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WEST-AFRICA: PRE-FEASIBILITY REPORT ON THE ELECTRONICS INDUSTRY

M66-1171

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The terms of reference were prepared by the secretariat. For this purpose, the secretariat drew from the report of the West African Industrial Co-ordination Mission (document E/CN.14/246), the recommendations of the West African Conference on Industrial Co-ordination held in Bamako 5 - 15 October 1964 (document E/CN.14/324, E/CN.14/INR/78) and the Symposium on Industrial Development in Africa (document E/CN.14/347, E/CN.14/AS/VI/7).

The study is based on data assembled by the expert from field work in West Africa during June-July 1966.

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INTRODUCTION

In pursuance of the recommendations made by the Conference on Industrial Co-ordination in West Africa (October 1964), the Secretariat of the Economic Commission for Africa decided to undertake further pre-feasibility studies. This report covers the possibilities of establishing electronic industries.

The report deserves general preliminary remarks.

1. Electronics although applied nowadays to many fields remains mainly connected with communications.

Communication in the broader sense of the word is like energy and transport, one of the basic infrastructures that a country must build to guarantee its development.

Communication as understood here refers to the possibility of channelling information of any nature from one point to another, in the shortest possible time, without alterations and misinterpretations. This communication must also be simple, reliable, safe and economical.

It brings to the disposal of the country the indispensable tool to develop its economy but it also gives to the government a powerful means of informing and educating the population.

In this respect, radio and television should no longer be considered as pure entertainment devices but rightly as an essential communication means. As such, they are of primary importance particularly to developing nations.

2. The application of electronics to numerous fields of activity is in perpetual development thanks to the immense fundamental researches carried out endlessly.

In the coming years, electronics will influence more and more deeply many sectors of the economy. No one nation can, consequently, afford to disinterest itself in the problem related to electronics.

3. This pre-feasibility report is based, as requested by ECA, exclusively on technical and economical considerations.

However, decision to implement industries is also based on many other factors resulting from the policy governments want to conduct.

The quite natural wishes towards industrialization might be unbalanced by the desire to provide the countries with essential equipments in the fastest and the cheapest way.

For instance, equipments for telecommunication, brcadcasting, etc... should preferably be imported if governments consider that more vital infrastructural work should be completed without delay. The industry manufacturing these equipments are so specialized that the "running in" period will be rather long and investment large.

On the other hand, for these industrial equipment, the exploitation costs namely efficient use, maintenance and service, might be a valuable argument in favour of local assembly or manufacture because this will help considerably the training of technicians. It is a fact that exploitation costs are generally much higher in countries which suffer from a lack of properly trained technicians.

In the so called Consumer Electronic field, although economically and technically feasible, Governments might abandon temporarily industrialization if they consider it essential to see the major part of their population in possession of radios and TV's in the shortest possible time. Borders wide open to imported sets and fierce competition amongst large production centres might achieve this aim quicker than local industry.

4. Although sound industry must be able to function economically without excessive protection, to help the starting of the operation some kind of protection has to be considered, while the factory has not yet reached its optimum production and efficiency.

The protection can be in the form of tax holiday and relief of Import Duties. This has immediate consequences on the financial balance of the country as Import Duties represent in West Africa the major source of income for the governments.

It is therefore an important point to take into consideration before implementing an industry.

Protection in form of prohibition of import is mostly inefficient for Consumer Electronic Products as it favours illegal imports. Moreover, competition with imported goods is an incentive for the local producers to keep up with foreign standards of quality, performance as well as prices.

CHAPTER I

CHARACTERISTICS AND CLASSIFICATION OF THE ELECTRONIC INDUSTRY

A. Characteristics of the Electronic Industry Taken from the Industrialization Point of View

(a) Technological Development:

This is a fundamental characteristic of the electronic industry. Continuous fundamental researches are very rapidly applied to the industry, and very rapidly render obsolete techniques and equipments. For example, it should be recalled that the introduction of transistors has completely changed the pattern of the radio market. Nowadays, researchesmade on Integrated Circuits, for instance, have reached such an advanced stage that their application on a sizeable scale can be expected in the next decade and a half, and it is obvious that at the moment this will happen, it will have immediate consequences, not only on the products concerned, but also on the equipment installed in the factories and on the feasibility of local and even sub-regional electronic productions. (See Annex III on the trend of technological development).

(b) Raw material

Raw material does not play significant role in the products and is hardly existent in the countries considered.

(c) Labour

The production techniques of electronic apparatus and/or parts are constantly improved to reach ever increasing quality and ever-decreasing cost. This can only be achieved by a high degree of mechanization, with the result that the labour cost constitutes only a minor and decreasing part of the cost price of the product.

However, the qualification of the personnel employed must reach a high standard to assure the continuous proper functioning of the equipment, as well as the maintenance.

Labour consequently requires a high degree of specialization, which can only be obtained by long and effective training.

(d) Equipment

For the reasons stated above, most of the equipment and know-how have to come from abroad. Generally, the equipment is so very specialized that very often it is designed and manufactured by the large enterprises which produce the electronic product itself.

(e) Management

One should emphasize the very essential role that management play in this type of industry, which requires long term planning control of stocks, efficiency in the production, constant quality level, intricate financing problems, and constant adaptation to market and technological conditions. A very strict accounting system is also imperative to keep the production costs under permanent control.

(f) Financing

Financing industrial development requires both equity capital and loans to finance capital equipment, know-how and other elements. Risk can be considerable, especially in a sector like the electronic industry, where changes both in know-how and markets are fast and often unpredictable. In view of this risk, only projects that are profitable can attract sufficient capital both locally and abroad.

An important support for financing such an industry are national and international development finance institutions. However, they cannot solve the whole problem. Finance will also have to be supplied by those enterprises that can supply the know-how, in order to assure their active participation to make the industry profitable.

B. Classification of Electronic Industry

The electronic industry is extremely diversified and touches a large part of the economy in all countries. For this analysis, the field of electronics has been divided into:

(a) Consumer Electronic Products

By Consumer Electronic Products, we understand all kinds of domestic appliances, of which the following items will be analysed individually, because they constitute by far, the most important items in volume.

(i) Radio : including transistor radio, valve radio and radiogram,

(ii) Television : of all sizes of picture tubes, and including also valve and transistorized TV,

(iii) Electrophones : mains and battery operated,

(iv) Tape-Recorders.

All other electronic products for domestic use, such as intercoms, walkie-talkie, small amplifiers, electronics in household appliances, etc... will be neglected in this analysis, as they do not represent any substantial volume.

(b) Industrial Electronics

Industrial Electronics constitutes in itself a very broad field of products. For this analysis, these have been divided into:

(i) Telecommunication

- Radio telecommunication equipment, including transmitters for broadcasting systems (TV and sound), microwave equipment including associated carrier equipment.
- Telephony equipment, including switching and telephone instruments.

(ii) Measuring instruments required for laboratories and industry. Due to the diversification of this type of equipment, it is impossible to analyse each type individually.

(iii) Miscellaneous: Including the electro-medical apparatus, defence instruments, etc...

(c) Parts and Components

These are the products which are necessary for the manufacture of electronic devices and for the servicing of electronic equipment. They include, up to this moment, namely transistors, tubes, picture tubes, coils, resistors, condensers, loudspeakers, etc...

(d) Associated Industries

The contribution of other industries to the manufacture or the use of electronic equipment, such as batteries, plastic for cabinets and parts, wood for cabinets, hardware, etc...

CHAPTER II

CURRENT DEMAND FOR ELECTRONIC PRODUCTS

1. CONSUMER ELECTRONIC PRODUCTS

A. Current demand in 1965

(i) The analysis has been made by number of sets. These are the only accurate figures available, and moreover, form a basis for the analysis of the market development up to 1980.

(ii) Analysis is based on import statistics for 1963, 1964 and 1965, as well as on production figures of the existing factories.

(iii) The current demand was deducted from the statistics. Incidental imports and incidental restriction of imports have as far as possible, been left out. Domestic supply was taken into consideration. An approximate value is also given divided in imported sets and locally produced sets.

Based on these remarks, the following tables are attached:

Table 1. Current radio demand for 1965
Table 2. Current TV demand for 1965
Table 3. Current electrophone demand for 1965
Table 4. Current tape-recorder demand for 1965
Table 5. Current total Consumer Electronic Products demand for 1965.

Parts and Components

The locally made products: radio, television and electrophone sets, are generally speaking, assembled from complete packages of parts and components.

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It is consequently impossible to divide the local imports of these parts per category of parts and/or products. The total estimated value of imported parts and components is given in first column of Table 5.

These figures do not include parts made locally, which are principally for the time being, a few wooden cabinets.

Associated Industries

Indications are given in Table 6. for the battery requirement in 1965, and in Table 7. for the approximate value of the wooden cabinets produced locally for the manufacture of radio and television sets.

B. Projection of Current Demand up to 1980

General Remarks

The development of Consumer Electronic Demand, particularly with regard to radio and television, deserves some comments.

Starting from the point of view that these commodities are considered much more as efficient communication means than pure entertainment device, it is of the utmost interest for the countries that the largest possible part of the population is in possession of radio and television.

To achieve this, certain conditions should be fulfilled.

(i) The coverage of the countries by radio and television transmission should be completed in the shortest possible time. In other words, the plans for expansion of the present radio and television network should be implemented. This is, in its turn, largely conditioned by the existence of the broadband microwave links to feed remote transmitters with programmes.

(ii) Both educative and entertainment programmes should be made available. Live programmes can only be considered by transmitting stations having well equipped studios. Such stations will unfortunately not be numberous. Sometimes one only per country, because of the cost involved.

TABLE 1

Current Radio Demand 1965

Country	Total Market		Import		Local Production		
	Number Sets	Approx. Value $	Number Sets	Approx. Value CIF US. $	Number Sets	Approximate Value US. $	
						Imported Parts C I F	Added Value
Dahomey	6.000	150.000	3.000	75.000	3.000	67.500	7.500
Gambia	6.000	90.000	6.000	90.000	-		
Ghana	50.000	780.000	30.000	450.000	20.000	270.000	60.000
Guinea	3.000	60.000	3.000	60.000	-		
Ivory Coast	30.000	750.000	25.000	625.000	5.000	112.500	12.500
Liberia	15.000	300.000	15.000	300.000	-		
Mali	9.000	180.000	9.000	180.000	-		
Mauritania	1.000	15.000	1.000	15.000	-		
Niger	4.000	100.000	4.000	100.000	-		
Nigeria	200.000	3.475.000	125.000	2.125.000	75.000	1.147.500	202.500
Senegal	20.000	500.000	19.000	475.000	1.000	22.500	2.500
Sierra Leone	20.000	400.000	20.000	400.000	-		
Togo	2.000	50.000	2.000	50.000	-		
Upper Volta	5.000	75.000	5.000	75.000	-		
	371.000	6.925.000	267.000	5.020.000	104.000	1.620.000	285.000

TABLE 2

Current Television Demand 1965

Country	Total Market		Import		Local Production		
	Number Sets	Approx. Value $	Number Sets	Approx. Value CIF US. $	Number Sets	Approximate Value US. $	
						Imported Parts C I F	Added Value
Dahomey	-		-				
Gambia	-		-				
Ghana	4.000	472.000	4.000	472.000			
Guinea	-		-				
Ivory Coast	700	82.600	500	59.000	200	21.240	2.360
Liberia	500	59.000	500	59.00			
Mali	-		-				
Mauritania	-		-				
Niger	-		-				
Nigeria	4.000	472.000	4.000	472.000			
Senegal	-		-				
Sierra Leone	100	11.800	100	11.800			
Togo	-		-				
Upper Volta	-		-				
	9.300	1.097.400	9.100	1.073.800	200	21.240	2.360

TABLE 3

Current Electrophone Demand 1965.

Country	Total Market		Import		Local Production		
						Approximate Value US. $	
	Number Sets	Approx. Value $	Number Sets	Approx. Value CIF US.$	Number Sets	Imported Parts C I F	Added Value
Dahomey	600	10.800	300	5.400	300	4.860	540
Gambia	200	3.600	200	3.600	-		
Ghana	3.000	58.000	2.500	45.000	500	8.100	4.900
Guinea	600	10.800	600	10.800	-		
Ivory Coast	4.000	72.000	4.000	72.000	-		
Liberia	2.000	36.000	2.000	36.000	-		
Mali	500	9.000	500	9.000	-		
Mauritania	400	7.200	400	7.200	-		
Niger	600	10.800	600	10.800	-		
Nigeria	21.000	418.000	16.000	288.000	5.000	81.000	49.000
Senegal	2.000	36.000	2.000	36.000	-		
Sierra Leone	3.000	54.000	3.000	54.000	-		
Togo	400	7.200	400	7.200	-		
Upper Volta	500	9.000	500	9.000	-		
	38.800	742.400	33.000	594.000	5.800	93.960	54.440

TABLE 4

Current Tape-Recorder Demand 1965

Country	Total Market		Import		Local Production		
	Number Sets	Approx. Value $	Number Sets	Approx. Value CIF US.$	Number Sets	Approximate Value US. $ Imported Parts CIF	Added Value
Dahomey	300	9.600	300	9.600	-		
Gambia	125	4.000	125	4.000	-		
Ghana	200	6.400	200	6.400	-		
Guinea	45	1.440	45	1.440	-		
Ivory Coast	1.500	48.000	1.500	48.000	-		
Liberia	600	19.200	600	19.200	-		
Mali	30	960	30	960	-		
Mauritania	15	480	15	480	-		
Niger	125	4.000	125	4.000	-		
Nigeria	3.250	104.000	3.250	104.000	-		
Senegal	1.000	32.000	1.000	32.000	-		
Sierra Leone	600	19.200	600	19.200	-		
Togo	300	9.600	300	9.600	-		
Upper Volta	100	3.200	100	3.200	-		
Total	8.190	262.080	8.190	262.080			

TABLE 5

Current Total Consumer Electronic Products Demand 1965

Country	Import Approx.Value CIF US.$	Local Production Approx. Value US. $	Total Approx. Value US.$
Dahomey	162.360	8.040	170.400
Gambia	97.600	-	97.600
Ghana	1.251.500	64.900	1.316.400
Guinea	72.240	-	72.240
Ivory Coast	937.740	14.860	952.600
Liberia	414.200	-	414.200
Mali	189.960	-	189.960
Mauritania	22.680	-	22.680
Niger	114.800	-	114.800
Nigeria	4.217.500	251.500	4.469.000
Senegal	565.500	2.500	568.000
Sierra Leone	485.000	-	485.000
Togo	66.800	-	66.800
Upper Volta	87.200	-	87.200
Total	8.685.080	341.800	9.026.880

TABLE 6

Current Dry Batteries Demand 1965

Country	All Imports	
	Number in Million Pieces	Approx. Value US. $
Dahomey	2	140.000
Gambia	0.8	56.000
Ghana	12	840.000
Guinea	2.2	154.000
Ivory Coast	6	420.000
Liberia	3	210.000
Mali	2.5	175.000
Mauritania	1.8	126.000
Niger	2.5	175.000
Nigeria	34	2.380.000
Senegal	6	420.000
Sierra Leone	6	420.000
Togo	1.5	105.000
Upper Volta	2.5	175.000
	82.8	5.796.000

TABLE 7

Radio and Electrophone Wooden Cabinets Manufactured Locally in 1965

	Radio		Electrophones		Total
	Number of pieces	Approx.Value US.$	Number of pieces	Approx.value US.$	Approx.value US.$
Dahomey	-		-		
Gambia	-		-		
Ghana	1.000	40.000	500	2.500	42.500
Guinea	-		-		
Ivory Coast	-		-		
Liberia	-		-		
Mali	-		-		
Mauritania	-		-		
Niger	-		-		
Nigeria	10.000	20.000	4.000	20.000	40.000
Senegal	-		-		
Sierra Leone	-		-		
Togo	-		-		
Upper Volta	-		-		
	11.000	60.000	4.500	22.500	82.500

A solution could be found in commercial TV which gets revenue from advertisements.

This can often be an acceptable solution for the urban areas but can hardly be envisaged for small transmitters in remote and under populated areas. Retransmitting of commercial programmes by state controlled microwave links could present some difficulties, notwithstanding the fact that regional stations are generally confronted with the language problem.

Educative programmes should be produced. Collaboration with international bodies (e.g. UNESCO) and with private firms should be sought.

Collaboration between the various African Broadcasting Stations is highly recommended. Exchange of programmes would not only help the diversification, but would also contribute to a better understanding amongst the nations (for instance, transmission by all stations of an "African Hour"). In this respect, the Association of Broadcasting stations "Union des Radiodiffusions et Télévisions Nationales Africaine (URTNA)", created in 1962, could play a very important role.

This URTNA groups 35 countries in Africa. The Secretariat General is divided in three departments : administrative, exchange of programmes and technical.

Among the achievements, mention should be made of the establishment of a list of programmes that countries are willing to exchange.

(iii) Reduce the price of the receivers to the public. This can be achieved by:

- low production costs which require large production units high degree of standardization (See Recommendations No. 415 and 416 of CCIR contained in Volume V of the Xth plenary assembly, Geneva 1963).

- low distribution costs by efficient marketing operation.

Bases for Estimate of Projection of the Demand up to 1980

(i) The over-all projection of economic growth in the country considered, namely population, GDP, import and export, private and public consumption, domestic savings and capital formation, has been given by the ECA in the Chart of West Africa National Account for 1960, 1965, 1980.

(ii) The development of the technology in the next 15 years, which will place at the disposal of the potential customers electronic apparatus cheaper and better adapted to the needs.

(iii) For West Africa only black-white TV has been taken into consideration, mainly because TV is considered to be of primary importance for the region as a means of communication and education. Colour TV does not offer, above this, much more than a purely commercial attraction, involving high extra costs which are in no way related to what is gained.

Figures are given in number of sets for the years 1965, 1970, 1975 and 1980.

An approximate value of the products expressed in US dollars is given for year 1980. The prices are based on prices in force in 1965, and should be understood ex-factory prices.

Table 8. Projection of current radio demand.
Table 9. Projection of current television demand.
Table 10. Projection of current gramophone/electrophone demand.
Table 11. Projection of current tape-record demand.
Table 12. Projection of current total Consumer Electronic Products demand.

Parts and Components

As a base for study of Industrial projects the total Consumer Electronic demand has been converted in number of parts and components required for manufacture (Table 13).

10 per cent is added to some of these numbers to take care of the need of production of other electronic equipment.

Associated Industries

Table 14. Projection of current dry cell batteries demand

Table 15. Projection of current plastic, metalware and wooden cabinets demand.

2. ESTIMATED DEMAND FOR INDUSTRIAL ELECTRONIC PRODUCTS OVER THE PERIOD 1965 - 1980

A. Telecommunication

It was found unrealistic to try to establish a current yearly demand for these types of products. Telecommunication projects are generally large infrastructure projects studied over many years, which cover the needs of a country for several years and the implementation of which also requires many years.

Being part of the infrastructure of a country, the demand for this type of equipment depends to a much lesser degree on the growth and purchasing power of the population than does the demand for Consumer Electronic Products.

Infrastructure is the responsibility of the governments which study its needs and make plans with the help of International Expert organizations, like ITU (International Telecommunication Union). Obviously, plans made on an International basis require close collaboration amongst the countries in a given region.

With regard to Africa, two main international Conferences have laid down the base of a general plan.

TABLE 8

Projection of Current Radio Demand

(total and per 1000 households)

Country	1965		1970		1975		1980		
	Market	per o/oo households	Market	per o/oo households	Market	per o/oo households	Market	per o/oo households	Approx. Value US. $
Dahomey	6.000	10	9.000	20	17.000	35	21.000	60	525.000
Gambia	6.000	100	7.000	100	8.000	100	10.000	100	150.000
Ghana	50.000	36	75.000	50	120.000	68	170.000	90	2.550.000
Guinea	3.000	5 - 10	14.000	20	27.000	35	52.000	60	1.040.000
Ivory Coast	30.000	46	43.000	60	65.000	80	90.000	100	2.250.000
Liberia	15.000	100	28.000	100	31.000	100	35.000	100	700.000
Mali	9.000	10	19.000	20	37.000	35	60.000	50	1.200.000
Mauritania	1.000	5 - 10	4.000	25	10.000	50	18.000	80	270.000
Niger	4.000	5-- 10	16.000	25	33.000	45	56.000	70	1.400.000
Nigeria	200.000	17	400.000	30	680.000	45	1.150.000	68	19.550.000
Senegal	20.000	30	36.000	50	56.000	70	80.000	90	2.000.000
Sierra Leone	20.000	40	28.000	50	40.000	65	56.000	80	1.120.000
Togo	2.000	5 - 10	8.000	25	17.000	45	29.000	70	725.000
Upper Volta	5.000	5 - 10	16.000	20	31.000	35	60.000	60	900.000
Total Sub-region	371.000	20	703.000	33	1.172.000	50	1.887.000	70	34.380.000

TABLE 9

Projection of Current Television Demand

Taking into account: Extension of broadcasting network.
total and per o/oo households within reach of Transmitter exclusively.

Country	1965		1970		1975		1980		
	Market	per o/oo households	Market	per o/oo households	Market	per o/oo households	Market	per o/oo households	Approx.value US. $
Dahomey	-	-	1.000	22	1.700	22	2.700	24	318.600
Gambia	-	-	500	10	300	21	500	22	59.000
Ghana	4.000	22	9.000	30	14.000	29	20.000	30	2.360.000
Guinea	-	-	1.000	14	2.000	14	4.000	18	472.000
Ivory Coast	700	25	3.000	18	4.500	17	6.000	17	708.000
Liberia	500	14	1.500	17	2.500	17	3.600	19	424.800
Mali	-	-	900	10	2.700	14	4.500	15	531.000
Mauritania	-	-	150	10	600	18	1.000	19	118.000
Niger	-	-	600	10	1.800	14	3.000	15	354.000
Nigeria	4.000	13	17.000	4	45.000	8.5	75.000	11	8.850.000
Senegal	-	-	3.000	20	7.000	29	10.000	30	1.180.000
Sierra Leone	100	2.2	2.500	2	3.800	21	5.700	23	672.600
Togo	-	-	300	10	900	15	1.500	15	177.000
Upper Volta	-	-	900	10	2.700	17	4.500	17	531.000
	9.300	2.7	41.350	7.8	89.500	12	142.000	14.4	16.756.000

TABLE 10

Projection of Current Gramophone/Electrophone Demand.

Country	1965	1970	1975	1980	
	Quantity	Quantity	Quantity	Quantity	Approx. value US.$
Dahomey	600	400	500	1.000	18.000
Gambia	200	300	500	1.000	18.000
Ghana	3.000	7.000	11.000	15.000	270.000
Guinea	600	850	1.250	2.000	36.000
Ivory Coast	4.000	5.000	6.000	9.000	162.000
Liberia	2.000	3.000	5.000	7.000	126.000
Mali	500	800	1.200	2.000	36.000
Mauritania	400	600	1.000	2.000	36.000
Niger	600	800	1.200	2.000	36.000
Nigeria	21.000	27.000	36.000	48.000	864.000
Senegal	2.000	3.000	5.000	8.000	144.000
Sierra Leone	3.000	4.000	6.000	9.000	162.000
Togo	400	600	1.000	2.000	36.000
Upper Volta	500	1.000	2.000	5.000	90.000
Sub-region	38.500	54.350	77.600	113.000	2.034.000

TABLE 11

Projection of Current Tape Recorder Demand.

Country	1965	1970	1975	1980	
	Quantity	Quantity	Quantity	Quantity	Approx. value US.$
Dahomey	300	500	1.000	2.000	64.000
Gambia	125	500	1.000	2.000	64.000
Ghana	200	1.000	3.000	5.000	160.000
Guinea	45	200	500	750	24.000
Ivory Coast	1.500	2.500	5.000	10.000	320.000
Liberia	600	1.500	3.000	6.000	192.000
Mali	30	200	500	1.000	32.000
Mauritania	15	100	300	700	22.400
Niger	125	500	1.000	2.000	64.000
Nigeria	3.250	7.000	12.500	15.000	480.000
Senegal	1.000	2.500	5.000	8.000	256.000
Sierra Leone	600	1.500	4.000	7.500	240.000
Togo	300	1.000	3.000	6.000	192.000
Upper Volta	100	500	1.000	2.000	64.000
Sub-region	8.040	13.200	40.800	67.950	2.174.400

TABLE 12

Projection of Current Total Consumer Electronic Products Demand

Country	1980
	Approx. value US. dollars
Dahomey	925.600
Gambia	291.000
Ghana	5.340.000
Guinea	1.572.000
Ivory Coast	3.440.000
Liberia	1.442.800
Mali	1.799.000
Mauritania	446.400
Niger	1.854.000
Nigeria	29.744.000
Senegal	3.580.000
Sierra Leone	2.194.600
Togo	1.130.000
Upper Volta	1.585.000
Total	55.344.400

TABLE 13

Projection of Current Parts and Components Demand

(in o/oo pieces unless otherwise specified.)

Material in o/oo pieces	1970	1975	1980
Loudspeakers	765	1.300	2.400
Coils	5.200	8.800	18.500
Printed Circuits	90	160	260
Tuners Output line trafo's Deflection coils	41	89	140
Picture tubes	41	89	140
Variable condensers	703	1.172	1.900
Trimmers	3.500	5.800	9.500
Ferrites	65 t.	107 t.	180 t.
Transistors (*)	8.000	12.000	20.000
Diodes (*)	2.500	4.000	7.000
Capacitors (*)	36.000	60.000	95.000
Resistors (*)	42.000	69.000	110.000

(*) For good order's sake, mention may be made that the possible partial introduction of Integrated Circuits in the not t o o distant future may reduce substantially the number of these components needed.

TABLE 14

Projection of Current Dry Batteries Demand

(Quantity in million pieces)

Country	1965	1970	1975	1980	
	Quantity	Quantity	Quantity	Quantity	Approx. value US.$
Dahomey	2	3	5	7.5	525.000
Gambia	0.8	1.0	1.2	1.5	105.000
Ghana	12	19	31	50	3.500.000
Guinea	2.2	3.5	6.5	9	630.000
Ivory Coast	6	11	17	25	1.750.000
Liberia	3	4	5	6	420.000
Mali	2.5	4	7	10	700.000
Mauritania	1.8	2.5	4.5	7	490.000
Niger	2.5	4	7	10	700.000
Nigeria	34	83	150	260	18.200.000
Senegal	6	11	17	25	1.750.000
Sierra Leone	6	7	8.5	10	700.000
Togo	1.5	2	3.5	5	350.000
Upper Volta	2.5	4	7	10	700.000
Sub-Region	82.8	159	270.2	436	30.520.000

TABLE 15

Projection of Current Plastic Metalware and Wooden Cabinet Demand

	1970		1975		1980	
		tons		tons		tons
Plastic:						
Cabinet	500,000 pieces, wieght	125	950,000 pieces, weight	240	1,700,000 pieces,weight	680
Cabinet accessories		40		80		225
TV front panel		26		54		84
TV accessories		4		11		18
Parts for loudspeakers		-		-		150
Artificial leather		30		65		100
TOTAL:		225		450		1.257
Metalware:						
Steel		190		330		850
Aluminium		140		320		500
Wooden Cabinets	240,000 pieces		340,000 pieces		450,000 pieces	

One is the ITU Conference in Rome, 1963, which a.o. refers to the broadband microwave network. The conclusions were published in a report named: "General Plan for Development of the International Network 1963-1968" (published by ITU).

The second refers to VHF/UHF Broadcasting and was held in Geneva in 1963. Recommendations were published in a report known as "Final Acts of the African VHF/UHF Broadcasting Conference" Geneva 1963 (published by ITU).

In the following survey, the telecommunication equipments are divided in two principal groups, e.g.

(i) Radio equipment
(ii) Telephony equipment

The radio equipment is sub-divided in:

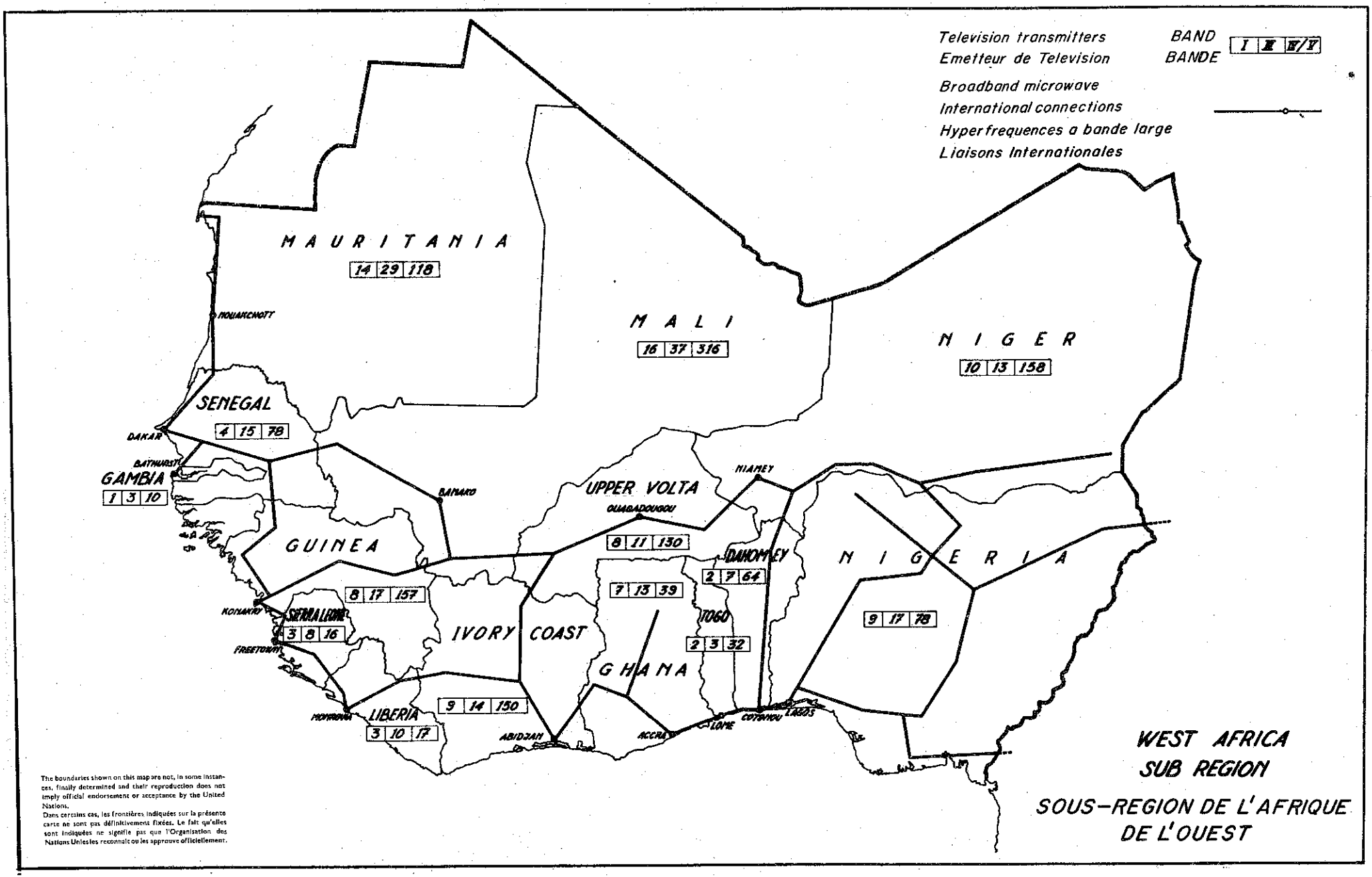
(i) Microwave equipment including carrier telephone equipment,
(ii) TV transmitters.
(iii) Sound broadcasting transmitters.

(i) Radio Communication equipment

- Microwave equipment including associated carrier equipment

Broadband microwave links are being used for transport of large numbers of "information" simultaneously. These informations can be telephone conversations, and/or Telegraph c.q. Telex but also TV and Sound broadcasting programmes.

The implementation of broadband microwave international network as recommended by the ITU will have a direct and great impact on the further development of the region involved and is therefore very essential.



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With regard to Telephony, microwave links will permit easy communications between the countries of the region. Today, these communications are either made through few submarine cables or through the existing H.F. transmitters. These two systems have the disadvantages to limit severely the number of communications. Moreover, direct connexions between neighbouring countries often do not exist and can sometimes only be obtained by channelling the communication via Europe.

In the same way, Microwave links are the most suitable way to exchange TV and Sound programmes amongst the countries.

The above mentioned general plan of ITU as laid down during the Rome Conference 1963 is limited to International connexions. Since these international links pass through the various countries, they also contribute to the development of their national telecommunication facilities.

The ITU Conference in Rome recommended the implementation of approximately 16,000 kms. of international microwave links for the 14 countries of West Africa Sub-region.

These links are shown on the map attached.

To cover the additional required national connexions a further 8,000 kms. is estimated, which brings the total length of microwave links to be installed at 24,000 kms.

It is reasonably expected that those links will be installed by 1980. The existing network represents a negligible part of this plan.

Estimated expenditures over 15 years

The estimated length for this type of connexions will be then 24,000 kms. by 1980. Prices are based on US.$ 2.- per metre for the total equipment, which means:

24,000 x 1,000 x US.$ = US.$ 48,000,000

This price does not include power supply masts, towers, antennae and civil works, and refers exclusively to the electronic equipment.

- TV. Transmitters

The ITU Conference in Geneva (1963) established as follows, the number of TV transmitters to be installed in the various countries:

	BAND		
	I	III	IV/V
DAHOMEY	2	7	64
GAMBIA	1	3	10
Ghana	7	13	39
GUINEA	8	17	157
IVORY COAST	9	14	150
LIBERIA	3	10	17
MALI	16	37	316
MAURITANIA	14	29	118
NIGER	10	13	158
NIGERIA	9	17	78
SENEGAL	4	15	78
SIERRA LEONE	3	8	16
TOGO	2	3	32
UPPER VOLTA	8	11	130
	96	197	1483

The existing number of TV transmitters represents a negligible part of the above listed number of planned transmitters.

For the moment, the following transmitters are in operation:

Country	Standard	BAND I Power output	BAND III Power output
GHANA	CCIR	3 x 15 KW	
IVORY COAST	OIRT	-	2 x 10 KW
LIBERIA	CCIR	-	1 x 2,5 KW
NIGERIA	CCIR	3 x 60 KW 1 x 40 KW 1 x 50 KW	1 x 10 KW 1 x 25 KW
Total number		8	5

Moreover, transmitters with very low power output are in operation:

		I	III
SENEGAL	OIRT	1 x 0,05 KW	
SIERRA LEONE	CCIR	1 x 0,10 KW	
UPPER VOLTA	OIRT	1 x 0,05 KW	
GHANA	CCIR		1 x 0,2 KW

Band I and Band III transmitters (VHF) have a relatively large coverage (approximately 100 to 150 kms. depending on power, location etc...). For that reason they are the first to be installed. It is reasonable to expect that by 1980 the total number of transmitters recommended will be in operation. The power output can be assumed 5 KW for Band I transmitters and 0.5 KW Band III transmitters.

Band IV and V transmitters (UHF) have a smaller coverage (approximately 10 to 30 kms.). They are preferably used for smaller communities.

These transmitters have generally a power output of 2 KW.

The supply of programmes for these transmitters is generally a problem. There is no question of having studios for each of them. Programmes have then to be available from one dispatching centre and either transported to the UHF transmitter by microwave links or in the form of videotape.

This programme problem and the large number of transmitters required suggest that by 1980, only a part of the plan will be realized. It is generally accepted that not more than 270 band IV/V transmitters will be in operation by 1980, which is as many as for Band I and Band III together.

This means that for the 14 countries of the Subregion, the following numbers are considered:

- Band I transmitters total 96 pieces
- Band III transmitters total 197 pieces
- Band IV/V transmitters total 270 pieces

Estimated expenditures over 15 years

Following guiding prices have been taken:

Band I transmitters	US.$ 100,000 pce
Band III transmitters	US.$ 50,000 pce
Band IV/V transmitters	US.$ 100,000 pce

Starting from this point, we have the following totals:

96 x US.$ 100,000	=	US.$ 9,600,000
197 x US.$ 50,000	=	US.$ 9,850,000
270 x US.$ 100,000	=	US.$27,000,000
		US.$46,450,000
Replacement and spares		US.$ 1,550,000
		US.$48,000,000

Here again, prices do not include power supply, studio equipment, masts, towers, antennae and civil works.

- Sound Broadcasting Transmitters

Contrary to TV transmitters, there are no ITU recommendations with regard to A.M. Sound Broadcasting transmitters to be installed, while for F.M., recommendations were made in the Geneva Conference (1963).

The total coverage of the country is the aim of each government. Densely populated areas can be covered (and some of them are already) by relatively powerful Medium wave AM transmitters. The coverage of such transmitters is approximately 100 kms. as a consequence of a high atmospheric noise level in West Africa.

In larger countries one medium wave transmitter will not suffice which implies that a second one or more should be considered.

But a more economic solution is, however, to implement one or more shortwave transmitters for such countries in addition to the medium wave transmitters (Short waves are less influenced by atmospheric noise than Medium waves). Shortwave transmitters to be erected at the same site preferably as near as possible to the capital of the country.

It can be assumed that one given shortwave transmitter can cover a distance up to 400 kms. and that a second transmitter operating on another frequency will be required when there is a need of covering a longer distance.

The frequencies allotted are from 2 to 27 Mc/s. However, care should be taken as far as technique

permits to narrow the frequency range effectively used. This has a direct implication on the cost of the receivers.

F.M. transmitters have also to be considered because these are very suitable for smaller communities.

The operating UHF frequency is hardly influenced by atmospheric noise. However, their coverage is quite small implying that to cover a country effectively a considerable number of transmitters is required. The cost of the installation will be considerably reduced if it is combined with the installation of Band I and III TV transmitters.

It should however be noted that the installation of F.M. transmitters will require specially designed receivers.

AM and FM receivers which will be needed for reception of both National and Regional programmes are more intricate and are substantially more costly. The more so that at the beginning, anyway, the quantities involved will permit only small marginal production.

In order to estimate the number of transmitters to be installed by 1980, it is assumed that:

- A.M. transmitters

  Most probably, in the capital of every country concerned, one 100 KW Medium-wave transmitter will come into operation by 1980, and depending on the size of the country, one or two 100 KW Shortwave transmitters.

  This means for the whole region a total of 14 Medium-wave and 24 Short-wave transmitters.

- F.M. transmitters

Being intimately associated with the installation of Band I and Band III TV transmitters it is reasonable to consider only the same number of F.M. transmitters as TV transmitters.

This gives 270 F.M. Broadcasting transmitters of an average output power of 5 KW each.

Estimated expenditures over 15 years

Following guiding prices have been taken for this:

100 kW AM Medium-wave transmitter	US.$ 200,000	pce
100 kW AM Short-wave "	US.$ 250,000	"
5 kW FM transmitters	US.$ 20,000	"

From this, the following totals result:

14 x US.$ 200,000 =	US.$	2,800,000
24 x US.$ 250,000 =	US.$	6,000,000
270 x US.$ 20,000 =	US.$	5,400,000
	US.$	14,200,000

Here again, prices do not include power supply, studio equipments, masts, towers, antennae and civil works.

Summary of expenditures for Radio telecommunication equipment:

- Microwave equipment ($9,600,000 -approx. (20%- is for carrier telephony equipment)	US.$	48,000,000 (of which
- TV transmitters	US.$	48,000,000
- Sound broadcasting transmitters	US.$	14,200,000
	US.$	110,200,000
- Miscellaneous	US.$	10,000,000
Grand Total:	US.$	120,200,000

(ii) Telephony

In order to make an estimate of the need for telephony equipment, it has to be taken into account the increase in the density of telephone subscribers in the next 15 years. This depends, amongst other reasons, upon the increase of the purchasing power and upon the growth of the population itself.

In the following analysis, use has been made of information released every year by the American Telephone and Telegraph Company.

Table 16. gives an extract for the years 1960, 1961, 1962, 1963 and 1965 of the number of telephones in the countries concerned and of the density of telephone subscribers per countries. For 1964, no information is available.

Nigeria, Ghana, Ivory Coast and Senegal are the countries with the largest number of telephones in use at the 1st January 1965.

In order to make an estimate of the number of telephones that will be in operation in the whole region by 1980, it is assumed that the density of telephone subscribers will double in the next 15 years. This supposition is, needless to say, arbitrary but takes into account plans for expansion. The more so because those plans are already partly in execution.

Supposing that the population increases by 50 per cent and the density of telephone subscribers by 100 per cent over the whole region, the number of telephones operating in 1980 will be

167,115 x 1,5 x 2 = 501,345

This means that in the period from 1/1/1965 to 1/1/1980

501,345 - 167,115 = 334,230 telephones

must be delivered and installed.

Estimated amounts for telephony (switching and instruments) for 1980

Assuming that the total number of telephones to be installed up to 1980 will be 334,230 and supposing that the needs will be homogeneously distributed over the 15 years (which is not true in practice), the yearly demand will be

$$\frac{334,230}{15} = 22,282$$

As a guiding price per telephone connexion, US.$ 100.- is taken, including US.$ 16.- for the telephone set.

From the above, it can be concluded that the total investment in telephony equipment will amount to

334,230 x US.$ 100 = US.$ 33,423,000

To this figure, approximately 10 per cent should be added for accessories and other types of telephone installations, which brings the total to US.$ 36,800,000 over the 15 years.

To Summarize, from what is described above, the total amount for telecommunication over the period of 15 years (electronic equipment only) will be

US.$ 120,200,000
US.$ 36,800,000 = US.$ 157,000,000

TABLE 16

Number of Telephone Sets Installed.

	1960		1961		1962		1963		1964		1965	
	Nr. of tele-phones	per 100 popu-lation	Nr.of tele-phones	per 100 popu-lation	Nr. of tele-phones	per 100 popu-lation	Nr. of tele-phones	per 100 popu-lation	Nr. of tele-phones	per 100 popu-lation	Nr. of tele-phones	per 100 popu-lation
Dahomey	1.871	0.11	2.010	0.10	2.150	0.10	2.180	0.10			3.500	0.15
Gambia	650	0.22	700	0.22	700	0.24	908	0.31			1.025	0.31
Ghana	24.917	0.51	23.816	0.34	26.234	0.37	28.514	0.40			32.511	0.42
Guinea	3.000	0.11	3.100	0.10	4.000	0.13	4.200	0.13			6.000	0.17
Ivory Coast	6.286	0.20	7.004	0.21	9.199	0.28	10.591	0.31			17.702	0.47
Liberia	2.100	0.15	2.100	0.16	2.300	0.17	2.600	0.20			3.000	0.28
Mali	2.723	0.06	2.800	0.07	3.000	0.07	3.400	0.08			4.400	0.10
Mauritania	255	0.03	300	0.04	300	0.04	350	0.04			1.000	0.12
Niger	1.321	0.05	1.549	0.05	1.700	0.05	1.661	0.05			2.270	0.07
Nigeria	37.246	0.11	41.661	0.12	47.998	0.13	53.949	0.15			60.428	0.11
Senegal	16.619	0.64	17.000	0.53	22.378	0.75	23.000	0.76			25.000	0.73
S. Leone	4.062	0.17	4.700	0.19	4.610	0.18	5.100	0.20			5.500	0.11
Togo	1.633	0.14	1.776	0.12	2.256	0.15	2.477	0.16			2.779	0.17
Upper Volta	1.242	0.03	1.228	0.03	1.300	0.03	1.300	0.03			2.000	0.04
Totals:	103.925		99.744		128.125		140.230				167.115	

B. Estimated Current Demand Development 1965 - 1980 for Measuring Instruments and Miscellaneous

The realistic estimates of this market encounter numerous difficulties:

- Import statistics are by far insufficiently divided and very much unspecified.
- Import of some industrial electronic equipment is concealed, as accessories of important industrial projects.
- The tremendous diversification of the products,
- Export statistics of main producing countries are irrelevant because very many equipments are diverted in transit to a country other than that of the ultimate user.

Table 17. Projection of current Electronic Measuring Instrument demand.

Table 18. Projection of current other Electronic Industrial Equipment demand.

TABLE 17

Projection of Current Electronic Measuring Instrument Demand

Country	1965	1970	1975	1980
Dahomey	20.000	36.000	66.000	120.000
Gambia	10.000	18.000	33.000	60.000
Ghana	200.000	430.000	930.000	2.000.000
Guinea	25.000	54.000	115.000	250.000
Ivory Coast	100.000	200.000	400.000	800.000
Liberia	10.000	18.000	33.000	60.000
Mali	60.000	120.000	240.000	480.000
Mauritania	10.000	18.000	33.000	60.000
Niger	10.000	18.000	33.000	60.000
Nigeria	1.000.000	2.280.000	5.200.000	12.000.000
Senegal	50.000	100.000	200.000	400.000
Sierra Leone	10.000	20.000	40.000	80.000
Togo	10.000	18.000	33.000	60.000
Upper Volta	10.000	18.000	33.000	60.000
	1.525.000	3.348.000	7.389.000	16.490.000

N.B. Excluding electricity meters

TABLE 18

Projection of Current Other **Electronic** Industrial Equipment Demand

Country	1965	1970	1975	1980
Dahomey	10.000	20.000	30.000	40.000
Gambia	10.000	20.000	30.000	40.000
Ghana	100.000	200.000	300.000	400.000
Guinea	10.000	20.000	30.000	40.000
Ivory Coast	80.000	160.000	240.000	320.000
Liberia	40.000	80.000	120.000	160.000
Mali	10.000	20.000	30.000	40.000
Mauritania	10.000	20.000	30.000	40.000
Niger	10.000	20.000	30.000	40.000
Nigeria	400.000	800.000	1.200.000	1.600.000
Senegal	100.000	200.000	300.000	400.000
Sierra Leone	10.000	20.000	30.000	40.000
Togo	10.000	20.000	30.000	40.000
Upper Volta	10.000	20.000	30.000	40.000
	810.000	1.620.000	2.430.000	3.240.000

CHAPTER III

ANALYSIS OF THE PRESENT INDUSTRY

1. Presently, the local industry in the field of electronics is limited to the assembly of radio, television and electrophone sets in various countries.

2. With a few exceptions, the local firms are working under technical assistance contract with reputable foreign firms, with the result that the sets produced are generally identical with sets produced by these firms with very few adaptations to local specific requirements. Practically, no designing is being carried out, except some amplifiers for electrophones.

The quality of the sets is in general very much comparable with similar models produced in industrialized countries.

3. Generally speaking, all parts are imported, with the exception of a few wooden cabinets, which are being manufactured locally.

4. The added value varies from case to case, as it depends mainly on:

- the manner in which parts are being imported. Some assemblers receive the chassis already assembled and aligned, some receive them in blocks pre-assembled and pre-adjusted, and others are really assembling from all loose parts.
- Most of the wooden cabinets for radio, radiograms, TV and electrophones are of local manufacture. The cost of these cabinets varies from US.$ 2.- for small transistor sets to approximately US.$ 50.- for large radiograms.
- All plastic cabinets (which represent approximately 80 per cent of all cabinets made) are imported although plans are being carried out for their local manufacture.

5. The labour directly employed in these industries is relatively small (less than 350 people in total). In general, African staff

trained by the firms rendering technical assistance is managing the assembly lines very satisfactorily.

6. The equipment installed varies in accordance with the assembly work done (see point 4.) but in general, is not very consequent (approximately US.$ 350,000.-)

7. Most of the assembly plants are not working at full capacity and whenever this is the case, production can easily be increased.

8. All production figures are for June 1966 when the various firms were visited and exceed production figures for 1965.

Assembly plants are already in operation in the following countries:

SENEGAL : Assembly of approximately 1,000 sets per year (transistor portable radio sets),
All parts are imported from France.

MALI : An assembly line for radio is now being installed in Mali, with undefined capacity, but working under the same conditions as the firm in Senegal.

IVORY COAST : One assembly plant producing, at the moment, approximately 5,000 transistor radio sets of two models, for the local market, and at intervals, manufacturing sets for Upper Volta.

Production of TV sets (1500 sets have been assembled but 700 still remain unsold).

This firm works with technical assistance from French firms, with French designs, all loose parts being imported.

GHANA : In Ghana, there are three assembly plants:

(a) 100 per cent state owned factory, working with technical assistance from Holland,

Assembly : one model of transistor radio, all loose parts imported from Holland,

producing in two shifts approximately 60,000 radio sets/year.

Sets are marketed under a Ghanaian brand name. Factory managed entirely by Ghanaians.

(b) Company 50 per cent Government controlled, and 50 per cent Japanese. Presently producing TV sets. Im fact, this company which has just started operations, has not yet reached the stage of assembly, but ready-made and aligned chassis are imported and fitted in a locally manufactured wooden cabinet. The production rate is about 3500 sets per year.

This firm works with technical assistance, from and under the management of a Japanese firm.

(c) A firm manufacturing approximately 1,000 radiograms per year, electrophones and a few amplifiers. Cabinets as well as a few mechanical parts, are also manufactured. This brings the local content to approximately 60 per cent of the total value.

Electronic parts are imported in kit form from England and Japan.

DAHOMEY : One firm assembling manufactured radios (two types). Blocks and parts all imported from France. Production: approximately 5,000 radio sets and 1,000 electrophones per year.

NIGERIA : (a) One firm working with technical assistance from Holland; assembling various types of transistor radio sets, with imported loose components, Production : approximately 55,000 sets/year Some wooden cabinets are produced locally.

(b) One firm working with technical assistance from Germany; manufacturing 3,500 radiograms and 6,000 to 7,000 transistor radio sets per year. All being fitted in wooden cabinets made locally.

(c) A firm assembling radio sets of Japanese and English origin, at the rate of approximately 36,000 per year. A certain quantity of wooden cabinets is made locally.

(d) A firm working with British technical assistance and manufacturing approximately 12,000 sets per year, of one model.
All fitted in wooden cabinets made locally.

(e) There are also two other firms which have started very recently, assembling relatively small quantities of radios and radiograms.

CHAPTER IV

DESCRIPTION AND ANALYSIS OF FEASIBLE INDUSTRIAL PROJECTS

1. ANALYSIS OF CONDITIONS OF SOUND INDUSTRIALIZATION

A. General

1. The most important reasons for a country to embark on a programme of industrialization in any field are the following:

(a) An expected cost advantage, which could result from:
- the utilization of available reserves of low-cost or high quality labour, energy or raw materials,
- the avoidance of transportation costs,
- the proximity of important markets that would justify large production runs,
- the same proximity of manufacturing to markets could also mean an increase in the efficiency of the sales organization, and thereby result in a decrease in distribution costs.

(b) Arguments of a macro-economic or political nature, such as:
- employing unemployed labour,
- saving or earning foreign exchange,
- avoiding uncertainties of supplies from distant sources, as they could be caused by exchange and political factors,
- diversifying the structure of the economy to prevent undue dependence upon a certain sector and its fluctuations,
- introducing certain types of know-how that come with the creation of new industries,

2. Sometimes, countries seem to be inclined to proceed with industries for the sole purpose of self-sufficiency. This principle is a sensible guide only up to a limited point, as it runs in conflict with the principle that every country will gain if it makes things in which it has a relative cost advantage and trades them internationally.

3. Projects which are commercially attractive only because of high tariff protection are a heavy burden on domestic consumers who are compelled to pay more for domestic products than they would for imports.

B. Conditions for Industrialization

1. Industrialization has to be based on an existing domestic market

From the import figures and the estimated demand for the year 1980, it can be seen that this condition is fulfilled provided West Africa Sub-region is considered as an entity. This is the minimum basic condition for the development of an electronic industry.

Each individual country in the region can hardly expect to have a fully integrated industry on its own. Each should then realize that in their own interest, they have to accept the fact that they must import parts required by their own market from other countries in the Sub-region and it is highly recommended that a machinery be established to facilitate the movements of goods over the borders in the Sub-region.

However, the fantastic diversification of the electronic products, especially in the field of industrial equipment, with completely different techniques and small quantity of articles of each category, limits the possibility of the establishment of industrial projects to the articles which are being mass-consumed and for which the continuity of the demand is guaranteed.

For certain types of articles, it should be realized that the total West-Africa Sub-region is even too small a market for establishment of sound industries and consequently, only Africa as a whole should preferably be taken into consideration. This is precisely the case of the products which require high investment, skilled labour and for which a production capacity is a determinant factor in the cost price of the product (e.g. transistors, diodes, resistors, capacitors). It is up to all African Sub-regions to decide in common which Sub-region is eventually the best to fulfil the supply functions for the other Sub-regions. Few centres of production covering the needs of the Sub-region or even Africa as a whole, can only function properly if co-operation amongst the countries is obtained and if the goods can flow over the borders in a kind of exchange process.

The possibility of export of products outside Africa seems very remote. The large enterprises in industrialized countries with which industry in the Sub-region would have to compete, have the very important advantages of mass-production and established powerful distribution organizations.

2. The mere assembly of electronic equipment based on imports of all the parts and components cannot be satisfactory for the Sub-region, unless it is considered as a first step towards a more integrated industry.

The project hereafter assumes that most of the components and parts which are technically and economically producible in the Sub-region are being effectively produced by 1980.

In other words, the integration of the industry is as complete as techniques and economy permit it. Certain types of products (for instance electronic valves), have been purposely omitted because either the market requirement will be too small in 1980 for economical industrialization, either the technological development shows that these products will surely be replaced by others (valves by transistors) in 1980.

Whenever the trend in technological development is not too clearly apparent, the plan is made on the 1965 techniques. This applies in particular to chemically produced Integrated Circuits. There are good reasons to believe that by 1980, a certain part of the domestic electonic appliances will make use of "Integrated Circuits". However, it is almost impossible to-day to estimate the extent of this introduction.

3. Technical and management assistance from abroad is essential. This is a primary condition, in this type of highly specialized industry, to achieve proper establishment, smooth start of the production, effective training of personnel, efficient management, constant product quality.

Moreover, this technical and management assistance must be guaranteed for a long term. This is the only way to make sure that the newly

established industry will keep pace with rapid and constant evolution of the technology.

4. Concentration and specialization of the production are necessary in order to reduce capital investment, to obtain lower cost price, to use efficiently the management resources, and to make possible effective training and less complex organization.

To satisfy these requirements, the number of projects for each activity is based on the following:

(a) Assembling Industry

Reasonably, very few assembly plants would be required to satisfy the total market requirement of the Sub-region. However, consideration should be given to the existing and the already planned assembly plants. Justification of a certain number of assembly plants in various countries can be found in the transport conditions, the specific market requirements and other economic motives of the country to participate actively in the electronic industry for the region.

It is anyway recommended to keep the number of countries entering this venture to the minimum; the number of assembly plants should be limited so that each can be assured of continuous working at full capacity and to combine wherever possible, in one factory, the assembly of similar appliances (ex. radio and TV in the same factory).

(b) Parts and Components

It is precisely to these articles that the rule of concentration plays the most important role. The number of factories to be in existence in 1980 has been determined by a minimum economical production capacity.

For the highly intricate components: transistors, diodes, resistors, as mentioned above, it is very much questionable to recommend establishment of production centres for the quantities required in 1980 for the West African Sub-region, but it should reasonably be considered to cover the needs of all Africa or at least two or three of the four Sub-regions.

Moreover, transistors, diodes, resistors and capacitors should be concentrated in one single unit, for economical reasons, as well as for the fact that these parts may be, before or after 1980, partly replaced by chemically produced Integrated Circuits.

For telecommunication equipment, radio and telephony, maximum concentration is absolutely essential. One single factory can only be considered.

(c) Associated Industry

Accessories to the assembly industry such as plastic and wooden cabinets, metalware, etc... should normally be next to the assembly plants. In fact, the manufacture of these products should preferably not be combined with the assembly factories because of the desired specialization.

5. Recommendation on the location of the various factories is being made based principally on the country potential market and transport conditions. Raw material availability has not been taken into consideration as this does not play a significant role in most of the articles.

Care was taken to distribute the industry as evenly as possible amongst the various countries but respecting the technical and economical contingencies with regard to the desired concentration.

Table 19 shows the recommended distribution.

RECOMMENDATION ON LOCATION OF PROJECTS

Countries	Radios Electroph.		Television		Tuners		Loud-speakers		Coils		Variable Condensers		Trimmers		Deflection unit		Line output transform.		Transistor		Diodes		Resistors		Capacitors		Ferroxcub.		Picture tubes		Telephone exchanges and sets		Carrier Telephone Equipment		Radio & TV transmitt.		Metalparts for Tele-communicat.	
	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Q	N	Weight	N	Q	N	1000US$	N	1000US$	N	1000US$	N	1000US$
DAHOMEY	1	100,000																																		
GHANA	1	200,000	1	30,000	1	20,000	1	500,000	1	5,000,000	1	700,000	1	2,500,000																						
GUINEA	1	100,000																																		
I.COAST	1	100,000	1	12,000	1	20,000	1	500,000	1	3,500,000	1	400,000	1	200,000																						
MALI	1	100,000																																		
NIGERIA	4	1200,000	2	74,000	2	60.000	2	1,000,000	1	10,000,000	1	800,000	1	5,000,000	1	140,000	1	140,000	1	15,000,000	1	6,000,000	1	110,000,000	1	95000,000	1	180tons	1	140,000	1	2,400	1	640	1	6,500	1	510
SENEGAL	1	100,000	1	12,000	1	20.000	1	200,000																												
S.LEONE	1	100,000	1	12,000	1	20,000	1	200,000																												
	11	2,000,000	6	140,000	6	140,000	6	2,400,000	3	18,500,000	3	1,900,000	3	9,500,000	1	140,000	1	140,000	1	15,000,000	1	6,000,000	1	110,000,000	1	95,000,000	1	180tons	1	140,000	1	2,400	1	640	1	6,500	1	510

N = Number of factories
Q = Quantity

2. CONSUMER ELECTRONIC PRODUCTS

A. General

1. Industrialization in the field of Consumer Electronic Products can be envisaged as it appears from the market analysis that these products fulfil the condition described in CHAPTER IV. I principally with respect to volume continuity and a possible limited diversification.

Industries established principally for this market can also aim at other finished products, such as Intercoms, simple professional equipments, etc... It must however be realized that these products require only a small number of parts and components compared with the requirement for radio, television and electrophone.

Tape-Recorder assembly was not considered because the volume is relatively small with rather high degree of diversification. Under certain conditions, however, small quantities could be assembled in any of the other assembly plants. Standard electronic parts and components are generally of the same types as for electrophone and do not represent any substantial volume.

2. Resulting from the projected current demand for 1980, the following production would be reached:

(a) Assembly of:	1,900,000	radio sets
	140,000	television sets
	120,000	gramophones/electrophones
	undefined	number of various electronic equipment for a volume of approximately 10 per cent of the total volume of radio, TV and electrophone.

(b)	which requires:	2,400,000	pieces loudspeakers
		18,500,000	" various types of coils
		260,000	quarto of printed circuits
		140,000	tuners
		140,000	line output transformers
		140,000	deflection coils
		1,900,000	variable condensers
		9,500,000	trimmers
		140,000	picture tubes
		180	tons of ferrite material
		20,000,000 (*)	transistors
		7,000,000 (*)	diodes
		95,000,000 (*)	various types of capacitors
		110,000,000 (*)	various types of resistors, including potentiometres, etc.

(*) If not replaced at the time by Integrated Circuits.

It should be noted that in any cases some kind of articles produced in the region have still to be imported in small quantities to cover the need of special applications.

For instance, 5,000,000 transistors of various types, uneconomical to produce in such a small quantity, will still have to be imported.

(c) Moreover, Associated Industries should provide:

1,700,000	plastic cabinets	Approx. weight	680 tons
	plastic accessories for radio	"	225 tons
140,000	plastic TV front panel	"	84 tons
	plastic accessories for TV	"	18 tons
	plastic parts for loudspeakers	"	150 tons
	plastic artificial leather	"	100 tons
	plastic total:		1,257 tons

	Various steel metalware mainly cadmium plated	" 850 tons
	Various aluminium metalware (mainly for TV antennae)	" 500 tons
	corrugated cardboard for packing	1,700 tons
	Various cables and wires for wiring of the apparatus only:	
	- common insulated wires	120 tons
	- shielded wires	10 tons
	- twin wire or coaxial cables for antennae	70 tons
450,000	Various wooden cabinets	
436,000,000	pieces Dry cell batteries.	

3. In the economical analysis of the various projects, the following parametres are taken:

(a) The factory spaces take into account manufacturing, stores and auxiliary spaces.

(b) All the prices are to be understood at the 1965 level. Imported products based on world market CIF price.

(c) In the estimates of working capital, no provision was made for debtors.

(d) Amortization of equipment is calculated on the base of 4 to 7 years, according to the product.

(e) It is assumed that each given project keeps 3 months stock of raw material and/or parts and no stock of finished products except for the assembly plants where 3 months stock of finished products are foreseen.

(f) Factory description hereafter refers to the situation evaluated in 1980.

(g) No taxes and duties of any kind, neither on raw material, nor on equipment, have been considered.

B. Description of the Projects

1. Assembly plants for radio, TV and electrophones, tuners and loudspeakers

It is assumed that a maximum of 11 assembly plants divided amongst 8 countries will be in operation by 1980.

Provision is made for 6 of these assembly plants, to assemble in the same premises, television sets and television tuners, as well as loudspeakers.

A minimum production of 100,000 radio sets and 12,000 television sets is considered economical. Small factories should concentrate on 2 or 3 basic models of radio and one television (possibly with various presentations). Large factories could produce a greater variety of models although the number should be limited as far as possible, to achieve high effeciency, to keep prices at the minimum and to reduce the problem of servicing.

The question of servicing is extremely important and by 1980, the number of trained Service technicians required will be considerable; doubts exist if there is the possibility to train a sufficient number in time.

For the loudspeakers, the minimum economical assembly is 100,000 pieces per year, while manufacture of the parts can only be considered for a production of 1,000,000 pieces.

In the description hereafter, assembly was exclusively considered. The manufacture of voice coils is incorporated in the recommended coil factory, while the manufacture of housing (presumably all in plastic by 1980) is included in the plastic industry. It is however recommended that only one centre produces all the housings required.

Cones and magnets have still to be imported.

For the TV tuners, all parts will be imported, the quantities involved do not justify their manufacture.

PROJECTS

Project No. 1

Recommended location: one in DAHOMEY
one in GUINEA
one in MALI

Three factories assembling each 100,000 radios and electrophones/year. Per factory, the following are estimated:

(a) Personnel

70 direct + 10 indirect + 15 others = TOTAL 95 persons

N.B. : Indirect personnel should be understood as the people working in production but not directly assembling sets, such as: controllers, people for the alignment, etc... Others include management, administration, secretaries cantine personnel, drivers, watchmen, etc...

(b) Buildings

Production	420m2	
Stores	420m2	
Quality Dept.	30m2	
Toolshop	30m2	
Others	250m2	= TOTAL 1,170m2

Estimated investment in buildings and land = US.$ 117,000.-

(c) Equipment

Production, stores, quality dpt., toolshop US.$ 70,000.-

Depreciation in 6 years.

(d) Working capital

3 months raw material	$ 408,000	
3 " finished products	$ 562,000	
Work in progress	$ 30,000	= US.$ 1,000,000.-

of which approximately US.$ 400,000 in foreign currency.

Project No. 2

Recommended location: NIGERIA.

One factory assembling 200,000 radios and electrophones per year. The following are estimated:

(a) Personnel

140 direct + 10 indirect + 15 others = 165 persons

(b) Buildings

Production	840m2	
Stores	840m2	
Quality Dept.	30m2	
Toolshop	30m2	
Others	420m2	= TOTAL 2,160m2

Estimated investment in buildings US.$ 21,600.-

(c) Equipment

Production, stores, quality Dept., toolshop US.$ 95,000.-

Depreciation in 6 years.

(d) Working capital

3 months raw material	$ 816,000	
3 " finished products	$1,124,000	
Work in progress	$ 60,000	= US.$ 2,000,000.-

of which approximately US.$ 800,000 in foreign currency.

Project No. 3

Recommended location: NIGERIA.

One factory assembling 300,000 radios and electrophones per year. The following are estimated:

(a) Personnel

210 direct + 15 indirect + 15 others = TOTAL 240 persons

(b) Buildings

Production	1260m2		
Stores	1260m2		
Quality Dept.	40m2		
Toolshop	40m2		
Others	630m2	=	TOTAL 3,230m2

Estimated investment in buildings and land US.$ 323,000.-

(c) Equipment

Production, stores, quality dept., toolshop US.$ 130,000.-

Depreciation in 6 years.

(d) Working capital

3 months raw material	$ 1,224,000		
3 " finished products	$ 1,686,000		
Work in progress	$ 90,000	=	US.$3,000,000.-

of which approximately $ 1,200,000 in foreign currency.

Project No.4

Recommended location: one in IVORY COAST
one in SENEGAL
one in SIERRA LEONE

Three factories, each assembling 100,000 radios and electrophones, 12,000 television sets, 20,000 television tuners, 200,000 loudspeakers per year.

Per factory, the following are estimated:

(a) Personnel

Radio & electrophone	70	direct	+	10	indirect
TV	24	"	+	4	"
TV tuners	10	"	+	2	"
Loudspeakers	11	"	+	2	"
Stores				3	"
Quality Dept.				2	"
Toolshop				2	"

115 direct + 25 indirect + 20 others
=160 persons

(b) Buildings

Radio & Electrophone	420m2	production	+ 420m2	stores
TV	200m2	"	+ 200m2	"
TV tuners	60m2	"	+ 20m2	"
Loudspeakers	70m2	"	+ 30m2	"
Quality dept.	30m2			
Toolshop	30m2			
Others	400m2			

TOTAL : 1,880m2

Estimated investment in buildings and land US.$ 188,000.-

(c) Equipment

Radio and electrophone(*)	$	70,000	
TV	$	22,000	
TV tuners	$	10,000	
Loudspeakers	$	21,000	
Quality Dept. (**)	$	20,000	
Toolshop (**)	$	10,000 =	US.$ 153,000.-

(*) including quality dept. and toolshop

(**) TV, TV tuners and loudspeakers.

Depreciation in 6 years.

(d) Working capital

Radio & electrophone			
- 3 months raw material	$ 408,000		
- 3 " finished products	$ 562,000		
- Work in Progress	$ 30,000	=	US.$ 1,000,000.-
Television			
- 3 months raw material	$ 315,000		
- 3 " finished products	$ 440,000		
- Work in Progress	$ 20,000	=	US.$ 775,000.-
TV tuners			
- 3 months raw material	$ 35,000		
- Work in Progress	$ 5,000	=	US.$ 40,000.-

Loudspeakers		
- 3 months raw material	$ 37,000	
- Work in Progress	$ 3,000	
- 1 month for shipping time of 45% of production	$ 6,000	= US.$ 46,000.-
TOTAL Working capital		= US.$ 1,861,000.-

of which approximately US.$ 700,000 in foreign currency.

Project No. 5

Recommended location: GHANA.

One factory assembling 200,000 radios and electrophones, 30,000 television sets, 20,000 TV tuners and 500,000 loudspeakers per year.

The following are estimated:

(a) Personnel

Radio and electrophone	140	direct	+	10	indirect
Television	60	"	+	5	"
TV tuners	10	"	+	2	"
Loudspeakers	27	"	+	4	"
Stores				6	"
Quality dept.				4	"
Toolshop				3	"
TOTAL:	237	direct	+	34	indirect + 30 others
	= 301 persons				

(b) Buildings

Radios and electrophones	840m2	production	+	840m2	stores
Television	500m2	"	+	500m2	"
TV tuners	60m2	"	+	20m2	"
Loudspeakers	185m2	"	+	75m2	"
Quality dept.	60m2				
Toolshop	60m2				
Others	1,000m2				

Total : 4,140m2

Estimated investment for buildings and land US.$ 414,000.-

(c) Equipment

Radio & electrophone	(*)	$ 95,000	
Television		$ 45,000	
TV tuners		$ 10,000	
Loudspeakers		$ 50,000	
Quality dept.	(**)	$ 25,000	
Toolshop	(**)	$ 10,000	= US.$ 235,000.-

(*) including quality dept, and toolshop

(**) TV, TV tuners, loudspeakers.

Depreciation in 6 years.

(d) Working capital

Radio & electrophone		
- 3 months raw material	$ 816,000	
- 3 " finished products	$1,124,000	
- Work in Progress	$ 60,000	= US.$2,000,000.-
Television		
- 3 months raw material	$ 800,000	
- 3 " finished products	$1,100,000	
- Work in Progress	$ 50,000	= US.$1,950,000.-
TV tuners		
- 3 months raw material	$ 45,000	
- Work in Progress	$ 5,000	= US.$ 50,000.-
Loudspeakers		
- 3 months raw material	$ 92,000	
- Work in Progress	$ 8,000	
- 1 month shipping time of 50 % of production	$ 15,000	= US.$ 115,000
TOTAL Working Capital		US.$4,115,000

of which approximately US.$ 1,800,000 in foreign currency.

Project No. 6

Recommended location: NIGERIA.

One factory assembling 300,000 radios and electrophones, 34,000 television sets, 34,000 TV tuners and 300,000 loudspeakers per year.

The following are estimated:

(a) Personnel

Radio & electrophone	210	direct +	15	indirect
Television	65	" +	6	"
TV tuners	66	" +	3	"
Loudspeakers	17	" +	3	"
Stores			7	"
Quality dept.			5	"
Toolshop			3	"

TOTAL = 358 direct + 42 indirect + 30 others
= 430 persons

(b) Buildings

Radio and electrophone	1240m2	production +	1240m2	stores
Television	580m2	" +	580m2	"
TV tuners	120m2	" +	125m2	"
Loudspeakers	60m2	" +	25m2	"
Quality Dept.	60m2			
Toolshop	60m2			
Others	1100m2			

TOTAL : 5,190 m2

Estimated investment in buildings and land US.$ 519,000

(c) Equipment

Radio & electrophone (*)	$ 130,000
Television	$ 50,000
TV tuners	$ 10,000
Loudspeakers	$ 30,000

(*) including Toolshop and quality dept.

Quality dept.	(**)	$ 25,000	
Toolshop	(**)	$ 10,000	= US.$ 215,000

Depreciation in 6 years.

(d) Working capital

Radio & electrophone		
- 3 months raw material	$ 1,224,000	
- 3 " finished products	$ 1,686,000	
- Work in Progress	$ 90,000	= US.$ 3,000,000
Television		
- 3 months raw material	$ 900,000	
- 3 " finished products	$ 1,300,000	
- Work in Progress	$ 55,000	= US.$ 2,255,000
TV tuners		
- 3 months raw material	$ 50,000	
- Work in Progress	$ 6,000	= US.$ 56,000
Loudspeakers		
- 3 months raw material	$ 55,000	= US.$ 55,000
TOTAL Working Capital:		US.$ 5,366,000

of which approximately US.$ 2,300,000 in foreign currency.

Project No. 7

Recommended location : NIGERIA

One factory assembling 400,000 radios and electrophones, 40,000 television sets, 26,000 TV tuners and 700,000 loudspeakers per year.

The following are estimated:

(a) Personnel

Radio & electrophone	280	direct +	20	indirect
Television	82	" +	8	"
TV tuners	13	" +	2	"
Loudspeakers	38	" +	5	"
Stores			8	"

** TV, TV tuners and loudspeakers

Quality Dept.	6 indirect
Toolshop	4 "
TOTAL:	413 direct + 53 indirect + 40 others
	= 506 persons

(b) Buildings

Radio & electrophone	1680m2	production	+ 1680m2	stores
Television	700m2	"	+ 700m2	"
TV tuners	90m2	"	+ 35m2	"
Loudspeakers	260m2	"	+ 105m2	"
Quality Dept.	80m2			
Toolshop	80m2			
Others	1400m2			

TOTAL : 6,810m2

(c) Equipment

Radio & electrophone (*)	$ 160,000	
Television	$ 55,000	
TV tuners	$ 10,000	
Loudspeakers	$ 60,000	
Quality Dept. (**)	$ 30,000	
Toolshop (**)	$ 15,000	= US.$ 330,000

(*) including Quality Dept., Toolshop

(**) TV, TV tuners, loudspeakers.

Depreciation in 6 years.

(d) Working capital

Radio and electrophone		
- 3 months raw material	$ 1,632,000	
- 3 " finished products	$ 2,250,000	
- Work in Progress	$ 118,000	= US.$ 4,000,000
Television		
- 3 months raw material	$ 1,180,000	
- 3 months fin.products	$ 1,500,000	
- Work in Progress	$ 65,000	= US.$ 2,745,000

TV tuners			
- 3 months raw material	$ 60,000		
- Work in Progress	$ 7,000	= US.$	67,000
Loudspeakers			
- 3 months raw material	$ 130,000		
- 1 month shipping time of 35 % of production	$ 25,000	= US.$	155,000
TOTAL Working Capital			US.$ 5,967,000

of which approximately US.$ 3,100,000 in foreign currency.

SUMMARY OF ALL ASSEMBLY PLANTS: (see table 20)

The total investment for 11 assembly plants in West Africa Sub-region is estimated at ..... US.$33,813,000,
of which ..... US.$14,214,000 in foreign currency.

It is estimated that approximately 3 to 5 million US.dollars are already invested.

The personnel employed would be	1,913	direct
	259	indirect
	235	others
TOTAL :	2,407	

TABLE 20

ASSEMBLY PLANTS

	PROJECT NO.						
	1	2	3	4	5	6	7
(a) PERSONNEL							
Direct	70	140	210	115	237	358	413
Indirect	10	10	15	25	34	42	53
Others	15	15	15	20	30	30	40
Total:	95	165	240	160	301	430	506
(b) BUILDINGS							
m2	1,170	2,160	3,230	1,885	4,140	5,185	6,810
Estimated value US.$ (1)	117,000	216,000	323,000	185,000	414,000	519,000	681,000
(c) EQUIPMENT							
US.$ (2)	70,000	95,000	130,000	153,000	235,000	255,000	330,000
(d) WORKING CAPITAL							
Total US.$ (3)	1,000,000	2,000,000	3,000,000	1,861,000	4,115,000	5,366,000	5,967,000
In foreign currency (4)	400,000	800,000	1,200,000	700,000	1,800,000	2,300,000	3,100,000
TOTAL INVESTMENT (1)+(2)+(3)	1,187,000	2,311,000	3,453,000	2,202,000	4,764,000	6,140,000	6,978,000
of which (2)+(4) in foreign curr.	470,000	895,000	1,330,000	853,000	2,035,000	2,555,000	3,430,000
Number of factor.	3	1	1	3	1	1	1
TOTAL INVESTMENT $	3,561,000	2,311,000	3,453,000	6,606,000	4,764,000	6,140,000	6,978,000
of which in foreign currency	1,410,000	895,000	1,330,000	2,559,000	2,035,000	2,555,000	3,430,000

2. Coils, variable condensers and trimmers

Project No.8

Recommended location: one in GHANA
one in IVORY COAST
one in NIGERIA

It is recommended to concentrate the production of these components in maximum three factories, each producing the three types of articles.

Concentration of coil production may be a point of argument, as nowadays it is generally accepted that set-assemblers produce some of the coils for their own use. This is because coils are considered as non-standard items made for a given electronic apparatus.

However, miniaturisation and standardization will gradually change this situation and it is believed that by 1980, coils will be produced better and cheaper on a relatively large scale with more mechanized processes, and will be adapted in any design.

Moreover, a certain number of coils will be replaced by ceramic filters.

Voice coils for loudspeakers manufacturing are included in the quantities mentioned.

One of these coils factories could also be the production centre for the relays needed for the telephone switching apparatus if they are assembled in a nearby factory (See paragraph III: Industrial Electronic Products).

With regard to variable condensers and trimmers, the minimum economical quantities to be manufactured are respectively 250,000 and 1,000,000.

Only assembly of these articles can be considered. Production of parts for this assembly requires much bigger production to be economical and consequently is not recommended.

Variable condensers are assumed to be of the foil dielectric type, use of which will presumably be generalized by 1980.

For the three factories in total, the following investment is estimated:

Three factories assembling/producing a total of:

- 18,500,000 coils (including 2,400,000 voice coils for loud-speaker)
- 1,900,000 variable condensers
- 9,500,000 trimmers.

For calculation purposes, these totals are divided equally over the 3 factories. Per factory, this results in:

(a) Personnel

- coils	121 direct	+ 8	indirect	workers
- variable condensers	60 "	+ 6	"	"
- trimmers	40 "	+ 4	"	
- Quality dept.		2	"	"
- Stores		3	"	"
- Toolshop		2	"	"
TOTAL :	205 direct + 25 indirect + 30 others = 260 persons			

(b) Buildings

- coils	600m2 production	+	100m2	stores	(20 %)
- variable condensers	200m2 "	+	40m2	"	(20 %)
- trimmers	100m2 "	+	20m2	"	(20 %)
- Quality Dept.	50m2				
- Toolshop	50m2				
- Others	440m2 (approx.50% of production space)				

TOTAL = 1000m2 production + auxiliary
160m2 stores
440m2 others
1600m2

Estimated investment in buildings and land: US.$ 160,000

(c) Equipment

- coils	US.$ 230,000	
- variable condensers	US.$ 45,000	
- trimmers	US.$ 25,000	
- Quality Dept.	US.$ 6,000	
- Toolshop	US.$ 14,000 =	US.$ 320,000

Depreciation 6 years.

(d) Working capital

- Coils	: 3 months raw material	US.$ 182,500
- Variable condensers	: 3 months raw material	US.$ 66,250
- trimmers	: 3 months " "	US.$ 14,250
		US.$ 263,000
- Work in Progress		US.$ 9,000
- One month transport	: coils $ 140,000	
	var.condens. $ 50,000	
	: trimmers $ 13,000 =	US.$ 203,000
Total Working capital		US.$ 475,000

of which US.$ 263,000 in foreign currency.

3. Deflection units and line output transformers

Project No. 9

Recommended location : NIGERIA.

The production techniques of these two articles are very similar and should then be concentrated in the same factory.

The minimum quantity for economical production is 100,000 pieces of each article. Ferroxcube cores can be supplied by ferrite factory.

One factory producing per year: 140,000 deflection units
140,000 line output transformers

This results in:

(a) Personnel

- deflection unit	18 direct + 3 indirect workers
- line output transformers	18 direct + 3 indirect "
- Stores	2 "
- Quality Dept.	2 "
- Toolshop	2 "
TOTAL	36 direct + 12 indirect + 10 others
	= 58 persons

(b) Buildings

- deflection unit	160m2 production + 50m2 stores (30 %)
- line output transformers	220m2 " + 60m2 " (30 %)
- Quality Dept.	30m2
- Toolshop	30m2
- Others	200m2 (50 % of production space)
TOTAL	440m2 production + auxiliary
	110m2 stores
	200m2 others = 750 m2

Estimated investment in buildings and land : US.$ 75,000

(c) Equipment

TOTAL US.$ 125,000

Depreciated in 6 years.

(d) Working capital

- Raw material	$ 81,000
- Work in progress	$ 3,000
- Transport finished goods	$ 50,000 =

TOTAL Working capital US.$ 134,000

of which US.$ 81,000 in foreign currency.

4. Transistors, diodes, resistors, capacitors

Project No. 10

Recommended location : NIGERIA.

The manufacture of the four types of articles mentioned should be combined in one single production unit in order:

(1) to comply with the necessity of concentrating the production on articles based on sophisticated technology, and

(2) to make provision for the fact that before or after 1980, a part of these components will be combined in one single chemically produced Integrated Circuit.

For a total requirement for the Sub-region of 20,000,000 transistors and 7,000,000 diodes, it is expected that 15,000,000 pieces and 6,000,000 pieces respectively of the most popular types, mainly used in Consumer Electronic Products, could be produced. The others required in too small quantities, do not justify or even permit the local production.

Technically speaking, the manufacture of a quantity of 15,000,000 transistors per year is feasible. There exists in the world factories producing quantities even lower.

However, the production volume has a direct influence on the cost price of the transistors, as this production requires high investments and relatively few people (the specialization of which requires long and effective training).

For semi-conductors, cost price is a determinant factor and must be at least equal to the world market CIF price. Protection of the industry by import restriction and import duties, or even total interdiction of import is mostly inefficient because large quantities of these articles can very easily be introduced illegally in the countries as they represent a high value in small volume and weight.

However, West Africa seems to be very well placed geographically and from the domestic market potential point of view, for the establishment of a transistor, diode and resistor production centre for a larger part if not all of Africa. The more so that transport does not present difficulties, articles being very light. Air transport does not affect very much the total cost. If sufficient load for the factory can be found, then a factory could be definitely recommended.

The Silicon Planar type of transistor in plastic encapsulation is considered here. The required investment is largely dependent on the types and series per types. The figures stated hereafter are to be taken as a rough estimate.

Diodes are of the sub-miniature type, in quantities of 6,000,000 per year.

The 95,000,000 capacitors are of the types used mainly in Consumer Electronic Products, such as : ceramic, pin-ups, R.C. combinations, styroflex, flat foils, polyester, as well as electrolytics. Minimum production is variable according to the type produced.

In view of the fact that before or after 1980, there is a chance that part of the requirement for this article will be replaced by the chemically produced Integrated Circuits, it is highly recommended to concentrate the production in one single factory combining the production of transistors, diodes and resistors.

Obviously, some types of condensers can be produced economically in small units, but definitely not the complete range. It is important to realize that small units created now with limited investments should be cautiously analyzed as in the long run they face the risk of competing with better equipped production centres, having cost advantages resulting from mass production and offering the complete range.

The 110,000,000 resistors are also of the type generally used in Consumer Electronic apparatus. The quantity mentioned includes carbon resistors, wirewound resistors, potentiometres, pre-set potentiometres.

The following are estimated:

(a) Personnel

- Transistors	70	direct +	11	indirect +	29	others
- Diodes	18	" +	5	" +	7	"
- Resistors	175	" +	27	" +	75	"
- Capacitors	317	" +	39	" +	370	"
TOTAL	580	" +	82	" +	481	"

= 1143 persons

(b) Buildings

- Transistors	640m2	production +	100m2	stores
- Diodes	160m2	" +	80m2	"
- Resistors	1500m2	" +	375m2	"
- Capacitors	2720m2	" +	680m2	"
- Others	1375m2			

TOTAL = 7630m2

Estimated investment in buildings and land : US.$ 763,000

(c) Equipment

- Transistors	$ 1,900,000 (*)	
- Diodes	$ 290,000	
- Resistors	$ 970,000	
- Capacitors	$ 1,980,000 =	US.$ 5,140,000

(*) This is a rough estimate. Equipment varies very much according to types, series and process.

Depreciation in 4 years for transistors and diodes, and 5 years for capacitors and resistors.

(d) Working capital

Transistors			
- 3 months raw material	$ 170,000		
- Work in Progress	$ 40,000		
- Finished products in transit	$ 285,000	= US.$	495,000
Diodes			
- 3 months raw material	$ 20,000		
- Work in Progress	$ 10,000		
- Finished products in transit	$ 64,000	= US.$	94,000
Resistors			
- 3 months raw material	$ 475,000		
- Work in Progress	$ 150,000		
- Finished products in transit	$ 265,000	= US.$	890,000
Capacitors			
- 3 months raw material	$ 500,000		
- Work in Progress	$ 150,000		
- Finished products in transit	$ 380,000	= US.$	1,030,000
TOTAL Working Capital		US.$	2,509,000

of which approximately US.$ 1,925,000 in foreign currency.

5. Ferroxcube material

Project No. 11

Recommended location : NIGERIA.

The total requirement of 180 tons of ferrite material is the base minimum quantity of production unit working economically. Raw material principally metal oxides, cannot unfortunately be produced locally as it requires very specialized equipment and techniques; nowadays, only a few firms in the world supply the whole market.

Consequently, one centre only, preferably for all Africa should be recommended.

The following are estimated:

(a) Personnel

30 direct + 4 indirect + 30 others = 64 persons

(b) Buildings

1600 m2 production
400 m2 stores
400 m2 others
2400 m2 total

The estimated investment in buildings and land is US.$ 240,000

(c) Equipment

TOTAL : US.$ 615,000

Depreciation in 7 years.

(d) Working capital

- 3 months raw material	$ 80,000	
- Work in Progress	$ 25,000	
- Finished products in transit	$ 40,000	US.$ 145,000

of which approximately US.$ 120,000 in foreign currency.

6. Picture tubes

Project No. 12

Recommended location : NIGERIA

The estimated production of 140,000 tubes does not permit more than the assembly of the gun to the imported bulbs and the deposit of the screen layers.

Joining of the bulbs cannot even be considered in view of the quantities.

Picture tube is a very bulky article, which involves high transport costs. Transport of the bulbs for assembly is also very

costly. Consequently, the picture tube factory located adjacent to the TV assembly plants may have some justification from the cost price point of view, but if the tubes have to be transported any great distance then the possible price advantage will be killed by transport costs and possible replacements.

Small plants for pumping the tubes could be considered in various locations, provided an average of 10,000 tubes a year could be envisaged.

The following are estimated:

(a) Personnel

80 direct + 10 indirect + 35 other : 125 persons

(b) Buildings

TOTAL 3,000m2

Estimated investment in buildings and land US.$ 300,000

(c) Equipment

TOTAL US.$ 750,000

Depreciation in 5 years.

(d) Working capital

- 3 months raw material	$ 390,000	
- Work in Progress	$ 130,000	
- 2 months finished products in transit	$ 500,000	= US.$ 1,020,000

of which approximately US.$ 785,000 in foreign currency.

SUMMARY OF PLANTS for manufacture or assembly of parts and components. (See table 21)

The total investment is estimated for the West Africa Sub-region at US.$ 14,681,000

of which in foreign currency ..... US.$ 11,290,000

The personnel employed would be: 931 direct
133 indirect
586 others
1,650 total

TOTAL INVESTMENT FOR CONSUMER ELECTRONICS WHENEVER ALL PROJECTS ARE IN OPERATION (See table 22)

Whenever parts and components will be produced locally, the total amount of the Working Capital will still be required. However, the part of it in foreign exchange, although reduced considerably will not completely disappear, as an estimated 20 per cent in value of components and parts will still be imported.

The total investment will be US.$ 48,464,000
in foreign currency ..... US.$ 15,504,000

C. Consideration on Associated Industries

1. Plastic

As stated above the plastic parts required by the electronic industry will most probably be produced adjacent to the radio and TV assembly plants, to eliminate as far as possible, transport costs of empty cabinets which would be prohibitive.

Moreover, by 1980, it is likely that facilities will be available in most of the countries to satisfy the needs for plastic articles other than those for the electronic industry.

Evaluation of the investment required for the electronic industry alone is then very much irrelevant.

As an indication, however, one could estimate roughly at US.$ 4,500,000 the total investment needed for the production of 1,700,000 radio plastic cabinets assuming this would be made in one single factory. More than half of the investment refers to the equipment.

Great attention should be paid to the problem of moulds.

Mould making is an extremely specialized activity and very expensive.

The most realistic solution would consist of importing existing moulds. The importation of moulds, however, is not justifiable unless

TABLE 21

		Project N°				
		8	9	10	11	12
a) PERSONNEL						
Direct		205	36	580	30	80
Indirect		25	12	82	4	10
Others		30	10	481	30	35
Total:		260	58	1,143	64	125
b) BUILDINGS						
m2		1,600	750	7,630	2,400	3,000
Estimated value US. $	(1)	160,000	75,000	763,000	240,000	300,000
c) EQUIPMENT						
US. $	(2)	320,000	125,000	5,140,000	615,000	750,000
d) WORKING CAPITAL						
Total US $	(3)	475,000	134,000	2,509,000	145,000	1,020,000
In foreign currency US $	(4)	263,000	81,000	1,925,000	120,000	785,000
TOTAL INVESTMENT						
(1)+(2)+(3) US $		955,000	334,000	8,412,000	1,000,000	2,070,000
of which (2)+(4) in foreign currency US $		583,000	206,000	7,065,000	735,000	1,535,000
Number of factories		3	I	I	I	
TOTAL INVESTMENT US $		2,865,000	334,000	8,412,000	1,000,000	2,070,000
of which in foreign currency		1,749,000	206,000	7,065,000	735,000	1,535,000

TABLE 22

Total Investment For Customer Electronics

Whenever All projects Are in Operation

in °/oo US $

Project n°	Buildings	Equipments	Working Capital		
			In foreign exchange	Total	
1	351	210	1.200	3.000	
2	216	95	800	2.000	
3	323	130	1.200	3.000	
4	564	459	2.100	5.583	Assembly
5	414	235	1.800	4.115	
6	519	255	2.300	5.366	
7	681	330	3.100	5.967	
	3.068	1.714	12.500	29.031	
			20 % still imported 2.500		
8	480	960	789	1.425	
9	75	125	81	134	
10	763	5.140	1.925	2.509	Manufacture of parts
11	240	615	120	145	
12	300	750	785	1.020	
	1.858	7.590	3.700	5.233	
Total	4.926	9.304	6.200	34.234	
Total investment				US $ 48.464	
Total investment in Foreign Currency				US $ 15.504	

a sufficient quantity of cabinets can be pressed on one mould, as otherwise the influence of the amortization on the cost of the cabinet will be too high or even unacceptable.

The very specific characteristic of the plastic industry induces then the radio assemblers to standardize to the maximum and to produce in large quantities a limited number of models.

For small quantities temporary importation of moulds on a rental basis could be considered, or the manufacture of cabinets in wood covered by plastic material although this solution might also be expensive.

2. Metalware

The same remark applies for metalware as for plastic. For the needs of the electronic industry alone and assuming one single production centre (which will be far from reality) a total investment of approximately US.$ 2,800,000 could be roughly estimated of which 2/3rds covers equipment only.

The problem of the dies is very similar to the problem of plastic moulds and leads to the same remark and conclusion.

3. Wooden cabinets

With regard to location of this industry, the same remark as for plastic cabinets applies even to a greater extent to wooden cabinets. A rough estimate of the investment shows a total of approximately US.$ 3,000,000 of which 1/3rd covers equipment.

N.B. These associated industries are however very important for the electronic assembly industry. Local manufacture of these products contributes to a very large extent to the currency saving (see par.IV.C).

It is therefore highly recommended to start production of these articles as soon as possible after the starting up of an assembly plant.

4. Dry batteries

The present manganese-dioxide batteries are manufactured in big and small factories side by side, from common manual operated to complete mechanical production set-ups; the first having relatively low investments and giving work to quite some people, the latter to a much greater degree demands high investment and relatively low labour.

The manufacture of dry batteries can only be done economically at the rate of 10,000,000 batteries a year as a minimum, preferably of one type only. This is no disadvantage, as about 70 per cent of all batteries are of the flash light size. Further important types are the baby cell, accounting for 10 per cent of the market and the penlight for 15 per cent of the market. The remaining 5 per cent is divided into very many types, the manufacture of which should definitely not be considered.

Basic materials of dry batteries are the following : manganese-dioxide, zinc of a constant specific purity, coal rods, a covering mantle of carton, plastic or metal, acetylene black, electrolytic solution (NH_4Cl) and some remaining materials like starch carton, compound. Although highly dependable on the size of the factory, the basic materials represent about 70 per cent of the production value of a battery.

Manganese-dioxide is found in Ghana where ore is of very good quality. The manufacture of good zinc, coal rods and acetylene black demand high standardized factories.

Based on the production of 20,000,000 batteries/year manufactured by the labour intensive process about 100 men can be employed. Total investment would amount to approximately 1,000,000 US.$, production value to about US.$ 1,400,000. A building of about 700 m2 is needed.

3. INDUSTRIAL ELECTRONIC PRODUCTS

A. General

1. No consideration can be given in this report to the possible manufacture of numerous types of electronic equipments analysed above under "Measuring Instruments" and "Other electronic professional equipments".

The reasons are that these equipments and/or products are far too much diversified and consequently do not give enough volume per type to justify manufacture in West Africa. However, various articles could be considered in the course of the next 15 years, if a sufficient demand is continuously guaranteed as additional production to an existing factory.

2. Some Telecommunication equipment (radio and telephony) manufacture can be considered as feasible provided strict conditions are obtained. These conditions are:

(a) The effective existence of a Free Trade Area in West Africa, which would permit one single production centre to supply the whole sub-region without payment of duties or taxes of any kind.

(b) Import of ready-made equipments manufactured in the zone should be completely prohibited. This in order to protect the industry from import of equipments under special and sometimes abnormal conditions.

(c) An absolute standardization of the equipment amongst the whole region.

3. Telecommunication Equipment manufacture requires : highly qualified personnel at all levels, trained to work with very great accuracy and very neatly. No industry should ever be recommended unless guarantee is obtained as to the availability of the personnel.

Training is long and costly.

4. Estimates of the total Electronic Equipment needed in the next 15 years as shown in CHAPTER TWO, represents only a part of the total expenditure required for the equipment operating actually.

Reference is made here to the installation cost, and to the auxiliary equipments such as : masts and towers, antennae, diesel generators and instruments, power cables, telecommunication cables, roads and other civil works, such as buildings.

Hereafter is a rough estimate of the order of magnitude of these auxiliary equipments per class of Electronic telecommunication equipment. The figures are, obviously, average figures and can differ sometimes from reality in specific cases. It gives, however, the importance of the total expenditure to be envisaged.

	Electronic equipment	Auxiliary equipment	Civil works	Installation
Microwave equipment & associated carrier eq.	100 %	100 %	100 %	25 %
Sound broadcasting(AM)	100 %	75 %	25 %	25 %
TV transmitting & FM broadcasting	100 %	75 %	25 %	25 %
Switching equipment	100 %	100 %	50 %	25 %

N.B. 1. Electronic Equipment : as described in CHAPTER FOUR.

2. Auxiliary equipment : masts, towers, diesels, antennae, etc... with the exception of Allied equipment for Switching Equipment which is mainly telecommunication cables

3. Civil works : buildings, roads, etc...

5. It is general practice in large telecommunication projects to make the installation on a "turn key" basis. This means that one company takes the full responsibility for the total execution of the project including electronic equipment, auxiliary equipment and civil works.

This responsibility is generally given to the manufacturer of the electronic equipment, although these equipments represent very often less than 30 per cent of the total expenditure.

This has two major consequences in connexion with the possible manufacture of telecommunication equipments.

(a) The local equipment manufacturer must have the technical possibility to undertake full responsibility for the project. This means that they must have at their disposal technical staff highly qualified in numerous fields apart from Electronics, such as : specialists in power plants, in diesel engines, in civil works, architects, metallic structural engineers, etc...

It is obviously not necessary nor feasible to have all auxiliary equipment made locally but specialists must be available for control and acceptance of the equipments.

(b) The general contractor must have the financial possibility to undertake the total projects.

B. Description of the Projects

Seeing the total volume of telecommunication equipment required in the Sub-region for 15 years, and provided conditions described above are fulfilled, there exists a possibility of assembling the equipments in four factories grouped in one unit.

(a) 1 factory for telephone exchanges and telephone sets
(b) 1 factory for carrier telephone equipments,
(c) 1 factory for microwave equipment, TV transmitters and Sound broadcasting transmitters
(d) 1 factory for metalware.

The factories are based on generally accepted worldwide techniques. It is however difficult to foresee exactly the technological development in the next 15 years, as it is already difficult to forecast over periods of 5 years.

A starting period of approximately 3 to 4 years before reaching full running production is to be taken into consideration.

It is also assumed that the total market requirement will be as far as possible evenly distributed over the 15 years. This can only be achieved by excellent planning between the 14 countries of the Sub-region. Small factories of the size described hereafter can hardly absorb high production peaks.

N.B.: The working capital referred to hereafter in the various projects does not take into consideration installation, auxiliary equipment and civil works.

It refers exclusively to the capital needed for the production of the electronic equipments.

1. Telephone exchanges and telephone sets

Project No. 13

Recommended location : NIGERIA.

It should be noted that 20,000 telephone sets per year is really the lower quantity limit for recommending local assembly. 30,000 sets/year would be a much more acceptable figure from the economical point of view. Consequently, before starting such a venture guarantee should be given that this minimum of 20,000 sets a year is certain.

The telephone exchanges are based on 20,000 lines per year. Each exchange would have from 200 to 400 lines as an average.

The number of lines per exchange has in fact relatively little importance as all components needed are irrespective of this number. The influence is mainly on the metallic cabinet.

It is assumed that the relays are manufactured in the factory.

Associated industries can provide plastic housing of telephone sets.

The factory should be air-conditioned and dust free.

In the personnel requirement, care is taken for a number of technicians for application which means study of projects, etc...

The total turnover of the factory (expressed in world market CIF prices 1965 level of similar imported requirement) is

$$\frac{36,800,000}{15} = \text{Approximately US.\$ 2,400,000 per year.}$$

The following are estimated:

(a) Personnel

150 direct + 15 indirect + 35 others = 200 persons

of which 30 with basic technical knowledge
3 with advanced " "
12 with Bachelor Degree
25 administrative
10 technical management level

(b) Buildings

2,000 m2 including stores and auxiliaries

Estimated investment in buildings and land = US.$ 200,000

(c) Equipment

Estimated at US.$ 400,000

Depreciation in 5 years.

(d) Working capital

For this type of equipment, the working capital has to be estimated at an average of one year's turnover, which means US.$ 2,400,000

of which approximately US.$ 1,600,000 in foreign currency.

2. Carrier Telephone Equipment

Project No. 14

Recommended location : NIGERIA.

This factory would produce terminal and repeater carrier telephony equipment for use on radio links.

The total volume over the 15 years is estimated at US.$ 9,600,000 (20 per cent of 48,000,000) which means an approximate yearly turnover of US.$ 640,000.

Some components such as transformers are supposed to be manufactured in the factory.

the following are estimated:

(a) Personnel

50 direct + 23 indirect + 7 others = 80 persons

of which 10 with basic technical knowledge
6 with Bachelor Degree
15 qualified Engineers

(b) Buildings

900m2 including stores and auxiliaries.

Estimated investment in buildings and land US.$ 90,000

(c) Equipment

Estimated at US.$ 300,000

Depreciation in 5 Years.

(d) Working capital

For this type of equipment, the working capital has to be estimated at 1,2 times the yearly turnover, which means US.$ 800,000

of which, approximately US.$ 320,000 in foreign currency.

3. Radio and TV transmitters

Project No. 15

Recommended location : NIGERIA.

This factory would produce microwave transmitters (approximately 1,000 transmitter receivers over 15 years), for an approximate value of US.$ 38,400,000 (80 % of US.$ 48,000,000).

Production of TV transmitters for an evaluated amount of
US.$ 48,000,000

Production of sound broadcasting transmitters for an amount of
US.$ 14,200,000

Various radio equipment US.$ 10,000,000

Total estimated amount of the production of the factory over 15 years US.$ 110,600,000

which means an average of

$$\frac{110,600,000}{15} = \text{approximately US.\$7,300,000/year}$$

It is assumed that transformers are manufactured in the factory.

The following are estimated:

(a) Personnel

140 direct + 45 indirect + 55 others = 240 persons

of which 56 with basic technical knowledge
60 with advanced technical knowledge
27 with Bachelor Degree
15 qualified Engineers

(b) Buildings

2,500m2 including stores and auxiliaries

Estimated investment in buildings and land US.$ 250,000

(c) Equipment

Estimated at US.$ 650,000

Depreciation in 5 years.

(d) Working capital

For this type of equipment, the working capital has to be estimated at an average of one year's turnover, which means

US.$ 7,300,000,

of which approximately US.$ 5,000,000 in foreign currency

4. Metal parts

Project No. 16

Recommended location : NIGERIA.

This associated industry is so closely connected with the other three factories described above that contrary to metal parts for Consumer Electronic Products, it should be located next to them. Moreover, the major part of its production should be reserved for the telecommunication assembly plants.

The total turnover of this factory is estimated at US.$ 510,000 per year.

The following are estimated:

(a) Personnel

80 direct + 16 indirect + 4 others = 100 persons

of which 22 with basic technical knowledge
8 with advanced technical knowledge
4 qualified Engineers

(b) Buildings

1500 m2 including stores and auxiliaries

Estimated investment in buildings and land US.$ 150,000

(c) Equipment

Estimated at US.$ 250,000

Depreciation in 5 years.

(d) Working capital

This factory, working exclusively for the other three telecommunication equipment factories, requires a working capital of an average of one year's turnover, which means

US.$ 510,000

of which approximately US.$ 200,000 in foreign currency

SUMMARY of plants for manufacture of telecommunication equipments (See Tables 23 & 24).

The total investment is estimated for the total West Africa Sub-region at US.$ 12,500,000

of which approximately US.$ 8,720,000 in foreign currency

The personnel employed would be 420 direct
99 indirect
101 others
620 total

IV. GENERAL INFORMATION ON THE PROJECTS

A. General Survey of Investment and Labour employed

Assuming that 16 projects would be implemented and in full operation, based on 1965 prices, the total investment for West Africa Sub-region (See Table 25) has been evaluated at:

Consumer Electronics	$ 48,464,000
Industrial Electronics	$ 12,500,000
Total	US.$ 60,964,000

of which, amount in foreign currency:

Consumer Electronics	$ 15,504,000
Industrial Electronics	$ 8,720,000
	US.$ 24,224,000

TABLE 23

		Project N°			
		13	14	15	16
a) PERSONNEL					
Direct		150	50	140	80
Indirect		15	23	45	16
Others		35	7	55	4
Total :		200	80	240	100
b) BUILDINGS					
m2		2,000	900	2,500	1,500
Estimated value US $	(I)	200,000	90,000	250,000	150,000
c) EQUIPMENT					
US $	(2)	400,000	300,000	650,000	250,000
d) WORKING CAPITAL					
Total US $	(3)	2,400,000	800,000	7,300,000	510,000
In foreign currency US $	(4)	1,600,000	320,000	5,000,000	200,000
TOTAL INVESTMENT US $ (I)+(2)+(3)		3,000,000	1,190,000	8,200,000	910,000
of which in foreign currency (2)+(4)		2,000,000	620,000	5,650,000	450,000
Number of factories		I	I	I	I

TABLE 24

Total Investment For Industrial Electronics

o/oo US $

Project n°	Buildings	Equipments	Working Capital	
			Foreign Exchange	Total
13	200	400	1.600	2.400
14	90	300	320	800
15	250	650	5.000	7.300
16	150	250	200	510
	690	1.600	7.120	10.210

Total investment	US $	12.500.000
Total investment in foreign currency	US $	8.720.000

The personnel employed would be:

Consumer Eelectronics :	direct	931	+	1913		
	indirect	133	+	259		
	others	586	+	235	=	4,057
Industrial Electronics:	direct	420				
	indirect	99				
	others	101			=	620
Total :						4,677 persons

B. Technical Assistance

No country can be an autarky from the point of view of know-how, not even the largest and most developed. There is always some need for foreign know-how, and to this rule the electronic industry is no exception. On the contrary, due to rapid technical changes and the fact that research in that branch of industry is becoming increasingly expensive, the exchange of know-how between enterprises and countries is necessarily on the increase.

The modern technology is the result of permanent fundamental research and the application of its results to products on the one hand and the continuous adaptation of production techniques on the other hand.

This involves a high degree of specialization for each sector of the existing industry which can be passed on to industries only be specialists.

Of course, a gradation does exist in the extent of technical assistance needed in accordance with the product.

1. The assembly of Consumer electronic apparatus and the manufacture of components for such products requires, besides specific technical assistance for establishment of the factory, training of personnel, and commencement of operations, help on longer terms to maintain permanent links with the specialized centres in order to ensure constant

TABLE 25

Total Investment For Electronic Industry

% US $

	Buildings	Equipments	Working capital	
			Foreign Exchange	Total
Consumer Electronic Products	4.926	9.304	6.20C	34.234
Industrial Electronic Products	690	1.600	7.12C	10.21C
Total	5.616	10.904	13.320	44.444

Total investment US $ 60.964.000
Total investment in Foreign Currency US $ 24.224.000

quality and permanently available advices to overcome normally expected production difficulties and to keep pace with the evolutions in products and production techniques.

Moreover, designs of apparatus assembled have to be reviewed frequently and, as long as the factory does not develop its own designs, such have to be obtained from specialized firms.

For these reasons technical assistance fees have to be guaranteed and must be payable in transferable currency. These expenditures therefore come in deduction of the Foreign Exchange Saving by local production.

These fees are relatively difficult to determine exactly in this rather generalized analysis as they depend mainly on the details of the technical assistance extended, which details are too complicated and extended for a report of this size.

For orientation only, a rough estimate was made of the total sum of fees expected to be claimed for the eventual production quantities mentioned for 1980 for all the projects described. This total amount, including expenses involved for expatriate specialists, should be evaluated between 6 and 7 million US dollars per year.

2. Technical assistance in the field of telecommunication equipments is even more necessary than for the Consumer Electronic Industry and is even more difficult to evaluate.

As a matter of fact, in this field of activity, technical assistance has to cover 2 different aspects:

(a) the technical assistance required for establishment and starting up of the factories,

(b) the technical assistance in the designing of the equipment.

In the telecommunication, the ratio of development cost to the total cost of labour plus material varies from 0.3 to 1. This illustrates the difficulties encountered in estimating the technical assistance fees that the various firms would claim.

As a rule it could be stated that with the exception of the telephone sets, the establishment of the telecommunication industry will be recommendable when technical assistance fees do not absorb the totality of the currency saving.

With regard to telephone sets as a rough estimation, US.$ 1 per set for technical assistance fee could be considered as a reasonable average.

C. Consideration on Foreign Currency Saving

The currency saving is calculated by deducting from the value of the imported equivalent products, the value of imported raw material and/or parts plus the amortization of the equipment imported against foreign currency and the technical assistance fees.

Various factors and/or parametres in the calculation of the currency saving are variable and consequently, absolute value of foreign currency saving is irrelevant, has in fact very little significance and might induce in wrong conclusions. It is therefore more realistic to estimate percentage of currency saving for each additional integration step.

1. Consumer Electronics

Assembly (radio, TV, electrophone, cabinets, metalware and some loudspeakers) gives a currency saving of 26 per cent and is the most important saving percentage in the total scheme.

A further 15 per cent currency saving can be obtained whenever conditions make feasible the local production of coils, trimmers, variable condensers, printed circuits and loudspeakers.

The manufacture or assembly of tuners, deflection units, line output transformers when minimum quantities for local production are reached, makes additional saving of only 5 per cent, while the production of picture tubes, transistors, diodes, resistors, capacitors and ferroxcube material brings an additional saving of 11 per cent for a rather high investment mostly in foreign exchange. These investments

will result in a net increase of total foreign exchange required, at least during the years over which the factories making the local production possible, are being built.

N.B.: The percentages given do not take into consideration the technical assistance fees which have to be deducted from the currency saving.

From this, it can then be seen that the Electronic industry integrated as described can bring a currency saving of approximately 57 per cent.

The industrialization will however have the result of reducing substantially the income of the governments as revenue from import duty will decrease.

It is however up to the governments to evaluate the whole situation and determine their policy in this matter.

2. Industrial Electronics

Remarks made for the evaluation of currency saving for Consumer Electronic Products are applicable also for telecommunication equipments.

Consequently, the percentage of currency saving has been roughly determined.

- For the factory No. 1: Telephone Switching Equipment (excluding technical assistance fees), the currency saving could be in the order of 33 per cent.
- For the factory No. 2: Carrier Telephone Equipment (excluding technical assistance fees) and provided relays are assembled locally and plastic housing of the telephone sets would be locally produced, it is expected that the currency saving would be in the order of 60 per cent.
- For the factory No. 3: Radio and TV transmitters (excluding technical assistance fees), and provided some components like

transformers are locally manufactured, it is expected that the currency saving would reach 22 per cent.

- For the factory No. 4: Metal parts (excluding technical assistance fees), the currency saving should be estimated at approximately 60 per cent. This 60 per cent has to be applied to approximately 5.5 per cent of the total amount of the equipment manufactured in the 3 other factories which means that the production brings an additional currency saving to the other factory of approximately 3.3 per cent.

D. Timing of the Industrialization

1. Consumer Electronics

Recommendation on the timing for industrialization are based on the forecast of the market demand from 1965 to 1980, and take as starting time for industrialization a minimum production capacity.

The minimum production capacity is in its turn determined by technical considerations as well as economical, namely that ex-factory prices concerned do not differ too much from CIF prices of such imported products.

For simplicity sake, periods of 5 years have been considered.

It is then recommended the following timing (See table 26).

- By 1970:

Radio and electrophone assembly plants of a minimum production per factory, of 100,000 sets.

TV assembly plants of a minimum production, per factory of 12,000 sets.

Manufacture of most of plastic cabinets and plastic parts

Manufacture of most of metalware

Loudspeakers assembly with a minimum production per factory of 100,000 pieces.

- By 1975

Extension of the factories described above to cope with the increased demand of the market.

In addition:

- manufacture of loudspeakers
- manufacture of coils with a minimum production, per factory, of 500,000 pieces
- assembly of trimmers, with a minimum production, per factory, of 1,000,000 pieces
- assembly of variable condensers, with a minimum production, per factory, of 250,000 pieces,
- etching of printed circuits.

- By 1980:

Extension of the factories described above to cope with the increased demand of the market.

In addition:

- Assembly of TV tuners with a minimum production of 20,000 pieces per factory,
- Manufacture of deflection units and line output transformers, with a minimum production of 100,000 pieces per factory.

- As from 1980:

Extension of the factories described above to cope with the increased demand of the market.

In addition, if conditions described in paragraph II.C are fulfilled:

- Assembly of picture tubes with a minimum production of 140,000 pieces, in one factory only,
- Manufacture of capacitors (minimum production varies per type) in one factory only.

TABLE 26

Number of factories	Number of projects	Radio Electrophon.	Television	T.V. tuners	Loudspeak.	Coils	Variable Condensers	Trimmers	Deflection Unit	Line output transformer	Transistors	Diodes	Capacitors	Resistors	Ferroxcube	Picture tubes
BY 1 9 7 0																
4	1	400														
1	4	100	12	20	200											
1	5	200	30	20	500											
6		700	42	40	700											
BY 1 9 7 5																
2	1	200														
1	3	300														
2	4	200	25	40	400											
1	5	200	30	20	500											
1	6	300	35	35	300											
1	8					6000	600	3000								
8		1,200	90	95	1,200	6,000	600	3,000								
BY 1 9 8 0																
3	1	300														
1	2	200														
1	3	300														
3	4	300	35	60	600											
1	5	200	30	20	500											
1	6	300	35	35	300											
1	7	400	40	25	700											
3	8					18,500	1,900	9,500	140	140						
1	9															
15		2,000	140	140	2,100	18,500	1,900	9,500	140	140						
AS FROM 1 9 8 0																
3	1	300														
1	2	200														
1	3	300														
3	4	300	35	60	900											
1	5	200	30	20	500											
1	6	300	35	35	300											
1	7	400	40	25	700											
3	8					18,500	1,900	9,500	140	140						
1	9										15,000	6,000	95,000	110,000	180 T	140
1	10															
1	11															
1	12															
18		2,000	140	140	2,400	18,500	1,900	9,500	140	140	15,000	6,000	95,000	110,000	180 T	140

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- Manufacture of transistors, diodes, with a minimum production of 20,000,000 of four types maximum, in the same factory as for capacitors,
- Manufacture of resistors, with a minimum production of 100,000,000 in the same factory as for capacitors, transistors and diodes,
- Manufacture of ferroxcube material with a minimum production of 200 tons, in one factory only.

2. Industrial Electronics

Contrary to Consumer Electronic Products, it is difficult to determine the most suitable time for the starting of industrialization based on common factors like purchasing power, growth of the population, growth of the demand, etc. The determinant factor here is the possibility of concentrating the production in one unit to supply the needs of the 14 countries. It is then recommended to start production only when international agreement at governmental level has been reached in this aspect.

E. Standardization

Standardization can contribute substantially in creating favourable conditions for industrialization. Diversification of production is one of the factors that makes economically sound development of industry difficult and therefore should be severely controlled.

In the radio field, in particular, transistor radios, the number of basic electronic designs should be reduced to the very minimum, for instance one design for single SW sets, one for single MW sets and one more elaborate design for three band sets MSS.

Commercialization of sets obviously imposes diversification. This can easily be obtained by giving to the same basic design various presentations by different cabinets (material : wood or plastic, shape, size, colour, etc...) as well as by the addition of gadgets (tone control, battery indicator, pick-up, extra loudspeaker, etc...).

Standardization in Broadcasting radio should start at the transmitters. Selection of the frequencies especially in SW should also take the receiving end point of view, and try as far as possible techniques permit, to reduce the frequency range in such a way that a maximum of 2 SW band receivers can receive all transmitters in the region.

For television, very unfortunately, there exists in the Sub-region different standards of transmitters, and efforts should be made to try to revert to one single standard. This is still feasible nowadays as the number of sets in use is small. If this could be achieved, production problems of both transmitters and receivers would be simplified and costs lower. Standardization on the size of the picture tube should also be recommended preferably on the 19" and 23", because it is believed that a large production of television sets will be used as community sets as well as for educational purposes.

For the components, as local production of parts will be highly concentrated in a few factories and for certain parts in one single unit, standardization will be gradually enforced. This standardization will require from the component manufacturers side an effort to help the assembly industry to incorporate the parts in their designs.

For all technical specifications, the countries should actively support the recommendation to standardize their products to comply with CCIR and CCITT standards.

Apart from the specific recommendation, general recommendation on standardization for other products are applicable to the electronic industry namely metric system, standard screws, nuts, etc...

F. Technological Development

The technological development in radio can easily be seen from the Chart No. 27 which represents graphically what is considered generally as the trend in the development in Western Europe up to 1980.

However, one should always bear in mind that 14 years ahead means that corrective action will be necessary during this time and that

technological development is certain to result in many unpredictable achievements.

For television a great part of the foreseeable technological development for radio is also applicable as many parts and components are used in both apparatus. Transistorization of television receivers will be carried out much further.

As far as components are concerned, silicon planar types of semiconductors will be generalized.

The present development in integrated circuit will continue and will play a great role in the future manufacturing techniques and will strongly influence the technological pattern. Practical application for the years 1975 and 1980 will be mainly directed to MF and LF sections of radio and TV.

For the passive components, although generally speaking no real technological revolution can be expected at short notice, developments are constantly carried out.

Telecommunication equipments are subject to constant technological developments which are almost impossible to foresee over such a long period.

It is however known that the following will be the general trend:

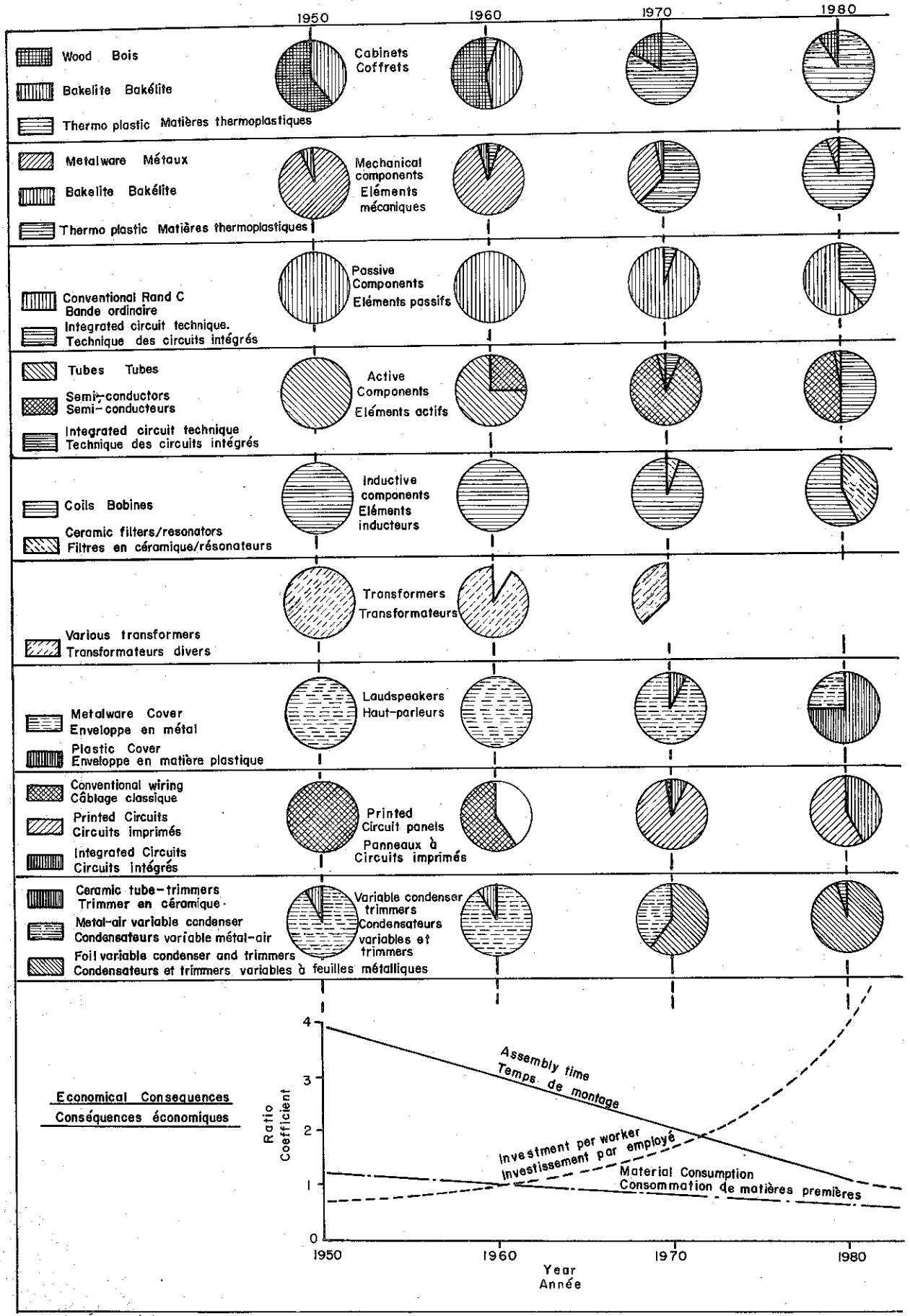
- for Radio and Carrier Equipments
  - transistorization has already started and will be extended considerably,
  - miniaturization and micro-miniaturization
  - introduction of Integrated Circuits.
- for Switching Equipments
  - Electronic Switching will most probably deserve great attention at the end of the period.

    If this would be introduced in the equipments, it is likely that technical assistance could hardly be obtained as foreign firms would have to master the techniques first.

- for metalware

  - the reduction in the size of the equipment due to transistorization and miniaturization will most probably introduce die casting instead of the present steel plate metallic parts.

Chart 27
Graphique 27
Technological development radio in western Europe
Les progres de la Technologie de la Radio en Europe de l'ouest



CHAPTER V

GENERAL

1. INFLUENCE OF INDUSTRIALIZATION ON COMMERCIALIZATION

1. Industry can only develop if its products are being sold. Very well organized and efficient marketing organizations are indispensable to guarantee the smooth distribution of the products and therefore continuous load to the factories.

As it was assumed all through this report that West-Africa Sub-region is considered an economic entity, the goods produced in the region have to be distributed over existing political borders. These additional difficulties have to be overcome by the marketing organization.

2. The success of a product is largely determined by the ability of the producer or his marketing organization to provide adequate, efficient and rapid "after sales service". From Point III. hereafter, it can be seen that more than 7.000 technical people of various levels are required for such a service. This is obviously one of the most crucial problems. Overlooking it would lead to failure of the industrialization.

All this is valid for all electronic products but becomes the key point for industrial products such as telecommunication.

For this product, not only is the maintenance of the equipment vital, but the equipment has to be operated properly. Training of operators must also be considered.

If these conditions are not fulfilled, the new industry will have to depend to a too large extent, on foreign assistance, resulting in substantial reduction in currency saving.

3. Although the creation of industries has not been recommended in this report unless cost prices of the products are at least comparable to world market prices, restrictions on imports of similar ready-made products should however be considered.

However, in the field of Consumer Electronics, competition with imported products will favourably influence the industry to keep pace with technological and economical developments of world markets.

Abnormal commercial practices may sometimes bring on an incidental basis into the Sub-region products below the world market price. This may affect very seriously the local industry as one of the condition of success is the continuity of supply and production.

4. Manufacture of parts and components by a limited number of factories will lead automatically to standardization.

At the moment of introduction of these parts and components, certain assembly plants may face difficulties in using them and may use this argument to get the authorization to carry on with the import of the parts they were using previously.

This problem can easily be overcome provided the part or component manufacturer makes the necessary design adaptations in a special laboratory and on his own account.

2. GENERAL CONSIDERATION ON STANDARDIZATION

Taking into consideration that West Africa is to quite an extent the result of ex-English and ex-French influences, it is clear that the continent is faced with a number of standardization problems in the technical, financial and economical sector.

The ECA at a session held in Addis Ababa in December 1963, recommended that the secretariat should undertake a study on standardization in Africa on a national, sub-regional and regional basis. ECA sponsored the study of the aspects of technical standardization and an international team of experts was formed to undertake a preliminary study.

The necessity for standardization in Africa

The need for standardization in African continent is very strong. The development of the trade both inter-African and with other parts of the world is influenced by standardization activities.

Industrial and Consumer products have to be controlled by standard test methods. Standardization always starts with measuring systems (weights and measures) and test methods. The next step is a variety reduction. In the smaller markets a great variety in articles used for the same purpose is inefficient in production and maintenance.

Different systems for energy supply, communications and transport will hamper the inter-African trade and make it impossible to set higher production units for efficient supply for a group of countries.

There already exists between the various African countries differences in electrical supply (voltage and plugs and sockets), TV systems, measuring systems (inch, mm). It is of the utmost importance to make sure that no new differences will be introduced and existing ones are removed before it is impossible. Co-ordinated standardization in the African countries is necessary, in particular for standards applicable to energy, transport, basic materials, manufactured goods, machinery and equipment.

The benefit of such co-ordination will be felt at several levels:

(a) with respect to inter-African trade, in order to facilitate the interchangeability and serviceability of African products and the co-ordination of investment policies in transport, energy, heavy and light industry, etc...

(b) with respect to domestic markets, in order to improve the quality of national production and facilitate its development.

(c) with respect to exports, in order to guarantee the quality of African raw materials or manufactured goods which will have to stand up to international competition;

(d) with respect to imports, in order to invite free competition from all over the world.

3. TRAINING OF PERSONNEL

(1) Personnel Requirement

(a) To accomplish the industrial plan in the electronic industry, it is estimated that approximately 1000 technicians of various levels will be needed in the factories.

Indications on the qualifications are given. These technicians are by the very nature of the industry highly specialized in production and control techniques.

Training of this personnel will have to be done within the limits of the technical assistance that factories must receive from foreign firms.

(b) The technical people alone cannot run industrial operations. They must be assisted by highly qualified administrative personnel which have also to be properly trained.

Moreover, as stated in CHAPTER ONE, very efficient managers must be at the head of the new factories.

(c) The "after sales service" considered as essential, will require by far, the largest number of trained technical people. This particular problem deserves more extensive consideration.

(2) Training of "After Sales Service" Technicians

(a) Estimation of required technical staff

Based on the state of the technique in 1965, it is estimated that the present need of 600 technicians will reach 6,700 in 1980. The repartition would be as follows:

Product	Number in use	Expected yearly market increase 1980	Number of technicians needed for maintenance-repair in 1980
TV	600,000	140,000	600
Radios	14,000,000	1,900,000	2,400
Record-players	1,000,000	100,000	500
Tape-recorders	250,000	100,000	500
Household-appliances and professional field			1,450
PTT - Army (Air Force) Airlines, transmitters teachers, sundry			1,250
TOTAL:			6,700

These figures are, of course, based on the present state of the electronics technology.

It may seem that with improvement in the quality of the products and the miniaturization and use of circuit blocks, the number of people needed for the maintenance would proportionally decrease. However, new and more complex apparatus will be introduced in West Africa, i.e. transmitters, telecommunication equipment, computers, so that the required number will still increase and that provision has to be made now for the necessary schools.

It is believed that this number of technicians will be divided in:

50 % first-line mechanics
33 % all-round technicians
17 % junior staff

(b) Training

The time factor is determinant for training such a large number of technicians in such a short time.

The conventional schools, mostly models of European schools, would hardly cope with the demand. Moreover, higher technical schools prepare people for research and development works. This is very essential for the future of the industry but does not help in solving the "after sales service" problem.

The technical teaching should then be adapted to the immediate demand of the industry. This can only be achieved by collaboration of existing technical schools, international aid and the industry itself.

New types of schools should mainly give practical courses directed towards the maintenance of electronic equipment already in use in the country. These schools could prepare technicians of the three levels required. The top level would however lead to further studies in conventional high schools.

Maximum use should be made of a growing number of scientifically developed methods and teaching aids.

(c) Practical execution

A typical school could be considered as follows:

3 classes of one year each		
1st class - mechanics	24	students/year
2nd class - technicians (electronics)	16	" "
3rd class - staff education	8	" "
	48	students/year

Evening classes for the follow-up of technicians already at work.

The students would have the following preparation:

- for the first year: secondary school (basic electricity school + selection test)
- for the 2nd year : 1st class + selection test
- for the 3rd year : selection test.

The considered industrial rate of growth implies that by 1980, there should be enough schools to train 1,400 students/year, thus approximately 25 schools.

Estimate cost per school

a.	exploitation costs per year	± US.$	80,000
b.	initial investment	± US.$	40,000
c.	building p.m.		
		± US.$	120,000
	for 25 schools	± US.$	3,000,000 a year

(d) Conclusions and recommendations

a. There is presently a lack of technicians which threatens to increase if action is not taken very soon.

b. The existing schools have not the facilities to train specialists for the maintenance and repair.

c. The government should remedy this situation with the technical support of the industry

d. Modern methods and aids should be applied to hasten and facilitate the training.

e. Industry should have a say in the establishment of curriculums for technical schools, and should keep the schools informed on the number and the qualifications of the required specialists.

GENERAL CONCLUSION

West Africa offers possibilities for sound industrialization in the field of Electronics, provided the implementation of the industry is made in strict discipline.

The fundamental conditions are summarized as follows:

- Economic Integration of the Sub-region
- Harmoneous development of the market demand
- Sound financial scheme and availability of foreign exchange
- Concentration and specialization
- Standardization and reduction of types
- Minimum production capacity
- Availability of trained personnel
- Technical assistance from foreign firms
- Management assistance from foreign firms
- Well organized distribution channels.

Certain projects should be considered on a broader basis than the West Africa Sub-region. These projects relate to products requiring high investment and low labour content, bringing relatively limited additional currency saving and directly affected by technological development.

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ANNEX

NOTE ON

THE LIGHT BULBS AND LIGHTING ACCESSORIES INDUSTRY

A. STANDARD BULBS.

The point here is current consumption bulbs, called GLS, (general Lighting Service), of 15 to 200 W and of all current voltages; in other words, the range suitable for manufacturing in automated and homogeneous production groups.

(1) Situation in 1965

Knowing the population of the territory in question rises to around 90 million inhabitants and admitting a yearly consumption of 0.1 bulb per inhabitant, one arrives at a present yearly market of 9 million bulbs. The consumption of 0.1 bulbs per inhabitant per year corresponds more or less with that of comparable countries, for example the Congo and India. On the other hand, export statistics of the different countries (data incomplete) suggest a total market inferior to 9 million bulbs. The conclusions however, will therefore not be essentially different.

All the requirements of bulbs in the territory in question are for the moment being imported, with the exception of Nigeria, which is partly supplied by local production.

The landed price at West African harbour for the imported 60W GLS bulb (this bulb may be considered a prototype for the complete range) can be estimated at 0.075 US$. According to a very provisional estimate and, with all necessary reserves, the local assembly of a quantity of 8 to 9 million bulbs would involve a net cost of 0.116 US$;

to this figure must be added the profit for the producer and the sales expenses. The price to the wholesaler would range from 0.165 to 0.17 US$, price to be compared with 0.075 US$ paid by the importer/wholesaler.

A Protective Levy of minimum 120 per cent of the CIf value to, at least, cover this difference must be imposed. This tariff however, may not be sufficient because certain producing countries, export from time to time, bulbs at prices inferior to the average world market prices.

A consequence of all this is evidently a substantial increase in the price of the bulb to the public. This must be well understood and accepted by the various governments.

Finally, it is essential that no Customs Tariff be imposed on the trading of bulbs within West African countries. The following estimates take into account a complete exoneration of Import Duties on investment equipment and raw materials.

(2) Situation in 1980

Not having disponible more reliable references, one is tempted to expect the West African market of GLs bulbs to increase annually by 10 per cent; the annual increase for the developing regions in Europe and the United States is estimated at 4 to 5 per cent.
However, it should be taken into account, the growth of the population, the progressive electrification and the increase in the consumption of bulbs due to better standards of living, improved economical conditions, etc...

Starting from the 9 million bulb market in 1965, this yearly 10 per cent increase gives in 1980 a market of approximately 38 million bulbs, or in other words, the consumption which is presently 0.1 bulb per inhabitant per year will then be 0.4 bulb per year, the level presently reached, for

instance, in Turkey. This calculation, however, does not take into consideration the growth of the population which could mean a decrease in the rate of consumption per inhabitant.

In principle, all that has been said above on the situation in 1965 is valid for 1980, the only difference being that the manufacturing series of the factory will be far more important (of course, once this stage has been reached, the manufacturing of comparable bulbs but of various presentations e.g. sphere and flame shaped, can be considered). Due to this phenomenon a reduction in price may be possible so that US$ 0.116 is reduced to 0.092 - 0.10. (The prices mentioned may suggest a fair exactitude; this however, is not so, they are pure estimates rendered uncertain by lack of data on a great number of essential elements for 1965 and especially so for 1980, for price of land, buildings, manpower, social charges).
The necessary protection tariffs may then likewise be reduced, without being completely suspended.

B. FLUORESCENT TUBES

Normally the market in fluorescent tubes is estimated at 1/10th of the market in GLS bulbs. However, for the countries in question, this proportion should preferably be 1/15th to 1/20th. This gives an actual market of some 500,000 fluorescent tubes and perhaps, 3 million tubes in 1980. With the equipment existing, a local manufacture of 900,000 to 1 million tubes could be expected, but the cost prices will still be very high and protection measures comparable with those described for GLS bulbs will be compulsory.

C. OTHER BULBS

It is very risky to determine anything definite on other types of bulbs; (car bulbs, photo bulbs, mercury bulbs, etc..) in

INTEGRATION

Concerning the industrial integration of the bulb manufacturing and given the production involved, the only possibility lies in the local manufacture of the glass for GLS bulbs and fluorescent tubes. Indeed, the manufacture of other components (sockets, filaments, eloctrodes, chemical materials, etc...) is highly automated and economical manufacture would involve quantities far exceeding the needs of the African industry. It is true that the manufacturing units available for producing the glass are suitable from the point of view of capacity, but it must be verified if they will permit manufacturing at a price comparable to that of the imported product. Glass for GLS bulbs is manufactured in Europe and in the United States on giant machines and it is well possible that the landed price in Africa would be far below that of the locally produced glass. Finally, if the sand available does not comply with certain strict technical specifications, sand would have to be imported and that, of course, would exclude any economical solution.

BALLASTS AND BATTENS

For ballasts and battens, production in small series can more easily be considered. Projects exist for a small manufacturing shop with a capacity of 50,000 ballasts. The solution is based on manual work and so, is excellently suited for the considered countries.

The investment in machines and equipment for the described capacity is something like 15,000,00 US$ FOB, the necessary area is about 100 m2, while there will be a further need of a team of 6 direct and 1 indirect persons. It is difficult to predict if this project is economical,

even if there exists a relatively important market of 50,000 ballasts per year. It would be necessary therefore to calculate the cost price which could vary quite substantially from one country to another, depending on the prices of raw materials (metal plate, copper wire and various other materials), and compare this calculation with the price of the imported ballasts in the countries in question.

If therefore, this type of project seems more readily feasible, nothing can be said before serious investigations have been made with regard to the market and cost price.

What is said above about the ballasts is applicable for the metal battens.

SUGGESTED LOCATION

NIGERIA.