The Kenyan Government has been aware for sometime for the need to develop a viable technological base in electronics. Consultancy support towards meeting this objective has been provided by UNIDO who supported 2 significant studies in the past, the first by ICME Business Consultants, Switzerland in 1981 and the second by Subramanian who prepared a series of reports on behalf of UNIDO covering the demand profile for the decade (1980-1990), the human resource needs to support these requirements and policies and

strategies to achieve this objective. In addition, to the above UNIDO sponsored studies the Kenyan Government had commissioned a separate study by the Electronics Trade and Technology Development Corporation (ETTDC), India. The reports of ICME and ETTDC had the same terms of reference, the central theme being the setting up of a Kenya Electronics Development Centre (KEDEC). Both these reports were reviewed by Subramanian, in the latter half of 1982, wherein he had pointed out certain limitations in the KEDEC concept and suggested alternative approaches. In addition, a pre-feasibility study was also prepared by him for the setting up of an Electronics Complex for the production of telecommunication equipment as a fully owned subsidiary of the Kenya Posts and Telegraphs Corporation (KPTC). This project, it is now believed, has been shelved since the Kenyan Government as a policy would not like to encourage investment in a fully owned Government Corporation and would prefer to encourage investment in the private or joint sector. The demand projections made in the above mentioned studies provides a useful perspective to the electronics scene in Kenya and would be summarised subsequently in the report. Similarly, Part III of the report had recommended the setting up of a "Centre for Electronics Design" as a part of the Kenya Industrial Research and Development Institute and is considered relevant by the author as a part of an overall strategy for the development of microelectronics. Finally the report on the development of informatics, titled "Computers, Kenya" published in 1982 by Prof. Scott, Institute of Computer Sciences, University of Nairobi provides an extremely useful quantitative and qualitative summary of vendors, users, service bureaus/software houses together with the existing manpower base in computers and therefore is of considerable relevance as a basic planning document in the development of an informatics strategy for Kenya.

#### Electronics In Kenya

The total market for electronics in Kenya is expected to grow from a base of KSh 546 million in 1980 to KSh 1500 million in 1990 or approximately a threefold growth. Consumer electronics and communications equipment could continue to constitute approximately

37% and 40% of this market, respectively. According to Subramanian the data processing sector would grow from KSh 41 million to KSh100 million in 1990, but this estimate appears to be erroneous since the market in Kenya was currently estimated to be \$15 million (KSh 240 million) per year and growing at a rate of 20%. In Appendix II the requirements of the KPTC during 1982 - 86 and 1986 - 1990 have been estimated. In the case of the consumer sector the market for radio sets is likely to increase from 200,000 sets in 1982 to 400,000 sets in 1990 and this would need an effective doubling of the assembly capacity. The requirement of colour and monochrome TV is not likely to exceed 50,000 sets by 1990. The prices of radio sets and TV sets are at present extremely high in Kenya and a policy for local assembly needs to be evolved to ensure that radio sets (1 to 3 band) and monochrome TV sets are made available at prices which stimulate their demand, thus making more effective use of the broadcast coverage in the country.

The installed base of mainframe computers (mini and above) has been estimated at 180 systems in 1984, while that of microcomputers was estimated at 1000 systems. While the overall market is growing at the rate of 20%, the growth of the microcomputer sector is higher. The current employment in the informatics sector has been estimated \* by Scott to be 2000 with the following breakup:

Data Processing Management	68
System Analysts	172
Programming	223
Operators	474
Data Control	190
Data Entry	<u>891</u>
Total	2,018

\* The estimate was made in 1982 and the figure in 1984 is closer to 4000.

Human Resource Requirements

Subramanian has estimated that the total employment in the electronics sector was 14,000 in 1980 with the following breakup:

Communications	7000
Assembly of Radios and TVs	1000
Computer Services	2000
Service Sector (Retail Trade and Maintenance)	4000
	<hr/>
	14,000

The forecast for personnel requirements in the electronics sector as a whole is expected to grow from 14000 in 1980 to 32,000 in 1990 and the profile of requirements is summarised below:

	1980	1990	1990	1990
		Service Sector	Mfc Sector	
Graduate Engineers	600	900	310	1,210
Qualified Technicians (Diploma Holders)	600	900	315	1,215
Skilled workers	2,400	3,600	1,250	4,850
Unskilled workers	7,800	11,700	4,060	15,760
Administrative	600	900	315	1,215
Computer Services	<u>2,000</u>	<u>8,000</u>	<u>-</u>	<u>8,000</u>
	<u>14,000</u>	<u>26,000</u>	<u>6,250</u>	<u>32,250</u>

### Conclusions and Recommendations

The projected requirements in electronics in Kenya clearly do not warrant a hardware oriented strategy for the microelectronics industry and this is particularly true with regard to the manufacture of standard general purpose components. However, there is scope for rationalising the structure of assembly of consumer electronic equipment in the country both in terms of better value addition and pricing. In terms of pricing both consumer electronic equipment and computers currently are 3 times the international price which militates against the development of the industry, in view of its sensitivity to price elasticity of demand. There is scope for setting up manufacture in the country of EPABX's, telephone instruments and 2 way communication equipment, but economics of scale clearly militate against manufacture of central digital switching equipment.

In Kenya, therefore, the strategy for the development of micro-electronics should be primarily to encourage systems integration and the interfacing of microprocessor based hardware together with the development of an autonomous software industry. It has to be remembered that software and its maintenance today constitutes 80% of the cost of a computer system. The major use of computers in Kenya and the region is currently oriented towards business applications and that too under the control and direction of MNC's which provide an integrated hardware and software package i.e. a virtual blackbox. Consequently, there is a need to promote the development of real time computer applications preferably on a nodal basis in the meteorological, transportation and energy sectors. In order to achieve the above objectives it would be essential to 'unbundle' the software from the hardware. Internationally also the trend has been to separate the production of 'hardware' from 'software' and this is especially true in the case of micro and minicomputers. A twofold strategy is called for (a) to encourage local effort at systems integration 'a la Comprite' (b) to facilitate the import of software in 'source code' so that it is feasible to upgrade, maintain and modify it locally. It is also important to create a computer aided design base in the country for the engineering sector as a whole and electronics in particular. Finally there is need to upgrade the government computer centre which is primarily used as a government service bureau and convert it into a National Informatics Centre.

RECOMMENDATIONS

1. In view of the impending 'digitalisation' of KP&TC's network there is a need for upgrading the capabilities of the Central Repair Depot both in terms of equipment/facilities and manpower. In addition KPTC would have to set up a 'software centre' in order to maintain its central office exchanges in the coming years. Preparations need to be initiated in order to prepare for data communications and action at a regional level initiated in order to evolve common standards between the various PTT's in the region. UNIDO should provide consultancy support in conjunction with ITU after making a precise assesemnt of KPTC's needs.
2. There is a need to implement the recommendation made by Subramanian in Part III of his report to set up a 'Centre for Electronics Design' as a part of KIRDI along the lines suggested in Appendix II of this paper. Such a centre would need an investment of \$1 million in terms of hardware. The objective is to create a basic capability in hardware interfacing, software development for microprocessor based applications and assist in building a capability for systems integration efforts in the country. UNIDO should provide consultancy support to draw up a detailed project report. Simultaneously, action should be intiated to fund the project through the UNDP programme.
3. There is a need for greater synergy between the department of electrical engineering , the Institute for Computer Sciences and the Physics department of Nairobi University. While the 'York linked project' is a noteworthy development, supplementary funds should be found to build up a micropo cessor applications laboratory by the acquisition of more MDS systems and microcomputers with networking capabilities. A M.Sc. course in microelectronics which covers both solid state technology and system engineering should be established with participation from all 3 departments. Further, the Institute of Computer Sciences in conjunction with the Electrical Engineering department should

start both a B. Sc. and M.Sc. level course in computer sciences. Emphasis at the University should be more on the development of real time applications rather than business applications.

4. There is a need to devise policies to 'unbundle' the hardware from the software in computers in consonance with international trends, especially, with regard to mini and microcomputers. Differential tariffs need to be introduced in favour of systems integration as opposed to the import of complete systems. The import of software, particularly, operating systems software in 'source code' should be allowed to be imported free of duty. Such an approach would provide the necessary filip for the development of a local software industry since it could enable the upgradation and maintenance of such software locally. MNC's selling mini & microcomputers should be asked to quote seperately for hardware and software, so that each of these can be taxed at a higher rate of duty, if it is imported as a complete system. In the case of software imports in a high level language a high rate of duty should be levied.
5. The role of the government computer centre should not be merely that of a service bureau but it should be augmented to that of a National Informatics Centre. The objective of such a centre should be to develop large data bases and associated software together with being a systems consultant to government department in their computerisation plans. Excellent models to emulate are the National Informatics Centre in India and in Tunisia, both of which were established through UN funding. UNIDO could provide consultancy support in the preparation of a feasibility report for such a project.
6. In order to meet the personnel requirements for the electronics industry, a well coordinated plan of action at a national level needs to be devised with the participation of various educational institutions to cover the entire spectrum of projected needs in this area.



7. In the area of consumer electronics if local assembly of radios and monochrome TV receivers is to be encouraged a suitable set of policies would have to be devised to ensure both price reduction and higher value addition. It is suggested that a 'pack value' approach be adopted for a limited number of models in each case. Within this 'pack value' imports of general purpose components e.g. ICS, transistors, diodes, carbon/metal film resistors and capacitors, should be placed on open general licence in the import policy at a low rate of duty, since these components would not be produced in the country. On the other hand import of PCB's foil varcos, loudspeakers and transformers & coils should be restricted and adequate protection provided for their local development. The sales tax on this class of products should not exceed 15-25% so that such equipment is produced within the country not in excess of 75% of the FOB prices. Such an approach, appropriately devised and implemented, could ensure both price reduction and greater value addition together with integrated development of the industry.
8. The current prices of locally available micro and minicomputers is almost 3 times the international price. By 'unbundling' the hardware and software of a system the objective should be to achieve price reduction through local systems integration & software development to a level not exceeding 75% of the international price.
9. A <sup>n</sup>odal agency needs to be created by the government to oversee the development of microelectronics in all its aspects and ensure proper coordination.
10. There is a need for much greater regional cooperation in this area in order to utilise regional resources in the most cost effective manner. Potential areas of cooperation are Communications, Manpower development and Informatics.

APPENDIX I

ORGANISATIONS VISITED

1. C R S Aloo  
Assistant Head of Telecommunications  
Services/PD&E  
KP&T Corporation  
P O Box 30301  
NAIROBI (Tel. 27401 Ext 423)
  
2. Central Repair Depot  
KP & T Corporation  
(Att: Mr Ghore, Tel 24930)
  
3. R Talib  
Managing Director  
COMPRITE  
P O Box 41043  
NAIROBI  
Kenya (Tel. 555422)
  
4. J Chaudri  
Area Marketing Manager  
East Africa,  
Agip House  
NCR(K) Ltd  
P O Box 30217  
NAIROBI (Tel. 333855)

5. **Mark Martyn-Fisher**  
Senior Account Manager  
Commercial/Industrial Systems  
Agip House  
Haile Selassie Avenue  
P O Box 30217  
NAIROBI
  
6. **Mr J M Hungu**  
Director of Industries  
Corperative House  
NAIROBI  
(Tel. 340010, Ext 269)
  
7. **Mr Nzomo**  
Senior Technical Officer (Electronics)  
Ministry of Commerce & Industry  
UCHUMI House  
NAIROBI
  
8. **Prof Bob Scott**  
Director, Institute of Computer Science  
P O Box 30197  
NAIROBI  
(Tel 43181)
  
9. **Prof Otieno Malo**  
Proffessor of Physics,  
University of Nairobi  
P O Box 30197  
NAIROBI  
(Tel 43185 Ext 292)

10. **Er W H Drake**  
Department of Physics  
University of Nairobi  
P O Box 30197  
NAIROBI  
(Tel 43185 Ext 288)
  
11. **J T Gatere**  
Director  
Sanyo -ARMCO  
Lunga Lunga Road  
P O Box 18263  
NAIROBI  
(Tel. 558718)
  
12. **S Bitew**  
Sales Operations Manager  
IBM  
Silopark House  
P O Box 30324  
NAIROBI
  
13. **R F Turnbull**  
Sales Director  
ICL  
Bruce House  
NAIROBI
  
14. **John Carling**  
Data Centre Limited
  
15. **Mr J Wouters**  
Managing Director  
Phillips (K) Ltd  
Off Lunga Lunga Road  
(Tel 557999)

16. Mr S Ali  
Manager  
UNIDO Project  
UCHUMI House  
NAIROBI
  
17. Dr Arunga  
Director  
KIRDI  
NAIROBI
  
18. Dr M O Adongo  
Head, Department of Electrical Engineering  
University of Nairobi  
NAIROBI

BRIEF DESCRIPTION OF ACTIVITIES OF ORGANISATIONS VISITED

K.P & TC

A basic decision has been taken by the Corporation to go in for 'digital switching' during the period 1986 - 1990 commencing with the major urban centres and subsequently to spread out over the rest of the country. KP&TC plans to increase the exchange capacity from 104,277 lines (1980) to 232,230 in 1986 and the number of connections will correspondingly increase from 73,932 to 170,000. KP&TC has also planned access to telephone service in rural areas by increasing small capacity rural exchanges. The 1982 - 1986 plan envisages addition of 86,000 lines (81,000 automatic), 5000 (trunk terminals), 2040 microwave channels and 1272 multiplex channels. The addition of terminal equipment would be 75,000 telephones, 1000 telexes and 140 data modems. In financial terms this is expected to cost \$69.6 million in foreign exchange, out of a total proposed expenditure of \$150 million for the entire programme. The proposed expenditure on foreign exchange for the period 1986 - 1990 is estimated at an additional \$200 million. The total market for the telecommunication sector for Africa as a whole has been projected at \$1.17 billion (Frost and Sullivan) of which switching and transmission constitute 14% and 25%, respectively.

The Central Repair Depot of KP&TC, primarily, repairs transmission and multiplex equipment. Each equipment has its test jigs and faults are located using a logic probe, with board level repair being done manually. It is a very small operation consisting of a few engineers supported by 10 technicians. The diagnostics and test equipment capabilities will have to be augmented significantly if repair of digital switching equipment is proposed in the future. The qualifications of the staff would also need to be upgraded correspondingly. At present the software capabilities at KP&TC are

quite limited but with the advent of data communications in future these would also need to be developed. There is need for a regional plan for standardisation among different national PTT's to ensure compatibility, as these new requirements develop. UNIDO could provide support in conjunction with ITU after making a precise assessment of KP&TC needs.

Kenya Industrial Research and Development Institute\*

The institute is administratively under the Ministry of Commerce and Industry but with linkages of the board or management, with the NCST and the Industrial Services Advisory Research Committee. Project proposals are submitted to the board after they are technically vetted by the R and D committee. The work at the Institute presently covers food technology (The Director, Dr A runga is a food technologist), ceramics, textiles & fibres, chemicals & leather. On the engineering side there are electrical, mechanical, chemical & civil engineering wings. The electronics division has been spawned recently with 2 professional staff, one of which is being trained in the UK. Proposed activities in electronics are to cover maintenance and repair of instruments and the design of instrumentation in future.

In this context, Part III of the report of Subramanian is extremely relevant. The report recommends to initiate work in 2 areas, HF/VHF (including video) and microprocessor based applications including the industrial process control sector. The primary advantage of locating the activity in KIRDI was its existing infrastructure in terms of machine shops, tool room and finishing facilities as well as its charter. In order to support these activities further it was proposed to set up a PCB prototype line with a plated through hole capability - (investment \$170,000) and a transformer & coil winding shop (investment \$65000). The other major hardware investments would be a HF and VHF laboratory (\$200,000) and a microprocessor applications laboratory to develop both software and hardware interfaces for industrial applications. In addition, it would be useful if a prototype laboratory for hybrid microcircuits is also added in Phase 2. The likely additional investment for this in terms of hardware would be \$200,000.

\* KIRDI has been identified as a possible Centre for electronics design for which a definite need exists

Subsequently, CAD capabilities could be superposed on the institute's computer (leased or otherwise) so that the design layout of both PCB's and hybrids could be done locally, an important requisite for the development of microelectronics hardware. The objective of the project could be to create a threshold level of competence in hardware interfacing and design. Such a capability does not currently exist in Kenya but the 'York linked' project being implemented at the Nairobi University comes close to it though within the context of a University environment. UNIDO should provide consultancy support for drawing up a detailed project proposal. Simultaneously action could be initiated to fund the project through the UNDP country programme. The project would need a hardware investment alone of \$1 million. Such an approach would not only create a basic microelectronics capability for hardware interfacing and software development but would assist in building a capability for systems intergration effects in the country.

KIRDI currently has a staff strength of 200 of which only 30 are professionals. The budget of the institute is currently KSh1.2 million of which 50% goes in salaries. The institute will shift to new premises when buildings are completed on the new site where work is about to commence.

#### University of Nairobi

There are 3 departments in the University of Nairobi who are involved in the development of manpower for microelectronics and informatics. These are the Department of Electrical Engineering, the Institute of Computer Sciences and the Department of Physics. While each of them is doing good work in its own sphere, the synergy between them needs to be increased so that a composite M.Sc. course covering both the hardware and software aspects of microelectronics can be designed and established. The present activities of each department are summarised below:



(a) Department of Electrical Engineering (EE)

The Department of EE is headed by Prof Adongo and produces approximately 15 graduate electronic engineers per year. The courses cover microwave and antenna propagation, communications and digital electronics, with limited facilities for being trained in the development of microprocessor based applications since a few MDS systems are available. The other stream in this department is concerned with power engineering. Given the emphasis, the largest employer for the electronics graduates, is likely to be the KP&TC.

(b) Department of Physics

The institute runs courses in applied electronics including solid state electronics and their current output in this area is 15 graduates per year. However, the department has taken a lead in conjunction with York University, UK to establish a programme to use microcomputers in scientific experiments for on-line applications which would need a base in hardware integration capabilities. The broader goal of the project is to provide computer literacy to undergraduate students in the University. The project is likely to run over a 3 to 5 year period with a total funding level of £400,000 to £600,000 and could consist of both a hardware and training component. The hardware would consist of 8 to 16 bit microcomputers to be inducted at a rate of 15 systems per year year (£16000). In addition, it is proposed to set up a PCB prototyping facility (£10,000 additional), with £25,000 for hardware diagnostics, namely, logic analysers and test equipment. There would be approximately 13 - 18 short term exchanges per year for training during the course of the programme. The programme is funded by the UK under bilateral aid. The concept is modelled on a similar experiment done at York University which was quite successful. However, in terms of software development this would leave a gap since there is no

provision to set up a software centre for microprocessor based applications along the lines suggested by Oliphant. It would, therefore, be useful to provide complementary assistance to the University for the purchase of adequate number of MDS systems and microcomputers with networking capabilities. UNIDO assistance for such a project deserves serious consideration, perhaps, jointly with UNESCO. An important point to be noted here is that Prof. O. Mailo (Physics) heads the Steering Committee, which includes both Prof Scott (Computer Sciences) and Prof Adongo (EE).

(c) Institute of Computer Science

The University Computer Centre is managed by the institute and has an ICL 2950 with 36 visual display units. In addition this institute offers the only full time practically oriented post-graduate diploma course in East Africa. There are 6 academic posts of which 4 are filled, with 2 abroad on training. At the systems analysis/programmer level the 4 senior positions remain unfilled, primarily, due to low staff salaries. The intake to the course would be 18 in 1984/85. UNESCO has given 2 scholarships for the training of trainers. The Government Computer Centre also sponsors 2 candidates every year. It is proposed to introduce 3 courses in 1985 in systems software, management planning systems and software engineering. The tuition fees are KShs.29 000. The institute proposes to upgrade their present system with a VME facility so that it can support Fortran 77. The proposed investment is £ 1.6 million. The budget of the institute is £96,000/year excluding maintenance and salaries.

The institute intends to instal 5 personal computers, namely, NCR's (Decision Mate V), IBM's (PC), ICL (PC), Apple's (Mackintosh) and Comart for which it is looking for a £10,000 grant. It also intends to acquire Video Recorders , TVs etc. (£7000) in order to introduce the Open University Software for computer teaching. A proposal has also been made to host a college of applied informatics on a regional basis under the TCDC scheme.

While, the Institute represents a pioneering effort in human resource development in East Africa it seems to have become somewhat static over the years. It is not clear why no B.Sc. and M.Sc. courses have been introduced to produce a more rigorous training at the University level since it is high level human resource development which in the long run is going to create a autonomous software base in microelectronics in the region. Resource constraints seem to have partly come in the way in upgrading both the hardware and software base and in building a contemporary programme support environment which is suitably equipped with the requisite software tools. UNIDO should provide support in preparing a plan of action for suitably augmenting the Institute's capabilities in order that it can play a more meaningful role in developing the region's software capabilities.

#### System Vendors

The major system vendors in Kenya and the region are ICL, IBM, NCR, WANG and Comprite in terms of mainframes. In terms of small business computers the common models are Comart, Wang, IBM, ICL, Decision Mate V, Olivetti M20.

##### a) NCR

The company has a staff of 80 people and its turnover in 1983 was KShs 80 million. The total Kenyan market according to them was \$15 million a year and growing at a rate of 20% per year. The company employs 20 degree level engineers in its engineering support division. All boards are repaired locally. NCR embraces the philosophy of providing a total service. There education centre runs several courses varying in a duration from 4 days to 4 weeks (excluding users). In Kenya because of the duty structure a computer costs 3 times the FOB price and this was a inhibiting factor supressing demand. They have a software support group which is developing a tour costing system (for tour operators)

and a hotel reservation system. The company has 30% of the market share and covers micros (Decision Mate V), Super Micros (Tower XP), minis (9100) and midis (9300,9400). The regional office for East Africa is in Nairobi.

(b) ICL

The oldest vendor in Kenya with 30% of the market here and claims to have 50% of the installed base. The best selling series is the DRS20 (networking capability) and the ME29. Total sales are approximately £4 million a year and the company employs 65 people. The office in Nairobi serves the whole of Africa including Egypt, Sudan and South Africa.

(c) IBM

The company's main thrust seems to be government sales of large systems. Thus, the government Computer Centre which is run like a government service bureau has 2 IBM mainframes, a 370/138 and a 4331. Their largest installation was commissioned in 1984 with Ethiopian Airlines and uses 2 IBM 4361 machines. The regional office for East Africa is Nairobi. Total number of employees is around 60.

(d) Comprite

The only company in Kenya and probably in East Africa doing systems integration. Their system is called CR7 and consists of a NOVA compatible CPU from Bytronix and second sourced peripherals from various vendors. They have purchased IPI's operating system. Software for business applications to support the CR7 has been developed in-house. Their biggest installation is with D.T. Dobie. The company also runs a service bureau based on 2 Burroughs machines, namely, the 3500 & 3700. They are also the agents for Apple and provide local maintenance support. The total number of employees is around 80. It was not possible to delineate the precise extent of their hardware/software

capabilities but they are presenting a paper at the meeting. However, there is a definite need to support the unbundling of hardware & software and such activity needs to be supported through suitable government policies, as a bulwark against total MNC dominance which is inimical to the creation of an autonomous software industry in the region.

(e) Sanyo-ARNCO & Philips

Between them they dominate the consumer electronics market for radios, radio cassette recorders, B&W TV and Colour TV. Radio assembly is done on a CKD basis using manual soldering techniques with the wooden cabinets of the larger models being fabricated locally. In the case of B & W TV the production is based entirely on SKD assembly. The prices of consumer electronic equipment is at least 3 times the international price, primarily, due to the high rate of import duty and sales tax. In view of the relatively high broadcast coverage for both radio & TV in Kenya such a policy militated against demand, standardisation, vertical integration in terms of components and local value added.