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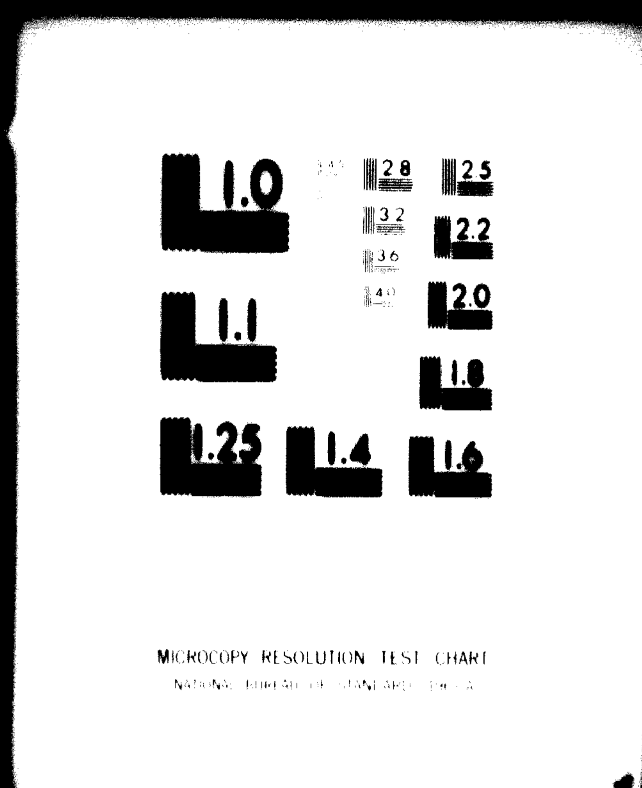
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DEVELOPMENT OF THE PETROCHEMICAL AND PLASTICS INDUSTRY IN THE [illegible] MEMBER COUNTRIES .

VOLUME I

SUMMARY AND CONCLUSIONS

January 1978

Bureau d'études industrielles
et de coopération de
l'Institut français du pétrole

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[illegible]

DIVISION ETUDES
INDUSTRIELLES

DEVELOPMENT OF THE PETROCHEMICAL AND PLASTICS INDUSTRY
IN THE OERS MEMBER COUNTRIES

VOLUME I

SUMMARY AND CONCLUSIONS

C 38/2967 January 1972

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This volume entitled : SUMMARY AND CONCLUSIONS presents, in a condensed form, the data and results of the detailed studies, that are dealt with in volumes II and III, emphasizing on the most important points.

I. INTRODUCTION - PURPOSE OF THE STUDY

I. INTRODUCTION - PURPOSE OF THE STUDY

The four Senegal River Riparian States constituting the OERS, i.e. Guinea, Mali, Mauritania, and Senegal have decided to organize and coordinate their industrial development and to promote the integrated utilization of their resources. One of the main problems encountered by the OERS, is the need to study and to evaluate the overall industrial potential of the four member countries, including the location of the industries and the specialization of each country. This report is the result of a feasibility study of the establishment of a petrochemical industry in the region. Due to the domestic market limitations in the four member countries of the OERS it is clear that such development can take place only over an extended period of time. The present study will consist therefore of the determination of the feasibility of the development of the plastics and synthetic fibers industry.

II. PLAN OF THE REPORT

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In addition to the present volume I - Summary and conclusions - presenting the main results of the study, the conclusions and the recommendations ; the report consists of three volumes :

VOLUME II : MARKET OF PLASTICS AND SYNTHETIC FIBRES FORECAST OF DEMAND UNTIL 1980

describing the present plastics and synthetic fibers industry and giving estimates about the plastics and synthetic fibers future consumptions in the considered countries.

VOLUME III : LOCAL DATA - TECHNO ECONOMIC STUDIES

presenting the local basic data : transportation facilities and costs, taxes and duties, construction costs, prices structures and the selection and the techno economic study of the most interesting projects.

VOLUME IV : APPENDIX

Gathering the minutes of the meetings held by the BEICIP Mission in the OERS member countries.

III. PLASTICS AND SYNTHETIC FIBERS INDUSTRIES - FUTURE CONSUMPTIONS

III. PLASTICS AND SYNTHETIC FIBERS INDUSTRIES - FUTURE CONSUMPTIONS

Plastics and synthetic fibers industry and future consumptions in the OERS countries are the subject of volume II. The information and data used to perform this study have been collected during the one month stay of two BEICIP experts in the OERS area.

III.1. Plastics industry

At present time, ther is neither resin production nor compound formulation in the OERS countries. The plastics processing industry is already established in the area. Tables 1 and 2 give the list of the companies involved in the plastics processing industry, the capacities of production, and the main equipment characteristics. The injection moulding, blow moulding, extrusion and blow extrusion equipment capacity is higher than required by the present consumption. Nevertheless this equipment has some limitations, there is no pipe manufacture, and the highest screw diameter of the extruders is 90 mm.

III.2. Synthetic fibers industry

There is neither synthetic fibers production nor synthetic fibers processing in Mali, Mauritania, and Senegal. The existing textile companies are located in Senegal. They are :

- ICOTAF: processing 2,000 t/year of cotton
- Société Textile Sénégalaise : processing 1,500 t/year of cotton
- Cotonniere du Cap Vert : processing 550 t/year of cotton

In the coming years, ICOTAF will install equipment to weave polyester-viscose and polyester-cotton yarns.

Table 1

Plastics processing industry

Main characteristics of the equipment

	Injection moulding			Extrusion - Blow extrusion		Other processing
	Shoe manufacture		Other products manufacture	Number of extruders	screw diameters mm	
	Number of presses	Capacity pairs/hour	Number of presses			
Firms in Senegal						
BATA	4	100 each	2			
CGEM	1			1(planned)	65	
FAP	1(planned)	70	2			
PETERSEN				1		
SAPROLAIT				3	40 each	Thermoforming
SEIB				2		
SENEGAL PLASTIC	2	100 each				
SIMPA	3	100 each	4	4	45-65-65-90	
SOCOSAC				1	20	
SODEC				2		
SOFARMEX						Polyurethane and polystyrene foam
NEWBE				2	40-85	Bag packaging
Firm in Mali						
MALIPLASTIQUE	6	630 overall		4	40	

Table 2

Plastics processing industry
Yearly capacities of production

	Injection moulding		Blow moulding	Extrusion Blow extrusion	Others
	Shoes Pairs/year	Other products Tons/year	Bottles 10^6 Bottles/year	Tons/year	Tons/year
Firms in Senegal					
BATA	3.600.000				
CGEM			8		
FAP	850,000	200	7		
PETERSEN			2		
SAPROLAIT			8		
SEIB			6		
SENEGAL PLASTIC	1,000,000	400			
SIMPA	2,000,000	300		1,300	
SOCOSAC				700	
SODEC			5		
SOFARMEX					200
TAXALEER					100
WERBE				700	
Firm in Mali					
MALIPLASTIQUE	4,200,000		1	200	

III.3. Plastics consumptions

The main plastics consumptions in 1980 have been estimated for the considered countries. The results of the study are summarized in the following tables 3 to 9.

Table 3

Total consumption of plastics* in 1970 in Mali, Mauritania and Senegal

	Mali	Mauritania	Senegal	TOTAL
Thermoplastics	410	270	4 000	4 680
Thermosetting and others	90	30	1 000	1 120
	500	300	5 000	5 800

* Expressed in terms of pure resins

Table 4

Total consumption of plastics in 1980 in Mali, Mauritania and Senegal

	Guinea	Mali	Mauritania	Senegal	TOTAL
Thermoplastics		7 600	4 160	18 900	
Thermosetting and others		1 000	540	2 600	
	9 000	8 600	4 700	21 500	46 100

* Expressed in terms of pure resins

Table 5

Breakdown of thermoplastics consumption in 1980
in Mali, Mauritania and Senegal
Tons

	Mali	Mauritania	Senegal	TOTAL
High density polyethylene	1,000	850	2,700	4,550
Low density polyethylene	2,000	500	5,000	7,500
Polyvinil chloride	3,035	1,500	7,150	11,685
Polystyrene	850	450	2,000	3,300
Polypropylene	700	850	2,000	3,550
Others	15	10	50	75
	7,600	4,160	18,900	30,660

a Expressed in terms of pure resins

Table 6

Breakdown of polyethylene consumption in 1980 by applications

Tons

	Mali	Mauritania	Senegal
- **Film**			
a) Packaging			
Heavy duty bags	500	150	1 500
General purpose bags	1 000	400	2 500
b) Agricultural uses	150	50	300
- Household goods, toys	400	200	800
- Crates, boxes, packing cases	150	150	300
- Hollow articles, bottles, cans	350	200	1 000
- Wire and cables	250	100	300
- Flexible pipes	100	50	150
- Paper coating	Neg.	Neg.	50
- Miscellaneous	100	50	300
TOTAL	3 000	1 350	7 700

Table 7

Breakdown of PVC consumption in 1980 by application[a]

Tons

	Mali	Mauritania	Senegal
Flexible PVC			
Footwear	600	400	2,000
Flooring	150	50	500
Calendered sheets	200	100	500
Cables and wires	150	100	300
Belting	100	-	200
Coating and others	150	100	500
Sub total flexible PVC	1,350	750	4,000
Rigid PVC			
Pipes	895	360	1,050
Fitting, profiles	140	90	200
Rigid sheets and films	150	50	300
Bottles	250	150	300
Records and others	250	100	800
Sub total rigid PVC	1,685	750	3,150
TOTAL	3,035	1,500	7,150

a Expressed in terms of pure resin

Table 8

Breakdown of polystyrene consumption in 1980 by application
Tons

	Mali	Mauritania	Senegal
Packaging	450	250	800
Household goods, toys	200	100	600
Foam	100	50	300
Miscellaneous	100	50	300
TOTAL	850	450	2,000

Table 9

Breakdown of polypropylene consumption in 1980 by application
Tons

	Mali	Mauritania	Senegal
Slit yarn (woven bags)	550	750	1,500
Injection and others	150	100	500
TOTAL	700	850	2,000

III.4. Synthetic fibers consumption

The main synthetic fibers consumptions in 1980, have been estimated for the considered countries. The results of the study are summarised in the following tables 10 and 11.

Table 10

Forecast of the demand of man made fibers in 1980 in Senegal, Mali and Mauritania

Tons

Country	Cellulosics	Synthetics	TOTAL
Senegal	1 700	3 200	4 900
Mali	450	850	1 300
Mauritania	150	250	400
	2 300	4 300	6 600

Table 11

Breakdown of the synthetic fibers consumption in 1980

Tons

Country	Polyester	Nylon	Acrylics and others	TOTAL
Senegal	2 200	630	350	3 200
Mali	600	150	75	825
Mauritania	50	50	25	275
	3 000	850	450	4 300

IV. TECHNO ECONOMIC STUDY OF THE MOST PROMISING PROJECTS

IV. TECHNO ECONOMIC STUDY OF THE MOST PROMISING PROJECTS

The estimated level of consumption of some products in the considered area prevents from contemplating local productions for several years.

This is the case for the following products :

- Resins other than PVC and low density polyethylene
- Nylon and acrylic fibers
- Calendered products

The market requirements and the possibilities of erection of downstream units do not allow the setting up of production of basic and intermediate petrochemical products such as olefins, aromatics, styrene, vinylchloride, caprolactam, dimethyl terephtalate, the size of the production units to be considered according to the needs being by far below the economical production level.

The raw material cost plays a leading part in the economics of some productions. Being too high it can prevent a local production. This is especially true for the raw materials with a relatively high transportation cost, ethylene for instance. In the case of the OERS countries, the ethylene transportation by boat over thousands of miles and the storage at disembarking port would at least double its cost. Local productions of polyethylene, vinylchloride, styrene, cannot be justified under such conditions.

The present study does not discuss the projects that will issue from the normal development of the already established companies ; it examines the following productions, based on the main needs of the OERS member countries :

- 10,000 t/year PVC production, mixing and compounding (from imported monomer) in Senegal start up in 1978.
- 1,500 t/year polyester fibers spinning. (from imported polymer) in Senegal start up in 1979
- 1,400 t/year PVC pipe production (from imported or locally produced PVC) in Senegal. Start up in 1975
- 900 t/year PVC pipe production in Mali or addition of such a production in Senegal. Start up in 1979.

V. CONCLUSIONS - RECOMMENDATIONS

V. CONCLUSIONS - RECOMMENDATIONS.

On the basis of the outlets studied in Volume II and of the techno economic studies presented in Volume III some conclusions and recommendations about possible future productions in the OERS countries can be emphasized.

V.1. PVC production

The profitability of such a production is low : pay out time 7.8 years. This is essentially due to the small size of the plant.

A local production can be able to compete with the imports only if favourable conditions are made sure, such as :

- Exemption from duties and taxes on equipment goods, raw materials and products.
- Exemption from income taxes
- Continuation of some taxes on imported PVC compounds.

The impact of the vinylchloride price is very important ; its cost reaches 38 % of the PVC compounds manufacturing cost.

The influence of the plasticizers, stabilizers and other additives prices is also significant. The profitability being the same, a 20 % increase of these prices leads to a 6 % increase of the PVC compounds prices.

Before to take the decision of the installation of a PVC compound production it is important to get the view of the local plastic material processors. It seems that they would be favourable to such a production despite their purchasing habits and the adaptation of their man power and equipment to peculiar resins if qualities and prices of the produced compounds can compete with the imported ones, and if the locally installed company can provide effective after sales service.

To sum up, this production can be considered in 1980 with the participation of an international producer able to get vinylchloride and additives at reasonable price, and to provide know how and after sales services. Without such a participation it seems better to wait longer in order to install a greater, more profitable plant.

- Three units producing each 3 800 000 heavy duty bags (from imported low density polyethylene) in Senegal. Dates of start up : 1974, 1977, 1979.

Table 12 summarises the main results of the techno economic studies.

Table 13 and 14 give the manpower, electricity and cooling water needs.

Table II

Techno economic characteristics of the studied productions

Production	Location	Date of Start up	Total Investment US $	Investment to be paid in foreign currency US $	Price of the product	Pay out time	Outlets
10,000 t/year of PVC (expressed in terms of resin) Plastisized and rigid compounds	DAKAR (Senegal)	1979	3,089,000	3,000,000	Rigid compound $ 296/ton Plasticized compound $ 354/ton	7.8	OERS market from 1980
1,500 t/year of polyester staples	DAKAR (Senegal)	1979	2,255,000	1,950,000	$ 1,400/ton	6.4	OERS market from 1980
1,400 t/year of PVC pipes	DAKAR (Senegal)	1975	471,000	400,000	$ 540/ton	2.8	OERS market from 1976 Senegalian and Mauritanian market from 1980
900 t/year of PVC pipes	DAKAR (Senegal) Alternative	1979	389,000	300,000	$ 540/ton	3.5	Malian market from 1980
	BAMAKO (Mali)	1979	325,000	265,000	$ 600/ton	2.8	Malian market from 1980
3,000,000 heavy duty bags/year	DAKAR (Senegal)	1976	238,000	195,000	$ 0,305/bag	3.2	OERS market from 1975
" " "	DAKAR (Senegal)	1977	238,000	195,000	$ 0,305/bag	3.2	OERS market from 1978
" " "	DAKAR (Senegal)	1979	238,000	195,000	$ 0,305/bag	3.2	OERS market from 1980

Table 10

Studied projects

Utilities consumption

Projects	Capacity Tons/year	Location	Cooling water consumption (make up) 10^3 M^3/y	Electricity consumption 10^3 Kwh/year	Fuel consumption Tons/year
PVC production	10.000	Bahar	140	3,970	1 300
Polyester fibers production	1.300	Bahar	30	3,200	400
PVC pipes production	1,400	Bahar	15	388	-
PVC pipes production	900	[illegible]	8	294	-
Polyethylene bags production	830	Bahar	3	270	-
Polyethylene bags production	830	Bahar	3	270	-
Polyethylene bags production	830	Bahar	3	270	

These needs are compatible with the infrastructures of Bahar and [illegible]

Table 14

Studied projects
Man power needs[a]

Project	Capacity Tons/year	Location	Engineers	Foremen	Employees	Skilled man power	Unskilled man power
PVC production	10,000	Dakar	6	12	6	20	45
Polyester fibers production	1,500	Dakar	2	8	6	40	30
PVC pipes production	1,400	Dakar	1	4	2	20	40
PVC pipes production	900	Bamako	1	4	2	16	28
Polyethylene bags manufacture	830	Dakar	1	4	2	12	24
Polyethylene bags manufacture	830	Dakar	1	4	2	12	24
Polyethylene bags manufacture	830	Dakar	1	4	2	12	24
TOTAL in DAKAR			12	36	20	116	28
TOTAL in BAMAKO			1	4	2	416	207

[a] For production only

V.2. Polyester staples spinning plant

The 1,500 t/year considered plant is based on the Malian, Mauritanian and Senegalian markets in 1980. If the Guinean market is opened to the production the unit would work at full capacity 2 or 3 years before. The pay out time of the project is 6.4 years, considering exemption from duties and taxes on equipment goods, raw materials and products, together with exemption from income taxes.

In conclusion of the techno economic study, the following points must be emphasized.

- The importance of the investment : US $ 2,255,000 for a 1,500 t/year production
- The very important impact of the raw material cost : more than 60 % of the manufacturing cost
- The need of a textile industry able to process the produced polyester staples.

If the decision of establishing such a fabrication is made, a more detailed study about the type of process, process owner selection, operating conditions, possible financial resources, will be necessary. Such a production will be more easily realised if process owners or producers participate in the project, because the products must have very particular qualities and must meet the existing practices of the market (very diversified). These firms could bring a contribution to the investments and a technical help.

V.3. PVC pipes production

The level of the investment, as well as the present existence of a plastic transformation industry in Senegal and in Mali suggests the installation of such productions by the private sector. The calculated profitabilities are attractive. Up to now the problems which have prevented such productions are related to the outlets, too little to justify a profitable production size. In fact, the PVC pipes market will grow fast in the OERS countries and local productions can be considered from 1974.

The requirements can be met by two factories :

1) 1,400 t/year production plant in Senegal, starting up in 1974, meeting the OERS requirements from 1975 and only the Mauritanian and Senegalian requirements from 1980. The calculated pay out time of this project is 2.8 years.

2) 900 t/year production plant in Bamako (Mali) starting up in 1970, meeting the Malian requirements from 1979. The calculated pay out time of this project is 2.8 years.

This factory can be installed either in Bamako, or in Dakar. The location in Bamako has the following advantages :

- Better profitability due to the high transportation cost of the plastics pipes from Dakar to Bamako
- Better distribution of the plastic processing industry inside the OERS area.

V.4. Polyethylene heavy duty bags production

Polyethylene heavy duty bags are presently manufactured in the OERS countries. The existing blow extrusion equipment is not quite appropriate to the economic production of such bags. It seems desirable to use the existing equipment for general purpose bags and to set up blow extruders with higher screw diameters, for heavy duty bags.

The level of the investment such as the present existence of this type of industry in Senegal suggests the intallation of such a production by the private sector either by existing of by new firms.

The requirements can be met step by step by the installation of three identical production facilities :

1) 3,800,000 polyethylene heavy duty bags manufacture starting up in 1974 and working at full capacity in 1975
2) 3,800,000 polyethylene heavy duty bags manufacture starting up in 1977 and working at full capacity in 1978
3) 3,800,000 polyethylene heavy duty bags manufacture starting up in 1979 and working at full capacity in 1980.

The calculated pay out time of each plant is 3.2 years.

Some economy will be realised installing the three blow extrusion lines in the same factory ; this advantage is not of prime importance.

V.3. Manpower training

The manpower needs are given in table 14

As far as the plastics processing industry is concerned the needs are :

- Engineers	5
- Foremen	20
- Employees and other skilled manpower	88
- Unskilled manpower	140

up to 1980 if all the projects are realised.

Even taking into consideration the needs resulting form the existing firms expansion the skilled manpower needs do not justify the installation of a plastics training center at the OERS countries level. On the other hand, such a center would be usefull if intended to meet not only the requirements of the OERS countries but also these of other West African countries like Sierra Leone, Liberia, Ivory Coast, Ghana, Upper Volta, Niger.

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DEVELOPMENT OF THE PETROCHEMICAL AND PLASTICS INDUSTRY

IN THE ARAB MEMBER COUNTRIES

VOLUME II

MARKET OF PLASTICS AND SYNTHETIC FIBERS

FORECAST OF DEMAND UNTIL 1980

January 1972

Bureau d'études industrielles
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DEVELOPMENT OF THE PETROCHEMICAL AND PLASTICS INDUSTRY

IN THE OERS MEMBER COUNTRIES

VOLUME II

MARKET OF PLASTICS AND SYNTHETIC FIBRES

FORECAST OF DEMAND UNTIL 1980

C 31/2017

January 1972

I. BASIC ECONOMIC DATA

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I. BASIC ECONOMIC DATA

End products consumption and future needs can be evaluated by linking them to basic economical data specific to each country.

They are mainly population and income data.

I.1. Population - Distribution of population

Tables 1 to 5 present population data for the considered countries and for the totality of OERS countries in 1960, 1970, 1980.

Table 1

Population in Guinea (inhabitants)

	1960	1970	1980	Annual rate of growth
. Rural population	2 750 000	3 360 000	4 120 000	2.2
. Urban population	192 000	302 000	592 000	7.4
. Non African population	8 000	8 000	8 000	0.0
TOTAL	2 950 000	3 670 000	4 720 000	2.6

Table 2

Population in Mali (inhabitants)

	1960	1970	1980	Annual rate of growth
. Rural population	3 757 000	4 470 000	5 408 000	2.0
. Urban population	396 000	596 000	956 000	5.5
. Non African population	4 000	4 000	4 000	0.0
TOTAL	4 157 000	5 070 000	6 368 000	2.4

Table 3

Population in Mauritania (inhabitants)

	1960	1970	1980	Annual rate of growth
. Rural population	895 000	1 090 000	1 175 000	1.9
. Urban population	43 000	128 000	248 000	9.2
. Non African population	2 000	2 000	2 000	0.0
TOTAL	940 000	1 220 000	1 425 000	2.3

Table 4

Population in Senegal (inhabitants)

	1960	1970	1980	Annual rate of growth
. Rural population	2 358 000	2 720 000	3 280 000	1.8
. Urban population	648 000	1 036 000	1 556 000	5.2
. Non African population	44 000	44 000	44 000	0.0
TOTAL	3 050 000	3 800 000	4 880 000	2.6

Table 5

Population in total OERS countries

	1960	1970	1980	Annual rate of growth
. Rural population	9 760 000	11 640 000	13 983 000	1.9
. Urban population	1 279 000	1 982 000	3 352 000	6.0
. Non African population	58 000	58 000	58 000	0.0
TOTAL	11 097 000	13 680 000	17 393 000	2.5

A point to be considered because it makes for the development of petro-chemicals demand is the growth rate of urban population.

This rate is especially high in the OERS countries as indicated in the tables 1 to 5.

This growth rate involves a quick change in the repartition of rural and urban population, the share of the latter in the total population increasing from 11.5 percent in 1960 to 19.5 percent in 1980 in OERS countries as a whole.

It should be noticed that the non-African population having generally a high standard of living is expected to remain constant.

1.2. Income , Gross Domestic Product.

A concept widely used for measuring - and consequently comparing - economic activity in different countries is the Gross Domestic Product (G.D.P.). per capita GDP is commonly used too, for appreciating standard of living in these countries although there are sometimes appreciable discrepancies between G.D.P. and consumer's expenditures (1).

The widespread use of petrochemical products such as plastics and man-made fibers among the generality of consumers,underlies the very approximate relationship observed between the average consumption of these products and the average per capita G.D.P. in a given country.(2)

With certain precaution explained later, this relationship can be a basis for a forecast of the demand of the above mentioned products : assuming a certain future income leads to an estimate of the probable consumption of these products.

In fact, a definite increase of demand is generally observed for a given increase of income. The ratio of demand increase to income increase defines the coefficient of elasticity.

As regards plastics for instance, it generally varies between 2 and 4 - a high value that has kept up in a large number of countries for a long time. This results from the action of economic incentives, such as declining prices and the gradual applications of plastics to a wider range of uses, known as "diffusion effect".

Owing to this effect, by the end of this decade the consumption of plastics should be at least twice what it was for the same income during the last years ; in countries with a low level of income (in the range of U.S. $ 50-100 per capita) it might be up to 5 times higher (due to a better availibility).

(1) For Mauritania for instance the correspondant figures are respectively $ 80 and $ 140

(2) This empirical relation is given as follows : Log. consumption = a log G.D.P. + b

Table 6 presents results and estimate of the per capita Gross Domestic Product for the considered countries in 1970, 1975, 1980.

Table 6

Per capita Gross Domestic Product (US $)

	1970	1975	1980
Guinea	100	120	150
Mali	55	75	100
Mauritania	150	200	240
Senegal	200	250	290

I.3. G.D.P. by industry of origin

Another point to be considered is the origin of G.D.P. As it appears in the following table 7, the major share of G.D.P. is still coming from primary sector (agriculture, forestry, fishing) in OERS countries. By comparison the share of this sector is only 6-7 % as an average in West European countries (but in the range of 20 % in less industrialized countries such as Spain, Portugal, Greece).

Table 7

G.D.P. by industry of origin (1968)

%

	Primary sector	Secondary sector	Tertiary sector	TOTAL
Mali	52	16	32	100
Mauritania	39	36	25	100
Senegal	34	20	46	100

However, the share of agricultural sector is gradually decreasing in GDP of all the OERS countries as a result of the higher rate of development in both secondary sector (industry mining) and tertiary sector (services).

In Senegal, for instance, the long term objectives of growth by sectors area as follows :

. agriculture + 3 % per year

. industry + 6.4 % per year

. Services + 6.2 % per year

An important consequence of this evolution is to allow a better developpement of the exchanges in the monetary system and the increase of purchase of manufactured goods (in Mauritania, for example 60-65 % of the agricultural production is self consumed).

II. PLASTICS CONSUMPTION

II. PLASTICS CONSUMPTION

II.1. Macroeconomic approach

II.1.1. Present and past consumption

In the considered countries, plastics consumption consists only of imports either as resins and compounds or as finished goods. Thus we studied in detail external trade statistics of the OERS countries and exports statistics of the European countries. Furthermore, complementary information were obtained during interviews with industrials and importators.

Tables 8 to 10 summarise the plastics importation data based on the official external trade statistics in the OERS countries broken down in polymerization products (thermoplastics resins) condensation products (mainly thermosettings resin) and manufactured goods, over the 1965-1970 period.

The figures given in these tables do not consider illicits imports ; they are expressed in total resins plus additives. From information obtained during interviews with industrial and importation we estimated the actual resins consumption in 1970. These estimations are presented in table 11.

Note. Data concerning Guinea are not available.

Table 8

Apparent plastics consumption in Mali
(1966-1970)

Tons

	1966	1967	1968	1969	1970
. Thermoplastics	17.4	5.6	59.1	60.0	121.8
. Thermosetting and others	4.2	4.2	12.2	15.0	44.5
. Manufactured goods (1)	31.8	83.7	61.0	80.0	94.2
TOTAL	53.4	93.5	132.3	155.0	260.5

(1) In the case of manufactured goods the consumption is at least twice higher on account of illicit import

Table 9

Apparent plastices consumption in Mauritania
(1965-1970)

Tons

	1965	1966	1967	1968	1969	1970
. Thermoplastics					200	
. Thermosettings and others					86	
. Manufactured goods					73	
TOTAL	40	110	90	100	367	327

Table 10

Apparent plastics consumption in Senegal

(1965-1970)

Tons

	1965	1966	1967	1968	1969	1970
Thermoplastics	1428	1740	2222	3200	3530	4063
. Thermosettings and others	259	430	486	635	670	880
Manufactured goods	299	476	505	612	414	626
TOTAL	1986	2646	3213	4447	4614	5569

Table 11

Total consumption of plastics resins in 1970 in Mali, Mauritania and Senegal

Tons

Country	Mali	Mauritania	Senegal	TOTAL
Thermoplastics	410	270	4 000	4 680
. Thermosetting and others	90	30	1 000	1 120
TOTAL	500	300	5 000	5 800

II.1.2. Rate of growth

Considering the relatively low level of the demand for plastic, in both Mali and Mauritania, no significant features can be pointed out from the above figures, as regards rate of growth of this demand (and, consequently, trend).

On the other hand, the increase of the demand appears more significative in the case of Senegal : annual growth rate was 23 % a year as an average over the 1965-1970 period.

By comparison, during the last two decades the world consumption of plastic has developed rapidly and also fairly regularly ; it has, in fact, just about doubled every five years, which corresponds to an average annual increase of 15 % ; it is expected that it will be almost the same during this decade.

It should be added that the demand for plastics in developing countries usually grows at a faster rate than that now observed in industrialized countries where the rate was previously higher.

II.1.3. Relationship with the income. Forecast

Let's consider figure n° 1 :

. Straight line 1968 I

Straight line 1968 I is defined from the data relative to many African and some Middle East countries : per capita income up to $ 300.

. Straight line 1968 II

Straight line 1968 II is defined from data relative to Latin American countries (where the level of income is somewhat higher than it is in African countries).

. Straight line 1980

Straight line 1980 represents the forecast of the demand for plastics in the above countries : this forecast is mainly based on the analysis of the past evolution and trend of the relationship between consumption of plastics and per capita income in these countries.

An important point ot be considered within the scope of this study is that a faster growth rate of the demand for plastics is expected from now for the countries with a low level of income such as many African countries (due to a better diffusion as it was previously)/

Although it is rather difficult to estimate accurately to what extent this will be, it can be assumed that the relationship between consumption of plastics and per capita income in the countries with a low level of income would be in a better accordance with that of the countries with a higher level of income (Fig 1 - straight line 1980).

The present figures (1970) of the per capita plastics consumption are as follows :

. Mali : 0.1 Kg per capita (including illicit imports)

. Mauritania : 0.2 Kg per capita

. Senegal : 1.5 Kg per capita

Referring to the relationship between consumption of plastics and per capita income, both Mali and Mauritania are merely found not far from the African countries the most comparable as regards level of income (Fig 1 - Straight line 1968 I).

On the other hand, the level of consumption of plastics in Senegal appears somewhat higher than that of many countries with a comparable level of income (Fig 1 - Straight line 1968 I and 1968 II).

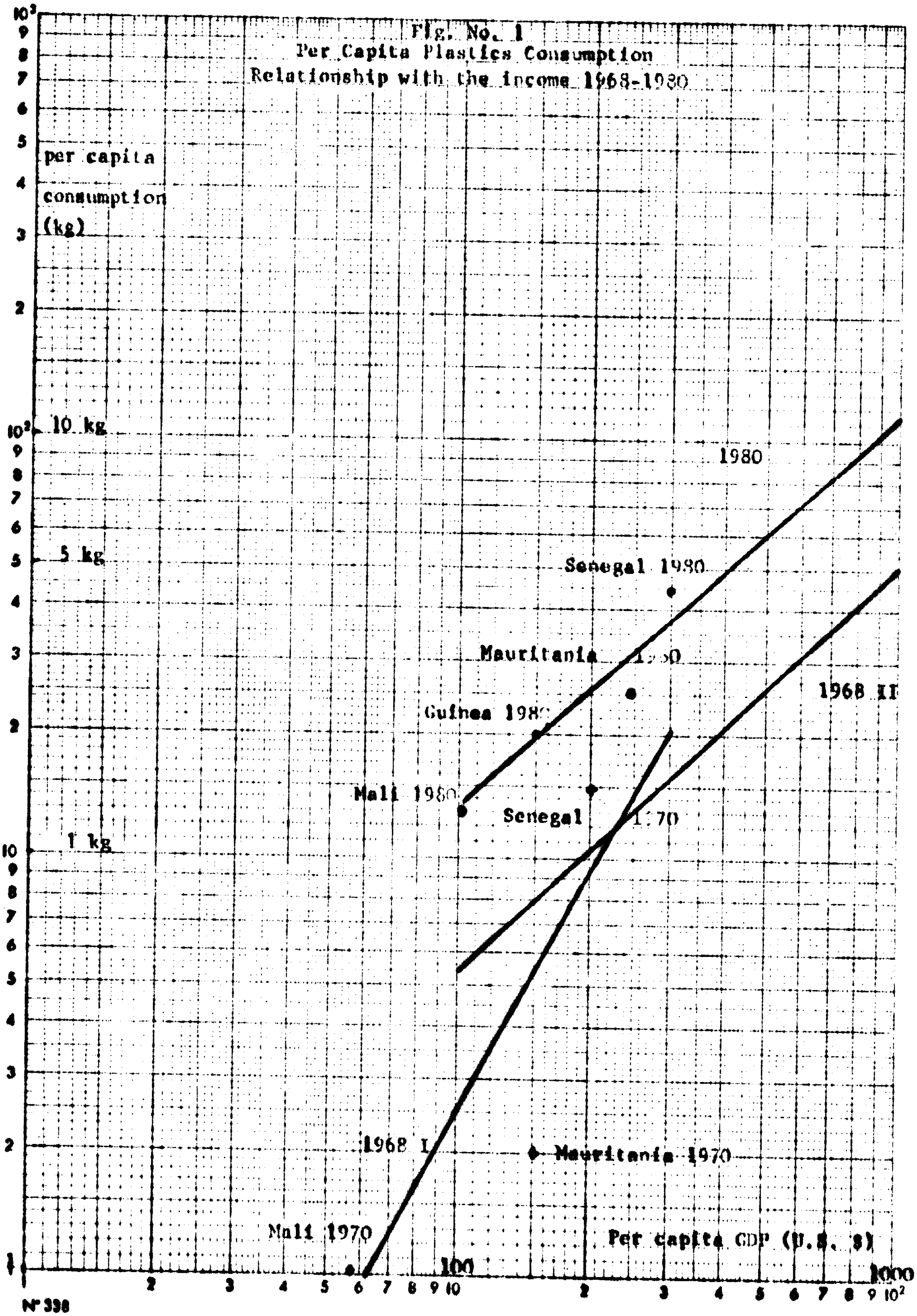
Fig. No. 1
Per Capita Plastics Consumption
Relationship with the income 1968-1980
per capita
consumption
(kg)
10 kg
5 kg
1 kg
1980
Senegal 1980
Mauritania 1980
1968 II
Guinea 1980
Mali 1980
Senegal 1970
1968 I
Mauritania 1970
Mali 1970
Per capita GDP (U.S. $)
100
1000
N° 338

Taking into account the preceding observation, the forecast 1980 of the demand for plastics in OERS countries is as follows, as first approximate.

Table 12

Plastics consumptions in 1980

	Per capita plastic consumption Kg		Inhabitants 10^6	Total consumption of plastics Tons	
	1970	1980		Range	Averaged
Mali	0.1	1.1-1.5	6.4	7.000-9.500	8.500
Mauritania	0.2	2.5-3.0	1.45	3.600-4.400	4.000
Senegal	1.5	4.5	4.9	22.000	22.000
Guinea	..	1.7-2.2	4.7	8.000-10.000	9.000
TOTAL			17.45		43.500

As regards the types of platics consumed, thermoplastics largely prevail now on all markets with proportions at least equal to 80-85 %.

Over this decade this percentage could still slightly increase so that the thermoplatics consumption would be as follow in 1980:

Mali	7.500 tons
Mauritania	3.500 tons
Senegal	19.500 tons
Guinea	7.500 tons
TOTAL	38.000 tons

II.2. Survey of plastics demand - General

Forecasting the demand for petrochemical products such as synthetic fibers and synthetic rubber is relatively easy since :

- their potential markets (e.g. textile goods, tires) are fairly well established and comparatively limited.
- penetration rates of synthetic materials in these markets are often high, chiefly in industrialized countries.

By comparison, the potential markets of plastics - namely, packaging, transports, building - are very large and their possible applications are not thoroughly known as yet.

Because of this situation, the demand for plastics should generally develop at a high rate over a long period which makes the long term forecast more difficult.

Forecast fo the demand of plastics is based on :

- macroeconomic consideration as previously shown (see II.1.)
- considerations specific to the considered country, depending on local conditions and present market data.

II.2.1. Structure of plastics consumption

Importance of thermoplastics consumption

It is well known that there are two major categories of plastics: thermoplastic and thermosetting resins.

The first and by far the most important group of plastics consists chiefly of the main plastics of "large tonnage" : polyethylene, PVC and polystyrene. These resins all apply a wide range of uses and their physical properties make possible the mass production of moulded goods which the low cost of raw material makes even more competitive.

The group of thermosetting resins consist chiefly of formaldehyde resins polyester and alkyd resins.

In West European countries, thermoplastics account now for almost 70 % of total plastics. This percentage has kept growing especially at the end of the sixties.

In developing countries, thermoplastics prevail on all markets, with proportions at least equal to those observed in industrialized countries. The share of thermoplastics is generally higher in countries with low consumption level.

In Senegal, the share of thermoplastics has been varying in the range of 80-85 percent of total of imported synthetic resins over the 1965-1970 period.

Taking into account the imported plastics manufactured goods - 10 percent of the total imports of plastics in 1969-1970 as against 15 percent over the 1965-1968 period - the above percentage could be slightly higher since they consist mainly of PVC shoes and polyethylene household goods.

Considering this high percentage, no further increase of thermoplastics should keep pace with that of total plastics.

There are at least twenty types of plastics. A few of them : polyethylene, PVC, polystyrene, plypropylene, all thermoplastics deserve special attention since they are plastics of large tonnage. They will be considered within the scope of this study.

In 1970, total imports of thermoplastics were slightly more than 4,000 tons, according to the external trade statistics. On the other hand, plastic materials processed by industry reached to 3 250 tons (table 1). This discrepancy chiefly comes from the fact that imported PVC compound for shoe manufacturing (about 2 000 t) only consists of 40-45 % of PVC pure resin.

As it appears in table 1, polyethylene accounts for slightly more than an half of total main thermoplastics and PVC for about a third.

Expressed as percentage, the corresponding figures are as follows

. L.D. polyethylene	35.5 %
. H.D. polyethylene	16.5 %
. PVC	30.5 %
. Polypropylene	13.0 %
. Polystyrene	4.5 %
TOTAL	100.0 %

By referring to the trend well established in more developed countries, a significant chage is likely to occur in the structure of the demand for thermoplastics : a slight increase of the share of PVC and polystyrene can be expected whereas the importance of polyethylene will decline to the same extent.

[illegible] Demand for thermoplastics by types

[illegible].1. Low density polyethylene

Reference to international markets :

- Industrialised countries

  In industrialised countries the most widespread application -namely films (general purpose and heavy duty bags) and sheets for packaging- have increased their proportion during the last years to account for half the total market at least. In some cases this percentage either reaches 60 % (France, West Germany) or is even higher : 67 % in Italy.

  This increase has been achiedved at the expense of moulded applications where other thermoplastics such as H.D. polyethylene, polypropylene, are more suitable than L.D. polyethylene by reason of their more specific properties. This application generally accounts for around 15 % of the total.

  Hollow articles - a field that H.D. polyethylene has largely penetrated - accounts for about 10 % of the total, except for Japan and the USA where it remains at a low level.

  While polyethylene pipes are gradually giving ground to PVC pipes, the same is not true regarding cable coating, where polyethylene will take the lead from PVC owing to the expansion of the market for telephone cables. These two applications generally account for 5-10 % of the total. The share of L.D. polyethylene going to extrusion coating (paper, aluminium) is at least the same.

No significant change should occur in this pattern during the next coming years, except that films could still gain some ground.

As regards plastics processing techniques, extrusion (films, pipes) is by far the most largely used, as shown in table 13.

Table 13

Pattern of L.D. polyethylene processing in West European countries

Percentage	EEC countries	U.K.	Spain
Extrusion	70 %	66 %	54 (films)%
Injection Moulding	19	16	17
Blow Moulding	10	10	23
Others	1	8	6
TOTAL	100	100	100

Developing countries

In these countries, the market for low density polyethylene is characterized by the existence of two branches only : films and sheets, and mouldings (usually by injection and sometimes by blowing). There is often no market for pipes or wire and cable coating.

In both basic branches the market trends, at least in the countries with a processing industry, are the same as in the industrialized countries, namely the predominance of films and sheets (60 % of the market) and a relatively important market for injection - moulded articles.

This structure will probably be maintained in the future, considering the enormous potential for polyethylene films and sheets represented by packaging, agriculture and building.

To the same extent as these countries can meet their requirements for piping or cable coating with PVC, it seems likely that L.D. polyethylene will apppear only marginally in these fields.

II.2.2.2. High density polyethylene

Reference to international markets

For some years rigid, unplasticised PVC in all its main applications - chiefly pipes, sheets and films, profiles - has been developing at a faster rate in all these countries than flexible or plasticised PVC.

In the long term, the use of rigid PVC will increase to about 60 % of the market, having just reached the 50 % level now.

The primary reason for this forecast is that difficulties in processing rigid PVC have largely been overcome by the introduction of improved types of compounds and machinery.

But it should be kept in mind that, while flexible PVC will decline in its share of the total vinyl market it will continue to grow in terms of absolute tonnages.

Rigid PVC :

. Pipe has been a growth area for PVC especially in building and civil and rural engineering. Sewage and water pipes as well as land drainage (1), are important areas of expansion.

. Rigid profiles are mostly used for applications in building. There is still room for much expansion, once legislative obstacles have been removed. Substantial sucess is yet seen in window frames. But in the case of roller shutters, saturation is already often complete.

. Films, rigid and semi rigid, are already well developed in the major consumer countries : USA and West Germany. It is beginning to make inroads in the other European countries as well. The main reason for the upsurge seems to lie in the proliferation of supermarkets. LD polyethylene film has of course a strong position in this area, but PVC barrier properties give it a special acceptance for several products lines.

. Bottles. For some time in France, bottling of vinegar and edible oils in PVC containers has reached relative saturation. This application is now coming into general use in some other countries (Italy).

The sale of flat mineral water in PVC bottles has increased phenomenally in France. This market will continue to grow and extend to other countries.

An outlet which seems possible in the near future, although the problems are not yet resolved, is the bottling of carbonated mineral water, slightly carbonated first, then fully sparkling.

As far as bottle production is concerned the trend has been towards captive operation installation. This makes it unlikely that resin suppliers might integrate forward into this area.

1) In this application polyethylene is still used as well but only for small diameter. Furthermore, its share is decreasing.

. Injection moulding. For a long time pipe fittings were the only substantial market for injection moulded PVC ; however easier processing combined with a demand for non-flammability may result in greater acceptance by the moulded product sector.

Flexible PVC :

. Calendered sheet and extruded films. The car industry is usually the biggest user of this outlet. The fastest growing sub-sector is packaging.

. Upholstery. PVC will continue to grow in this sector not-withstanding the competition of polyurethanes which give a better looking leather-like fabric.

. Cable and wire. The main user of this application is the building industry.

. Flooring. This use of PVC has been declining as sufted carpets are taking the main growth in the floor covering market.

. Footwear. Unlike in the UK, the growth of PVC in this sector is usually slow with a strong consumer preference towards leather.

By way of illustration, the pattern of PVC consumption by end uses is given below in the case of EEC countries

Rigid PVC :		
	pipes and profiles	24.6 %
	foils and films	9.8 %
	sheets	3.2 %
	bottles	3.2 %
	other	8.2 %
	TOTAL	49.0 %
Flexible PVC :		
	foils and films	10.5 %
	cables	9.7 %
	flooring	9.7 %
	pipes and profiles	6.0 %
	other	15.1 %
	TOTAL	51.0 %

Gradual change is expected to occur in this pattern during the next coming years according to the past trend, involving a rise of the share of rigid PVC end uses (chiefly due to rigid pipes, profiles and bottles).

As regards PVC processing, extrusion usually takes up about 50 % of this market as shown in the table below :

Table 15

Pattern of PVC processing in West European countries

%

	EEC Countries	U.K.	Spain
Extrusion	50	39	52
Moulding	12	21	11
Calendering	27	29	21
Coating	11	11	11
TOTAL	100	100	100

Developing countries

The quantities of flexible PVC are relatively greater. This trend is however likely to be reversed especially in countries already having a well developed processing industry.

- The increase in the market for pipes, especially for water supply and irrigation which require small diameters, should begin to make itself felt from now on. Sheets and profiles will begin to appear.

In contrast with the industrialized countries some applications of flexible PVC should establish themselves or increase their proportion of total consumption :

- The development of floor covering in PVC or vinyl asbestos tiles depends solely upon the installation of calendering equipment.

- Under the same conditions synthetic leather should account for a substantial proportion of the market.

- Plastic footwear. Plastic should make great strides because of its low cost compared with classic types of footwear.

- As in the industrialised countries, the coating of electric and telephonic cables will increase relatively less rapidly.

II.2.2.4.Polystyrene

Reference to international market

In industrialised countries household goods, toys and electric parts .... (injection) are by far the most widespread use of polystyrene. But its share in the total has been gradually declining as a result of the advance in the production of packaging products (extrusion forming, and to a lesser extent, foams) and refrigerator doors and inner liners (extrusion).

The polystyrene processing industry reflects the relative importance of these two main outlets of polystyrene, as shown below :

Table 16

Pattern of polystyrene processing in West European countries

%

	EEC countries	U.K.	Spain
Moulding	75	73	81
Forming, extrusion	25	27	19
TOTAL	100	100	100

In developing countries as well as industrialized countries, polystyrene, despite its brillant past and dominant place in moudled goods, will account for a relatively decreasing though ever appreciable share of the market.

II.2.3. Demand for thermosetting plastics - Case of the OERS countries

In the group of thermosettings there are four main types of resins : formaldehyde (phenolic and amino plastics) polyester, alkyds and urethanes resins. Their usual long-established existence has ensured their solid implantation and their wide diffusion throughout the world but their limited applications and their relatively high prices have considerably restricted their market, to the advantage of other resins.

- The development of demand for urea formaldehyde is due to the development of its by far most widespread application - namely adhesives used in the wood industry : chiefly manufacture of plywood, fiber particle boards. Other outlets of urea resins include moulding materials and products for textile and paper treatment.

- Only one outlet is found for alkyd resins : the manufacture of paints (especially glycerophtalic).

The importance of this kind of points varies considuably from one country to another, depending on local habits.

Anyway, the growth rate of consumption is usually low.

- Reimforced plastics are the most widespread application of polyester. In fact, reimforced polyesters usually from the bulk of remforced plastics. The main outlets of reimforced polyester an in building, transport and leisure (especially boats).

- The main applications for urethanes resins are found as both flexible and rigid foam car upholstery, furniture, mattress and pillow manufacture are the largest outlet of flexible urethane foam ; rigid urethane foam is used as insulating materials in both transport and building industry.

By now (1970) present total consumption of thermosetting is just reaching the 1,000 tons level in Senegal, Mali and Mauritania. This consumption is expected to exceed 4,000 tons in 1980.

However, taking into account a percentage breakdown of thermosetting resins consumption based on international market comparisons, no opportunity for locally manufacturing any thermosetting resin at economic scale will appear over this decade.

An exception concerns urethane resins flexible foam : a plant recently installed in Senegal is able - with a nominal capacity of 100 tons a month - to meet all the needs of OERS countries over this decade.

II.3. Senegalian market

II.3.1. Present situation

The end uses breakdown of the main thermoplastics can easily be done from interviews with main processors.

II.3.1.1. Polyethylene

As it appears in table 17, films have taken up the largest share of polyethylene application, as usually observed in international market.

Almost all polyethylene film is used for packaging either as heavy duty bags (fertilizers) or as general purpose film (biscuits and other foodstuffs, retail trade).

Table 17

End uses breakdown of polyethylene - Senegal 1970

tons

	LD Polyethylene	HD Polyethylene	Total	Percentage
- Film of which:				
. heavy duty bag	300		300	18
. general purpose	640	120	760	45
- Household goods, toys	30	280	310	18.5
- Bottles	175	125	300	18
- Others	5		5	0.5
Total	1,150	525	1,675	100.0

HD polyethylene accounts for slightly more than 30 % of the total polyethylene. Rather higher than the ones usually observed on the international markets. Main outlet of HD polyethylene is in injection moulding applications chiefly household goods and toys. It has taken up the largest share of these markets.

On the other hand, the shares held by HD polyethylene in other polyethylene markets : hollow articles i.e. bottles, and films are smaller : respectively 40% and 20%. These above mentioned features are not quite different from that currently observed in the international market.

II.3.1.2. PVC

As it appears in the table 18, the major outlet for PVC is the plastic shoes manufacture - the other applications far behind - as usually seen in developing countries.

Table 18

End uses breakdown of PVC - Senegal 1970

resin 100%	tons	percentage
- shoes	800	82
- bottles	25	2.5
- others	155	15.5
total	980	100.0

PVC rigid applications such as pipes and bottles - the major outlet of PVC in developed countries - are still very small in Senegal. But their share will grow quickly in the next coming years.

II.3.1.3. Polystyrene

There are two main outlets in Senegal for polystyrene :

- injection moulding (chiefly household goods)
- bottles

Table 19

End uses breakdown of polystyrene-Senegal 1970

	tons	percentage
Injection moulding	70	47
Bottles	55	36.5
Foam	25	16.5
Total	150	100.0

Foam is another use of polystyrene with a growing importance. Polystyrene foam is mainly used either as insulating material, or for packaging.

II.3.1.4. Polypropylene

In Senegal, nearly all the consumed polypropylene is used as slit yarn for the manufacture of woven bags (table 20).

Table 20

End uses breakdown of polypropylene Senegal 1970

	tons	percentage
Slit yarn	400	96.5
Injection moulding	15	3.5
Total	415	100.0

Considering the expected development of this application, it is likely to hold the largest share of polypropylene market.

Compared with the international market, the level of polypropylene consumption in other applications - chiefly injection moulding - is very low, even in relative value.

II.3.2. Main applications of thermoplastics by sectors of use - forecast

Forecast of thermoplastics needs will be based on an analysis of the demand for these materials in their main outlets, taking into account the competition from other non-plastic materials.

The development of the demand for thermoplastics in their main present and future outlets will be considered successively.

II.3.2.1. Packaging

Substantial outlets for thermoplastics are found in the field of packaging. In this field, thermoplastics are gaining ground, displacing other materials such as paper and cardboard, wood, glass, tin, jute in their traditional outlets.

On the other hand, the coefficient of elasticity of the demand for packaging materials, versus income is always higher than 1.0. So a substantial increase of the demand for thermoplastics can be expected in the next coming years.

II.3.2.1.1. Bags

Main products to be packed.

The main products to be packed are the agricultural and industrial products.

Agricultural products

In order to estimate the outlet for the packaging in the field of agricultural products, we are led to consider the magnitude of future Senegalese crops (1980)

This forecast is chiefly based on :

- importance and evolution of crops during the last years
- existence of a deficit(e.g. maize, sugar) now filled up by imports. These last ones should decrease or even disappear. In some cases, a part of the production will be exported.

Main agricultural products are listed below :

Groundnut

It is the main agricultural production in Senegal constituting 2/3 of the agricultural monetary income; it ranks first among the exported products. The crop outpassed the level of one million tons in 1964-1965; then it fell off substantially during the following years (1966, 1968 and 1969) due to the bad climatic conditions.
Referring to the readjusted third Plan, the production should again reach one million tons in 1972. From this date, the groundnut production can be expected to grow at the rate of 5 percent a year as an average, according to the development of the demand on export markets. This increase leads to estimate this production at about 1,500,000 tons in 1980.

Sorghum

It largely contributes to the human food (annual consumption almost 150 kg per capita) This crop,more and more linked with groundnut fell under the bad climatic conditions.
This crop currently higher than 500,000 tons is going to be increased in the next coming years : 750,000 tons in 1972/1973.
It should exceed one million tons in 1980 if outlets can be found on export markets.

Table [illegible]

Main crops in Senegal - Forecast

10^3 tons

	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70 unadjusted	1972/73 IIIrd plan	1980 est
Paddy	77	106	110	122	125	110		136	165	300-350
Sorghum	484	470	502	564	483	535	485	636	750	1000-1100
Maize	37	27	37	41	42	30		48	52	100
Manioc	107	107	136	180	141	230				300-400
Garden prod.	30	32	32	32	35	41		40	45	100-150
Groundnuts	886	959	1010	1132	881	1005		800	950-1000	1300
Cotton								11,5	30	65-100
Cane Sugar										30-60
Pineapple									0,5	10
Bananas									4	20-25
Tomatoes								1	5	

Rice

This cereal ranks second after sorghum in human food (annual consumption 75 kg capita). Referring to the national needs, local production is still short of 160 - 180,000 t per year.
In order to reduce this deficit, the Government initiates a program of development of this crop (Casamance river area).
The production target for 1973 is 165,000 tons.
The present deficit should decrease or even disappear at the end of the seventies. Then national production could reach 300-350,000 tons.

Maize

Maize is used for human food and animal feed. Production is in the range of 50,000 tons/year, just enough to meet the needs of the local market.
This production can be expected to double at the end of the seventies.

Manioc

The crop of manioc currently reaches 250,000 tons/year. No particular incentive to increase this production is planned. Nevertheless, it could be in the range of 350,000 - 400,000 tons in 1980.

Gardens' production

The volume of production of garden products amounts to 40,000 tons/year; it will increase considerably:

- crop for local market : potatoes, onions, tomatoes.
- crop for export market : french beans, tomatoes.

The production could be in the range of 100 - 150,000 tons in 1980.

Sugar cane

The consumption of sugar overpasses 50,000 tons/year. In practice, it is wholy supplied by import. Therefore, the Senegalian Government is going to undertake a program for developing the crop of sugar cane; this program could be achieved for 7 years (Richard Toll). Then the deficit of sugar will strongly decrease : the production could be in the range of 50-60,000 tons, whereas the consumption will reach 60-70,000 tons.

Cotton

According to the IIIrd plan, the crop of cotton could overpass the needs of local market giving an excess available for export. The production target is 33,000 tons in 1972-1973; it could be doubled or even trebled if outlets are found on export market.

Fruits

A developing program for fruits production is set up by the Government : both quality and quantity will be improved in order to supply local and export markets.
Two particular productions are to be developed especially :

- Bananas: now imported. Production target : 4,000 tons in 1973. Possible production : 20,000 tons in 1980.
- Pineapples : Production target 1,000 tons in 1973. Possible production 10,000 tons in 1980.

Productions of other fruits are also to be considered : citrus, mangoes, avocados.

Industrial products

There are at least two industrial products that deserve special attention since they require substantial quantities of packaging materials : fertilizers and cement.

Fertilizers

During the last past years, the consumption of fertilizers has been varying largely, due to the bad climatic conditions.
For instance, fertilizers consumption was :

- 33,800 tons in 1965/66
- 48,900 tons in 1966/67
- 62,300 tons in 1967/68
- 89,200 tons in 1968/69

Average consumption of fertilizers per 1000 ha. of arable land is about 20-25 kg in the current year, i.e. 5 - 6 kg per 1000 ha. of agricultural nutrient (N, P_2O_5, K_2O). This is nearly the same level of consumption as seen in some African countries, such as Algeria, Tunisia, Kenya. By comparison, consumption of agricultural nutrients is 11.3 kg in South America and 40 kg in the world as a whole. On the other hand, the ratio of fertilizer nutrients used in Senegal is N : 1 - P_2O_5 : 2 - K_2O : 1. Referring to the international market where this ratio is usually in the range of 1-1-1 or 2-1-1, a large increase of nitrogenous fertilizers use can be expected.

A program for developing the use of fertilizers has been set up by the Government, especially in the case of groundnut and sorghum. According to the IIIrd plan, the fertilizer consumption should be in 1972/73 :

- [illegible] tons for groundnut production
- [illegible] tons for sorghum production

Although these goals cannot be achieved, due to the bad climatic conditions, they allow to get an order of magnitude of the fertilizer consumption in 1980.
Thus, the consumption of fertilizers is estimated to be in the range of 300 - 400,000 tons in 1980:

- 100 - 150,000 tons for groundnut crop
- 100,000 tons for sorghum crop
- 100,000 tons for other crops, especially the most recently developed (rice maize, cotton, sugar cane, bananas).

Cement

Cement production varied between 180,000 t and 200,000 t over the 1961-1968 period. It reached 240,000 tons in 1970. The consumption of cement is tentatively estimated at 400,000 tons in 1980 assuming a 6 percent growth rate over the 1968-1980 period.

Other products

There are some other products, mainly derivatives of agricultural production that require substantial packaging materials. Their national markets have been estimated in 1980.

- groundnut oil cake = 600,000 tons
- flour = 100,000 tons
- cattle feedstuff = 100,000 tons

Some food products like biscuits, salt, grinded coffee will require appreciable quantities of packaging materials too.

B. Materials competing for packaging.

In the field of packaging, at least two materials are competing with plastics : paper products and natural fibres, such as jute and sisal.

Paper products.

The major share of paper products consumed in Senegal is imported. Table 22 shows the evolution of imports over the 1966-1970 period.

Table 22

Import of paper products 1966 - 1970

tons

	1966	1968	1969	1970.
Paper products, total	9,932	11,000	12,648	13,621
of which :				
. Kraft	1,232	1,974	1,965	3,138
. Coated paper	1,090	1,115	1,392	1,505
. Paper bag	851	938	917	1,153

Source: SONEPI

As it appears in this table; these imports have been steadily growing (averaged rate : 8.4% per year), especially in the case of Kraft paper and cardboard. Besides these imports, a plant having produced 5,300 tons of cardboard in 1970 (La Rochette), is partially supplying the market.

Referring to the past trend, the consumption of paper products for packaging can be estimated at about 20,000 tons in 1975, 30,000 tons in 1980.

Since paper has to compete chiefly with LD polyethylene film in packaging applications, the ratio $\frac{\text{LD Polyethylene}}{\text{paper}}$ for packaging is noteworthy. In many industrialized countries, this ratio is only in the order of 1/10 - despite a dramatic rise (often more than 20% a year) in this use of LD polyethylene - it is expected to be about 1/3 at the end of the seventies. In Senegal, the above mentioned ratio is still $\frac{1}{15}$ - by referring to the trend observed in industrialized countries, it could be in the range of 1/7 - 1/8 in 1980.

Another point to be considered is the relative price of the two above mentioned materials : on a weight basis, the price of a paper bag is only about a third of the polyethylene bag. But taking into account the "utility poundage" of L.D. polyethylene (since it is two or three times lighter than paper for the same use), the price of polyethylene bags is close to the paper bag one.
The relatively high price of paper products is due to the fact that they are imported. This situation, rather favourable to the development of the demand of polyethylene, could be upset if a paper factory will be locally installed.

Jute, sisal

Two natural fibres are chiefly used for packaging purpose : sisal and jute. Both are imported; Cotton and cellulosic fibres are used here too, but to a smaller extent. The present market of these textile bags is close to 7,000 tons a year. Recently, woven bags made of polypropylene slit yarn ([illegible]) made inroads into this market : [illegible]00 tons of this material were used in 1970. Polypropylene bags being used for one-use application compete more easily with jute bags than with strong sisal bags since the latter ones are chiefly used in four-or-five times applications (carriage of groundnut, paddy). As regards prices, polypropylene bags - sold $ 0.45 each - easily compete with imported jute bags. Sisal bags are sold $ 0.60 each.

C. Thermoplastics to be used in packaging application

Forecast (1980) of the demand for thermoplastics in packaging applications has been set up, taking into account :

- quantity of products that will be produced in 1980
- the share of these products to be packed since a variable part of the production is shipped in bulk
- the competition between various packaging materials.

Agricultural and industrial products

Table 21 summarises the needs of thermoplastics to be used for the packaging of main agricultural products. As it appears in this table, a substantial outlet for polypropylene is found in this field.

As far as fertilisers and cement are concerned, the picture is as follows :

. fertilisers

LD polyethylene heavy duty bags are the only ones to be used for the purpose of fertilisers packaging, having totally displaced paper. This in good agreement with trends in Europe. First, assuming that only a rather small part of fertilisers output will be stored and shipped in bulk.
Second, the weight of each bag - still 300 grams - could decrease somewhat in proportion with the bag wall thickness.

The needs of LD polyethylene heavy duty bags should be in 1980 about 1500 tons (300,000 tons of fertilisers packed in bags weighing 250 grams and holding 50 kg of fertilisers each.

. cement

The use of polyethylene heavy duty bags for packaging cement is unlikely to develop, at least in the near future, although some studies in this field are carried out in Europe. Cement production is shipped entirely in paper bags.

Other products

By now, about 400 tons of polyethylene film are used for the packaging of various food-stuffs such as biscuits, salt,grinded coffee. In addition, 300 tons of polyethylene film are used in the retail trade. Taking into account the expected expansion in the field of packaging - especially in the former one - and a further penetration of polyethylene film in this field, consumption of polyethylene film should be here at least 2000 tons in 1980 (annual growth rate 11 % as an average over the 1970 - 1980 period).

II.3.2.1.2. Bottles

A. Main products to be bottled

Main products to be bottled are : vegetable oil, vinegar, bleaching liquid and milk. All the mineral water consumed in Senegal is imported up till now. However, a growing share of this market will be soon supplied by locally produced and bottled mineral water.
By now, the national consumption of groundnut vegetable oil amounts to 40,000 tons a year, i.e. almost 45,000,000 litres.-referring to the coefficient of elasticity of food consumers expenditure with the income - close to 1.0 - the consumption of vegetable oil will be in the range of 70 - 75,000,000 litres in 1980.

By comparison, vinegar and bleaching liquid represent only a small outlet for bottling. Pasteurised and sterilised milk - still mainly made from imported powder milk - represents an appreciable outlet for bottling. However, the level of consumption of pasteurised and sterilized milk remains rather low - for instance 10,000 l/Day as an average in the Dakar area - due to the consumer to use cheaper powder or concentrated milk (1). A better expansion of the demand for milk in bottle can be expected in the next coming years, especially when using locally produced milk.

(1) Two plants of concentrated milk are being installed and expected to be on stream in 1972 : SIPL with a capacity of 9,000 tons a year and CODIPRAL-NESTLE.

Table 23

Main vegetable production and derived products packaging forecast in 1980

	Estimated production in 1980 1000 tons	Part of the production to be packed % total	in plastic	Traditional packaging	Plastic packaging	Quantity of Plastic materials used tons Polyethyl.	Polypropyl.	Polystyr.
Paddy	300-350	30	-	sisal bags (jute)	-			
White rice	250-300	50	40	jute bas (paper)	PP woven bags or polyethyl. bags		350	
Sorghum	1000-1100	30	20	Jute bags (sisal)	PP woven bags		600	
Maize	100	40	30	Jute bags	PP woven bags		100	
Manioc	350-400	15	10	-	PP nets		50	
Garden Prod.	100-150	50		Wooden boxes, cardboard	Pe film, polystyr.	200	-	100
Groundnut	1500	20	-	Sisal bags (carriage)	-		-	
Pea-nuts	50	90	80	Jute bags	Polyethyl. bags	150		
Cotton fibre		100		Jute canvas	PP fastener strip Polyethyl. film		50	
seed				Jute bags	PP bags Pe bags			
Sugar	60	100	80	-	-			
powder	20	100	30	Cotton bags	Polyethyl. bags	50		
others	40	100	80	Jute, sisal bags	PP woven bags		100	
Groundnut oil-cake	300	10-20	10	Jute bags	PP woven bags		100	
Cattle feedstuff	100	70	65		PP woven bags		200	
Flour	100	50	30	Cotton bags	Pe doubled paper bags	50		
Fruits		50		Wooden boxes cardboard	PP woven bags Polyethyl. film Polystyr. foam boxes	50		200
Total						500	1500	300

As regards mineral water, imports over the 1963-1970 period were as follows :

millions of liters :	1963 :	3,221
	1964 :	2,133
	1965 :	2,560
	1966 :	2,417
	1967 :	1,722
	1968 :	2,225
	1969 :	2,256
	1970 :	2,776

A. Local production (CGEM project), allowing a lower price, will undoubtedly make for a better expansion of the demand for mineral water. The planned production is 2,500,000 bottles of 1,5 liters. 5 years after the start-up of the plant - expected to be in 1972/1973 - it could reach 3,000,000 bottles at the end of the seventies, assuming the demand for mineral water is going to double.

B. Materials competing for bottling.

In the field of bottling, glass is practically the only one material to compete with plastics; in addition, few quantities of wax coated paper boxes are used for milk packaging.
For bottling purpose, plastics should easily compete with glass since glass bottles are still totally imported. However, the additional cost of non-re-useable plastic bottle is now entirely supported by the final consumer : that prevents from a better development of these bottles.

C. Thermoplastics to be used in bottling applications.

The forecast for the demand of thermoplastics has been set up, taking into account :

- the quantities of liquids that will be produced
- the share of these liquids to be bottled
- the competition between glass and thermoplastic materials, i.e. polyethylene and PVC.

Concerning edible oil, the share of the total demand, distributed in bottles has been steadily growing over the last past years. In 1970, it was almost 25 % of the total :

- 6.0 million liters in glass bottles (7-7.5 in 1971)
- 4.0 million liters in plastic bottles

Assuming that the share of edible oil distributed in bottles will keep growing and a further penetration of plastic bottles in this field, about 25-30 million of the latter ones will be used in 1980. The corresponding quantity of plastic materials is in the range of 1000 tons (each bottle weighing 35-37 g).

As it appears in Table 24, both polyethylene and PVC are used for this purpose : resp. 100 tons and 25 tons. However, polyethylene is often considered as an inadequate oxygen carrier. As a result and looking into the projects of local producers, the major share of this market will be held by PVC, as shown in table 22. The same is true for vinegar and bleaching agent.

Milk will remain packed in polyetylene one-liter bottle, weighing 42 grams a piece. However, it could be partially packed in cheaper polyethylene small bags (1 liter bag weighing no more than 10 grams a piece).

Table 24

Consumption of plastic materials for bottling

tons

	1970		1980	
	Polyethylene	PVC	Polyethylene	PVC
Vegetable oil	100	25	250	750
Milk	150	-	500	-
Mineral water	-	-	-	150
Vinegar, bleaching agent and others	50		250	100
Total	300	25	1000	1000

The quantity of mineral water to be produced and bottled locally in 1980 will require more than 150 tons of PVC. There is no other appreciable outlet for PVC bottle than the above mentioned one (since, for instance, the consumption of wine possibly packed in PVC bottles remains at a very low level); on the contrary, there are many other applications for polyethylene bottles: pharmaceutics, household liquid detergent, shampoos and eventually soft drinks.

II.3.2.1.3. Hollow articles.

There are many other products able to be packed in various "hollow articles": cans, boxes and containers. Considering the motor lube oil, for instance: the totality of the lube oil consumed in Senegal is imported, blended and conditioned by Compagnie Senegalaise de Lubrifiants. The normal capacity of the plant is 9000 tons. The production was 4800 tons in 1970 (expected to be 7000 tons in 1971). The sales on the local market were 2370 tons the same year; this market is estimated at 6000 tons in 1980, taking into account a larger ratio of lube oil versus gasoline and gas oil consumption.

At present time, lube oils are packed in metallic containers manufactured by [illegible]. However, lube oils are able to be packed in polyethylene cans containing 2 liters of lube (weighing 120 grams). Assuming that about 1/3 of lube will be distributed in cans in 1980 and some quantities of lubes will be packed anyway in metallic cans, the potential outlet for polyethylene is estimated at about [illegible] tons.

By the same way, the outlet for plastic materials, as hollow articles for various products could be estimated hardly reaching the level of 300 tons in 1980. In this field, plastic material to be used is mainly polyethylene.

[illegible].4. Miscellaneous packaging.

In addition to the above mentioned, there are various plastic package able to be used and possibly produced in Senegal. For instance, either rigid PVC blister packaging (mainly used in the case of fatty materials, edible fat and butter) or thermoformed polystyrene boxes (other dairy products).
At present time, most of the dairy products are sold in bulk or semi bulk, or else simply wrapped but such factors as sanitation standards or change in methods of distribution will lead to improve the packaging.
Another favourable factor is that per capita dairy products consumption in Senegal is rather low and can be expected to grow.
The packaging of various dairy products should require 150 tons formed or vacuum-formed PVC film in 1980. An additional quantity of this material - estimated at 50 tons - could be used for packaging of various products. Considerable outlets are found by polystyrene in the field of packaging either as thermoformed film and sheet or as various containers. Market for this packaging materials is estimated, resp. at [illegible] and [illegible] tons in 1980.

b. Various containers made from polystyrene foam. Main outlets of such containers or trays are found in the fruits and fish packaging. It should be noted that the density of this material is usually lower than 15-35 kg/m^3

c. Plastic crates for carrying glass bottles.

There is no good prospect for this application since the more and more used plastic bottles are only packed in cardboard boxes. The use of crates for carrying vegetables and fruits can be considered too (1).

d. Plastic open boxes used for fish handling.

These two latter applications require polyethylene: the corresponding quantity is estimated at 500 tons in 1980.

e. At least 50 tons of polyethylene will be used in 1980 for coating paper. Main field of application is found in packaging (milk etc.).

(1) Certain crates (400x600x220 mm) with a capacity of 42 liters and weighing 1,4 kg have been recently developed in Europe.

10.3.2.2. Agricultural uses of polyethylene film.

There are four main applications for polyethylene film in agriculture :

- water resource conservation
- non-chemical weeding
- alteration of the crop cycle
- silage protection

The expansion of their use in Senegal is not in the near future since the economics of using film in agriculture are not well established.
Application of polyethylene films now considered in agriculture are:

- wrapping of fruits on the tree
- covering of vegetables (tomatoes) and flowers crop production during the rainy season.
- shelters for aviculture
- banana plantations; reservoir (both reservations requiring black polyethylene film).

As an estimate, the use of agricultural film could be no more than 300 tons in 1980.

Agricultural film can be made of virgin grade, if re-use is practicable, in which case it lasts 2 to 4 years. A substantial part of the market can consist of film made from reworked scrap which lasts through a single season.
Furthermore, PVC flexible film is starting to be used successfully for this purpose in some countries (Italy for instance) especially in the case of [illegible], greenhouses etc.

III.3.2.3. Household goods, toys.

The household goods considered mainly, consist of buckets, wash-basins, dustbins etc. In this field tin is still largely used in Senegal because of the consumers' behaviour towards fire-resistant materials and furthermore, the rather bad quality of some plastic articles when appearing on the market.
At present time, Senegalese market is chiefly supplied by local processing industry : in 1970 300 tons from polyethylene materials, 65 tons from polystyrene.
In addition, some quantities of plastic household goods and toys are imported; thus the Senegalese market in this field appears to be in the range of 500-600 tons a year.
Assuming a better acceptance by consumers for plastic household products, the market of these products should be in the range of 1,500 - 2,000 tons in 1980 of which polyethylene : 800 tons, polystyrene 600 - 700 tons. Various plastic materials can be used too, but to a smaller extent : polypropylene, urea melamine etc.

[illegible].3.2.4. Footwear.

As observed in many African countries, the cheap plastic shoes are commonly used in Senegal: the present market is around 5,000,000 pairs a year, i.e. 1,2-1,3 pairs per inhabitant as an average.

A growing share of the Senegalian market is supplied by the local processing industry. The figures of this production (1000 pairs) were as follows over the 1965 - 1969 period :

1965	:	1,306
1966	:	1,779
1967	:	2,206
1968	:	2,943
1969	:	3,040
1970	:	3,300
1971	:	4,000

The local industry with a capacity already exceeding the size of the Senegalian market is able to supply the whole market.
A further expansion of this production can still be expected, due to the expected development of the consumers needs : Senegalian market is estimated to be close to 10,000,000 pairs of plastic shoes in 1980, i.e. slightly more than 2 pairs per inhabitant. In terms of weight, the correspondent figure is about [illegible] tons of shoes (or PVC compound) i.e. at least [illegible] tons of PVC pure resin.

[illegible].3.2.5. Piping

There is an appreciable potential outlet for thermoplastics in the field of piping. At present, thermoplastics only have made very mild inroads in this field but will be gaining ground in the coming years.

A. Materials competing for piping

In the piping market, thermoplastics chiefly have to displace asbestos-cement and, to a smaller extent, cast iron.
By now, the demand for asbestos-cement pipes amounts to 750-800 tons a year consisting of :

- half of low pressure use pipe (locally produced)
- half of high pressure use pipe (imported)

The demand for cast iron pipe - not locally produced up till now - is no more than 100 - 200 tons a year (according to the external trade statistics).
The demand for the plastic pipes is 100 tons.
The choice between different materials depends to a great extent on the diameter and, consequently, the field of pipe applications.
For instance :

- PVC is preferably used for diameters from 20 mm up to 150 mm (individual connections, water distribution and sewage)
- asbestos-cement for diameters from 100 mm up to 300 mm (mainly water distribution and sewage irrigation)
- cast iron for diameters from 250 to 400 mm (water adduction).

Considering the potential market of PVC as piping material, the penetration of this thermoplastic could be close to 100 percent of the market in the case of individual connections, at least 50 percent (in terms of length) in the case of water distribution, sewage and irrigation but very small in the case of water adduction.

B. Thermoplastics to be used in piping applications.

A forecast (1980) of the demand for thermoplastics in piping applications has been set up, taking into account :

- total quantity of pipes to be used
- the share of the market to be held by thermoplastics

There are three main fields of applications for thermoplastics :

1 - Individual water connections and plumbing
2 - Water distribution and supply - sewage
3 - Irrigation, drainage

1. Individual water connections and plumbing.

The demand for pipes is closely linked with the activity in the building industry and the needs of the population in this field :

- needs of the population inadequately housed as yet
- needs involved chiefly by the increase of the urban population : 50,000 inhabitants per year as an average (of which 35,000 in the Dakar area) corresponding approximatively to 10,000 housing per year to be erected in urban areas.

By now, building industry by far, does not reach this level of production :

- during the IInd plan, 2500 housings were erected in the public sector (OHLM) in urban areas and about 250 housings in rural areas.
- during the IIIrd plan (1969-1973) 7000 housings should be erected in the public sector. In addition, about 2000 housings will be erected in the private sector. Thus, 9000 housings should be erected in total during the IIIrd plan period i.e. 2250 per year as an average.

Taking into account the potential demand in this sector, construction of housings can be estimated tentatively at 10,000 units in 1980.

A reasonable estimate for PVC use in piping when all the vertical piping and connections to the sanitation network is made of this material, would be 0.25 kg/m^2 ; it corresponds to 170 tons of PVC in 1980.

In addition, individual water connections require 3 kg of PVC pipe per housing as an average (7 meters of pipe ⌀ 20 - 50 mm - 0.4 kg/m).
So the potential market for PVC pipe can be estimated here at 30 tons in 1980.
Thus the outlet for PVC pipe in the housing would be about 200 tons in 1980. Furthermore, a small market always exists for replacement, small alterations etc.
Non-housing construction is more difficult to quantify since it encompasses a variety of heterogeneous categories but it can be estimated that non-housing will represent one-third of total building, erected in Senegal in 1980.
Thus the potential market for PVC piping would be 300 tons for total buildings erected in Senegal.

B. Water distribution and supply - sewage.

Planned investment in the field of water distribution, water supply and sewage over the period of the IIIrd plan summarized in table 25. These investments allow to estimate roughly the present potential outlet for PVC pipe.

Table [illegible]

Planned investment in the field of water supply and sewage

$ 1000

	IIIrd Plan	Readjusted IIIrd Plan
- CAP VERT		
Water distribution, electricity	[illegible]	400
- DIOURBEL		
Sewage, water supply	[illegible]	[illegible]
- THIES		
Water supply	[illegible]	-
Sewage	[illegible]	385
Total	3,385	1,385

Assuming that : the piping raw material amounts to 50 - 70 % of the total investment;

a penetration of 50 % into this market for PVC pipe;

a cost of about $ 2/kg for this latter,

the present potential market for PVC pipe would be : 500 tons i.e. 125 tons a year as an average, according to the initial IIIrd plan and 240 tons i.e. 60 tons a year, according to the readjusted IIIrd Plan.

A development of the use of PVC pipe at an annual growth rate of 15% - 20% from the rather low level indicated in the readjusted IIIrd Plan, leads to estimate this market in 1980 in the range of 250 tons - 330 tons. This rough estimate can be checked by referring to the data relative to the length and the annual increase of networks.

A. The drinking water supply and distribution system consists of 1000 km of pipes in the Cap Vert area, 300 km in the other areas of Senegal (excluding individual connections). This drinking water net is going to grow at the rate of 40 km a year; it could grow at the rate of 100-150 km a year at the end of the seventies.

Assuming that PVC pipe will capture the major share of this market, especially in the case of diameters in the range of 50-- 90 mm, the demand for PVC pipe in this field will amount to 200 tons in 1980 (100,000 m x 1,9 kg/m as an average) .Including a part of the market of higher diameter pipes - from 90 to 150 mm - leads to an additional quantity of 50 tons of PVC piping materials (10,000 m x 5 kg/m as an average).

B. Sewage could represent an appreciable outlet for PVC pipe, at least in the next coming years, especially when considering the projects of development of sewage system in the following cities : Saint Louis, Louga, Thies, Kaolak, Diourbel, Tambacounda and Ziguinchor.
At present, the total length of the network is 300 km; it will grow at the rate of 50 km a year, possibly 75 km a year in 1980. The usual diameters are in the range of 75 - 250 mm.
Assuming that PVC pipe would capture at least 50-60 percent of this market (in terms of length) chiefly in the case of the smallest diameters, the demand for such pipes would be 70 tons in 1980 (1.5 kg/m as an average).

Another outlet exists for PVC pipe : conduct for electric and telephone wires, for which we have assumed an arbitrary estimate of 30 tons in 1980. In this case, the pipes are much lighter than for the previous use: 0,5 kg/m as an average.

3. Irrigation - Drainage

Irrigation is an important potential future outlet for PVC pipe; especially when considering the developing plan for the Senegal River. This Plan includes the irrigation of an area of 300,000 ha; it will be gradually implemented, at first, on the basis of 3 - 4,000 irrigated ha per year.

On the other hand, there are some opportunities to use piping in the next coming years : for instance, in the Casamance basin, in the case of high yield crops, such as cotton and vegetables. In this latter case, flexible PVC hose competes with rigid material in the smallest diameters.

In addition, the use of PVC pipe is planned in Richard Toll for sugar cane culture (ø 45 mm). Generally speaking, the irrigation of one ha of land requires about 300 m of PVC pipe (ø 75 - 100 mm - 0,5 kg/m as an average) i.e. 150 kg of this material per ha. Thus irrigation of, say, 2000 ha by the way of PVC pipe in 1980 would correspond to an outlet of 300 tons of such a material.

Although drainage appears to be used to a smaller extent than irrigation, it is a non-negligible outlet for PVC pipe, also in the agricultural field. PVC drainage pipe is a corrugated one weighing 0,30 kg/m and usually competing with concrete pipe for this use.

Drainage of one ha of land requires about 300 meters of such PVC pipe (100 kg/ha). For instance, possible drainage of an area of 1000 ha in 1980 would require 100 tons of PVC pipe.

Thus, the total market for PVC pipe in 1980 in the agricultural field (both irrigation and drainage) can be estimated at 400 tons.

Fittings for rigid PVC pipe will account for about 10 percent of the 1000 tons total annual demand for the sector in 1980. Thus an additional outlet for 100 tons of PVC materials can be estimated.

Besides rigid PVC pipe applications, there is a market for flexible - usually low diameter - polyethylene pipe: this market consists of general purpose material but no single applications stand out. In Europe, these products represent a quantity equal to 10 - 15% of the PVC pipe market. Referring to the European market, Senegalian market should reach 150 tons in 1980.

In addition, few quantities of flexible PVC hose will be used, mainly in the gardening sector. Flexible PVC pipe represents 10% of the rigid pipe market. Thus a demand for 100 tons of this material can be assumed in 1980.

II.1.2.6. Wire and cables

By referring to comparable countries, wire and cable coating should represent an outlet of 1000 tons a year in 1980 for plastic materials. Both polyethylene and PVC are used for the coating of wire and cable but polyethylene is usually gaining ground in this field. Furthermore, polyethylene is preferably used for telecommunications as well as for low tension power transmission; PVC is preferred when electrical insulating projects are required as it is the case in the building industry.

The estimated outlet for wire and cable applications is 500 tons for polyethylene; 300 tons for PVC compound i.e. 200 tons of PVC pure resin.

11.3.2.7. Building materials.

There are various applications of plastic materials - mainly PVC - in the building industry (the parenthesized figures are those for the market estimated in 1980; they are expressed as pure resin):

- asbestos flooring (500 tons of PVC)
  The possibilities of increased market penetration seem somewhat limited and more linked with the development of the building industry than with replacement market.

- profiles, inside and outside window blinds.
  The application of profiles for door and window frames seems limited in the near future. Wood is still comparatively cheap and the building trade more used to handle it. On the other hand, aluminum competes with these materials. Nevertheless, a market of 150-200 tons for PVC materials can be estimated in this field in 1980. Inside and outside window blind can be an additional outlet for PVC, but very small in terms of weight (50 tons).

- polystyrene foam

  Polystyrene is more and more used as insulating material in building as well as in freezing industry (150 - 200 tons).

III.3.2.8. Miscellaneous uses

In addition to the above mentioned applications for thermoplastics, there are still many other ones but less important in terms of weight; they will be scrutinized hereafter : (parenthesized figures are the market estimated in 1980) :

- upholstery, luggage, clothes
  Manufacture of these articles requires either PVC calendered sheet and film or PVC coating (at least 500 tons of PVC)

- belting (200 tons of PVC)

- record (100 tons of PVC)

III.3.3. Summary of the demand for thermoplastics.

III.3.3.1. Polyethylene.

The main outlet for polyethylene is found by far in the film applications, chiefly as packaging materials. Other significant outlets for polyethylene are found either in further packaging applications, such as hollow articles (bottles etc.) or in manufacture of household goods and toys.
By comparison, the other applications of polyethylene are rather small in terms of quantity. They include : wire and cable, flexible pipe, paper coating and in addition miscellaneous other uses : that account usually for about 3% of all these plastic materials consumed on industrialized markets. This heterogeneous category includes namely monofilament, powder etc.
This market is estimated at 200 tons in Senegal in 1980.

All the market data and previously estimated forecasts are summarized in the following table 30.

Table 26

Consumption breakdown of polyethylene

tons

Applications	Size of the markets 1970	1980
. Film		
a) packaging		
- heavy duty bag -(fertilizers)	300	1,300
- general purpose bag		
- agricultural products	[illegible]	300
- retail trade and others		2,000
b) agricultural uses		300
. Household goods, toys	400	[illegible]
. Crates, boxes	-	300
. Hollow articles: bottles, cans	[illegible]	1,000
. Wire and cable coating		200
. Flexible pipes		150
. Paper coating		50
. Miscellaneous		200
Total tons	1,[illegible]	7,[illegible]

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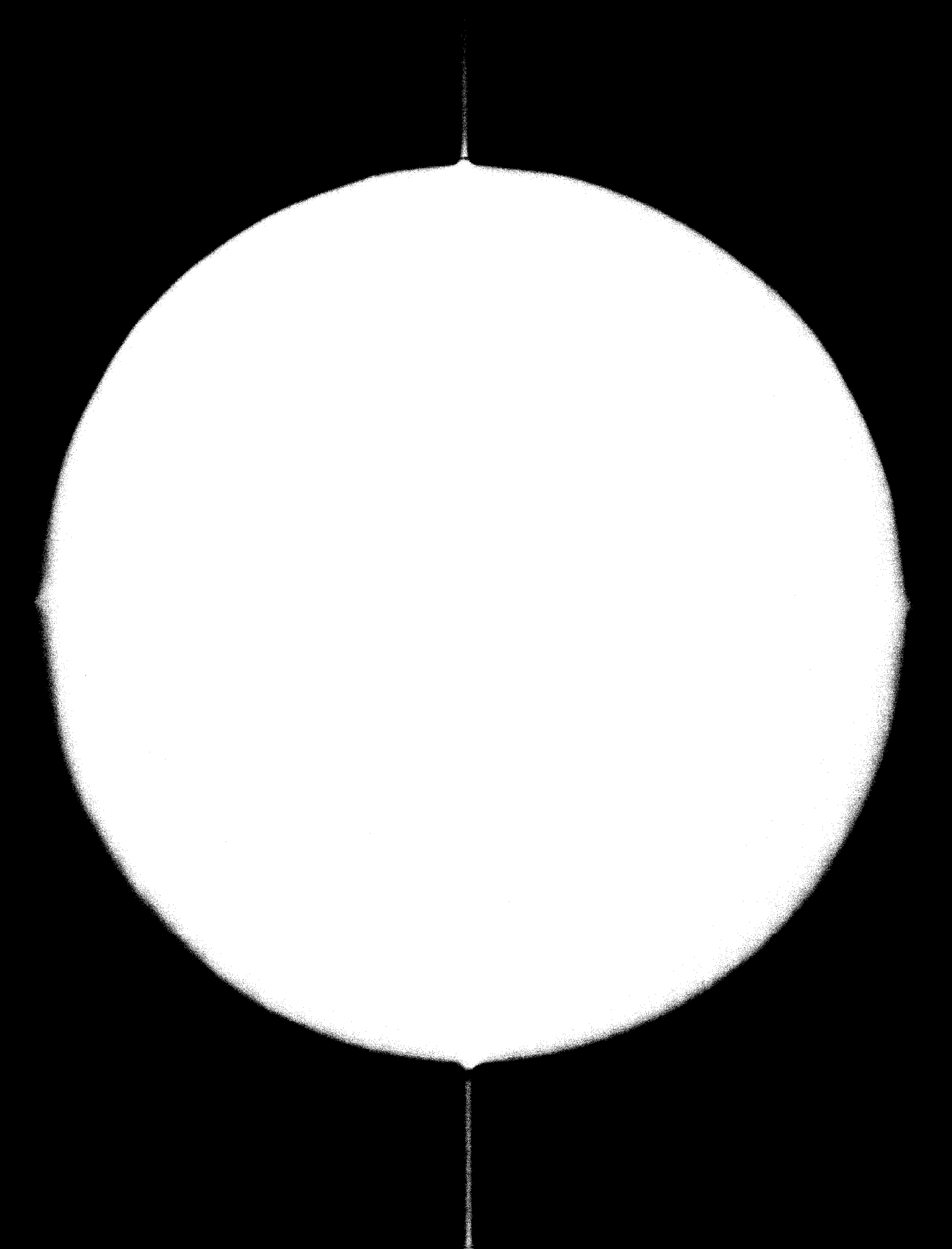

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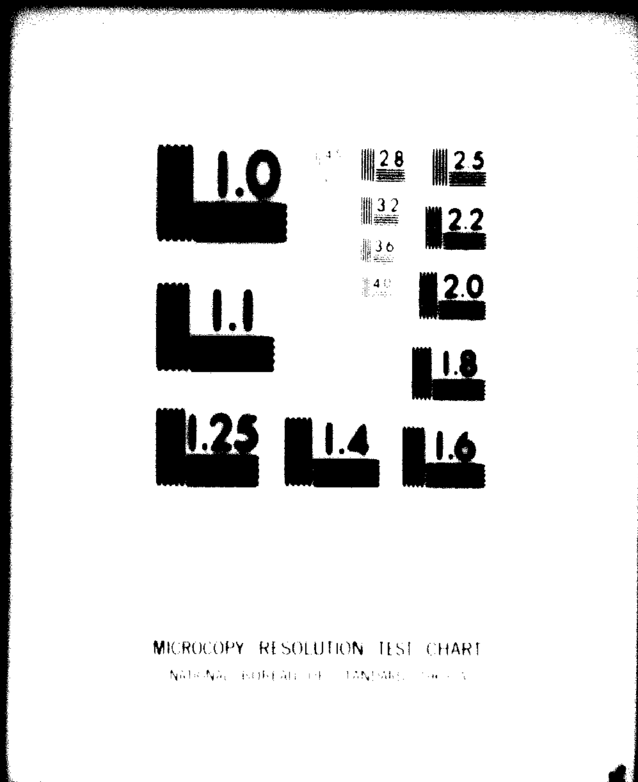
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2.8
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MICROCOPY RESOLUTION TEST CHART

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As it appears in this table, the polyethylene consumption will be multiplied four times over this decade. This corresponds to a steady annual growth rate of 15% as an average.

As shown in the following table, film application will continue to hold the major share in the polyethylene market with percentage comparable with those observed in industrialized countries. On the other hand, the share of the market held by household goods and, to a smaller extent, hollow articles is going to decrease in terms of percentage whereas the share of such applications as crates, boxes, wire and cables etc. will strongly increase (from almost nil today).

Table 27

Consumption breakdown of polyethylene
(Figures are expressed in percentage)

Applications	1970		1980	
. Film		57		58.5
. heavy duty bags	16		19.5	
. general purpose bags	41		32.5	
. agricultural uses			6.5	
. Household goods		24		13
. Crates, boxes		-		6.5
. Hollow articles		17		13
. Others		2		9
Total		100		100.0

As regards the types of polyethylene to be used, H.D. polyethylene accounts yet for slightly more than 30 percent of the total polyethylene. Only a small further increase of the share of H.D. polyethylene can be expected over this decade. Thus, 2,700 tons of H.D. polyethylene should be used in 1980, accounting for 35 percent of the total polyethylene market.

II.3.3.2. P.V.C.

As shown in table 26, the main present outlet for PVC is found by far in shoes manufacture. Other significant applications for PVC include chiefly : pipes, flooring (both are still imported), bottles and coating (for instance, leather-like articles).
By comparison, the other applications of PVC : sheet, record, belting, appear very small in terms of quantity.

All the market data and previously estimated forecasts are summarised in the following table 28.

Table 28

Consumption breakdown of PVC
(all figures are expressed in tons)

Applications	Size of the market 1970	1980
- Flexible PVC		
. Footwear	1,000	2,000
. Flooring	200	500
. Calendered sheets	-	500
. Cables and wire	-	300
. Belting	-	200
. Coating and others	200	500
subtotal, flexible PVC (100% pure resin)	1,400	4,000
- Rigid PVC		
. Pipe	100	1,050
a) building		300
b) water distribution		250
c) sewage		100
d) irrigation, drainage		400
. Fittings, profiles	-	300
. Rigid sheets and films	-	500
. Bottles	75	500
. Records		300
. Others		500
Subtotal, rigid PVC	200	3,150
total	1,600	7,150

As it appears in this table, the PVC (pure resin) consumption will be multiplied 4.5 times over this decade. This corresponds to a very steady annual growth rate of slightly more than 16% as an average.

As shown in the following table 29, during the 1970-1980 period, footwear will be losing ground in terms of percentage in the total PVC outlet. On the other hand, other applications, especially the piping ones, will hold a growing share of the market. This evolution will involve heavy change in the consumption breakdown of PVC.

Table 29

Consumption breakdown of PVC
(figures are expressed in percentage)

Applications	1970		1980	
Flexible PVC		88		56
Footwear	63		28	
Flooring	12.5		7	
Sheet	-		7	
Other	12.5		14	
Rigid PVC		12		44
Pipe, fittings	6		19	
Sheet			7	
Bottles	6		7	
Others			11	
Total	100	100	100	100

As regards the types of PVC to be used, rigid (unplasticized) PVC accounts yet for 12% of the market. As a result of the expected expansion for the main PVC rigid applications the share of this latter material will be growing up to 44% of the total. This figure is very close to those now observed in industrialized countries.

Concerning flexible PVC, it should be noted that the above mentioned figure for flexible PVC (4,000 expressed in 100% pure resin) corresponds to about 6500 tons of PVC compound (including at least 2000 tons of plasticized).

II.3.3.3. Polystyrene.

There are three main outlets for polystyrene resins : packaging materials (thermoformed film and sheet) household goods and toys.

Although a better expansion can be expected for packaging applications, as usually observed on the international market, household goods and toys will still hold an important share of the market in 1980. In addition, there are miscellaneous end uses for polystyrene; they include combs, brushes, shoe heels. They are estimated at 300 tons in 1980.
Main outlets for polystyrene foam are found in : building industry (the inner wall covering of cold stores) and packaging field. They are estimated at 300 tons of polystyrene foam in 1980.

All the previous estimates are summarized in the following table 30.

Table 30

Consumption breakdown of polystyrene
(all figures are expressed in tons)

Applications	Size of the markets	
	1970	1980
. Packaging		
- thermoformed film and sheet	65	500
- boxes	-	300
. Household goods, toys	70	600
. Miscellaneous	-	300
. Foam	25	300
TOTAL	150	2,000

II.3.3.4. Polypropylene

The main outlet for polypropylene is found as slit yarn in the manufacture of woven bags. No major change will occur in this figure over this decade since a big expansion is expected in the demand for polypropylene woven bags. On the other hand, injection moulding applications film, sheet, will only take a small part of the market, by difference with industrialized countries where these applications are still market leaders in tonnage terms. It should be noted that polypropylene competes with HD polyethylene in most of these applications.

The forecast of the demand for polypropylene by end-uses is summarized in the following table 31.

Table 31

Consumption breakdown of polypropylene
(figures are expressed in tons)

Applications	Size of the markets	
	1970	1980
Slit yarn (woven bags)	400 (1)	1,500
Injection and others	15	500
TOTAL	415	2,000

(1) a half is exported

II.4. Mali

II.4.1. Present situation

According to the external trade statistics, imports of plastic materials amounted to 260 tons in 1970 (against : 155 t in 1969) However, this figure would be at least doubled, taking into account illicit imports (mainly consisting of shoes and household goods).

When considering plastic material processed by industry, thermoplastics accounts for about 75 % of the total ; this percentage is certainly higher -possibly 90 %- if illicit imports of plastic shoes and household goods are included in the total.

Considering this high percentage a slight decrease of thermoplastics share can be expected during the next coming years.

In 1970, imports of thermoplastics were slightly more than 120 tons. Almost all this materials was processed by the single manufacture now in operation in Mali : MALIPLASTIQUE. In addition, few quantities of thermoplastics are used by MALILAIT for the packaging og milk and dairy products.

As it appears in the following table 32, PVC is the main thermoplastic processed by the industry.

Table 32

End uses breakdown of thermoplastics
1970

Applications	PVC	Polyethylene	Polystyrene
. Shoes	80(1)		
. Flexible hose, filament	15		
. Bottle	10		
. Milk packaging		10	
. Dairy products and closures			5
TOTAL	105(1)	10	5

(1) PVC compound, so that the total figure expressed in 100 % PVC film resins is only 60 tons

No major change will occur during the current year in the profile of the demand for thermoplastics, considering the manufacture development of both PVC shoes - 20 tons a month - and PVC bottle, and the beginning of the production of polyethylene film.

On the other hand, the share fo the market held by polyethylene resin is obviously higher than suggested by the above figures when considering both imports of goods packed in polyethylene film and illicit import of polyethylene household goods.

Looking at the future , no significant feature can be pointed out from the present data on plastic market in Mali.

Thus forecast of thermoplastics needs will better be based on an analysis of the demand for these materials in their main outlets, eventually taking into account the competition with other non-plastic materials.

The development of the demand for thermoplastics in their main present and future outlets -especially packaging and piping-will be successively considered.

II.4.2. Main outlets for thermoplastics - Forecast

II.4.2.1. Packaging

Although thermoplastics have only made mild inroads in the field of packaging in Mali, a substantial development of the use of this material can be expected in the next coming years.

This development will be linked with the expansion of the packaging activity and, to a lesser extent, with the displacement of other materials such as paper and cardboard, wood, glass, tin, jute and sisal out of their traditional outlets.

II.4.2.1.1. Bags

A- Main products to be packed

The main products to be packed are the agricultural and industrial products.

- Agricultural products

As previously done in the case of Senegal, we have to consider the order of magnitude of future Malian crops (1980), in order to estimate the outlet for plastic packaging in this field.

Main agricultural products are listed below (see table 33).

. Groundnuts

At present time the crop of groundnut amounts to 120 000 tons. By the way of a better productivity and modernization, the crop should reach 167 000 tons in 1972/1973, according to the objectives of the Plan.

Table 33

Main crops in Mali - Forecast

tons

	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73		1980
Agricultural production								
1. State supported :								
. Cotton fibre	11,300			25,000	30,000	33,750		70,000
. Groundnut		93,800	119,800	119,800	140,900	167,400		250,000
. Paddy		172,000				250,000		600,000
. Vegetables	58,000					73,000		100-150,000
. Fruits	10,000					10,000		20,000
. Sugar cane	33,000	49,700				70,000		100-150,000
2. State non supported :								
. Sorghum	830,000					900,000		1,200-1,300,000
. Maize	65,800					90,000		150,000
. Feculent	30,400					34,000		50,000
. Manioc, sweet potato	75,000					84,000		100,000

From this date, groundnut production can be expected to grow at least at the rate of 5 percent a year as an average, according to the development of the demand on national and export markets.

This increase leads to estimate this production at about 200,000 tons in 1980.

. Sorghum

It largely contributes to the human food consumption in an even higher proportion than observed in Senegal 160-170 Kg per capita.

Thus no spectacular increase of this production should be expected, unless outlets can be found on export market. The production is estimated to be in the range of 1,200-1,300,000 ton in 1980.

. Rice

This cereal ranks second after Sorghum in human food (annual consumption : 35 Kg per capita)

Local production of paddy - up to 172,000 t in 1968/69 is just meeting the needs of Mali. Malian Government initiates a long term program of development for this crop allowing exportable surplus.

The objectives of production are the following :

250,000 t in 1973

480,000 t in 1977

Thus a production of 550,000-600,000 t - of which 300-350,000 t for internal market - can be estimated in 1980.

. Maize

Maize makes for human food and feed. The production was close to 66,000 t in 1967/68 and was planned to reach 90,000 t in 1972/73.

This production can be expected to reach 1[illegible]0,000 t in 1980

. Manioc, sweet potato

The crop of manioc currently reaches 75,000 t a year It is planned to reach 84,000 t in 1973 and could be in the range of 100-150,000 t in 1980.

. Garden produces

The volume of production of garden produces amounts to 60,000 t a year.

It is planned to reach 73,000 t in 1973 and could be in the range of 100-150,000 t in 1980.

. Sugar cane

At present time, the yearly demand for sugar is in the range of 30,000 t (6.2 Kg per capita). The major share of the market is supplied by imports (22,000 t a year as an average over the 1965/1969 period 33,300 t in 1970)

A long term program is undertaken by Government for developing the crop of sugar cane. But the future production could hardly meet the need of Mali, when considering the demand of the market 40-45,000 t in 1975, 50-60,000 t in 1980.

. Cotton

Cotton ranks first among the items exported by Mali.

Production of cotton fibers was 11,300 t in 1967/1968; it is planned to reach 34,000 t in 1973. This production could be easily doubled from 1973 to 1980 or more, if outlets are found on export market.

. Fruits

No spectacular increase of the crop - 10,000 t a year is expected during the next coming years.

. **Industrial products**

At least two industrial products deserve special attention since they require substantial quantities of package materials : fertilizers and cement.

. **Fertilizers**

During the last past-years, the consumption of fertilizers has been growing but remains still at a rather low level.

Expressed as fertilizers nutrients the corresponding figures were :

1963/64	:	1,150 t
1964/65	:	1,700 t
1965/66	:	2,081 t
1966/67	:	2,913 t
1967/68	:	3,369 t
1968/69	:	4,322 t (about 15,000 t of fertilizers)

The rates of fertilizer nutrient used in Mali is
N : 1 -P_2O_5 : 1.5 -K_2O : 2

Referring to the international market where this ratio is usually in the range of 1.1.1. or 2.1.1., the use of nitrogenous fertilizers will probably be preferably developed (specially in the case of paddy production).

But anyway, a dramatic increase of the demand for fertilizers at first involved by Government programs for developing agricultural production can be expected over this decade. Crops requiring large quantities of fertilizers are paddy, sorghum, cotton, groundnuts, sugar cane.

Taking into account the previously estimated figures of future agricultural production, the consumption of fertilizers will probably be in the range of 100-150,000 t in 1980.

. **Cement**

At present time, demand for cement is about 50,000 t a year. Some years ago Malian market was supplied by imports (34,000 t in 1965, 38,600 t in 1966, 28,500 t in 1967). A factory, on stream in September 1969, will supply a growing share of the market (capacity 50,000 t a year) : the imports were only 13,300 t in 1970. Referring to the expected economic development of Mali, the present figure of the demand should be easily doubled in 1980, i.e. 100,000 t).

. **Other products**

There are some other products requiring substantial packaging materials. Their national market have been estimated as follows (1980) :

Groundnut oil cake	100,000 t
Flour	25,000 t
Salt	30-35,000 t (imports 1970 : 16,000 t)

In addition, miscellaneous food products will require appreciable quantities of packaging material.

B- Material competing for packaging

Paper products and natural fibers such as jute, sisal and dah are the two main materials to compete with plastics in the field of packaging.

. **Paper products**

All paper products consumed in Mali are still imported In 1968, the imports amounted only to about 1,500 t having yet steadily increased during the last past years ; however, they were only 1,027 t in 1970.

Furthermore, erection of a factory of carboard with a capacity of 800 t a year is planned.

Thus, the consumption of paper remains at a rather low level in Mali, reflecting the still low development of packaging industry.

This situation should allow a better development of plastic materials (such as polyethylene film) in the field of bagging where competition has hardly begun.

Assuming a steady growth - probaly fairly higher than 10 % a year - for bagging use and a rate of penetation of about 30 % for polyethylene film into this market, demand for this latter could be in the range of 1,500 tons in 1980.

. Jute, dah

Two natural fibers are used for packaging purpose jute and dah.

The former one is imported as sacks ; for instance, 2,214 t in 1966 1,428 t in 1967.

Government initiates a program for developing crop of dah in order to meet all the local needs in the field of woven bags and tarpaulins. In 1972, the crop of dah is expected to be 800 tons.

A further development of this crop will be then eventually decided, depending on the results of the first development of this crop.

As regards polypropylene woven bags, their use is planned in the next coming years, when the crop of dah will be still insufficient to meet the needs of local market. Taking into account the "utility poundage" of this material and the remaining demand for jute, an outlet of 500-600 tons a year exists for polypropylene as woven bags in 1972-1973.

C- **Thermoplastics to be used in packaging application**

Forecast (1980) of the demand for thermoplastics in packaging applications has been set up taking into account :

- quantity of products
- the share of these products to be packed since a variable part of the production is shipped in bulk
- the competition between various packaging materials.

Agricultural and industrial products

Table 34 summarizes the needs of thermoplastic, possibly used for the packaging of main agricultural products, chiefly rice and other cereals.

As it appears in this table, the potential outlet for polypropylene in this field can be estimated at 2,300 t in 1980.

Considering the increasing quantities of dah to be probably produced in Mali - for instance 6,000-8,000 t in 1980 of which a part will be exported - effective demand for polypropylene bag would be only in the range of 500-600 t in 1980.

As far as fertilizers and cement are concerned the picture is as follows :

- Fertilizers

  Generally speaking, L.D. polyethylene heavy duty bags are the only ones to be used for the purpose of fertilizers packaging, having totally displaced paper.

  Assuming that only a small part of fertilizers consumption will be stored and shipped in bulk (eliminating use of bags) the needs of L.D. polyethylene heavy duty bags should be in the range of 500 tons (100,000 t of fertilizers packed in bags weighing 250 g and holding 50 Kg of fertilizers each).

Table 34

Outlets for plastic bag packaging of agricultural products in Mali (1980)

tons

	Estimated crop (1980)	Plastic materials to be used : polyethylene	polypropylene	polystyrene
. Cotton fibre	70,000		50	
Cotton seed	100,000		150	
. Groundnut	250,000		-	
. White rice	350-400,000		1,100	
. Vegetables	100-150,000	200	-	100
. Fruits	20,000	50	-	100
. Sugar (demand)				
in powder	15,000	50		
in loafs	25,000		50	
. Sorghum	1,200-1,300,000		600	
. Maize	150,000		150	
. Feculent	50,000		50	
. Manioc	100,000		50	
. Miscellaneous			100	
Total		300	2,300	200

. **Cement**

The use of polyethylene heavy duty bags for packaging cement is unlikely to develop, at least in the near future.

However, this application would represent a potented outlet for 500 t of L.D. polyethylene.

. **Other products**

By now, the level of consumption of polyethylene film for bagging is still at a very low level (precise data are not available).

However, a steady growth of this polyethylene application can be expected during this decade, especially for the packaging of various foodstuffs such as biscuits, grinded coffed, salt, etc.

Packaging of salt (consumption estimated in 1980 : 30,000 t) for instance, could require 120 t of polyethylene film in 1980.

Taking into account the expected expansion in the field of packaging and a further penetration of polyethylene films, consumption of this latter should be 600-800 tons in 1980 (including retail trade).

II.4.2.1.2. Bottles

A- Main products to be bottled

Main products to be bottled are : vegetable oil, vinegar, milk and bleaching agents.

All the mineral water consumed in Mali is imported ; no change will occur in this feature during this decade.

By now, the yearly quantity of the total edible oil commercialized in Mali amounts only to 2,500 t , i.e. 2,800,000 litres. Local consumption of refined edible oil amount to 3,500 t (as against 3 000 t in 1968/69) it is expected to reach 4,200 t in 1972/1973 and, with the same rate of growth than observed during the last years, 7,000 t (8,000,000 litres) in 1980.

Vinegar and bleaching agent represent an additional, small outlet for bottling.

On the other hand, milk represents an appreciable outlet for plastic bottling and packaging.

Almost all the milk consumed in Mali is produced locally. The production growing with about the same rate than the population amounted to 120,000,000 litres in 1967/68 ; it is expected to reach 140,000,000 litres in 1972/73, and 165,000,000 litres in 1980.

Only a very small but growing share production is sold through modern trade circuit (3,500 l per day of pasteurized milk).

In fact, Government is initiating a program of development for milk collecting and processing.

One milk factory is already on stream at BAMAKO with a capacity of 50,000 l a day ; erection of another one milk factory is planned at SEGOU (at first 1,500 l a day).

When achieved, this industrial development will allow a considerable milk more and more packed with plastic (polyethylene).

B- Materials completing for bottling

In the field of bottling, glass is pratically the only one material to compete with plastics ; for bottling purpose, plastics should easily compete with glass since glass bottle are still imported imported. However, the addtional cost of non reusable plastic bottle will probably be entirely supported by the final consumer : that prevent, to some extent, from a better development of these bottles.

C- Thermoplastics to be used in bottling applications

The forecast of the demand for thermoplastics has been set up taking into account :

- the quantities of liquid that will be produced
- the share of these liquids to be bottled
- the competition between glass and thermoplastics materials i.e. polyethylene and PVC.

Considering the future market of edible oil - 8,000,000 litres in 1980 - and a higher proportion of this oil distributed in plastic bottles, this application would represent an outlet for 200 t of PVC resin (5,500,000 bottles weighing 37 g each).

At present time, pasteurized milk is packed in cheap small polyethylene bags containing 1 l, 1/2 l or 1/4 l each. Taking into account the lightweight of this packing material, this application could hardly require 100 t of polyethylene in 1980.

However, milk could be partially packed in polyethylene 1 l bottle (weegling 42 g a piece) giving an additional outlet for polyethylene of about 50 t in 1980.

Miscellaneous products can be packed in plastic bottles, too : vinegar (PVC) bleaching agent (1), liquid detergent (polyethylene is usually preferred for these applications).

Table 35 shows the estimated quantity of plastic materials to be used for bottling applications in 1980.

Table 35

Consumption of plastic materials for bottling
1980 (Tons)

	Polyethylene	PVC
. Vegetable oil	-	200
. Milk	150 (1)	-
. Vinegar, bleaching agent etc	100	50
TOTAL	250	250

(1) Including 100 tons of polyethylene bags

II.4.2.1.3. Hollow articles

Miscellaneous products can be packed in hollow articles such as cans and various containers.

By referring to the other, countries with the same income level, this markets will represent an outlet for 100 t of polyethylene in 1980.

1) A plant with a yearly capacity of 425 000 l of vinegar, 756 000 l of bleaching agent is on stream for 1971

II.4.2.1.4. Miscellaneous packaging

In addition to that above mentionned there are many opportunities for plastic packaging :

For example :

A- Either rigid PVC blister packaging and thermoformed polystyrene containers, respectively used for fatty or non-fatty dairy products distribution. Furthermore, both rigid PVC and polystyrene can be used as thermo-formed films and sheet in many others packaging applications.

In 1980, the demand for these materials can be estimated at :

- 100 t for PVC
- 250 t for Polystyrene

B- Various containers and trays made from polystyrene foam. Main outlet of such as containers and trays can be found in the fruits and fish packaging.

C- Polyethylene crates for carrying glass bottles. There is not good prospect for this application since the more and more used plastic bottles are packed in card-board boxes.

The use of crates for carrying vegetables and fruits can be considered too.

These applications could require 150 tons of poly-ethylene in 1980.

II.4.2.2. Agricultural uses (1)

Considering the possible application for polyethylene films :

- water ressource conservation
- silage protection

(1) The use of plastic pipe in agricultural sector is considered with piping as a whole.

- wrapping of fruits on the tree

- shelter for agriculture, etc.

the use of agricultural film could be about 150 t in 1980.

Agricultural film can be made of virgin resin, if reuse is praticable, in which case it last 2 to 4 years A substantial part of the market can consist of film made from reworked scrap which lasts only a single season.

II.4.2.3. Household goods and toys

Plastic household goods mainly consists of backet wash basins dustbins, etc.

In this field, tin is still largely used in Mali as usually observed in many African countries.

At present time, Malian market is mainly supplied by illicit import (local production has even been stopped by such as competition) and no advisable figure of the demand is available.

However, by referring to the figures observed in some other African countries, the demand for plastic household goods and toys should be in the range of 600 t in 1980.- about the same quantity than seen in Senegal today -. Both polyethyelene (400 t) and polystyrene (200 t) will be used for these applications.

II.4.2.4. Footwear

As observed in many African countries the cheap plastic shoes are commonly used in Mali.

By now, about 500-600,000 pairs of PVC shoes are manufactured in Mali (by MALIPLASTIQUE). Imports (including illicit imports) would probably at least double this figure. Thus, the present market for plastic shoes is overpassing the level of 1,000,000 pairs a year.

Although plastic shoes manufacture compete with local leather industry and, consequently, its development is not considered at least in the near future, the demand for plastic shoes will steadily expand during this decade : the market is estimated to be close to 0.5 pairs per inhabitant in 1980, as an average i.e. 3,000,000 pairs for Mali as a whole.

In terms of weight the correspondant figure is about 1,300-1,400 t of shoes (or PVC compound) i.e. 600 t of PVC pure resin.

II.4.2.5. Piping

There is an appreciable potential outlet for PVC in the field of piping.

At present time, thermoplastics have only made mild inroads in this field but will be gaining grounds in the next coming years.

Forecast (1980) of the demand for thermoplastics in piping application has been set up taking into account:

- total quantity of pipes to be used
- the share of the market to be held by thermoplastic

There are three main fields of application for thermoplastics :

1. Individual water connection and plumbing.
2. Water distribution and supply. Sewage
3. Irrigation - drainage

1. **Individual water connection and plumbing.** The demand is linked with the activity in the building industry and the needs of the population in this field.

   - needs of the population inadequately housed as yet
   - needs chiefly involved by the increase of the urban population : an average over the 1970-1980 period corresponding theretically to 8-10,000 housings per year to be erected in urban areas (especially BAMAKO area).

   By now, building industry by far do not reach this level of production : during the Plan 1970-1972 only 400 housings (of which 300 in BAMAKO) will be erected in public sector - the same figure than during the 9 last past years.

   In addition, some housings will be erected in private sector and in rural areas.

   Thus, about 200 housings are now erected each year.

   Taking into account the potential demand in this sector but, on the other hand, the heavy investment in the building industry, construction of housings can be tentatively estimated at 5 000 units in 1980, as a maximum.

   A reasonable estimate for PVC use in piping when all the vertical piping and connection to the sanitation network is made of this material would be 0,25 kg/m^2 it corresponds to 85 tons of PVC in 1980.

   In addition, individual water connection require 3 Kg of PVC pipe per housing as an average. So, the potential market for PVC pipe for this application can be estimated at 15 tons in 1980.

Thus, the outlet for PVC pipe in the housing sector would be about 100 t in 1980.

Non housing industrial construction is more difficult to quantity but should represent one third of total building erected in Mali i.e. 50 t in 1980.

As a result, the potential market for PVC piping for all the building sector would be 150 t in 1980.

B- Water distribution and supply - Sewage

Planned investments in the field of water distribution water supply and sewage over the period of the Plan amount to $ 6,000,000 (of which 65 % in BAMAKO area). This figure allow to estimate roughly the present, potential, outlet for PVC pipe.

Assuming that :

. the piping raw materials amounts to 50-70 % of total investment

. a penetration of 50 % into this market (especially in the case of water distribution) for the PVC pipe

. a cost of about $ 3 per kg for this latter.

the present potential market for PVC pipe would be about 600 t (i.e. 200 t a year as an average) over the three-years period of Plan.

Considering the rather high level of investments in this sector, development of these investments can be expected to be moderate over this decade.

Consequently, the demand for PVC pipe in this field is estimated to be no more than 350 tons in 1980 (as an average annual growth rate 6 %).

Sewage could represent an appreciable future outlet for PVC pipe, especially when considering the projects of development of sewage system in BAMAKO.

Assuming that PVC pipe would capture at least 50-60 % of this market (in terms of length) chiefly in the case of smallest diameters, the demand for such pipes would be 75 tons in 1980 (1.5 Kg/meter as an average).

Another outlet exists for PVC pipe : conduit for electric and telephonic wires for which we have assumed an arbitrary estimate of 20 t in 1980. In this case, the pipes are much lighter than for the previous use : 0.5 kg/metre as an average.

3. Irrigation - Drainage

Irrigation is an important potential future outlet for PVC pipe, when considering long term program of agricultural development (especially in the case of the Office du Niger).

Generally speaking, the irrigation of one ha. of land requires about 300 m of PVC pipe i.e. 150 Kg of this material.

On this basis irrigation of, for instance, 1 500 ha by the way of PVC pipe in 1980 would correspond to an outlet of 225 t of such as material.

Including PVC pipe for drainage purpose, the total market for PVC pipe in agricultural field can be estimated at 300 t.

Fittings for rigid PVC pipe will account for about 10 % of 900 t total annual demand for the sector in 1980.

Thus, an additional outlet for 90 tons of PVC materials can be estimated.

Besides rigid PVC pipe applications, there is a market for flexible - usually low diameter - polyethylene pipe : this market consists of general purpose material but not single application stands out. In Europe, these products represent today 10-13 % of the PVC pipe market. Referring to the European market, Malian market should reach 100 t in 1980.

In addition, few quantities of flexible PVC hose are used, mainly in gardenning sector 80,000 meters of such as hoses are yearly produced by MALIPLASTIQUE.

The market for these pipes can be estimated at 50 t in 1980.

II.4.2.6. Wire and cables

By referring to comparable countries and considering the programs of development for both electric network (a telecommunications program is planned for the next 20 years), wire and cable should represent an outlet for 500 t of plastic materials in 1980.

Both polyethylene and PVC are used for the coating of wire and cables but polyethylene is usually gaining ground in this field. Furthermore, polyethylene is preferably used as well for telecommunications as for low tension power transmission ; on the other hand, PVC is preferred when electrical insulation properties are required, as it is the case in the building industry.

The outlet estimated for wire and cable application, is 250 t for polyethylene, 250 t for PVC compound i.e. 150 t of PVC pure resin.

II.4.2.7. Building materials

There are various applications for plastic materials - mainly PVC - in the building industry. (The parenthesized figures are these of market estimated in 1980 ; they are expressed as pure resin).

- asbestos flooring (150 tons of PVC) the development of the market is linked with the activity in the building industry, more than with replacement market.
- profiles inside and outside window blind. The application of profiles for door and window frames seem limited in the future when considering the next erection of a plant for the manufacture of 20,000 aluminium windows per year.

Nevertheless, a small market for PVC materials can be estimated in this field in 1980. In addition, inside and outside blind can be an outlet for PVC (50 t in total).

- polystyrene foam. Polystyrene foam is more and more used as insulating materials as well in building as in freezing industry.

II.4.2.8. Miscellaneous uses

Major fields of application for the main thermoplastics have been yet under consideration, allowing a fairly accurate forecast (1980) of the demand for thermoplastics in these fields of applications.

In addition to the above mentioned applications for thermoplastics, there are yet many others ones but less important in terms of weight ; they will be studied hereafter parenthesized figures are the markets estimated in 1980 :

. ulphostery, luggage, clothes

Manufacture of these articles require either PVC calendered sheet and film or PVC coating (about 200 t of PVC).

. belting, mainly used in mining industry (100 t of PVC)

. record (100 t of PVC).

II.4.3. Summary of the demand for thermoplastics

II.4.3.1. Polyethylene

The main outlet for polyethylene is found by far in the film applications chiefly as packaging materials. Other significant outlets for polyethylene are found either in other packaging application such as hollow articles or in manufacture of household goods and toys. By comparison the other applications of polyethylene are rather small in terms of quantity.

They include : wire and cable, flexible pipe, paper coating, etc.

In addition, there are miscellaneous other uses for polyethylene ; they account usually for about 2-3 % of all the plastic materials consumed on industrialized market.

All the market and previously estimated forecast are summarized in the following table 36.

As it appears in this table film applications -1,750 t in 1980 - will hold the major share in the polyethylene market : 60 % , a percentage comparable with those observed in industrialized countries.

As regards the types of polyethylene to be used, H.D. polyethylene should account in 1980 for about 35 % of total polyethylene market, considering the heavy penetration of H.D. polyethylene in some outlets : hollow articles, household goods, tap and other injection moulded articles.

Table 36

Consumption breakdown of polyethylene (1980) in Mali

tons

Applications	Size of the market
. Film	
a) packaging	
. heavy duty bag	
- fertilisers	500
. general purpose bag	
- agricultural products	300
- retail trade and others	700
b) agricultural uses	150
. Household goods, toys	400
. Crates, boxes	150
. Hollow articles, bottles, cans	350 (1)
. Wire and cables	250
. Flexible pipes	100
. Paper coating	
. Miscellaneous	100
TOTAL	3,000

(1) including 100 tons of polyethylene bags for milk packaging

II.4.3.2. PVC

As shown in table 37, plastic shoes manufacture will remain an important outlet for PVC.

However, in 1980, the major share of the PVC market will be held by pipe manufacture. Other significant applications for PVC include bottles, sheets, flooring, cables and wires, etc.

As regards the types of PVC to be used the share of rigid (unplasticized) PVC in PVC market will be growing during this decade, up to 55 % in 1980.

Concerning flexible PVC it should be noted that the estimated figure for 1980 - 1,350 t expressed in 100 % pure resin - correspond to almost 2,500 t of PVC compound (including about 1,000 t of plasticizer).

II.4.3.3. Polystyrene

There are two main fields of application for polystyrene resins : packaging materials (chiefly thermoformed film and sheet, and household goods and toys).

Although a better expansion can be expected for packaging applications as usually observed on international market, household goods and toys will still hold an appreciable share of the market in 1980.

Main outlets for polystyrene foam are found in :

- building industry and the inher wall covering of cold stores.
- Packaging field.

Table 37

Consumption breakdown of PVC (1980)
(all figures are expressed in tons)

Applications	Size of the market	
- Flexible PVC		
. Footwear		600
. Flooring		150
. Calendered (or extended) sheet		200
. Cables and wire		150
. Belting		100
. Coating and others		150
Subtotal, flexible PVC (100% pure resin)		1,350
- Rigid PVC		
. Pipe		895
a) building	150	
b) water distribution	350	
c) sewage	95	
d) irrigation, drainage	300	
. Fittings, profiles		140
. Rigid sheet and film		150
. Bottles		250
. Records		100
. Others		150
Subtotal, rigid PVC		1,685
TOTAL		3,035

These applications will require 100 t of polystyrene foam in 1980.

All the previous estimates are summarized in the following table 38.

Table 38

Consumption breakdown of polystyrene
(1980)
All figures are expressed in tons

Application	Size of the market
. Packaging	
- Thermoformed film and sheet	300
- Boxes	150
. Household goods, toys	200
. Miscellaneous	100
. Foam	100
TOTAL	850

II.4.3.4. Polypropylene

The main -almost single- outlet for polypropylene is found as slit yarn in manufacture of woven bags.

The future of this polypropylene applications in Mali heavily depends on the development of crop of dah as previously shown considering the probable development of this crop, effective demand for polypropylene bag would be only in the range of 500-600 t in 1980 (potential market 2,300 t).

Table 39

Consumption breakdown of polypropylene
(1980)
Figures are expressed in tons

Applications	Size of the market
Slit yarn (woven bags)	500-600 (2,300 t potential)
Injection and others	150
TOTAL	700

II.5. Mauritanian market

II.5.1. Survey of plastics demand

According to the external trade statistics, imports of plastic amounted to 327 tons in 1970 (as against 367 tons in 1969 and about 100 tons over the 1966-1968 period). Although no accurate data concerning these figures are available, it can be assumed that these imports of plastics consist of :

- articles or semi products (such as pipe, film, etc.) since there is reportedly no processing industry already in activity in Mauritania.
- thermoplastics to a great extent (probably in the range of 80-90 percent) as usually observed on developing market.

Looking at the future, no significant feature can be pointed out from the present data on plastic market in Mauritania. Thus forecast of thermoplastics needs will better be based on an analysis of the demand for these materials in their main outlets, eventually taking into account the competition from other non plastic materials.

II.5.2. Main outlets for thermoplastics forecast.

II.5.2.1. Packaging

Packaging activity is still at a rather low level in Mauritania. Consequently, the development of the use of thermoplastics will be chiefly linked with the expansion of packaging activity and, for a small part, with the displacement of other materials such as paper, jute, wood and glass out of their traditional outlet.

II.5.2.1.1. Bags

The main products to be packed are the agricultural and industrial products. By comparison with both Senegal and Mali, agricultural production is not very important in terms of quantity, although a growing share of the needs of population are met by local crops (with exception of rice).

The figures of agricultural yearly production are estimated as follows :

- Sorghum 100,000 tons
- Dates 12-15,000 tons
- Maize 4,000 tons
- Niebé 10,000 tons
- Groundnut 800 tons
- Vegetables 400 tons

Sorghum largely contributes to the human food. No particular incentive for developing this crop is considered by Government, at least in the next coming years. However, the crop should be at least 150,000 tons in 1980.
Rice ranks second after sorghum in human food. At present time, the major share of the market is supplied by imports with a local production amounting only to 700 tons. However, the crop of rice is intensively developed and should reach the level of 6,000 tons at the end of the Plan period (1973). A further development of this crop is planned : the crop could be close to 20,000 tons for some years and possibly to 30 - 35,000 tons in 1980.

Date is another crop for which a steady growth of the production is planned. Both local and export market are considered. 30,000 tons seem a possible figure of production in 1980.
No dramatic increase of other crops such as cereals (maize, wheat) vegetables and fruits can be expected as yet.

Some industrial products deserve special attention since they require substantial quantities of packaging materials : fertilizers, cement; furthermore, mining products represent an additional outlet for packaging materials in Mauritania. Current demand for fertilizers is about 3,000 tons a year (i.e. 1,000 tons of fertilizer nutrients).
A dramatic increase of fertilizers consumption can be expected over this decade chiefly linked with the development of the crops of rice(requiring more nitrogeneous fertilizers), dates, cereals, etc. and, eventually cotton and sugar cane.

Taking into account the previously estimated figures of future agricultural production, the consumption of fertilizers should be in the range of 30,000 tons in 1980.
At present time, demand for cement is reportedly no more than 10,000 tons. Considering the expected economic development of Mauritania, the present figure of the demand should be easily doubled or even trebled in 1980, i.e. 20 - 30,000 tons. Furthermore, the erection of a factory of either 20,000 tons (Nouhadibou) or 40,000 tons (Nouakchott) has been considered.

Mining industry needs growing quantities of bags for packaging of concentrated copper ore. This concentrated ore is produced and exported by SOMIMA. The present production is 20,000 tons and planned to be 50,000 tons in 1972-1973. A possible figure for 1980 would be 100,000 tons.

Besides, various products will require still non negligible quantity of bag packaging materials in 1980 :

- salt (total demand in 1980:30,000 t)
- sugar (30,000 tons)
- fish powder (a plant with an initial capacity of 50 t/day is going to be installed at Nouadhibou by SIGP).

Forecast of the demand for thermoplastics in packaging applications can be set up, taking into account :

- probable quantity of products to be produced in 1980
- the share of these products to be packed since a variable part of the production is shipped in bulk
- the competition between various packaging materials.

The needs of thermoplastics for the bag packaging of main agricultural products are summarised in table 40.

As it appears in this table 40, the bag packaging of agricultural products will require no more than 300 tons of plastic materials in 1980.

Table 40

Opportunities for plastic bags

in Mauritania in 1980

tons

Estimated crop 1980		Plastic materials to be used		
		polyethylene	polypropylene	polystyrene
Sorghum	150,000		50	
White rice	30,000		100	
Date	20,000	100		50
Cereals			50	
Vegetables, fruits		50		50
Others			50	
Total		150	250	100

A possible outlet can be mentioned for polyethylene as reusable case for handling date. Such a case weights 1.4 kg a piece and holds 20 kg of fruits (such cases can be used for fish handling too).

As far as fertilizers, cement, copper ore are concerned, the picture is as follows:

- fertilizers

  L.D. polyethylene heavy duty bags are usually the only ones to be used for the purpose of fertilizers packaging, having totally displaced paper.

Assuming that only a small part of fertilizers consumption will be stored and shipped in bulk (eliminating the use of bags), the needs in 1980 of L.D. polyethylene heavy duty bags should be in the range of 150 tons (30,000 tons of fertilizers packed in bags weighing 250 g and holding 50 kg of fertilizers each).

- Cement

The use of polyethylene heavy duty bags for packaging cement is unlikely to develop, at least in the near future. This application would have to represent a potential outlet for 150 tons of L.D. polyethylene.

- Copper ore

Considering a production of almost 100,000 tons of concentrated copper ore in 1980, the outlet for polypropylene woven bags would be about 350 tons plus 50 tons of polyethylene film (inner lining).

By now, the level of consumption of polyethylene for bagging miscellaneous other products is still at a very low level. However, a steady growth of this polyethylene application can be expected during this decade, especially for the packaging of products such as biscuits, sugar, salt.

Packaging of salt (consumption estimated in 1980 10,000 tons) for instance could require by itself 40 tons of polyethylene film; packaging of sugar (30,000 tons in 1980) could require 50 tons of polyethylene and 50 tons of polypropylene woven bags.

Taking into account, the expected expansion in the field of bag packaging and especially a steady penetration of polyethylene film, the consumption of this latter should be in the range of 300-400 tons in 1980 (including retail trade).

II.3.2.1.2. Bottles, hollow articles.

Main products to be bottled are vegetable oil, vinegar, milk and bleaching agents. No accurate data concerning the present market of these liquids are available. However, we can get a tentative estimate of the local needs of plastic bottles in 1980 by referring to the needs of comparable countries such as Senegal and Mali.

Table 41 shows the estimated quantity of plastic materials to be used for bottling applications in 1980.

Table 41

Consumption of plastic materials in Mauritania for bottling (1980)

tons

	polyethylene	PVC
- vegetable oil	-	100
- milk	100	-
- vinegar, bleaching agents	50	50
Total	150	150

In addition, miscellaneous products can be packed in hollow articles such as cans and various containers.
This market can be estimated to 50 tons of polyethylene in 1980.

II.5.2.1.3. Miscellaneous packaging

There are many other opportunities for plastic packaging. For instance :

a. Either rigid PVC blister packaging or thermoformed polystyrene containers, respectively used for fatty and non fatty dairy products.
Furthermore, both rigid PVC and polystyrene can be used as thermoformed film and sheet in many other packaging applications.

The demand for these materials can be estimated at :

50 tons for PVC
100 tons for polystyrene

b. Various containers and trays, made from polystyrene foam. Main outlet of such containers and trays can be found in fish packaging (25 tons).

c. Polyethylene crates for carrying glass bottles. There is not good prospect for this application considering the future expansion of the demand for plastic bottles usually packed in cardboard boxes.
The use of crate for carrying vegetables and fruits can be considered too.
These applications could require 50 tons of polyethylene in 1980.

II.5.2.2. Agricultural uses

Considering the possible applications for polyethylene films, especially both water ressource conservation and silage protection, the use of agricultural film could be no more than 50 tons in 1980.
Note : The use of plastic pipe in agricultural sector is considered with piping as a whole.

II.5.2.3. Household goods and toys

Plastic household goods, mainly consist of buckets, wash basins and dustbins. In this field, tin is still largely used in Mauritania, as usually observed in many African countries.
No data of present demand for plastic household goods is available. It is presumably at a low level.
However, by referring to the figures observed in some other African countries, the demand for plastic, household goods and toys should be in the range of 300 tons in 1980.
Both polyethylene - 200 tons - and polystyrene - 100 tons - will be used for these applications.

II.5.2.4. Footwear

As in many African countries, the cheap plastic shoes are commonly used in Mauritania.
By now, there is not plastic shoes factory in Mauritania : they are all imported.
By comparison with many West African countries (Senegal, Ivory Coast), the demand for plastic shoes will probably steadily expand during this decade : the market can be estimated to be about 1.2 - 1.3 pairs per inhabitant in 1980. The same figure than now observed in Senegal. Thus this will amount to 2,000,000 pairs for Mauritania as a whole.

In terms of weight, the correspondant figure is about 900 - 1000 tons of shoes (or PVC compound) i.e. 400 tons of PVC pure resin.

II.5.2.5. Piping

There is an appreciable potential outlet for PVC in the field of piping.
At present time thermoplastics have only made mild inroads in this field but will be gaining ground in the coming years.
Forecast (1980) of the demand for thermoplastics in piping applications has been set up, based on :

- total quantity of pipes to be used
- the share of the market to be held by thermoplastics

There are three main fiels of application for thermoplastics :

1 - Individual water connection and plumbing
2 - Water distribution and supply - sewage
3 - Irrigation - drainage

1. **Individual water connection and plumbing.**

The demand for pipes is closely linked with the activity in the building industry and the needs of the population in this field. These needs are chiefly involved by the strong increase of urban population : about 12,000 inhabitants per year as an average over the 1970 - 1980 period, corresponding theoretically to 2,500 - 3,000 housings per year to be erected in urban areas.

Considering a possible program of construction of 2500 housings in 1980 and a heavy penetration of PVC piping in this sector (20 kg per housing), the outlet for PVC resin could be about 50 tons in 1980.
Non-housing, industrial construction is more difficult to quantify but should represent one third of total building erected in Mauritania. As a result, the market for PVC piping for all the building sector would be 75 tons in 1980.

2. **Water distribution and supply - Sewage.**

Planned investments in the field of water distribution and supply over the IInd plan period 1970-1973 amount to almost $ 2,000,000 (of which 48% in Nouadhibou area). This figure allows to estimate the present potential outlet for PVC pipe.
Assuming that :

- the piping raw materials amount to 50-70% of the total investment.
- a penetration of 50% into this market for PVC pipe.
- a cost of about $ 2.5/kg for this latter .

The present potential market for PVC pipe would be about 200 tons (i.e. 50 tons a year as an average) over the four-years period of the Plan.

On the other hand, the program of water distribution consists of the installation of 20 km of pipes per year as an average. The diameters range from 60 to 250 mm.
Considering the future programs of investment in the sector of water supply and distribution, consequently, the demand for PVC pipe in this field can be estimated at about 150 tons (with the water system growing by at least 50 km a year at the end of the seventies).

As regards sewage, the present program consists of the installation of about 10 km of pipe per year; it could be in the range of 20 - 30 km in 1980. Assuming that PVC pipe would capture at least 50 - 60 percent of this market (in terms of length) chiefly in the case of smallest diameters, the demand for such pipes would be 25 tons in 1980.

Another outlet exists for PVC pipe : conduct for electric and telephone wire for which an arbitrary estimate of 10 tons in 1980 has been assumed.

3. Irrigation

Irrigation does not seem an important future outlet for PVC pipe, at least over this decade, considering the programs of agricultural development. Thus, a figure of 100 tons of PVC pipe appears to be hardly reached in 1980.
Fittings for rigid PVC pipe will account for about 10 percent of 360 tons total annual demand for the sector in 1980. Thus an additional outlet for 35 tons of PVC materials can be estimated.

Besides rigid PVC pipe applications, there is a market for flexible - usually low diameter - polyethylene pipe : this market consists of general purpose material. In Europe these products represent today a quantity equal to 10-13% of the PVC pipe market. Referring to the European market, Mauritanian market should reach 50 tons in 1980.

In addition few quantities of flexible PVC hose are used, mainly in gardening sector. The market for these pipes can be estimated at 25 tons in 1980.

II.5.2.6. Wire and cable.

By referring to comparable countries and considering the programs of development for both electric network (the program of investment in this sector will amount to 1,250,000 for Nouakchott only over the 1970-1973 period) and telephone network, wire and cable could represent an outlet for 250 tons of plastic materials in 1980.

Both polyethylene and PVC are used for the coating of wire and cable but polyethylene is usually gaining ground in this field.
Polyethylene is preferably used as well for telecommunications as for low tension power transmission; on the other hand, PVC is preferred when electrical insulation properties are required, as it is the case in the building industry.
Thus the outlet estimated for wire and cable applications is 100 tons for polyethylene, 150 tons for PVC compound i.e. 100 tons of PVC pure resin.

II.5.2.7. Building applications.

There are various applications for plastic - mainly PVC - in the building industry (the parenthesized figures are these of markets estimated in 1980; they are expressed as pure resin).

- asbestos flooring (50 tons of PVC)
- various profiles (50 tons of PVC)
- polystyrene foam more and more used as insulating material as well in building as in freezing industry (25 tons of polystyrene).

II.5.2.8. Miscellaneous uses.

In addition to the above mentioned applications for thermoplastics, there are many other ones but less important in terms of weight; they will be scrutinized hereafter (parenthesized figures are those of the market estimated in 1980):

- upholstery, luggage, clothes (manufacture of these articles requires either PVC calendered sheet and film or PVC coating (100 tons of PVC).
- belting (50 tons of PVC)
- record (50 tons of PVC)

II.5.3. Summary of the demand for thermoplastics

II.5.3.1. Polyethylene.

The main outlet for polyethylene is found by far in the film applications, chiefly as packaging materials.
Other significant outlets for polyethylene are found either in other packaging applications such as hollow articles or in manufacture of household goods and toys.
By comparison, the other applications of polyethylene are rather small in terms of quantity. They include : wire and cable, flexible pipe etc.

All the market data and previously estimated forecast are summarized in the following table 42.

Table 42

Consumption breakdown of polyethylene (1980)

(all figures are expressed in tons)

Applications	Size of the market
Film	
a) packaging	
. heavy duty bag	
- fertilizers	150
. general purpose bag	
- agricultural products	50
- retail trade and others	350
b) agricultural uses	50
Household goods, toys	200
Crates, boxes	150
Hollow articles, bottles, cans	200
Wire and cables	100
Flexible pipes	50
Miscellaneous	50
Total	1,350

As it appears in this table, film applications - 600 tons in 1980 - will hold the major share in the polyethylene market, almost 50% of the total.

As regards the types of polyethylene to be used, HD polyethylene should account in 1980 for about 35% of total polyethylene market.

II.5.3.2. PVC

As shown in table 43, plastic shoes manufacture will be the major outlet for PVC in 1980. The manufacture of pipe will rank second as outlet of PVC.
Other significant applications for PVC include bottle, sheet, flooring cable and wire.

As regards the types of PVC to be used, the share of rigid (unplasticized) PVC in total PVC market will be 50% in 1980.
Concerning flexible PVC, it should be noted that the estimated figure for 1980 - 750 tons expressed in 100% pure resin - corresponds to about 1300 tons of PVC compound (including about 500 tons of plasticizer).

Table 43

Consumption breakdown of PVC in 1980
(all figures are expressed in tons)

Applications	Size of the market
- **Flexible PVC**	
. Footwear	400
. Flooring	50
. Calendered (or extruded)sheet	100
. Cables and wires	100
. Coating and others	100
Subtotal flexible PVC 100% pure resin	750
- **Rigid PVC**	
. Pipe	
a) building	75
b) water distribution	150
c) sewage	35
d) irrigation, drainage	100
. Fittings; profiles	90
. Rigid sheets and films	50
. Bottles	150
. Records and others	100
Subtotal, rigid PVC	750
Total	1,500

II.5.3.3. Polystyrene

There are two main applications for polystyrene resins : packaging materials (chiefly thermoformed film and sheet) and household goods and toys.
Although a better expansion can be expected for packaging applications, household goods and toys will still hold an appreciable share of the market in 1980.

Main outlets for polystyrene foam are found in :

. building industry and the inner wall of cold stores (mainly for fishing industry).
. packaging field (mainly for fishing industry).

These applications will require 50 tons of polystyrene foam in 1980.

All the previous estimates are summarised in the following table 44.

Table 44

Consumption breakdown of polystyrene (1980)

(all figures are expressed in tons)

Applications	Size of the market
. Packaging	
- thermoformed film and sheet	150
- boxes	100
. Household goods and toys	100
. Miscellaneous	50
. Foam	50
Total	450

III.B.3.4. Polypropylene

The main - almost single - application for polypropylene is found as slit yarn in manufacture of woven bags.
Main products to be packed in such as bags are the following : agricultural products, concentrated copper ore, fish powder.

On the other hand, the other applications of polypropylene i.e. various injection moulded goods will represent only a small outlet for this thermoplastic : about 100 tons in 1980.

Table 45

Consumption breakdown of polypropylene (1980)

(all figures are expressed in tons)

Applications	Size of the market
- Slit yarn (woven bags)	750
- Injection and others	100
Total	850

III. SYNTHETIC FIBRES DEMAND IN OERS COUNTRIES

III. SYNTHETIC FIBRES DEMAND IN OERS COUNTRIES.

During the period following the end of World War II, world consumption of man-made fibres - cellulosic and non-cellulosic - has been expanding continuously at a higher growth rate than for textile fibres, so that their share of the total fibre market has been growing considerably, approaching 40 percent of the total consumption at the moment. However, growth in the cellulosic fibre consumption has slowed down considerably from the middle of the sixties; at present the cellulosic demand is plateauing.

The synthetic fibres consumption, on the other hand, has grown at a rate of 20-25% per annum throughout the sixties; from now, they largely prevail in the amount of annual increase of textile fibre consumption.

These features show how helpful it is to forecast the level of the synthetic fibres demand within the total textile fibre demand.

III.1. Demand of textile as a whole.

The figures of the per capita fibre consumption in OERS countries are summarized in the following table 46 (F.A.O. statistics).

Table 46

Per capita total fibres consumption

kg/inhabitant

	1964	1965	1966	1967	1968	1969
Senegal	6.3	5.5	6.9	4.6	3.1	2.3
Mali	0.9	1.2	1.3	0.95	0.9	0.9
Mauritania	0.1	0.2	0.4	1.0	0.8	0.9
Western Africa		1.5		1.4	1.3	1.5

Source : F.A.O.

Although textile consumption in Senegal fell down during the last years, the present textile consumption level - presumably in the range of 3.5 - 4 kg - is still not far from the averaged textile consumption level in both Latin American countries - 4.3 kg - and Middle East countries - 4.7 kg.

Referring to the Senegalian living standard, which expressed as per capita GDP was : \$ 200 in 1969, the consumption is somewhat below the average of both Latin American / \$ 550 and Middle East countries \$ 350 . Senegalian fibre consumption is relatively high.
However, considering the high level of consumption reached in 1964, 1965 and 1966, a partial recovery of the past Senegalian demand can be expected over the seventies, so that the per capita textile consumption could again easily reach a level of 5 kg in 1980.

Thus, the rate of this growth would be close to 2.5 percent per year on a per capita basis.

Furthermore, the demand for clothing rises with consumer incomes, the elasticity coefficient of the expenses in textile goods versus incomes being close to 0.9.
Taking into account the expected rise of the living standard but, on the other hand, the fairly higher price of man-made fibres, which will partially displace natural fibres in textile applications during this decade, the future Senegalian textile consumption can be estimated at about 5 kg per capita in 1980, a figure in accordance with the above estimated.

Malian textile consumption amounts to 0.9 kg per capita, thus the level of the textile consumption in Mali is found fairly lower than in African countries (1.7 kg per capita as an average).
However, Malian consumption is about the same as the consumption observed in many African countries, with a comparable income level (Chad, Nigeria, Upper Volta, etc.).
Taking into account as previously done :

. the elasticity coefficient of the expenses in textile goods versus incomes.
. the expected rise of the living standard
. and, to some extent, the higher prices of man-made fibres,

Malian textile consumption can be totally estimated to be close to 1.2 kg per capita in 1980, a figure corresponding to an annual increase of 2.5% as an average or a per capita basis.

Mauritanian textile consumption amounts to 0.9 kg per capita, after having increased considerably over the 1964-1967 period.
However, the consumption level is still rather low, relating the per capita textile consumption with the income.
Thus, a further demand for textile expansion can be expected over this decade.

Considering also the expected rise of the living standard, the textile consumption level in Mauritania is estimated at 1,3 kg per capita in 1980, corresponding to an annual increase of 3.5 % as an average on a per capita basis.

In terms of weight, the figures for 1980 corresponding with the above per capita estimations, are the following :

Senegal	:	24,500 tons
Mali	:	7,600 tons
Mauritania	:	1.900 tons
Total	:	34,000 tons

III.2. Structure of textile demand : natural and man-made fibres.

III.2.1. Reference to the international market.

During the last decade, a major change has occurred in the structure of the world textile demand, reflecting the spectacular rise in the consumption of man-made fibres, especially synthetics.
In fact, the world consumption of man-made fibres has been expanding continuously between 1960 and 1970, so that their share of the total fibres market rose from 22 to 39 percent in terms of weight.

In the developing countries, the penetration of man-made fibres into the textile market was more moderate : they accounted for only 23 percent of the total in 1969.

In the African developing countries, man-made fibres counted 23% of the total demand in 1969 but with a fairly lower level of this demand : 1.6-1.7 kg per capita. However, the consumption percentage of man-made fibres remains very low in both Western and Central African countries, respectively 9 and 14 percent.

III.2.2. OERS Countries.

(Present and past consumption)

In the considered countries, man-made fibres consumption consists only out of imports, either as fibres (staple and yarn) or as manufactured textile goods (woven and knitted fabrics. These data are available from external trade statistics of each OERS country. Table 47 summarizes the man-made fibres consumption in the OERS countries.

Table 47

Man-made fibres consumptions in
Senegal, Mali and Mauritania.

Senegal			
	Synthetics	Cellulosics	Total man-made
1965	195	1205	1400
1966	460	1430	1890
1967	450	660	1110
1968	405	718	1123
1969	359	548	907
1970	999	614	1613
Mali			
	Synthetics	Cellulosics	Total man-made
1967	75	10	85
1968	90	33	123
1969	75	130	205
1970	65	76	141
Mauritania			
	Synthetics	Cellulosics	Total man-made
1969	9	16	25
1970	16	30	46

As appears in this table, the demand for man-made fibres has been varying in all the considered countries who still have a low consumption level. Anyway, comparing the figures of the total textile market, inroads of man-made fibres still appear very mild in this market.

At the moment, the shares of the man-made fibres in the total textile market are as follows :

- Senegal : 8-10%
- Mali : 5%
- Mauritania : 4%

Referring to the trends observed in international markets, especially those of the developing countries, the penetration of man-made fibres in the Senegalian textile market should be about 20% of the total in 1980.

This percentage is not far from the present figure now observed in Latin American countries as an average. In this area, the local production almost met 50% of the needs in 1970.

In the same way, the penetration of man-made fibres into the total textile market can be estimated at 15 - 20% in Mali and Mauritania in 1980. On the other hand, the penetration of man-made fibres into the textile market could be limited to some extent by the development of cotton crop in both Senegal and Mali over this decade.

In terms of weight, the figures corresponding with the above estimation (1980) are the following (the parenthesized figures are those of the per capita consumption):

Senegal	4,900 tons	(1,0 kg)
Mali	1,350 tons	(0,2 kg)
Mauritania	350 tons	(0,25 kg)

Relationship with the income.

Referring to the existing relationship between consumption of man-made fibres and per capita income, OERS countries - especially Mauritania and Mali - are still found fairly below developing countries as far as man-made fibres consumptions are concerned.

Let us consider figure no. 2

- straight line 1968 I is defined from the data relative to many developing countries: per capita man-made fibres consumptions and per capita income.
- straight line 1968 II is defined from data relative to Latin American countries (where the income level is somewhat higher than in African countries).
- straight line 1980 represents the forecast of the demand for man-made fibres in the above mentioned countries : This forecast is mainly based on the analysis of the past evolution and trend of the relationship between consumption of man-made fibres and per capita income in these countries.

An important point to be considered within the scope of this study, is that a faster growth rate of the demand for man-made fibres (as for plastics) can be expected from now for the countries with a low level of income such as many African countries.

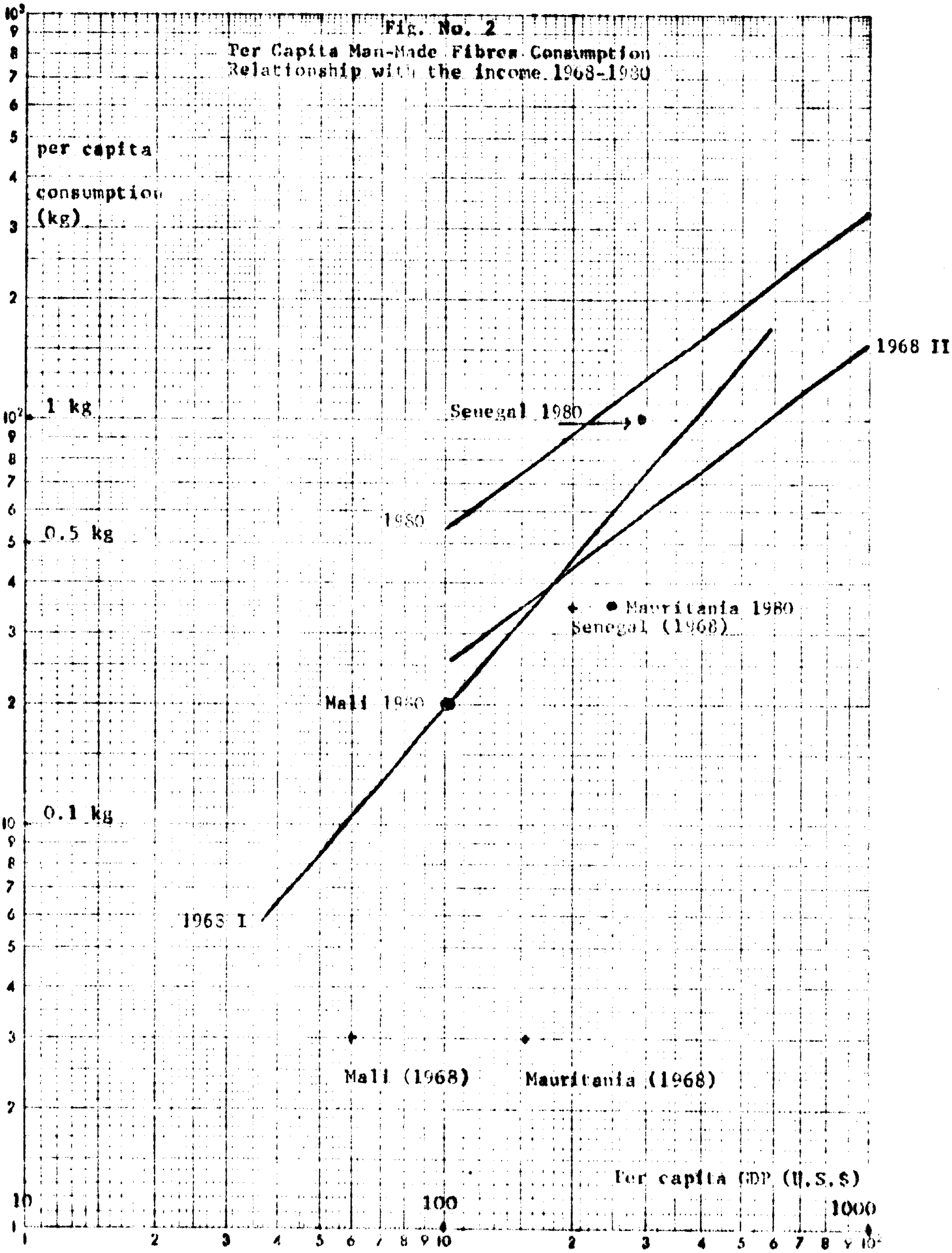
Fig. No. 2
Per Capita Man-Made Fibres Consumption
Relationship with the income 1968-1980
per capita
consumption
(kg)
1 kg
0.5 kg
0.1 kg
Senegal 1980
1980
1968 II
Mauritania 1980
Senegal (1968)
Mali 1980
1968 I
Mali (1968)
Mauritania (1968)
Per capita GDP (U.S.$)
10
100
1000

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Although it is rather difficult to estimate accurately to what extent this will be, it can be assumed that the relationship between consumption of man-made fibres and per capita income would be in a better accordance with that of the countries having a higher income level.

Taking into account, the above mentioned observation, the forecast (1980) of the demand for man-made fibres based on the relationship with the expected income in 1980 is as follows :

Senegal	:	1.0 kg per capita
Mali	:	0.2 kg per capita
Mauritania	:	0.35 kg per capita

These figures are the same as those based on the trends observed in both textile demand as a whole and structure of this demand (1).
Our definitive forecast results from the above estimations, as shown in the following table :

Table 48

Man-made fibres demand forecast in 1980

	Per Capita man-made fibre consumption 1980 kg/inhabitant	Inhabitants 10^6	Man-made fibres consumption tons
Senegal	1.0	4.9	4,900
Mali	0.2	6.4	1,300
Mauritania	0.3	1.4	400
TOTAL	0.5	12.7	6,600

(1) With the exception of Mauritania for which an average figure of 0.3 kg is estimated.

III.3. Structure of man-made fibre demand : cellulosic and synthetic fibre.

III.3.1. Reference to the world markets.

As said above, the world consumption of man-made fibres has been expanding continuously during the last decade. But the growth has been quite different for cellulosics as opposed to synthetic fibres. As a result of the rapid expansion in world consumption of synthetic fibres and the moderate use in cellulosic fibre uses, the share of the man-made market held by synthetics has been growing considerably during the last decade. Thus, synthetics which accounted only for 21% of the total in 1960, accounted for 38% in 1965 and 59% in 1970. This proportion is still expected to increase somewhat during this decade and anticipated to exceed the 75% level in 1980.

Another point to be considered is that, usually, the rate of penetration of synthetic fibres into the man-made fibres market is roughly linked with the consumption level :

- 62% in developed countries as an average
- 52% in Latin American countries
- 48% in developing countries
- 33% in African developing countries

III.3.2. OERS countries.

In Senegal, the share of synthetic fibres into the man-made fibres market has been growing over the 1965-1969 period from 15 to 35-40% of the total. In 1970, this percentage was still 62%, a figure, equal to that now observed in industrialised countries as an average.

In Mali, the share of synthetic fibres into the man-made fibres market has been varying over the last past years, with a rather high percentage (55% as an average over the 1967-1970 period).

In Mauritania, synthetics account for 35% of the total but this figure has little significance considering the present low level of consumption. Referring to the trends observed on international markets, the share of synthetics has been estimated in 1980 at about 65% of the total in all the OERS countries.

In terms of weight, the corresponding quantity of both cellulosics and non-cellulosic man-made fibres will be as given in table 49.

Table 49

Forecast (1980) of the demand for cellulosic and synthetic fibres in OERS countries.

tons

	Cellulosics	Synthetics	Total
Senegal	1,700	3,200	4,900
Mali	450	850	1,300
Mauritania	150	250	400
TOTAL	2,300	4,300	6,600

In addition, it can be noticed that the penetration of synthetics into the man-made fibres market should be more easy since they have not to displace cellulosics, on the contrary what it was precedently in more industrialized countries.

On the other hand, a further development of cellulosic fibres demand can be expected, especially when considering their uses in blends for fabrics such as light-weight suiting.

III.4. Structure of synthetic fibres demand - forecast.

III.4.1. Reference to the international markets.

There are three main synthetic fibres types : polyamids, polyester and acrylics.
During the sixties, heavy changes have occurred in the structure of worldwide synthetic fibre consumption.
They can be summarized and commented as follows :

- the share of polyester has been considerably growing from 1960 up till now, reaching 1/3 of the total synthetics (as against only 16% in 1960).
- the share of polyamids has been decreasing continuously so that they now account for less than 40% of the total (against 60% at the beginning of the sixties).
- the share of acrylics has been slightly growing. Now, the account for about 80% of the total.

This evolution can be observed in most countries; the only difference concerns the relative importance of the main synthetic fibres.

According to the past trend and to the better prospects in polyester fibres, the main feature to be observed is the fact that polyester fibres will be overtaken by polyamids in all markets during this decade.

III.4.2. OERS countries.

No data are available in terms of weight about the types of synthetic fibres used in OERS countries. However, it can be assumed that the share of polyester is largely exceeding the level of half of the total synthetic markets in Senegal.

A further expansion of the share of polyester fibres can be expected. This expansion will be linked with the development of their uses as staple, usually as the major constituent in blends with both cotton and viscose rayon in suits, trousers, skirts, shirts, dresses, lingerie etc.

A slower development of the demand for both polyamids (exclusively used for knitwear) and acrylics, less suitable to the local climatic conditions, has been assumed.
As a result of the above mentioned considerations, the polyester share has been estimated at about 70% of the total synthetic films, that of polyamids 20%, acrylics and others accounting for about 10% of the total.

In terms of weight, the correspondant figures appear in the following table 49;

Table 49

Consumption breakdown of synthetic fibres by type - Forecast 1980

	Polyester	Nylon	Acrylics and others	Total
Senegal	2,200	650	350	3,200
Mali	600	150	75	825
Mauritania	200	50	25	275
Total	3,000	850	450	4,300

III.4.3. Meeting the future requirements - possible share of a local productions.

The total consumption of polyester, nylon and acrylic fibres in the OERS countries are given in table 49.
On the basis of these data, a local production of polyester fibres can be considered.
In order to determine the capacity of local production, the following fact, illustrated by table 50 must be considered :

In the majority of the producing countries, where the total consumption is relatively low, only a part of the needs are met by the local production. The limitation is generally not due to the capacity of production.
The reason is the need of deversification of the market. As the local weaving and printing industry cannot meet all the required qualities, a part of the needs is met by imports, generally as low cost remnant fabrics.

This will certainly occur in the OERS countries if a local production is installed, because of the relative low level of consumption and the diversification and special quality needs of the market. For instance, a local polyester staple fibre production would meet about 50% of the total polyester staple fibre needs.

Table 30

Synthetic fibre staple consumptions and production capacities

in some countries in 1970

tons

Country	**Turkey**	**Brazil**	**Chile**	**Peru**	**Egypt**	**Korea**	**Thailand**
Capacity of production	10,000	20,000	6,000	2,000	700	33,000	2,000
Total consumption	15,300	22,000	6,400	4,100	1,700	32,000	9,100
needs met by local production	6,000	16,500	2,600	1,800	400	19,000	3,600
imports	9,300	5,500	1,800	2,300	1,300	13,000	5,500
Share of the consumption met by local production %	40	75	59	44	23	60	40

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DEVELOPMENT OF THE PETROCHEMICAL AND PLASTICS INDUSTRY

IN THE GULF ARABIAN COUNTRIES

VOLUME III

LOCAL DATA - TECHNO-ECONOMIC STUDIES

January [illegible]

Bureau d'études industrielles
et de coopération de
l'Institut français du pétrole

[illegible]
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[illegible]
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[illegible]

[illegible]

[illegible] [illegible]

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[illegible]

1. SELECTION OF THE MOST PROMISING PROJECTS

1.1. Productions not studied. Reasons

1.1.1. Level of consumption

The estimated consumptions of some products in the considered area prevent for several years, projects of local production.

This is the case with products the outlets of which will remain at a very low level :

- resins other than PVC and low density polyethylene
- Nylon and acrylics fibers : the consumption of these fibers will be about 850 tons for nylon and 450 tons for acrylics in 1980 and the share of such a consumption to be met by local productions will not exceed 60 %
- Calendered products (see paragrap 1.2.)

1.1.2. Raw materials cost

The raw material cost plays a leading part in the economics of some petrochemical productions. Being too high, it can prevent a local production. This is specially the case with raw materials the transportation cost of which has an important effect.

Ethylene is one of these raw materials. Its selling price is about $ 7/ton at the big US and European steam cracking units. The transportation cost (either by pipe line or by boat) increases appreciably this price. In the case of the [illegible] countries the ethylene transportation by boat over thousand of miles and the storage at disembarking port would at least double its price . Local productions of polyethylene, vinylchloride, styrene cannot be justified under these conditions.

3.1.3. Size of production units

The market requirements and the possibilities of erection of down-stream units do not allow the setting up of production of basic petrochemicals such as olefins and aromatics and of intermediate petrochemical products such as styrene, vinylchloride, caprolactam, dimethylterephtalate, the size of the production units to be considered according to the needs being by far below the economical production level.

3.1.4. Extension of existing productions

The projects that will issue from the extension of existing productions due to normal development of the already established companies have not been studied.

1.2. Considered productions

1.2.1. End products manufacture

We step aside because of too little market or raw material non availability the totality of the basic and intermediate petrochemical products : olefins and aromatics, vinylchloride styrene, caprolactam dimethylterephtalate.

The production of Low density polyethylene that could be studied due to the consumption level after 1980 in the considered area, has been step aside because the raw material ethylene woul be available at too high cost.

The studied productions correspond to sizes justifiying in other circumstances (industrialized or developping countries) the erection of economical production units. There are :

- suspension PVC manufacture, from imported VCM
- Polyester fibers spinning from imported polymer

The sizes of the production units have been selected, according to the possible outlets in the OERS countries. They also correspond to current technical and economic criterium.

1.2.1.1. Suspension PVC manufacture

As far as PVC production is concerned the size of the production units that can be erected from the technical and economic point of views, corresponds to a minimum of 10 000 tons/year.

The total suspension PVC needs in Mali, Mauritania and Senegal would reach about 9 400 tons in 1980 according to table 1.

Table 8

PVC requirement breakdown by type of polymerization processes in Mali, Mauritania, Senegal (1980)

Tons

	Emulsion	Suspension	Copolymers	Total
Piping	-	2 305	-	2 305
Rigid Injection Moulding	-	300	-	300
Footwear	-	3 000	-	3 000
Blow Moulding	-	900	-	900
Calendering	[illegible]	800	[illegible]	1 [illegible]
Rigid Extrusion	300	350	-	[illegible]
Flexible Extrusion	-	1 300	-	1 300
Records	-	-	450	450
Others	430	400		830
	1 [illegible]	9 355	1 000	11 [illegible]

However, 800 tons are needed for calendering purposes, and it is doubtful that such an industry would be established in the OMVS area, as the unitary capacities are far higher than the needs. So, the actual suspension PVC needs in 1980 are about 8 600 tons.

The needs of Guinea have not been studied in detail but they would reach at least 20 % of the total OMVS consumption.

Furthermore, there are no PVC production facilities in Western Africa and some export possibilities would exist outside the OMVS area, in Gambia, Ivory Coast and Ghana for instance. A 10 000 tons/year suspension PVC unit working at full capacity in 1980 can be considered. It is necessary to add to the resin PVC production a compounding and mixing unit able to produce the main rigid and plasticized PVC qualities needed by the market. The 10 000 tons/year resin production would correspond to a total tonnage of 14 000 tons/year of PVC resin compounds.

More than 50 % of the production capacity will be consumed in Senegal. Furthermore, Dakar is the better location of production as far as distribution inside the OMVS countries and exports problems are concerned. So it is to be desired that the production facilities are erected in Senegal near Dakar.

[illegible]. Polyester fibers manufacture

As indicated in Volume II, chapter III, the synthetic fibers consumption in Mali, Mauritania and Senegal will be 3 000 tons of polyester, 830 tons of nylon and 430 tons of acrylics and other, in 1980. In Volume II, chapter III it has been shown that a local production would only meet a share of the needs. The outlets for a local production have been estimated at 1 300 tons of polyester, 300 tons of nylon and 300 tons of others synthetics. The only production to be taken into account is a polyester fiber production. At this level a polymerization plant would have a too small size and we considered a spinning unit of 1 300 tons/year. Such a unit would work at full capacity in 1980 according to the needs of Mali, Mauritania and Senegal and about 2 or 3 years before if the Guinean market is opened to the production. It is dubious to rely on export possibilities outside OMVS because at this time other facilities could exist in Western Africa. More than 2/3 of the production will be consumed in Senegal. A cotton spinning and weaving industry is established in this country. So it seems to be desirable to consider the polyester fiber spinning unit in Senegal.

[illegible] End product activities

[illegible] Plastics processing

The existing plastics processing industry in Mali, Mauritania and Senegal has been studied in Volume I and II. The existing production capacities are summarized in tables [illegible] and [illegible], volume I.

- Injection moulding

  Shoe manufacture. The total shoe manufacture capacity in the OMVS area is [illegible] pairs per year. This capacity is highly superior to the present needs. Additional facilities will be needed before [illegible], in order to meet the [illegible] pairs requirements for [illegible]. This will be certainly done by setting up of additional presses inside the existing factories.

  Other injection moulding productions. The present capacity is [illegible] tons/year ([illegible] presses). The requirements will be met step by step according to the market development by extension of the existing facilities.

- Blow moulding

  The present capacity is about [illegible] tons per year. A doubling will be necessary to meet the [illegible] requirements.

- Extrusion - blow extrusion

  The main outlets for extrusion products are polypropylene bags PVC pipes and polyethylene films

  - The polypropylene bags requirements will certainly be met by increasing the capacity of [illegible].
  - There is not at present time PVC pipe manufacturer; such a production has to be considered. The requirements for [illegible] are indicated in the following table [illegible].

Table [illegible]

PVC pipes requirements in 1980

Country	Mali	Mauritania	Senegal	Total
Pipe requirements (tons of PVC)	[illegible]	[illegible]	1 000	[illegible]

Two alternatives are taken into consideration :

1) The setting up of a pipe production in Senegal by two extruders (screw diameter 120 and [illegible] mm) with a capacity of 1 [illegible] tons per year corresponding to the Malian, Mauritanian and Senegalese needs in 197[illegible] and the Mauritanian and Senegalese markets after 1980.

Addition of a new extruder (screw diameter 120 mm) in the same factory in 1980.

2) The setting up of a pipe production in Mali by two production extruders (screw diameters 120 and [illegible] mm) working at full capacity in 197[illegible].

The setting up of a pipe production in Mali by one extruder (screw diameter 120 mm) with a capacity of [illegible] tons per year corresponding to the Malian market in 1980.

- At present time the production capacity of polyethylene films is about 1 [illegible] tons per year. The equipment consists of :

1 extruder screw diameter [illegible] mm

1 extruder screw diameter [illegible] mm

1 extruder screw diameter [illegible] mm

1 extruder screw diameter [illegible] mm

1 extruder screw diameter [illegible] mm

The Malian, Mauritanian and Senegalese polyethylene film market in 1980 is given in table 3.

Table 3

Breakdown of polyethylene film market in 1980

Tons

	Mali	Mauritania	Senegal	Total
a) Packaging				
Heavy duty bags	500	150	1 500	2 150
General purpose bags	1 000	400	2 300	3 700
b) Agricultural uses	150	50	500	700
TOTAL	1 650	600	4 300	6 550

The totality of the heavy duty bags and about half of the agricultural uses are made of films the thickness of which are superior than 100 microns. The equipment better adapted to produce economically such films are blow extruders of high screw diameters (at least 120 mm) presently no existing in the considered countries. The setting up of this type of equipment must be considered, the existing extruders of lower screw diameter being also adapted to general purpose bags manufacture.

The average output of a 120 mm screw diameter blow extruder being 800 tons per year, only the Senegalese market is big enough to justify the setting up of such equipment.

The better location is Senegal, the outlets being the Malian, Mauritanian and Senegalian needs. The requirements meeting will be realized step by step by starting up of 100 mm screw diameters blow extruders.

In 1980 three blow extruders will be needed.

The program of installation meeting the requirements is :

1 blow extruder in 197[illegible] working at full capacity in 197[illegible]

1 blow extruder in 1977 working at full capacity in 197[illegible]

1 blow extruder in 197[illegible] working at full capacity in 1980

each blow extruder being followed by drawing line, welding printing and handling equipment for bags manufacture.

The techno economic study of the installation of one blow extruder in the Senegalian conditions has been performed.

Calendering

The total outlets for a calendering industry in the considered consumption level is too little to justify the installation of a calendering industry.

[illegible] Synthetic fibers processing

As far as synthetic fibers processing is concerned, weaving and all the processing after spinning have not been studied. The reason is that the polyester produced as staple will be used mixed with viscose and cotton and all the downstream processing will be done by integration to existing production.

[illegible]

[illegible]. [illegible]

[illegible]. General

[illegible]. Organisation des Etats Riverains du Senegal

Conscious of the necessity of coordinate and harmonize their policies of development in the economical, social, and cultural fields the four countries riparian of the Senegal river: Guinea, Mali, Mauritania and Senegal established an inter state organism named Organisation des Etats Riverains du Senegal (OERS).

The OERS Executive Secretariat undertook studies and projects aiming at the promotion of the economical social and cultural integrated development of the sub region.

[illegible]. Concerned Countries

The concerned countries are the four countries riparian of the Senegal river : Guinea, Mali, Mauritania and Senegal.

- GUINEA

Guinea is bounded on the north-west by Portuguese Guinea, on the east by the Ivory Coast, on the north and north-east by Senegal and Mali, on the south by Liberia and Sierra Leone, and on the west, by Atlantic Ocean.

The area is [illegible] sq.km

The population was in [illegible] [illegible] inhabitants
The main cities are

Conakry (capital)	[illegible] inhabitants
[illegible]	[illegible] inhabitants
[illegible]	[illegible] inhabitants
[illegible]	[illegible] inhabitants
[illegible]	[illegible] inhabitants
[illegible]	[illegible] inhabitants

- **MALI**

Mali is bounded on the north by Algeria, on the west by Mauritania and Senegal, on the south by Guinea and Ivory Coast, on the east by Upper Volta and Niger.

The area is 1, 235,000 Sq KMs

The population was in 1970 5 070 000 inhabitants

The main cities are :

Bamako (capital)	150 000 inhabitants
Kayes	32 000 inhabitants
Segou	32 000 inhabitants
Sikasso	17 000 inhabitants
Mopti	15 000 inhabitants
Gao	12 000 inhabitants
Tombouctou	10 000 inhabitants

- **MAURITANIA**

Mauritania is bounded on the north west by Rio de Oro, on the north by Algeria, on the east and the south by Mali, on the south by Senegal, and on the west, by the Atlantic Ocean.

The area is 1,031,000 Sq kMs

The population was in 1970 1,220,000 inhabitants

The main cities are :

Nouakchott	40 000 inhabitants
Nouadhibou	20 000 inhabitants

- **SENEGAL**

Senegal is bounded on the north by Mauritania, on the east by Mali, on the south by Guinea, on the west by the Atlantic Ocean.

The area is 197 000 Sq kms

The population was in 1970 3,800,000 inhabitants

The main cities are :

Dakar (capital)	580 000 inhabitants
Kaolak	70 000 inhabitants
Thies	70 000 inhabitants
Rufisque	50 000 inhabitants
Saint Louis	50 000 inhabitants
Ziguinchor	30 000 inhabitants
Diourbel	30 000 inhabitants.

IV.2. Transportation facilities

IV.2.1. Guinea

- Roads : Length roads is 10 000 km of which 6 000 km of high traffic ways.

- Railways : A railway track of 664 km links Conakry to Kankan
  A railway track of 143 km is laid between Conakry and the Fria Industrial Complex.

- Ports : Conakry is a modern sea port. The traffic was in 1960 600 000 tons of embarked goods and 1,300,000 tons of disembarked goods.
  There is a mineral port at Kassa, traffic 10 000 tons of bauxite a day. The banana wharf is mainly used for exporting bananas.

- Importation: The major part of the imported goods are discharged at Conakry.

IV.2.2. Mali

- Roads : Length roads is 13 000 km, two thirds only are passable all the year.

- Railways : The railway track Dakar Niger, (1 288 km) has 641 km in Mali : Kayes-Bamako-Koulikoro.

  The rolling material consist of :

  26 Carriages for travellers
  300 Carriages for goods
  4 Tanks (25 m^3 each)
  10 Diesel engines
  3 Railcars
  9 Tractors.

  The traffic is indicate in table 6.

Table 4

Railway traffic in Mali

Year	1965/1966	1966/1967	1967/1968	1972/1973
<u>Travellers</u>				
Number (10^3)	267	540	[illegible]	
Number (10^3)	[illegible]	[illegible]	77 [illegible]	[illegible]
<u>Goods</u>				
Quantity (10^3 tons)	[illegible]	234	[illegible]	
Tons Kms (10^3)	[illegible]	115 [illegible]	[illegible]	144 [illegible]

- River system : 1 750 km of the Niger river and 800 km on the Senegal river are navigable during a part of the year. The traffic is indicated in table 5.

Table 5

River traffic in Mali

Year	1965/1966	1966/1967	1967/1968	1972/1973
<u>Travellers</u>				
Number (10^3)	[illegible]	[illegible]	[illegible]	
Number km (10^3)	[illegible]	[illegible]	[illegible]	[illegible]
<u>Goods</u>				
Quantity (10^3 tons)	[illegible]	[illegible]	[illegible]	
Tons miles(10^3)	[illegible]	[illegible]	[illegible]	[illegible]

• Importations : Mali is a country without littoral. It is dependent upon the sea ports of Dakar (Senegal) and Abidjan (Ivory Coast). 60 % of the importations come from Dakar by road, 40 % come from Abidjan by road or by railway up to Bougouni and by road from Bougouni to Bamako.

11.2.3. Mauritania

• Roads : Length roads is 6 104 km of which asphalted 94 km.

• Railways : A railway track of 650 km links Fort Gouraud to Nouadhibou. The traffic is mainly constituted of ore and water.

• Ports : There are two sea ports in Mauritania : Nouadhibou and Nouakchott.
In Nouadhibou there are a merchant port, a fishing port and a port for ore.

The merchant port has not crane facility. The landing is realized by the board equipment of the ships. The heavy material is landed by the crane for ore belonging to MIFERMA.

In 1980, the traffic was [illegible] 000 tons of disembarked goods and 14 000 tons of embarked goods.

The traffic of the port for ore was in 1980, 16 000 tons of disembarked goods and 7 [illegible] 000 tons of embarked goods.

In Nouakchott there is a wharf located at 7 km south-west of the capital. The wharf is 300 m long ; it consists of a working platform ([illegible] m x 27 m) and of a gangway ([illegible] m x 7 m).

The main facilities consist on

3 electric cranes
20 [illegible]
2 tractors
3 elevators
1 travelling gantry crane.

In 1980, the traffic was 40 000 tons of disembarked goods and 340 tons of embarked goods. This quantity will increase notably with the activity of the SOMIMA, exportation of copper ore.

- Importation : The imported goods are disembarked at Nouakchott and Nouadhibou or come by road from the port of Dakar.

10.2.4. Senegal

- Roads : The total length of roads, reaches about 10 000 km of which asphalted 3 000 km.

- Railways: Two main tracks link Dakar to Kidira (645 km) and Dakar to Saint Louis (263 km). The remainder of the system consists of some connections : Guiguinco-Kaolack-Diourbel M'backe Louga-Linguere Thiaroye-M'bao Thiaroye-Kaolack. Total length of the main tracks : double 62 km, single 970 km.

  Total length of the secondary tracks 132 km.

  The transportation capacity consists of 3 [illegible] seats for travellers, 1 [illegible] m^3 of liquid goods, 26 000 tons of solid goods. The traffic is indicated in table 6.

Table 6

Railway traffic in Senegal

Year	[illegible]	[illegible]	[illegible]	[illegible]
Travellers				
Number (10^3)	3 [illegible]	3 [illegible]	3 [illegible]	
Km (10^6)	[illegible]	377	[illegible]	
Goods				
Quantity (10^3 tons)	1 [illegible]	1 [illegible]	1 [illegible]	
Tons km (10^6)	[illegible]	[illegible]	[illegible]	[illegible]*

* Traffic with Mali [illegible]. 10^6 tons km ; Internal traffic [illegible]. 10^6 tons km

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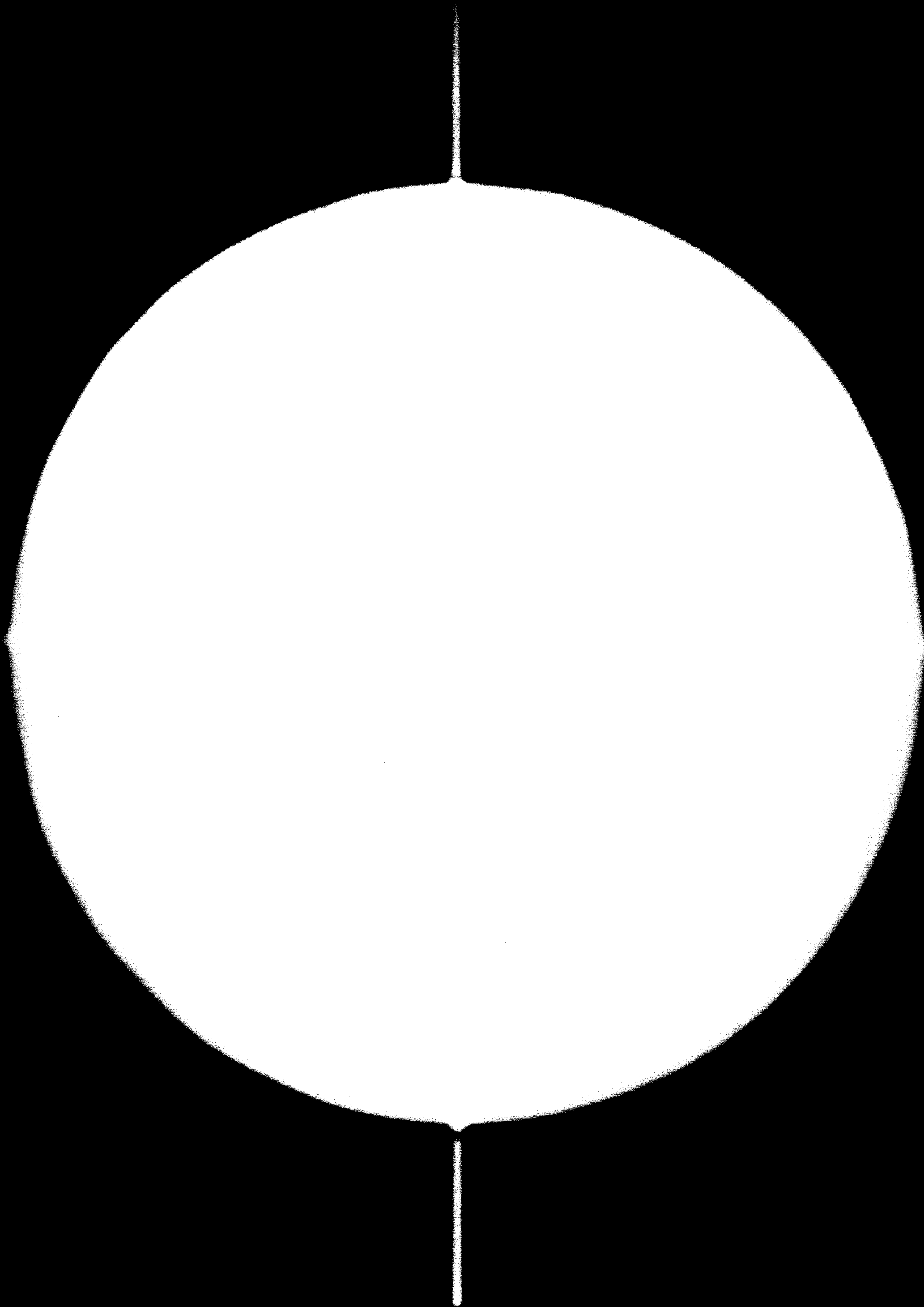

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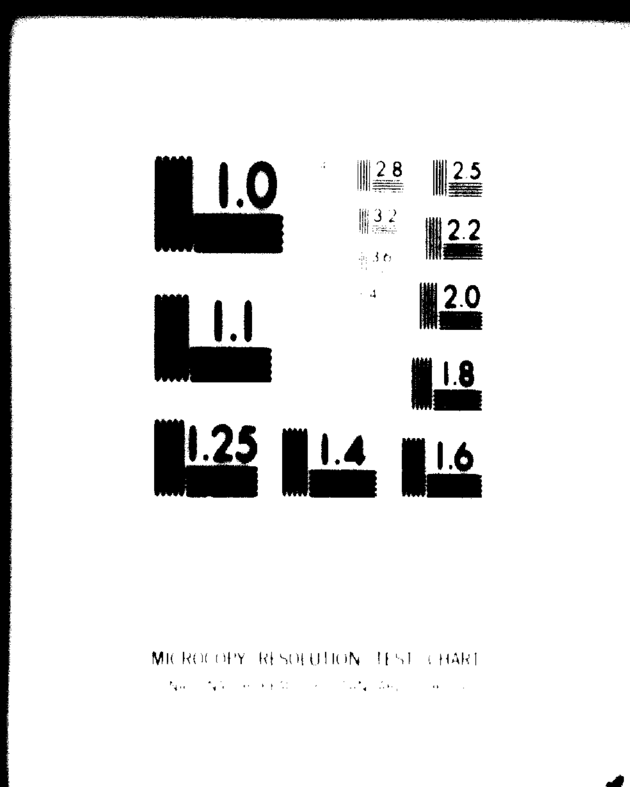
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- **Sea ports** : Dakar is a modern sea port ; in 1969, the traffic was 1 974 000 tons of disembarked goods and 1 559 000 tons of embarked goods. About 200 000 tons of edible oil and ground nut are exported from the port of Kaolak and the annexes of the Saloum river.

- **River system** : In Senegal the main navigable rivers are the Senegal river border between Mauritania and Senegal, the Casomance river connecting Ziguinchor to the Ocean and Sine and Soloum rivers linking the Kaolak area to the Ocean.

- **Importation** : The major part of the imported goods are disembarked at Dakar.

II.2.5. Connectiona between the OERS countries for industrial products

- Guinea-Senegal

At present time the industrial exchanges between Guinea and Senegal are occasional. There are realized by cabotage between the porta of Conakry and Dakar. The cost can be estimated at $ 12/ton.

- Guinea-Mali

There are realized by road from Conakry to Bamako or by railway from Conakry to Kankan and by road from Kankan to Bamako.

- Guinea- Mauritania

The exchages of industrial products between Guinea are scarce. There are realized by cabotage between Conakry and Nouakchott. The cost can be estimated at $ 14/ton.

- Senegal-Mauritania

The exchanges between Senegal and Mauritania are mainly done by road between Dakar and Nouakchott. The flow runs essentially from Dakar to Nouakchott. The costs are $ 25/ton from Dakar to Nouakchott and $ 20/ton from Nouakchott to Dakar.

- **Mali-Mauritania**

  The exchanges of industrial products between Mali and Mauritania are negligeable.

- **Senegal-Mali**

  The exchanges of industrial products between Senegal and Mali are done by the railway track Dakar-Bamako. This track is congested and must be equipped in order to meet the future transportation requirements. At certain periods the non-prioritary products remain during weeks in the railway warehouses before of beeing forwarded. The costs between Dakar and Bamako vary between $ 20 and 70/ton according to the goods.

II.2.6. Future requirements for infrastructure involved by the development of plastics and synthetic fibers product consumption.

The quantities of plastics and synthetics fibers products to be consummed in the OERS countries (respectively about 50 000 and 5 000 tons/year) are low if compared with the total quantities of transported products and will not require special requirements for infrastructure.

II.3. Taxes and Duties

Due to the importance of the investments and of the created employment the petrochemical production will be submitted to the following main conditions in the considered countries.

II.3.1. Guinea

- Custom duties on equipment : : exoneration
- Custom duties on raw materials : exemption for 5 years
- Income taxes : exemption for 5 years of the 33 % income taxes.

II.3.2. Mali

- Custom duties on equipment : exoneration
- Custom duties on raw materials : exemption for 10 years
- Income taxes : exemption for 5 years of the 50 % income taxe.

II.3.3. Mauritania

For enterprises investment of which is superior to $/ 270 000 :

- Custom duties on equipment : exoneration
- Custom duties on raw materials : exemption for 5 years
- Income taxes, exemption for 5 years of the 20 % income taxes.

For enterprises, the investment of which ranks between $ 110 000 and $ 270 000.

- Custom duties on equipment : 50 % exoneration
- Custom duties on raw materials : 50 % exoneration for 3 years.
- Income taxes : exemption for 3 years of the 20 % income taxes.

II.3.4. Senegal

For enterprises the investment of which is superior to $ 145 000 for the Cap Vert area or to $ 73 000 outside the Cap Vert area.

. Custom duties on equipment : exoneration

. Custom duties on raw materials : exoneration for 5 years

. Income taxes : exemption for 5 years for the Cap Vert area and for 8 years outside the Cap Vert area of the 33,33 % income taxes.

II.4. Construction cost in the concerned countries

II.4.1. Investment cost breakdown

The estimation of investment is based upon European installations.

In order to settle the actual investment cost of the same units built in the OERS countries, it si necesseary to amend the equivalent European costs with a multiplying factor, which takes into account the increase due to the local actual conditions (equipment availibility building and erection possibilities, transportation costs). The installations have been assumed to be built in Dakar (Senegal) Bamako (Mali) and Nouakchott (Mauritania). The calculation of the multiplying factors applied to the total investment is carried out from the estimation of partial coefficients corresponding to the different items of the investment.

Two types of breakdown have been considered for the investment costs. The first one corresponds to downstream petrochemical units such as polymerizations and synthetic fibers polymerization and spinning plants ; the second one corresponds to plastics transformation units such as extrusion, injection moulding, and blow moulding plants.

The table 7 sums up the approximate breakdown for the investment cost.

Table 7

Breakdown of the investment cost in Europe

%

Items	Downstream petrochemical units	Plastics transformation units
On site equipment	61	80
Engineering	13	
Civil Engineering	16	14
Erection	10	6
	100	100

It has to be noticed that the studied costs incorporate no tax and no custom duty on equipment and engineering services that will be the general case.

II.4.2. Cost of construction in Dakar (Senegal)

II.4.2.1. Equipment

It seems that, at present time, the Senegalian industry can be able to manufacture only a minor part of the equipment required for the construction of the plants. The steel being imported, the local share will be very little. Therefore it has been assumed that all the material will be imported. Although it is quite possible than American or Asiatic Companies migh supply the needed materials and services it appears that presently more contractor and materials comes from Europe. Accordingly it has been assumed that the equipment will come from Europe.

The additional cost for sea packaging, transport, insurances and labour charges have been estimated at 8 % of the equipment cost. In comparison with a basis 100 for the equipment cost in European conditions, the cost of equipment delivered to the site in Dakar will be

$$100 \times 1.08 = 108$$

of which 2 % in local currency.

II.4.2.2. Engineering and procurement

Engineering and procurement are essentially performed in the contractor's offices. Some expenses will be charged because of the long distance from the erection site. This increase is estimated at 15 %. In comparison with a basis 100 for the engineering and procurement cost in European conditions, the cost will be 115 of which 10 % in local currency.

In the case of plastics transformation units, the engineering and procurement expenses are included in the equipment cost.

II.4.2.3. Erection

For the above mentioned reasons it has been assumed that a part of the erection will be done by European firms. We estimate that local manpower will cover wholly or partly the following items :

. Hoisting

. Piping

. Painting and insulation

. Setting of electricity

on a basis 100 in Europe the erection cost will be 180 in Senegal, of which 20 % in local currency.

II.4.2.4. Civil Engineering

From informations obtained in Senegal it has been assumed that the cost of civil engineering is 20 % lower than in European countries.

On a basis 100 in Europe, the civil engineering cost will be 80 in Senegal, of which 90 % in local currency.

II.4.2.5. Overall coefficients. Breakdown between foreign and local currency.

The overall coefficient to apply to the investment of downstream petrochemical and plastics transformation plants in Europe in order to obtain the similar investment costs in Senegal are 1.18 and 1.17 as calculated in table 8 and 9.

These tables give the breakdown between foreign and local currency.

Table 8

Downstream petrochemical units

Construction cost in Senegal

Basis plant erected in Europe = 100

	Construction cost breakdown in Europe	Coefficient for local conditions	Construction cost in Dakar (Senegal)	Local currency	Foreign currency
On site equipment	61	1.08	65.90	1.30	64.60
Engineering	13	1.15	14.95	1.50	13.45
Civil engineering	10	0.80	8.00	7.20	0.80
Erection	16	1.80	28.80	5.80	23.00
	100		117.65	15.80	101.85
			Rounded to 118		
Breakdown on the basis of plant erected in Senegal = 100				13	87

Table 9

Plastics transformation units

Construction cost in Dakar (Senegal)

Basis plant erected in Europe = 100

	Construction cost breakdown in Europe	Coefficient for local conditions	Construction cost in Dakar (Senegal)	Local currency	Foreign currency
On site equipment	80	1.08	86.40	1.70	84.70
Civil engineering	6	0.80	4.80	4.30	0.50
Erection	14	1.80	25.20	5.00	20.20
	100		116.40	11.00	105.40
			Rounded to 117		
Breakdown on the basis of : plant erected in Senegal = 100				9	91

II.4.3. Cost of construction in Bamako (Mali)

II.4.3.1. Equipment

At present time, the Malian industry is not able to manufacture the equipments required for the construction of the plants. It has been assumed that all the material will be imported.

The additional cost for sea packaging, transport, insurances and charges have been estimated at 13 % of the equipment cost. In comparison with a basis 100 for the equipment cost in European conditions, the cost of equipment delivered to the site in Bamako will be 113 of which 6 % in local currency.

II.4.3.2. Engineering and procurement

Engineering and procurement are essentially performed in the contractor's offices. Some expenses will be charged because of the long distance from the erection site. This increase is estimated at 15 %. In comparison with a basis 100 for the engineering and procurement cost in European conditions, the cost will be 115, of which 10 % in local currency. In the case of plastics transformation units, the engineering and procurement expenses are included in the equipment cost.

II.4.3.3. Erection

For the above mentioned reasons, it has been assumed that a part of the erection will be done by foreign firms. We estimate that the local manpower will cover wholly or partly the following items:

. Hoisting

. Piping

. Painting and insulation

. Setting of electricity

On a basis 100 in Europe, the civil engineering cost will be 80 in Bamako of which 90 % in local currency.

II.4.3.4. Civil Engineering

From informations obtained in Mali, it has been assumed that the cost of civil engineering is 20 % lower than in European countries.

On a basis 100 in Europe, the civil engineering cost will be 80 in Bamako, of which 90 % in local currency.

II.4.3.5. Overall coefficients. Breakdown between foreign and local currency.

The overall coefficient to apply to the investment costs of downstream petrochemical and plastics transformation plants in Europe in order to obtain the similar investment costs in Mali are 1.21 and 1.20 as calculated in tables. These tables 10 and 11 give the breakdown between local and foreign currency.

II.4.4. Cost of construction in Nouakchott

II.4.4.1. Equipment

At present time, the Mauritanian industry is not able to manufacture the equipments required for the construction of the plants. It has been assumed that all the material will be imported.

The additional cost for sea packaging, transport, insurances and chargea have been estimated at 9 % of the equipment cost. In comparison with a basis 100 for the equipment cost in European conditions, the cost of equipment delivered to the site in Nouakchott will be 109 of which 3 % in local currency.

II.4.4.2. Engineering and procurement

Engineering and procurement are essentially performed in the contractor's offices. Some expenses will be charged because of the long distance from the erection site. This increase is estimated at 15 % . In comparison with a basis 100 for the engineering and procurement cost in European conditions the cost will be 115, of which 10 % in local currency. In the case of plastics transformation units, the engineering and procurment expenses are included in the equipment cost.

Table 10

Downstream petrochemical units

Construction cost in Bamako (Mali)

Basis plant erected in Europe = 100

	Construction cost breakdown in Europe	Coefficient for local conditions	Construction cost in Bamako (Mali)	Local currency [a]	Foreign currency
On site equipment	61	1.13	68.90	4.10	64.80
Engineering	13	1.15	14.95	1.50	13.45
Civil engineering	10	0.80	8.00	7.20	0.80
Erection	16	1.80	28.80	5.80	23.00
	100		120.65	18.60	102.05
			Rounded to 121		
Breakdown on the basis of plant erected in Mali = 100				15	85

a Malian and Senegalian currency

Table 11

Plastics transformation units

Construction cost in Bamako (Mali)

Basis plant erected in Europe = 100

	Construction cost breakdown in Europe	Coefficient for local conditions	Construction cost in Bamako (Mali)	Local currency[a]	Foreign currency
On site equipment	80	1.13	90.40	5.40	85.00
Civil engineering	6	0.80	4.80	4.30	0.50
Erection	14	1.80	25.20	5.00	20.20
	100		120.40	14.70	105.70
			Rounded to 121		
Breakdown on the basis of plant erected in Mali = 100				12	88

a Malian and senegalian currencies

II.4.4.3. Erection

For the above mentioned reasons, it has been assumed that a part of the erection will be done by foreign firms. We estimate that the local manpower will cover wholly or partly the following items.

. Hoisting

. Piping

. Painting and insulation

. Setting of electricity

On a basis 100 in Europe, the erection cost will be 180 in Nouakchott of which 20 % in local currency.

II.4.4.4. Civil Engineering

From information obtained in Mauritania, it has been assumed that the cost of civil engineering is 20 % lower than in European countries.

On a basis 100 in Europe, the civil engineering cost will be 80 in Nouakchott of which 90 % in local currency.

II.4.4.5. Overall coefficients. Breakdown between foreign and local currency.

The overall coefficient to apply to the investment costs of downstream petrochemical and plastics transformation plants in Europe in order to obtain the similar investment cost in Mauritania are 1.19 and 1.18 as calculated in tables 13 and 13. These tables give the breakdown between local and foreign currency.

Table 12

Downstream petrochemical units

Construction cost in Nouakchott (Mauritania)

Basis plant erected in Europe = 100

	Construction cost breakdown in Europe	Coefficient for local conditions	Construction cost in Nouakchott (Mauritania)	Local currency	Foreign currency
On site equipment	61	1.09	66.50	1.90	64.50
Engineering	13	1.15	14.95	1.50	13.45
Civil engineering	10	0.80	8.00	7.20	0.80
Erection	16	1.80	28.80	5.80	23.00
	100		118.25	16.40	101.85
			Rounded to 119		
Breakdown on the basis of plant erected in Mauritania = 100				14	86

Table 13

Plastics transformation units

Construction cost in Nouakchott (Mauritania)

Basis plant erected in Europe = 100

	Construction cost breakdown in Europe	Coefficient for local conditions	Construction cost in Nouakchott (Mauritania)	Local currency	Foreign currency
On site equipment	80	1.09	87.20	2.50	84.70
Civil engineering	6	0.80	4.80	4.30	0.50
Erection	14	1.80	25.20	5.00	20.20
	100		117.20	11:00	106.20
			Rounded to 118		
Breakdown on the basis of plant erected in Mauritania = 100				9	81

II.5. Utilities, Manpower

II.5.1. Utilities cost

For relatively high consumption, the considered unitary costs of utilities are the following :

Electricity :

Mali	Bamako	\$ 0,05/Kwh
Mauritania	Nouakchott	\$ 0,10/Kwh
	Nouhadibou	\$ 0,05/Kwh
Senegal	Cap vert	\$ 0,03/Kwh

Cooling water (Make up)

Mali	Bamako	\$ 0.10/m^3
Mauritania	Nouakchott	\$ 0.40/m^3
	Nouhadibou	\$ 0.70/m^3
Senegal	Cap vert	\$ 0.15/m^3

Fuel

Mali	\$ 85/ton
Mauritania	\$ 40/ton
Senegal	\$ 29/ton

II.5.2. Manpower costs

The manpower costs in the considered coutries are given in table 14 These costs are concerning the required manpower for the production units (staff, skilled and unskilled workers). In order to take into account the necessary supervision and some extra-costs for the foreign expatriated manpower, mainly during the first years of production, we have added in all the economic calculations an average value of 25 % of that basic manpower cost.

The average annual costs, which are given in table include the salaries and all the other allowances :

- social charges, fringe benefits
- holidays with pay, sick leave
- housing and transportation allowances.

Table 14

Manpower costs
in US $/year

	Mali	Mauritania	Senegal
Engineers	20 000	20 000	20 000
Foremen	1 500	1 500	2 000
Employees	1 100	1 100	1 300
Skilled Manpower	1 100	1 100	1 300
Unskilled Manpower	500	500	600

II.6. Fixed charges

The fixed charges correspond to items approximately proportional to the investment related to each production. The basis of these charges are the same for the considered countries.

II.6.1. Amortization

The amortization has been taken for calculations purposes at 10 % per year of the amortizable investment. This corresponds to a 10 years legal amortization.

II.6.2. Interests

- The interest on the borrowed capital has been calculated as based on the borrowed share the amortizable investment with an average 4 % per year rate which implies an actual interest around 7 % when loans are refunded by equal instalment over ten years.

  Half of the capital has been assumed to be borrowed.

- The short term interest on working capital reaches 7 % of this amount.

II.6.3. General plant and overhead expenses

The general plant and overhead expenses includes three main items :

- Expenses for the general services (guard house, social services, gardens).
- Corporate over heads and administrative cost.
- Expenses in the general office or in the other offices (staff and employees costs, equipment).

  These expenses have been estimated at 2 % of the investment.

II.6.4. Insurances and taxes

For the considered kind of industry the rates of insurance are rather high, since they can reach nearly 1 % of the erected cost. We have added to this item the hereabove mentionned minor taxes (see paragraph II). We adopted 1 % of the investment of every unit for value of this item.

II.6.5. Maintenance

The spare parts and the necessary equipment of buildings and workshops being included in the investment cost, some other charges must be kept in view ; they are mainly the labour expenses for maintenance and the replacing of spare parts. For this item we took as a basis 3 % of the total investment.

II.7. Existing and probable price structure

Presently the polymers consumed as granulated in the OERS countries are high and low density polyethylene PVC resin, PVC compound, high impact and general purpose polystyrene. All these polymers are not consumed in each country. Mauritania for instance where there is no plastic transformation industry does not consume plastic as granules. There is not synthetic fibers consumed as in this area.

Tables 15, 16, 17 present the presently prevailing price structures or the most probable price structures if the consumption would begun. The considered products are the main plastics, synthetic fibers and intermediate products in the plastics and synthetic fibers manufacture. The given prices are average prices ; they are base on the statistics of the countries exporting to this area and on interviews of the local importers.

The majority of the imported plastics comes from the EEC countries and benefits by some duties exemptions. The tables consider this fact.

In the case of products consumed by priority holding firms, the duties indicated in tables 15, 16, 17, can be reduced or suppressed.

Table 18 present the delivery prices without taxes. These prices represents the raw material prices for priority holding firms.

In Mali, Mauritania and Senegal, the taxes on added value collected on the imported raw materials are returned to the company by deducting them from the taxes on added value collected on the finished goods.

Table 15

Existing and probable price structure in Senegal

	FOB Europe prices $/Ton $/Ton	Maritime transportation cost $/Ton	CIF Dakar price $/Ton	Duties* $/Ton	Landing and transit cost $/Ton	Delivered prices Taxes on added value excluded $/Ton	Taxes on added value $/Ton	Delivered Taxes on added value included $/Ton
LD Polyethylene	230	18	248	28	6	282	37	319
HD Polyethylene	320	18	338	38	6	382	51	433
PVC rigid compound	270	18	288	32	6	326	44	370
PVC plasticized compound	330	18	348	39	6	393	53	446
Polypropylene	340	18	358	40	6	404	54	458
Polystyrene (General purpose)	270	18	288	32	6	326	43	369
Polystyrene (High Impact)	350	18	368	41	6	415	55	470
MVC	150	22	172	20	6	201	27	228
Polyester staple	1 375	19	1 394	155	6	1 555	210	1 765
Polyester polymer	756	18	774	86	6	866	115	981

* Fiscal import duties Contractual tax, tax for statistics.

Table 16

Existing and probable price structure in Mali

	FOB Europe prices $/Ton	Transport and transit costs $/Ton	Delivered prices out of duties $/Ton	Duties[a] $/Ton	Delivered prices Taxes on added value excluded $/Ton	Taxes on added value $/Ton	Delivered prices Taxes on added value included $/Ton
LD Polyethylene	230	48	278	42	320	64	384
HD Polyethylene	320	48	368	55	423	85	508
PVC resin	270	48	318	48	366	73	439
PVC compound	330	48	378	37	435	87	522
Polypropylene	340	48	388	58	446	90	536
Polystyrene (General purpose)	270	48	318	48	366	73	439
Polystyrene (High impact)	350	48	398	60	458	92	550
MVC	150	55	205	31	236	47	283
Polyester staple	1 375	50	1 420	213	1 633	328	1 961
Polyester polymer	756	48	804	121	925	186	1 111

a Fiscal import taxes

Table 17

Existing and probable price structure in Mauritania*

	FOB Europe prices $/Ton $/Ton	Maritime transportation cost $/Ton	CIF Nouakchott $/Ton	Duties $/Ton	Landing and transit cost $/Ton	Delivered prices Taxes on added value excluded $/Ton	Taxes on added value $/Ton	Delivered Taxes on added value included $/Ton
LD Polyethylene	230	21	251	73	7	331	39	370
HD Polyethylene	320	21	341	99	7	447	53	500
PVC resin	270	21	291	85	7	383	45	428
PVC compound	330	21	351	102	7	460	55	515
Polypropylene	340	21	361	105	7	473	56	529
Polystyrene (General purpose)	270	21	291	84	7	382	45	427
Polystyrene (High Impact)	350	21	371	107	7	485	57	542
MVC	150	25	175	50	7	232	27	259
Polyester staple	1 375	22	1 397	403	7	1 807	212	2 019
Polyester polymer	756	21	777	224	7	1 008	118	1 126

* Fiscal import duties, contractual tax, tax for statistics.

Table 18

Delivered prices without taxes

(Raw materials cost for priority holding firms)

$/Ton

	SENEGAL	MALI	MAURITANIA
LD Polyethylene	254	278	258
HD Polyethylene	344	368	348
PVC rigid compound	294	318	298
PVC plasticized compound	354	378	358
Polypropylene	364	388	368
Polystyrene general purpose	294	318	298
Polystyrene high impact	374	298	378
MVC	178	205	184
Polyester staple	1 400	1 420	1 404
Polyester polymer	780	804	784

II.8. Probable prices evolution

The prices of the considered products are close to the manufacturing costs. One can assume that they will follow their evolutions.

During last years, the general trend has been the decline of prices, mainly because of the technical improvements given to the manufactuting processes and of the higher plants capacities. Since two years, this trend is crossed by the very consequent rise occuring in the field of the constructions costs. One can assume that the prices will remain more or less firm.

II.9. Origin and means of transport of the polymers

The majority of the imported plastics, comes from France, Nederland and West Germany.

The polymers consumed in Senegal are landed in Dakar, the polymers going to Mali are landed in Abidjan (Ivory Coast) and reach Bamako by trucks ; as regards Mauritania, the products are supposed to be landed in Nouakchott.

III. METHODOLOGY AND DATA [illegible] USED FOR THE CALCULATIONS

III. METHODOLOGY AND MAIN ITEMS USED FOR THE CALCULATIONS

III.1. The investment costs

The investment costs, include the following items :

a) Process units

Process units costs including equipment, transportation, civil engineering land and engineering services costs.

b) Offsites costs

Offsites costs as they are calculated include :

- Buildings :
  - administration buildings
  - laboratories
  - workshop
- General installations
  - steam production and distribution
  - cooling water conditionning circulation and distribution
  - distribution of fuel
  - distribution of cooled and drinkable water
  - fire prevention
  - canteen
  - infirmary
  - sewage system
  - treatment of sewage
  - roads and fences
  - flare
- Storages

For each project, the calculations are performed on the basis of the process units and offsites erected cost in Europe. In order to determine the actual investment for the construction of such units in the OERS countries it is necessary to apply correcting factors to the cost of the units erected in Europe.

These correcting factors are the following (See II.4. Vol III).
Downstream petrochemical units :

1.21 for erection in Mali (Bamako)

1.19 for erection in Mauritania (Nouakchott-Nouhadibou)

1.18 for erection in Senegal (Cap Vert area)

Plastics processing units

1.21 for erection in Mali (Bamako)

1.18 for erection in Mauritania (Nouakchott, Nouhadibou)

1.17 for erection in Senegal (Cap Vert area)

c) Licence and know how

Licence and know how expenses are taken on the basis of a cash payment and not annual disbursements nor running basis have been considered

d) Start up expenses

Start up expenses are calculated on the basis of the foreign experts assisting the start up, three month of labour, one month of variable charges and one week of raw materials.

e) Interests

Interests during construction are taken as an average at 7 % of the erected cost. This corresponds to the charges of interest during the delays of repayment between the shipping of machinery and the start up of units.

f) Contingencies

Contingencies are taken at 7 % of the erected cost and cover unforeseen delays in the erection and start up and contingency expenses.

g) Initial catalyst and chemicals charges

h) Spare parts

The sum of these itmes, a) up to f) , gives the amortizable investment.

- The working capital is taken as 1 month of raw materials plus variable charges.

  This value can reasonably be kept for the normal production of units as actual figures, assuming that no special unexpected event could occur.

III.2. Variable charges

They include :

- Expenses for utilities consumption
- Expenses for catalysts and chemicals
- Expenses for manpower

They are calculated on the basis given in II.6. Vol.II.

III.3. Fixed charges

They include

- Amortization
- Interests and financial charges
- General plant and overhead expenses
- Insurances and taxes
- Maintenance

They are calculated on the basis given in II.6. Vol.III.

III.4. Operating cost

The operating cost is the sum of the variable and fixed charges.

III.5. Manufacturing cost

The manufacturing cost of the products will be obtained by adding raw material expenses to the operating cost.

The costs of these raw material is often difficult to determine. They are composed of several items, the most important of them being in the case of imported raw materials

- FOB price
- Transportation and miscellaneous costs, up to landing in the country.

The sum of these two items constituting the CIF price.

- Taxes and custom duties applicable to this CIF price.

All the operating and manufacturing cost calculations are performed, on the basis of the nominal capacity of productions. The fixed charges being constant, the manufacturing cost of the products increases proportionaly to the diminution of the rate of production.

III.6. Sales price of the products - Evaluation of the profitability of the projects.

Economic components added to the manufacturing cost allow to determine the sales prices of the products manufactured in the plants. They are mainly :

- the benefits
- the income taxes
- the taxes on products

The sum of these components, depending on the profitability of the project will determine the sales price of the product. Inversely a profitability being fixed a sales price can be infered. The benefits are related to the annueal rate of repayment of the investment, inverse of the pay-out time. Table 19 summarises the different connections.

Table 19

Connections between pay out and benefits

Pay out time	PO
Annual rate of investment repayments	$\frac{1}{PO}$
Cash flow	$\frac{\text{Investments}}{PO}$
Benefits after taxes	$\frac{\text{Investments}}{PO}$ - Amortisation
Sales price = manufacturing cost + benefits before taxes	

The pay out time is often used as a rough criterion of profitability If the legal amortization period of the equipment is 10 years a pay out time superior to 10 years will denounce the non profitability of the projects. The production under these conditions must firmly be ruled out. On the contrary a pay out time of 5 to 7 years (usually obtained in petrochemical plants) will favourably incite to set up a production. Such favourable pay out times would be around 3 to 5 years for industries evolving more rapidly such as plastics transformation industry.

Other more sophisticated criterions of profitability valuation might be considered, as for instance, the year by year evolution of the financial factors (cash flow, net income) from the start up of the construction or the discounted rates of return.

Nevertheless to evaluate whether or not a project is profitable the criterion of pay out time, although approximate was judged adequate.

III.7. Manufacturing cost breakdown between foreign and local currencies

It is interesting to know what will be the breakdown of the manufacturing cost between foreign and local currencies, in order to know what will be the saving in foreign currencies achieved by the installation of each considered production.

Tables 20 and 21 give the considered breakdown of the different items of the operating cost in local and foreign currencies.

Table 20

Breakdown of operating cost in Senegal

	Downstream petrochemical units		Plastics transformation units	
	% in foreign currency	% in local currency	% in foreign currency	% in local currency
Variable charges				
Utilities	70	30	70	30
Catalysts chemicals	100	0	100	0
Manpower	0	100	0	100
Fixed charges				
Amortization	0	100	0	100
Interests on borrowed capital	87	13	91	9
Interests on working capital	60	40	60	40
Maintenance	70	30	70	30
General overheads	10	90	10	90
Insurances	87	13	91	9

Table 21

Breakdown of operating cost in Mali

	Downstream petrochemical units		Plastics transformation units	
	% in foreign currency	% in local currency	% in foreign currency	% in local currency
<u>Variable charges</u>				
Utilities	70	30	70	30
Catalysts Chemicals	100	0	100	0
Man Power	0	100	0	100
<u>Fixed charges</u>				
Amortization	0	100	0	100
Interests on borrowed capital	85	15	88	12
Interests on working capital	60	40	60	40
Maintenance	70	30	70	30
General overheads	10	90	10	90
Insurances	85	15	88	12

IV. TECHNO ECONOMIC STUDIES

IV. TECHNO ECONOMIC STUDIES

IV.1. PVC production

IV.1.1. Location of the plant

The plant is localized in Dakar, Senegal. (see paragraph I.2.1.)

IV.1.2. Qualities of products. Capacity of production

The plant produces PVC resin and compounds, from imported vinyl-chloride and plasticizers. The capacity of the polymerization section is 10 000 tons/year of PVC resins. The breakdown of the resins qualities are given in table 22.

Table 22

Breakdown of the produced resins by K value range

K value range	Below 60	61-65	66-70	Total
Outlet				
Piping	1 200	1 200	300	2 700
Rigid injection moulding	600			600
Footwear		3 500		3 500
Blow moulding	1 000			1 000
Rigid extrusion		200		
Flexible extrusion		1 500		1 500
Others		300	200	500
	2 800	6 700	500	10 000

The total capacity of the compounding and mixing unit is 15 400 tons per year. This unit is able to produce the main rigid and plasticized PVC qualities needed by the market. Table 23 gives the production breakdown.

Table 23

PVC compouding and mixing unit

Breakdown of production

Tons/year

Component	Resin	Plasticizers	Other products	Total production
Uses				
Pipes and others rigid uses	4 500		400	4 900
Footwear	3 500	3 500	200	7 200
Flexible uses	2 000	800	500	3 300
	10 000	4 300	1 100	15 400

IV.1.3. Date of start up

The plant will start up in 1977 and will work at full capacity in 1980.

IV.8.4. Main characteristics of the process units.

The PVC plant is based on a suspension type process. It can produce 10 000 PVC resins from 10 600 tons/year of imported VCM. The various qualities obtained are in a wide range with, for instance, K value varying from 55 to 70.

The reaction occurs discontinuously in several reactors in water phase, when specific agents are added. Cooling requirements are met by recirculated cooling water.

After the polymerization plant including a classification and a granulation section, a compounding and mixing plant is installed.

This plant consists of two mixing and compounding lines producing 6 900 tons/year of rigid PVC and 10 300 tons/year of plasticized compound.

The following are included in the battery limits of this unit :

- all the intermediate storages of PVC powders or granulates
- the storages and warehouses for the products (stored in bags) corresponding to 15 days of production
- the VCM and additives storages, corresponding to 1 month of consumption.

IV.8.5. Main characteristics of the utility production

IV.8.5.1. Utilities needs

Table 24 gives the utility requirements of the process units.

Table 34

Main utility requirements of the process units

Utility	Unit	Requirements
Power	Kwh/h	440
Cooling water 25°C(Δt 4°C)	M^3/h	170
Steam 9 bars	T/h	1.8
Process water	M^3/h	1

IV.1.5.2. Power supply and distribution

The electric power needed in the complex is supplied by the public grid at 5 500 volts.

The distribution is performed at 2 levels :

380 volts
110 volts (for safety, lighting and control intrumentation)

IV.1.5.3. Cooling water system

The system is a circulating one with cooling tower. The make up needed is town water.

IV.1.5.4. Steam production

Steam is produced in a boiler of 2 tons/h. Boiler feed-water is obtained by demineralising town water. This water is mixed with oil free condensate and degased before entering the boilers.

Fuel is used for steam production. The fuel system includes the equipment for pumping heating and distribution

IV.1.5.5. Air and inert gas supply

- Service air and instrumentation air are produced in the plant
- the needed nitrogen is purchased.

IV.1.6. Offsite facilities - Buildings

This item includes

- Safety and five fighting system
- Sewerage
- Laboratory for raw materials, chemicals and products testing such as for customers services.
- workshops, stores and other buildings. The total building area is 2 000 square meters.

IV.1.7. Economic study

The profitability of the PVC unit and the yearly foreign currency balance resulting from the installation of this unit in Senegal have been determined.

Table 25 to 28 give the elements of the operating cost.

The profitability calculations and the foreign currency balance are indicated in tables 29 to 32

The calculations are performed according to the hypothesis given in chapter II and III.

The results are summarized in tables 29 to 32 and fig. 1.

Table 25

PVC production plant 10 000 tons/year [a]
Estimation of the investment

US $

Process units	3 400 000	
Utilities		
Electric power supply and distribution	16 000	
Cooling water system	46 000	
Steam production	100 000	
Waste water purification system	18 000	
Compressed air production and distribution, inert gas distribution, miscellaneous	30 000	
Off site facilities, buildings	250 000	
Total cost of plant erected in Europe	3 860 000	
Total cost of plant erected in Senegal		4 555 000
Interests during construction		327 000
Contingencies		327 000
Licences and know how		65 000
Initial catalysts and chemicals charges		330 000
Start up expenses		180 000
Spare parts		45 000
Total investment		5 829 000
Working capital		327 000

[a] In terms of resin

Table 26

PVC production plant 10 000 tons/year

Utilities requirements

Utility	Unit	Process units	Utilities production and distribution. Off sites	Total requirements
Electric power	10^3 Kwh/y	3 520	450	3 970
Cooling water	10^3 M^3/y	1 360	50	1 410
Process water	10^3 M^3/y	8	-	8
Steam	Tons/year	14 400	-	14 400
Inert gas	10^3 M^3/y	1	Neg	1

Table 27

Utilities purchased outside the plant

Utility	Unit	Quantity
Electric power	10^3 Kwh/year	3 970
Water make up	10^3 M^3/year	140
Fuel	Tons/year	1 300
Inert gas	10^3 M^3/year	1 020

Table 28

PVC production plant 10 000 tons/year

Man power requirement

	Men
Engineers	4
Foremen	12
Employees	6
Skilled manpower	30
Unskilled manpower	45

Table 29

PVC production plant 10 000 tons/year

Estimation of the operating cost

	$/Year	
<u>Variable charges</u>		
Utilities		
Electric power	119 100	
Water make up	21 000	
Fuel	37 800	
Inert gas	200	
TOTAL	178 100	
Manpower		
Engineers	80 000	
Foremen	24 000	
Employees	7 800	
Skilled workers	26 000	
Unskilled workers	27 000	
Subtotal	164 800	
Supervision	41 200	
TOTAL VARIABLE CHARGES	206 000	
Chemicals catalyst	33 000	
TOTAL FIXED CHARGES		417 000
<u>Fixed charges</u>		
Amortization	582 900	
Interests on the borrowed capital	116 600	
General plant and overhead expenses	116 600	
Insurances and taxes	58 300	
Maintenance	174 900	
Interests on the working capital	22 800	
TOTAL		1 072 100
OPERATING COST		1 489 200

Table 30

PVC production plant 10 000 tons/year

Manufacturing cost

	US $/year
Vinylchloride 10 600 tons at $/178/T	1 886 800
Plasticizers additives 5 400 tons at $ 300/T	1 620 000
Total raw materials	3 506 800
Operating cost	1 489 200
Manufacturing cost	4 996 000

Table 31

PVC production plant 10 000 tons/year

Profitability calculations

	US $/year
Sales of products	
Rigid PVC compound 4 900 tons at $ 294/T	1 440 600
Plasticized PVC compounds 10 500 tons at $ 354/T	3 717 000
Total sales	5 157 600
Manufacturing cost	4 996 000
Gross profits	161 600
Cash flow	744 500
Pay out time (without taxes)	7.8 years

Under the conditions presently prevailing in the Cap Vert area : exemption for 5 years of the 33.33 % income taxes, the pay out time becomes : 8.0 years.

The influence of the monomers cost on the PVC compounds prices is presented in the following figure.

The influence of the plasticizers, stabilisers and other additives prices is also notable. The profitability being the same, a 20 % increase of these prices leads to a 6 % increase of the PVC compounds prices.

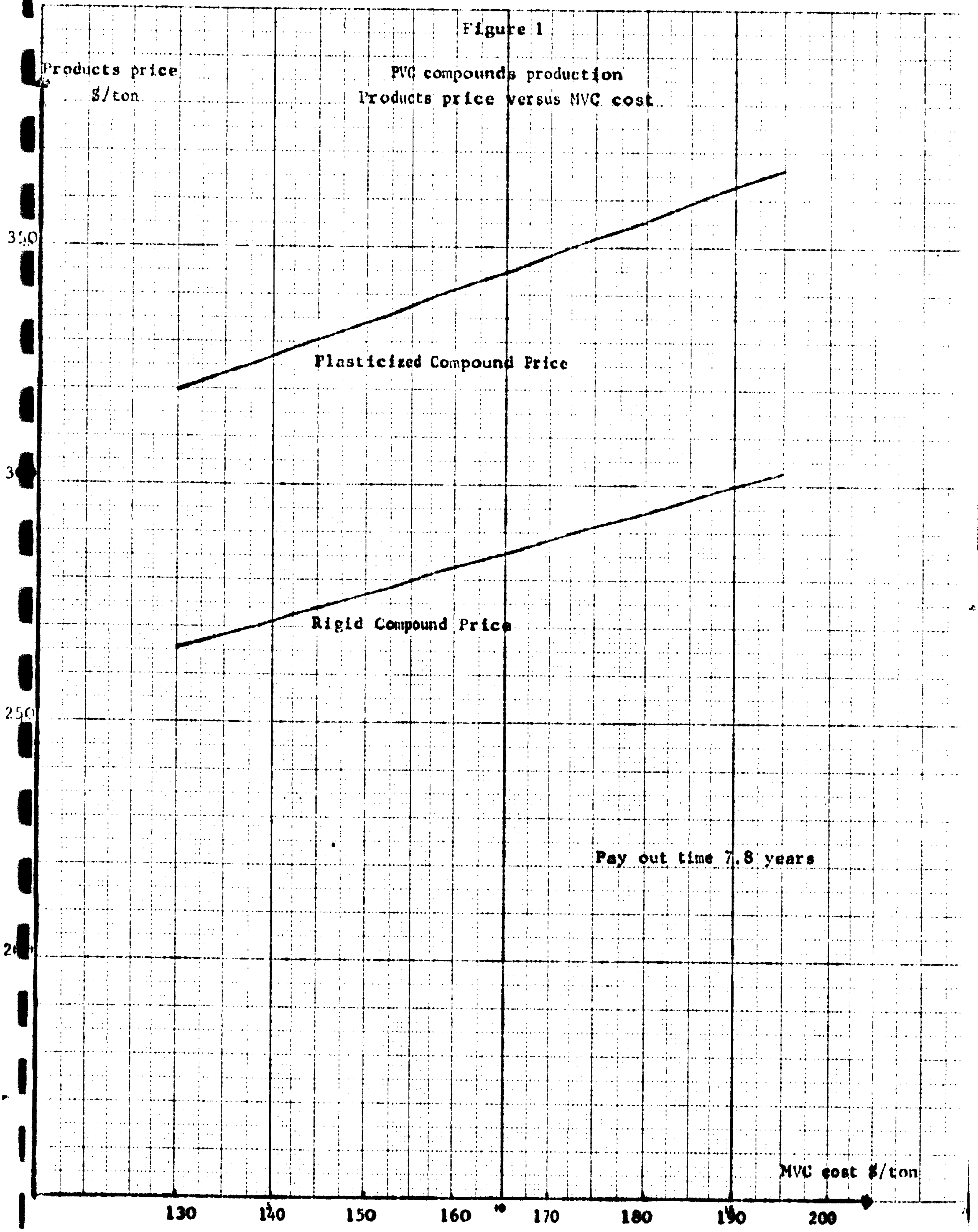


Figure 1
Products price
$/ton
PVC compounds production
Products price versus MVC cost
Plasticized Compound Price
Rigid Compound Price
Pay out time 7.8 years
MVC cost $/ton
250
130
140
150
160
170
180
190
200

Table 32

PVC production plant 10 000 tons/year

Foreign currency balance

Investment to be paid in foreign currency	US $ 5 080 000	
Yearly foreign currency balance at country level	US $/year	
Credit		
Rigid PVC compound	1 440 600	
Plasticized PVC compound	3 717 000	
TOTAL CREDIT		5 157 600
Debit		
Raw materials		
Vinylchloride	1 886 800	
Plasticizers, additives	1 620 000	
Total raw materials	3 506 800	
Variable charges		
Utilities	124 700	
Catalyst-chemicals	417 100	
Total variable charges	541 800	
Fixed charges		
Interest on borrowee capital	101 400	
Interest on working capital	700	
Maintenance	122 400	
General overheads	11 700	
Insurances	50 700	
Total fixed charges	299 900	
TOTAL DEBIT		4 348 500
YEARLY BALANCE		809 100

IV.2. Polyester fibers production

IV.2.1. Location of the plant

The plant is localized in Dakar, Senegal. (See paragraph I.2.1.)

IV.2.2. Qualities of products. Capacity of production

The plant is a spinning unit. It produces polyester staples from imported polymer.

The total capaicty of production is 1 500 tons/year.

The production of the unit will be used for clothing purpose.

400 tons/year will be mixed with viscose and will have the following specifications :

denier	3
length	60 mm

1 100 tons/year will be mixed with cotton and will have the following specifications :

denier	1.5
length	40 mm

IV.2.3. Date of start up

The plant will start up in 1977 and will work at full capacity in 1980.

IV.2.4. Main characteristics of the process units

The polyester staple plant can produce 1 500 tons/year of polyester staple, from 1 550 tons/year of imported polymer.

The polymer chips are melted in extruders. The melt is fed via metering pumps to spinnerets. The polyester leaving the spinnerets is cooled by conditioned air and solidified to form filaments. A molecular orientation is introduced by collecting the solidified filaments at a velocity considerably greater than that at which they are extruded. After application of antistatic lubricant, the filaments from several adjacent spinning positions are collected together to give tows. The tows are deposited in cans. The tows are hot streteed in steaming ducts, crimped, dried and heat stabilized. After that, they are cut and compressed to form bales. The bales are then wrapped and strapped, and transferred to the warehouse for dispatch.

The equipment is composed of :

- 1 spinning machine equipped with 2 extruders feeding each 4 spinning positions.
- 1 take-up machine, 8 positions, equipped for can deposits
- 1 treatment line for tow stretching, treatment,cutting and wrapping.
- Accesories for preparation fo the oiling agents, for spinnerets cleaning and checking device, transportable cans, set of knives, crimping plates.

The following are included in the battery limits of this unit :

- all the storages and warehouses for the products corresponding to 1 month of production
- the polymer and additives storages, corresponding to 1 month of consumption.

IV.2.5. Main characteristics of the utility procurement

IV.2.5.1. Utility needs

Table 33 gives the main utility requirements of the process units.

Table 33

Main utility requirements of the process units

Utility	Unit	Requirements
Power	Kwh/h	360
Cooling water 25°C (Δt 4°C)	M^3/h	60
Steam	T/h	0.5
Nitrogen	M^3/h	3
Compressed air	M^3/h	100

IV.2.5.2. Power supply and distribution

The electric power needed in the plant is supplied by the public grid at 5 500 volts.

The distribution is performed at 2 levels :

380 volts

110 volts (for safety lighting and control instrumentation)

IV.2.3.3. Cooling water system

The system is a circulating one, with cooling tower. The make up needed is town water.

IV.2.3.4. Steam production

Steam is produced in a boiler of 0.8 tons/h ; boiler feed water is obtained by demineralized town water. This water is mixed with oil free condensates and degassed before entering the boilers. Fuel is used for steam production. The fuel system includes the equipment for pumping, heating and distribution.

IV.2.3.5. Air and inert gas supply

- Compressed air is produced in the plant
- The needed nitrogen is purchased.

IV.2.4. Off site facilities, buildings

This item includes :

- Safety and fire fighting system
- Sewerage
- Laboratory for raw materials, chemicals and products testing such as for customer services.
- Workshops, stores and other buildings. The total building area is 3 300 square meters. The total building volume is 30 000 cubic meters, of which 1 300 conditionned at 18-21° C and 63-67 % of relative humidity.

IV.3.7. [illegible]

The profitability of the polyester fibre unit and the foreign currency balance resulting from the installation of this unit in Senegal have been determined.

Tables 34 to 37 give the elements of the operating cost.

The profitability calculations and the foreign currency balance are indicated in table 38 to 41.

The calculations are performed according to the hypothesis given in chapters II and III.

The results summarized in tables 38 to 41 and Fig. 2.

Table 34

Polyester spinning plant 1 500 tons/year
Estimation of the investment
US $

<u>Process units</u>	940 000	
Utilities		
Electric power supply and distribution	13 000	
Cooling water system	27 000	
Steam production	56 000	
Waste water purification system Compressed air production and distribution, inert gas distribution, miscellaneous	17 000	
Off site facilities, buildings	310 000	
Total cost of plant erected in Europe	1 363 000	
Total cost of plant erected in Senegal		1 608 000
Interests during construction		115 000
Contingencies		115 000
Licenses and know how		270 000
Initial catalysts and chemicals charges		5 000
Start up expenses		186 000
Spare parts		96 000
Total investment		2 395 000
Working capital		188 000

Table 35

Polyester spinning plant 1 500 tons/year

Utilities requirements

Utility	Unit	Process units	Utilities production and distribution. Off sites	Total requirements
Electric power	10^3 Kwh/y	2 880	400	3 280
Cooling water	10^3 M^3/h	480	20	500
Steam	Tons/y	4 000	-	4 000
Inert gas	10^3 M^3/h	24	neg.	24
Compressed air	10^3 M^3/h	800	-	800

Table 36

Utilities purchased outside the plant

Utility	Unit	Quantity
Electric power	10^3 Kwh/year	3 280
Water make up	10^3 M^3/year	30
Fuel	Tons/year	400
Inert gas	10^3 M^3/year	24

Table 37

Polyester spinning plant 1 500 tons/year

	Men
Engineers	2
Foremen	8
Employees	6
Skilled manpower	40
Unskilled manpower	30

Table 38

Polyester spinning plant 1 500 tons/year

Estimation of the operating cost

	$/year	
<u>Variable charges</u>		
Utilities		
Electric power	98 400	
Water make up	7 500	
Fuel	11 600	
Inert gas	4 800	
TOTAL	122 300	
Manpower		
Engineers	40 000	
Foremen	16 000	
Employees	7 800	
Skilled workers	52 000	
Unskilled workers	30 000	
Subtotal	145 800	
Supervision	36 400	
TOTAL	182 200	
Chemicals and catalysts	45 000	
TOTAL VARIABLE CHARGES		349 500
<u>Fixed charges</u>		
Amortization	225 500	
Interests on the borrowed capital	45 100	
General plant and overhead expenses	45 100	
Insurances and taxes	22 600	
Maintenance	67 700	
Interests on the working capital	9 300	
TOTAL FIXED CHARGES		415 300
OPERATING COST		764 800

Table 39

Polyester spinning plant 1 500 tons/ton
Manufacturing cost

	US $/year
Raw material polymer polyester : 1 550 tons/year at $ 780/year	1 209 000
Operating cost	764 800
Manufacturing cost	1 973 800

Table 40

Polyester spinning plant 1 500 tons/year
Profitability calculations

	US $/
<u>Sales of products</u>	
(polyester staples 1 500 tons/year at $ 1 400/T)	2 100 000
Manufacturing cost	1 973 800
Gross profit	126 200
Cash flow	351 700
Pay out time (without taxes) years	6.4

Under the conditions prevently prevailing in the Cap Vert area : exemption of 5 years of the 33.33 % income taxes, the pay out time becomes 6.6. years.

The influence of the polyester polymer cost on the polyester price is presented in the following fig. 2.

Table 41

Polyester spinning plant 1 500 tons/year

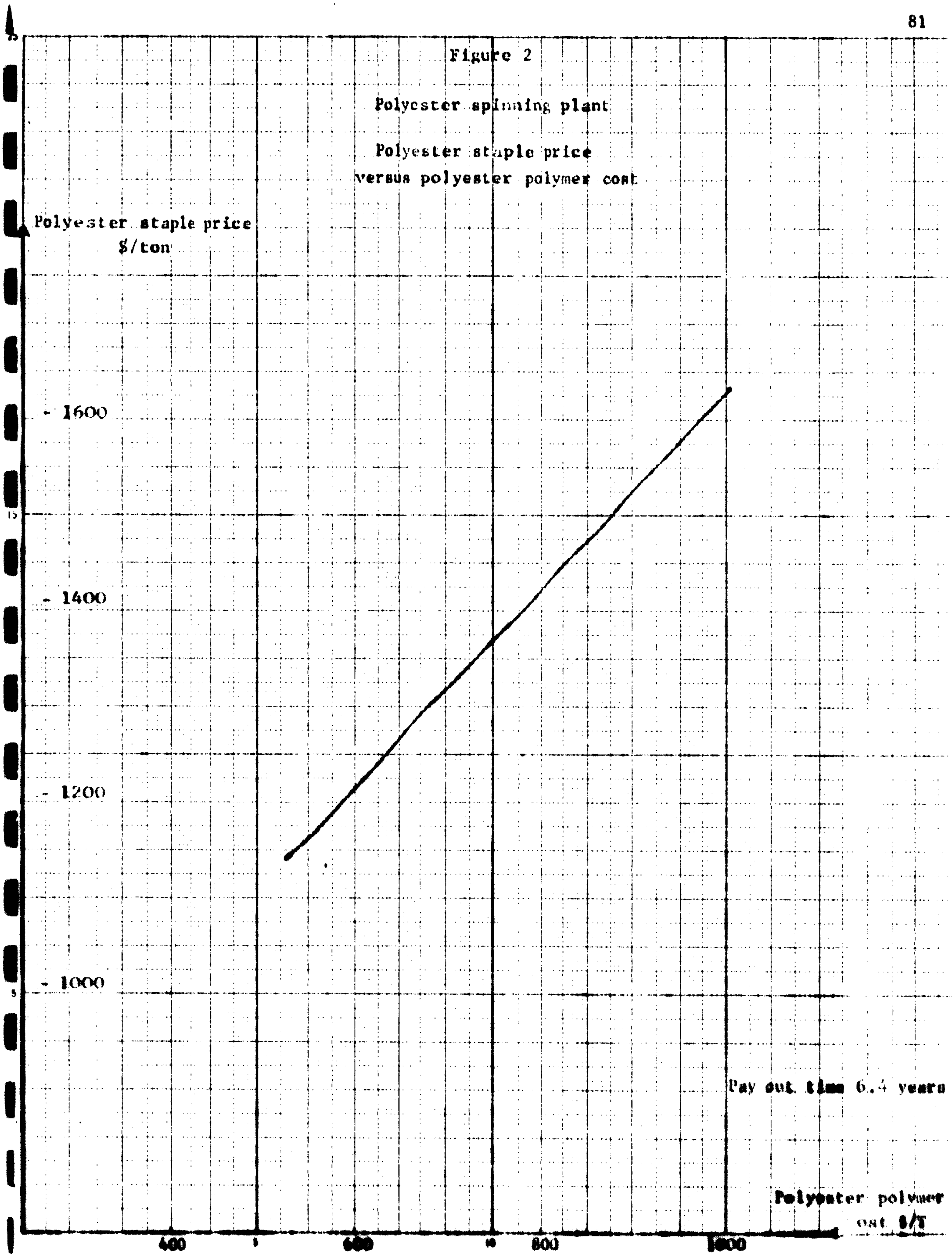
Foreign currency balance

Investment to be paid in foreign currency	US $ 1 950 000	
Yearly foreign currency balance at country level	US $/year	
<u>Credit</u>		
Polyester staples		2 100 000
<u>Debit</u>		
Raw materials		
Polyester polymers	1 162 000	
Variable charges		
Utilities	85 600	
Catalysts and Chemicals	45 000	
Total variable charges	130 600	
Fixed charges		
Interest on borrowed capital	39 200	
Interest on working capital	5 300	
Maintenance	47 600	
General overheads	4 500	
Insurances	19 700	
Total fixed charges	116 300	
TOTAL DEBIT		1 408 900
YEARLY BALANCE		691 100

Figure 2

Polyester spinning plant

Polyester staple price
versus polyester polymer cost



IV.3. PVC pipes production (1 400 tons per year)

IV.3.1. Location of the plant

The plant is located in Dakar, Senegal. (See paragraph I.2.1.)

IV.3.2. Qualities of products. Capacity of production

The plant produces rigid pipes made of PVC. The capacity reaches 1 400 tons per year. The raw material is imported or locally produced rigid PVC. The majority of the produced pipes consists of pipes having diameters inferior to 90 mm. A little share if expressed in terms of length but non negligible if expressed in term of weight (about 20 % of the total) consits of pipes the diameters range of which is 90-150 mm. Over 150 mm the pipes made of cast iron and asbestos cement will probably remain more economical.

IV.3.3. Date of start up

The plant will start up in 1975 and will work at full capacity in 1976.

IV.3.4. Main characteristics of the equipment

The pipes are produced by extrusion

The material consists of :

1 extruder screw diameter 120 mm
1 extruder screw diameter 90 mm
2 Regulation and operating boxes
2 operating blocks for the motors
2 drawing, cutting and collecting lines

- **Extruders.**

  The barrels are equipped with electric heating in several zones and with cooling facilities. The screws are connected to the motors through gear reducers. The heads are fixed to the barrels by collars ; differently shaped heads can be adapted.

- **Regulation and operation.**

  Each extruder has its regulation and operation equipment : a box including regulating and operating circuits, allowing to adjust the head and barrel temperatures with a great accuracy (± 1° C) an operating block with a regulated by induction variable speed motor, a gear box, an operating electric equipment.

- **Drawing, cutting and collecting equipment.**

  After extrusion, the pipes are drawn by a variable speed caterpillar. The pipes are automatically cut at the required length, they are taken up by a collecting machine.

IV.3.5. <u>Main characteristics of the utility procurement</u>

IV.3.5.1. Utility requirements.

Table 40 gives the main utility requirements of the process units.

Table 40

Main utility requirements of the process equipment

Utility	Unit	Requirements
Power	kWh/h	30
Cooling water 25° C (Δt 4°C)	m^3/h	17.5
Compressed air	-	Neg.

IV.3.5.2. Power supply and distribution

The electric power needed in the factory is supplied by the public grid at 5 500 volts.

The distribution is performed at 2 levels :

380 volts

110 volts (for safety, lighting and control instrumentation)

IV.3.5.3. Cooling water system

The system is a circulating one, with cooling tower. The make up needed is town water.

IV.3.5.4. Compressed air supply

Compressed air is produced in the plant.

IV.3.6. Off site facilities. Buildings

This item includes

- Safety and fire fighting system
- Workshop, storage of PVC and pipes, corresponding to 1 month of production.

IV.3.7. Economic study

The profitability of the PVC pipes production unit and the yearly foreign currency blance resulting from the installation of this unit in Senegal have been determined.

Tables 41 to 40 give the elements of the operating cost.

The profitability calculations and the foreign currency balance are presented in tables 45 to 48.

The calculations are performed according to the hypothesis given in chapters II and III.

The results are summarised in tables 45 to 48

Table 41

PVC pipes production 1 400 tons/year

Estimation of the investment

Process units	240 000	
Utilities		
Electric power supply and distribution	4 000	
Cooling water system	20 000	
Compressed air production and distribution, inert gas distribution, miscellaneous	5 000	
Off sites facilites, buildings	40 000	
Total cost of plant erected in Europe	309 000	
Total cost of plant erected in Senegal		365 000
Interests during construction		26 000
Contingencies		26 000
Start up expenses		50 000
Spare parts		4 000
Total investment		471 000
Working capital		45 000

Table 42

PVC pipes production 1 400 tons/year
Utilities requirements

Utility	Unit	Process units	Utilities production and distribution. Off sites	Total requirements
Electric power	10^3 Kwh/y	472	30	502
Cooling water	10^3 M^3/y	140	10	150

Table 43

Utilities purchased outside the plant

Utility	Unit	Quantity
Electric power	10^3 Kwh/year	502
Water make up	10^3 M^3/ year	15

Table 44

Man power requirements

	Men
Engineers	1
Foremen	4
Employees	2
Skilled manpower	20
Unskilled manpower	40

Table [illegible]

PVC pipes production [illegible] tons/year

Estimation of the operating cost

		$/year	
Variable charges			
Utilities			
Electric power		[illegible]	
Water make up		[illegible]	
	TOTAL	[illegible]	
Manpower			
Engineers		[illegible]	
Foremen		[illegible]	
Employees		[illegible]	
Skilled workers		[illegible]	
Unskilled workers		[illegible]	
	Subtotal	[illegible]	
Supervision		[illegible]	
	TOTAL	[illegible]	
	TOTAL VARIABLE CHARGES		[illegible]
Fixed charges			
Amortization		[illegible]	
Interests on the borrowed capital		[illegible]	
General plant and overhead expenses		[illegible]	
Insurances and taxes		[illegible]	
Maintenance		[illegible]	
Interests on the working capital		[illegible]	
	TOTAL FIXED CHARGES		[illegible]
OPERATING COST			[illegible]

Table 66

PVC pipes production 1 400 tons/year
Manufacturing cost

	US $/year
PVC rigid compound ([illegible] tons/year at $ [illegible]/ton)	[illegible]
Operating cost	[illegible]
Manufacturing cost	[illegible]

Table 67

PVC pipes production 1 400 tons/year
Profitability calculations

	US $/year
Sales of products ([illegible] tons/year at an average price of $ [illegible]/t)	[illegible]
Manufacturing cost	[illegible]
Gross profits	[illegible]
Cash flow	[illegible]
Pay out time (without interest) years	[illegible]

Table 40

PVC pipes production 1,400 tons/year

Foreign currency balance

Investment to be paid in foreign currency		US $ 400 000
Yearly foreign currency balance at country level		US $/Year
Credit		
PVC pipes		756 000
Debit		
Raw materials	486 300	
Variable charges		
Utilities	18 600	
Catalysts and Chemicals	-	
Total variable charges	18 600	
Fixed charges		
Interest on borrowed capital	[illegible]	
Interest on working capital	[illegible]	
Maintenance	[illegible]	
General overheads	[illegible]	
Insurances	6 300	
Total fixed charges	[illegible]	
TOTAL DEBIT		[illegible] 400
YEARLY BALANCE		[illegible] 600

IV.4. PVC pipes production (900 tonsper year)

IV.4.1. Location of the plant

The plant is located either in Dakar, Senegal, or in Bamako, Mali. (See paragraph I.2.1.).

IV.4.2. Qualities of products. Capacity of production

The plants produces rigid pipes made of PVC. The capacity reaches 900 tons/year. The raw material is imported or locally produced rigid PVC. The majority of the produced pipes consists of pipes having diameters inferior to 90 mm. A little share if expressed in terms of length but non negligible if expensed in terms of weight (about 20 % of the total) consists of pipes the diameters range of which is 90-150 mm. Over 150 mm the pipes made of cast iron and asbestos cement will probably remain more economical.

IV.4.3. Date of start-up

The plant will start up in 1979 and will work at full capacity in 1980.

IV.4.4. Main characteristics of the equipment

The pipes are produced by extrusion.

The material consists of :

1 extruder screw diameter 120 mm

1 regulation and operating box

1 operating block for the motor

1 drawing, cutting and collecting lines

- Extruder

  The barrels is equipped with electric heating in several zones and with cooling facilities. The screws are connected to the motors through gear reducers. The heads are fixed to the barrels by collars ; differently shaped heads can be adapted.

- Regulation and operation

  The extruder has its regulation and operation equipment : a box including regulating and operating circuits, allowing to adjust the head and barrel temperatures with a great accuracy (± 1° C) an operating block with a regulated by induction variable speed motor, a gear box, an operating electric equipment.

- Drawing, cutting and collecting equipment.

  After extrusion, the pipes are drawn by a variable speed caterpillar. The pipes are automatically cut at the required length, they are taken up by a collecting machine.

IV.4.3. Main characteristics of the utility procurement

IV.4.3.1. Utility requirements

Table 40 gives the main utility requirements of the process units.

Table 40

Main utility requirements of the process equipment

Utility	Unit	Requirements
Power	Kwh/h	33
Cooling water 25°C (Δt 6°C)	M^3/h	10
Compressed air	-	Neg

IV.4.5.2. Power supply and distribution

The electric power needed in the factory is supplied by the public grid at 5 500 volts.

The distribution is performed at 2 levels :

380 volts

220 volts (for safety, lighting and control instrumentation).

IV.4.5.3. Cooling water system

The system is a circulating one, with cooling tower. The make up needed is town water.

IV.4.5.4. Compressed air supply

Compressed air is produced in the plant.

IV.4.6. Off site facilities. Buildings

This item includes

- Safety and fire fighting system
- Workshop, storage of PVC and pipes, corresponding to 1 month of production.

IV.4.7. Economic study

The profitability of the PVC pipes production plants and the yearly foreign currency balances resulting from the installation of the units have been determined.

Tables 50 to 53 give the elements of the operating costs.

The profitability calculations and the foreign currency balances are presented in tables 54 to 58

The calculation are performed according to the hypothesis given in chapter II and III.

The transportation costs from Dakar to Bamako taken into consideration are $ 26/ton for PVC granulates, and $ 30/ton for plastics pipes.

30 % of theses transportation costs have been assumed to be paid in foreign currency.

The results are summarized in tables 54 to 58

Table 30

PVC pipes production 900 tons/year

Estimation of the investment

	Plant erected in Senegal		Plant erected in Mali	
<u>Process units</u>	150 000		150 000	
Utilities				
Electric power supply and distribution	4 000		4 000	
Cooling water system	18 000		18 000	
Compressed air production and distribution, inert gas distribution, miscellaneous	4 000		4 000	
Off sites facilities, buildings	30 000		30 000	
Total cost of plant erected in Europe	206 000		206 000	
Total cost of plant erected in [illegible]		248 000		249 000
Interests during construction		17 000		17 000
Contingencies		17 000		17 000
Start up expenses		40 000		40 000
Spare parts		2 000		2 000
Total investment		309 000		325 000
Working capital		29 000		32 000

Table 31

PVC pipes production 900 tons/year

Utilities requirements

Utility	Unit	Process units	Utilities production and distribution. Off sites	Total requirements
Electric power	10^3 Kwh/y	264	30	294
Cooling water	10^3 M^3/y	80	5	85

Table 32

Utilities purchased outside the plant

Utility	Unit	Quantity
Electric power	10^3 Kwh/year	294
Water make up	10^3 M^3/year	8

Table 33

PVC pipes production 900 tons/year

Man power requirements

	Men
Engineers	1
Foremen	4
Employees	2
Skilled manpower	16
Unskilled manpower	20

Table 54

PVC pipes production 900 tons/year

Estimation of the operating cost

	$/year			
	Plant erected in Senegal		Plant erected in Mali	
Variable charges				
Utilities				
Electric power	8 800		14 700	
Water make up	100		100	
TOTAL	8 900		14 800	
Manpower				
Engineers	20 000		20 000	
Foremen	8 000		6 000	
Employees	2 600		2 200	
Skilled workers	20 800		17 600	
Unskilled workers	16 100		12 900	
Subtotal	67 500		58 700	
Supervision	16 900		14 700	
TOTAL	84 400		73 400	
TOTAL VARIABLE CHARGES		93 300		88 200
Fixed charges				
Amortization	31 900		32 300	
Interests on the borrowed capital	6 400		6 300	
General plant and overhead expenses	6 400		6 300	
Insurances and taxes	3 200		3 300	
Maintenance	9 600		9 800	
Interests on the working capital	2 000		2 300	
TOTAL FIXED CHARGES		59 500		60 800
OPERATING COST		152 800		149 000

Table 55

PVC pipes production 900 tons/year

Manufacturing cost

US $/ton

	Plant erected in Senegal	Plant erected in Mali
Rigid PVC compounds		
930 tons at $ 294/ton	273 400	
930 tons at $ 318/ton		295 700
Operating cost	152 800	149 000
Manufacturing cost	426 200	444 700

Table 56

PVC pipes production 900 tons/year

Profitability calculations

US $

	Plant erected in Senegal	Plant erected in Mali
Sales of products		
900 tons/year at an average price of $ 540/ton	486 000	
900 tons/year at an average price of $ 590/ton		531 000
Manufacturing cost	426 200	444 700
Gross profit	59 800	86 300
Cash flow	98 700	180 000
Pay out time (without taxes) years	3.5	2.0

Table [illegible]

PVC pipes production [illegible] tons/year

Plant erected in Senegal

Foreign currency balance

Investment to be paid in foreign currency	US $ [illegible]	
Yearly foreign currency balance at country level		
Credit		
PVC pipes		[illegible] 000
Debit		
Raw materials	[illegible]	
Variable charges		
Utilities	6 [illegible]	
Catalysts and Chemicals	-	
Total variable charges	6 [illegible]	
Fixed charges		
Interest on borrowed capital	[illegible]	
Interest on working capital	[illegible]	
Maintenance	6 [illegible]	
Insurance	[illegible]	
Total fixed charges	17 [illegible]	
TOTAL DEBIT		[illegible]
YEARLY BALANCE		[illegible]

Table 36

PVC pipes production 900 tons/year
Plant erected in Mali

Foreign currency balance

Investment to be paid in foreign currency		US $ [illegible]
Yearly foreign currency balance at country level		
Credit		
PVC pipes		58 730
Debit		
Raw materials	306 700	
Variable charges		
Utilities	10 400	
Catalysts and Chemicals	-	
Total variable charges	10 400	
Fixed charges		
Interest on borrowed capital	5 700	
Interest on working capital	1 200	
Maintenance	9 400	
General plant and overheads expenses	700	
Insurance	2 900	
Total fixed charges	[illegible]	
TOTAL DEBIT		[illegible]
YEARLY BALANCE		[illegible]

IV.5. Polyethylene bags production

IV.5.1. Location of the plant

The plant is located in Dakar, Senegal. (See paragraph 1.2.1.).

IV.5.2. Quality of products. Capacity of production

The plant produces heavy duty bags, made of imported low density polyethylene. The thickness of these bags is 200 μ. Each bag weights 220 gr. The total capacity of production is 836 tons/year 3 800 000 bags/year.

IV.5.3. Date of start up

Three plants identical to the one described in this chapter will be needed up to 1980.

1 starting up in 1974 and working at full capacity in 1975

1 starting up in 1977 and working at full capacity in 1978

1 starting in 1979 and working at full capacity in 1980.

Some economy will be realized installing the three blow extrusion lines in the same factory ; this advantage is not of prime importance.

IV.5.4. Main characteristics of the equipment

The bags are produced by blow extrusion.

The material consists of :

1 extruder screw diameter 100 mm with heads

1 regulating and operating box

1 operating box for the motor

1 compressed air generation and diffusion system

1 chill roll cooling system to cool the film after extrusion.

[illegible] drawing line with [illegible] rolls and heating equipment.

Auxiliary equipment for welding, printing ([illegible] colours) handling.

IV.[illegible]. Main characteristics of the utility equipment

IV.[illegible]. Utility requirements

Table [illegible] gives the main utility requirements of the process equipment.

Table [illegible]

Main utility requirements of the process equipment

Utility	Unit	Requirements
Power	kWh/h	[illegible]
Cooling water [illegible]°C (at [illegible]°C)	m^3/h	[illegible]
Compressed air ([illegible] kg/cm^2)	-	[illegible]

IV.[illegible]. Power supply and distribution

The electric power needed in the factory is supplied by the public grid at [illegible] kV cables.

The distribution is performed at [illegible] levels :

[illegible] volts

[illegible] volts (for safety, lighting and control instrumentation) [illegible] Cooling water system

The system is a circulating one, with cooling tower.
The make up needed is town water

[illegible] Compressed air supply

Compressed air is produced in the plant.

[illegible] Off site facilities, buildings

Site area includes :

- Safety and fire fighting system
- Warehouses [illegible] of polyethylene and bags, according to 1 month of production

[illegible] Economic study

The profitability of the heavy duty bags production and the yearly foreign currency balance resulting from the installation of [illegible] unit in Senegal are been determined.

Tables [illegible] to [illegible] give the elements of the operating cost.

The profitability calculations and the foreign currency balance are indicated in tables [illegible] to [illegible].

The calculations are performed according to the hypotheses given in chapters II and III.

The results are summarized in tables [illegible] to [illegible].

Table [illegible]

Polyethylene bags production [illegible] tons/year

Estimation of the Investment

US $

Process units	[illegible]	
Utilities:		
Electric power supply and distribution	[illegible]	
Cooling water system	[illegible]	
Compressed air production and distribution, inert gas distribution, miscellaneous	[illegible]	
Off site facilities, buildings	[illegible]	
Total cost of plant erected in Europe	[illegible]	
Total cost of plant erected in Senegal		[illegible]
Interests during construction		[illegible]
Contingencies		[illegible]
Start up expenses		[illegible]
Spare parts		[illegible]
Total investment		[illegible]
Working capital		[illegible]

Table [illegible]

Polypropylene bags production [illegible] tons/year

Utilities requirements

Utility	Unit	Process units	Utilities production and distribution. Off sites	Total requirement
Electric power	[illegible]	[illegible]	[illegible]	[illegible]
Cooling water	[illegible]	[illegible]	[illegible]	[illegible]

Table [illegible]

Utilities purchased outside the plant

Utility	Unit	Quantity
Electric power	[illegible]	[illegible]
Water make up	[illegible]	[illegible]

Table [illegible]

Polypropylene bags production [illegible] tons/year

Man power requirements

	No.
Engineers	[illegible]
Foremen	[illegible]
Employees	[illegible]
Skilled occupations	[illegible]
Unskilled occupations	[illegible]

Table [illegible]

[illegible] production [illegible] tons/year

Estimation of the operating cost

	[illegible]	
Variable charges		
Utilities		
Electric power	[illegible]	
Water make up	[illegible]	
Total	[illegible]	
Personnel		
[illegible]	[illegible]	
[illegible]	[illegible]	
Engineers	[illegible]	
Skilled workers	[illegible]	
Unskilled workers	[illegible]	
Subtotal	[illegible]	
[illegible]	[illegible]	
Total	[illegible]	
Total variable charges		[illegible]
Fixed charges		
Depreciation	[illegible]	
Interests on the invested capital	[illegible]	
General plant and overhead expenses	[illegible]	
Insurances and taxes	[illegible]	
Maintenance	[illegible]	
Interests on the working capital	[illegible]	
Total fixed charges		[illegible]
Operating cost		[illegible]

Table [illegible]

Polyethylene bags production [illegible] tons/year
Manufacturing cost

	US $/year
Raw material	
[illegible]	[illegible]
Operating cost	[illegible]
Manufacturing costs	[illegible]

Table [illegible]

Polyethylene bags production [illegible] tons/year
[illegible]

	US $/year
Value of production	
[illegible]	[illegible]
Manufacturing costs	[illegible]
Gross profits	[illegible]
Cash flow	[illegible]
Pay out time [illegible] years	[illegible]

Table [illegible]

Polyethylene bags production for ...

Foreign currency balance

Investment to be paid in foreign currency	US $ per year	
Yearly foreign currency balance at country level		
Credit		
Polyethylene bags		[illegible]
Debit		
Raw materials		
polyethylene	[illegible]	
Variable charges		
Utilities	[illegible]	
Solvents and Chemicals	-	
Total variable charges	[illegible]	
Fixed charges		
Interest on invested capital	[illegible]	
Interest on working capital	[illegible]	
Maintenance	[illegible]	
General plant overhead expenses	[illegible]	
Insurance	[illegible]	
Total fixed charges	[illegible]	
Total debit		[illegible]
Yearly balance		[illegible]

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DIVISION ETUDES
INDUSTRIELLES

DEVELOPMENT OF THE PETROCHEMICAL AND PLASTICS INDUSTRY IN THE OERS MEMBER COUNTRIES

VOLUME IV

APPENDIX

C 31/[illegible]

January 1972

In this volume are gathered the minutes of the meetings held by the BELGIAN mission in the OEEC member countries.

[illegible]

of the [illegible] September [illegible]

Organization visited : [illegible]
Persons encountered : Mr. [illegible] in charge of [illegible] [illegible] and the [illegible] industry [illegible]

Mr. [illegible] informed of the [illegible] requirements in [illegible], proposed to help arrange appointments with the official [illegible].

These appointments were made with the following organizations

1) [illegible] - société [illegible] d'études et de promotion industrielle

2) [illegible] and [illegible] board

3) Planification board

4) Board of Industries

5) Statistical Office

[illegible]

[illegible]

[illegible] : [illegible]

[illegible] : [illegible]

1. [illegible]

[illegible]

1.1. [illegible]

[illegible]

1.2. [illegible]

[illegible]

2. [illegible]

[illegible]

Some products to be listed will be free of any customs duty when exchanged between the [illegible] countries ; quota will be determined. The list of these products will extend gradually.

The minimum and maximum prices will be fixed, taking into consideration production and transportation costs.

MINUTES OF THE MEETING

of the [illegible] September [illegible]

Organisation visited : CNEPI : centre national d'études et de promotion industrielle - Dakar - Sénégal.

Person contacted : Mr. [illegible] - Président directeur général

The following documents have been given by CNEPI and discussed between UNIDO Team and CNEPI :

- Etude de marché des produits dérivés du pétrole
- Coût des facteurs industriels au Sénégal

- Etude de marché des produits dérivés du pétrole

Numbers of data on past consumption of main petrochemical derivatives in Mali, Mauritania and Senegal and of some informations regarding the plastics, rubber, synthetic fibres, detergents and pesticides industries in the above mentioned countries.

- Coût des facteurs industriels au Sénégal

Presents the costs of the factors to be considered in calculating industrial costs, as well as some aspects of the legislation.

The points considered are the following :

- manpower costs
- electricity, water and petroleum products costs
- transportation
- financial charges
- taxes
- statute book of investments (Summary)

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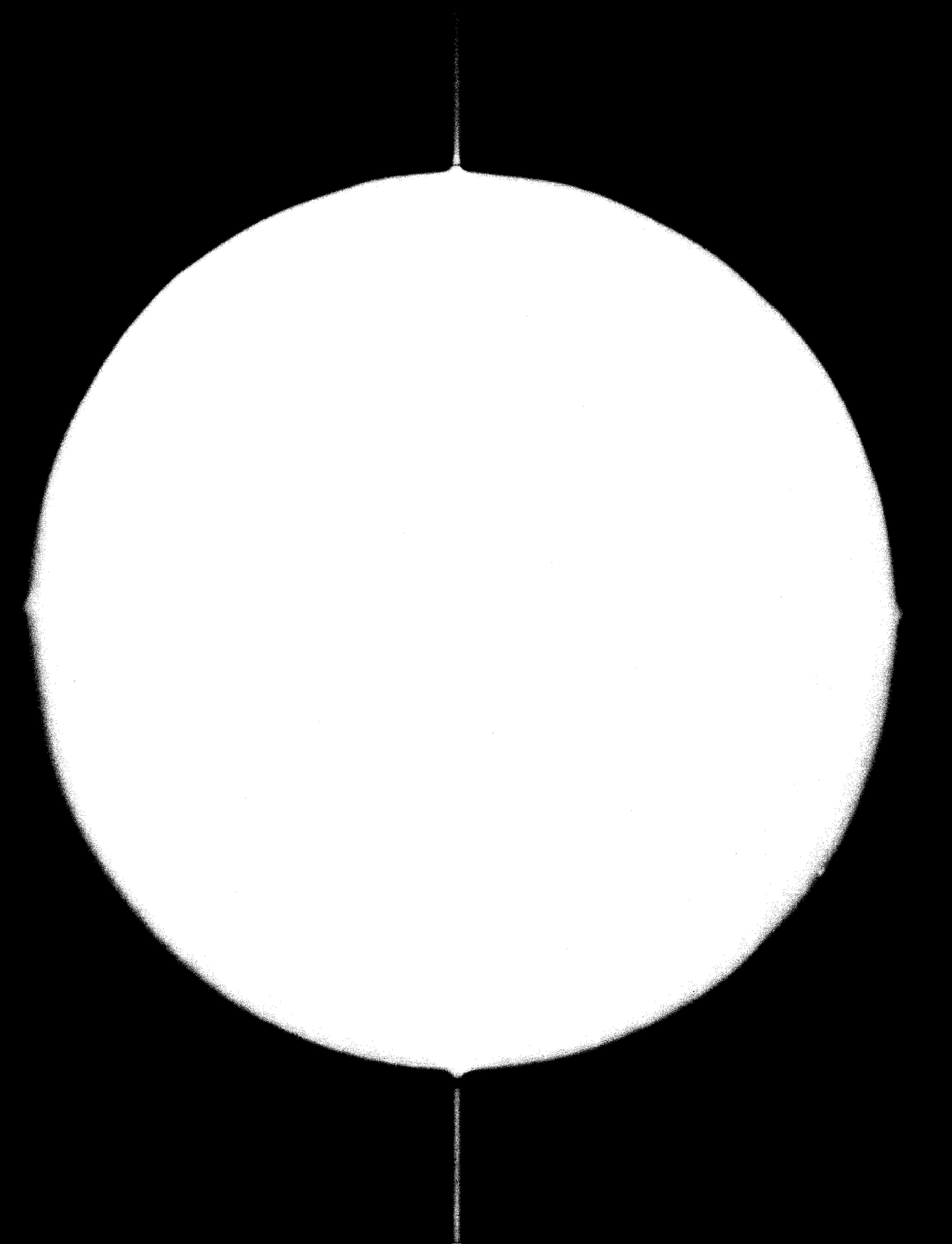

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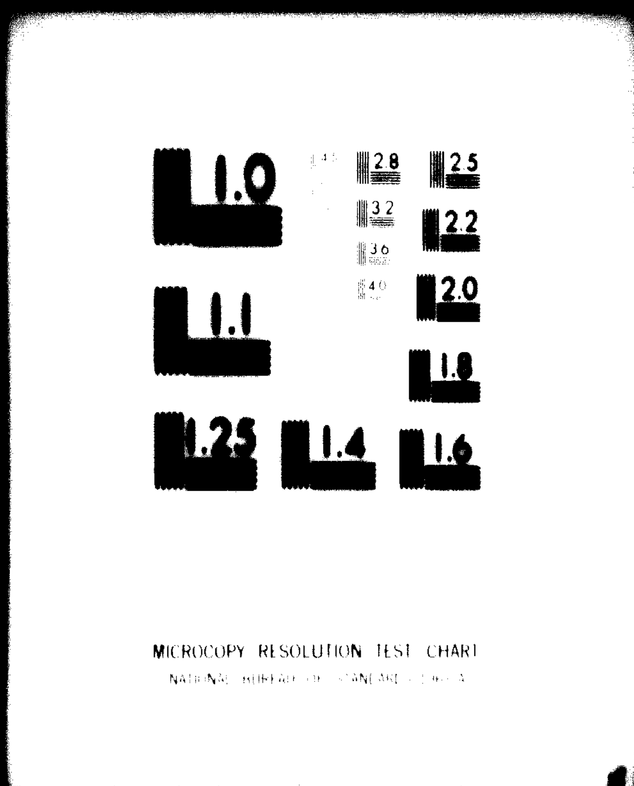
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Mr. ALEXANDRENE stressed the importance of the agricultural sector in the future development of plastics demand. The partial substitution of business men and civil servants for traditional farmers will involve a better equipment of the agricultural sector. Consequently, the use of plastics in this field should develop especially.

Mr. ALEXANDRENE pointed out the lack of technical training in the field of the plastics industry in Senegal. At present time, foremen working in this industry in Senegal are foreign. The establishment of a training centre on a regional basis (including OERS countries, Ivory Coast and "pays de l'entente") would be helpful.

MINUTES OF THE MEETING
of the 15th September 1971

Organization visited : Geology and Mine Board - DAKAR - SENEGAL -

Person encountered : The Director of the Geology and Mine Board

1. THE REFINING INDUSTRY IN SENEGAL

The S.A.R. - Société Africaine de Raffinage - refinery is located in M'BAO near Dakar. This refinery has a capacity of about 1 million tons of crude oil per year . At present time the quantity of processed crude is 600 - 700,000 tons. The output covers all domestic requirements for petroleum products, except for lubricants and aviation gasoline.

Some petroleum products are exported to the other OERS countries excluding Guinea.

2. THE LUBE INDUSTRY

The totality of the lube oils consumed in Senegal is imported and conditioned by Compagnie Senegalaise de Lubrifiants. Nominal capacity of C.S.L. (1) is 5 000 tons/year. Lubes are packaged in metal containers manufactured by FUMOA.

3. POSSIBILITY OF CONSTRUCTION IN SENEGAL

Civil works and building are generally handled by Senegalian companies.

Two Senegalian companies are able to perform works in the field of coppersmith's : CMA (Chaudronnerie Manutention Africaine), and ACMD (Ateliers et Chantiers Maritimes de Dakar).

(1) Total 50 % , Mobil and Shell 25 % each.

MINUTES OF THE MEETING

of the 16th September 1971

Organization visited : Planification Board - DAKAR - SENEGAL

Person encountered : Mr. DIOP, Head of Control Department
Miss CAUSSE, Assistant to Head of Control Department
Mr. MOSCHETTI Technical adviser

A copy of the Development Plan in Senegal 1969-1973 was given to the ONUDI team.

1. GROSS DOMESTIC PRODUCT (G.D.P.)

The Gross Domestic Product is expected to grow by 5.5. percent a year at constant value. This rate of growth has not been achieved for 1969-1970 ; but this objective is assumed to be reached.

2. AGRICULTURAL SECTOR

Agricultural is preponderant in the Gross Domestic Product ; its share is expected to remain constant in the coming years.

Important agricultural programs are under consideration :

- development of market gardening in the following areas : NIAYES (3000-4000 ha) THIES and the lakes region.
- watering by sprinkling of the banana plantations of the CASAMANCE Valley
- implantation of an agroindustrial complex (sugar production in RICHARD-TOLL)

3. TEXTILE INDUSTRY

Spinning and weaving will be developed in Senegal in order to meet Senegalian requirements. Up to now there are no textile projects based on the export market outside OERS.

MINUTES OF MEETING

of the 16th September 1971

Organisation visited : SONEPI - DAKAR - SENEGAL-

Person encountered : Mr. MONTANDON - expert

1. FISCH PACKAGING

Mr MONTANDON expects a great development of the use of plastics (shrink films) for fish packaging :

- vacuum packaging of smoked fish consumed in Senegal in order to protect it from degradation
- packaging of frozen fish to be exported previously gutted at low cost in Senegal. In fact, the market of frozen expensive fish such as turbots, red mullets is expected to grow markedly in Europe and the U.S.

2. VEGETABLE AND FRUIT PACKAGING

There are some opportunities to develop the packaging of vegetables - for instance radishes inside plastic bags - and fruits :

- bananas up to now wrapped in kraft paper and protected by natural fibers
- pineapples put inside polystyrene foam shells. This packaging would be especially suitable for better quality fruits and should protect them from the damaging noticed at present time.

Possible applications of plastics in agriculture :

- wrapping of fruits on the trees in plastic films permeable to U V rays.
- covering of vegetables (tomatoes and flowers crop productions during the rainy season).
- shelters made of plastics for aviculture.

3. HOUSEHOLD APPLICATIONS

It should be noted that plastics application do not increase rapidly in Senegal. The reason seems to be the low quality (short life) of the first goods introduced in the market.

MINUTES OF THE MEETING

of the 17th September 1971

Company visited : S.I.M.P.A. – DAKAR - SENEGAL

Person encountered : Mr. GABE

Company created in 1958 - Plastics processing

Production : shoes, films, bags, household goods

1. EQUIPMENT

- 3 injection moulding machines for shoe manufacture ; capacity : 100 pairs (220-600g) per hour each.
- 4 injection moulding presses with a capacity of moulds of 1 Kg, 300 g, 150 g, 50 g.
- 4 SAMAFOR extruders, screw diameter: 45 mm (two), 65 mm, 90 mm. The last one is only for heavy duty bag production.
- welding and cutting machines

  . The moulds are imported

  . All this equipment works three shifts per day.

2. RAW MATERIALS

All the raw materials are imported.

The factory processes :

L D polyethylene	700 tons a year
H.D polyethylene	100 tons a year
P.V.C.	500 tons a year
Polystyrene	10 tons a year
Polypropylene	5 tons a year

3. MAIN PRODUCTS

- Heavy duty bags 300μ thick weighing 300 g each ; 1 million bags per year (300 tons)
- other bags 400 t a year
- shoes : 1 million pairs a year

4. MAIN CUSTOMERS

- SIES (fertiliser manufacture) 300 tons a year
- Printania (stores) 300 tons a year

5. PRICES

- Raw materials

	CIF	Delivered to factory
L.D polyethylene	$ 250/t	$ 310/t
H.D polyethylene	$ 350/t	$ 410/t
P.V.C.	$ 270/t	$ 325/t

Average freight rate from Europe to Dakar : $ 22/ton

- Products (average prices)

  Heavy duty bags $ 0.7/Kg

  Others bags $ 1.10/Kg

  Pairs of shoes $ 0.55

  Household goods $ 1.10/Kg (polyethylene)

6. UTILITIES

The factory consumes electricity and cooling water. Electric power cost is : $ 47/1000 KWH for 600 KVH. Cooling water used is town water at $ 0.15/M^3. This water is recirculated.

7. MANPOWER

123 men , of which foreign : 3

MINUTES OF THE MEETING

of the 18th September 1971

Company visited : P.E.S.(Plastiques et Elastomères du Sénégal)- DAKAR
Person encountered : Mr. LOREQUART

Company created in 1969 _ On stream in May 1971

Production : polyurethane flexible foams

Two other plants with the same importance are situated in ABIDJAN and DOUALA.

1. EQUIPMENT

- Mixing of components
- 5 high pressure (30-40 Kg/cm^2) metering pumps
- 1 head
- conveyor belt
- manufacture foam is cut by hot wire ; the cost of a cutting equipment is considered as too high
- Nominal capacity of the plant:100 tons a month (based on 175 hours)

2. RAW MATERIAL

- DESMODUR : toluene diisocyanate, naphtylene
- DESMOPHEN : polyethers and polyesters mixed
- current consumption of the above two main components : 15 tons a month (minimum economic scale output)
- activator, dyes

It should be noted that about 30 percent of the raw materials is lost during the processing.

3. MAIN PRODUCTS

- Flexible polyurethane foams in blocks 30 meter long and 0,7 meter thick Density 15-17 Kg/M^3
- Furthermore, these blocks are cut into suitable forms for the manufacture of mattresses and, in smaller quantities, cushions.
- Wastes of foam after cutting are recovered and flocked
- The manufacture of rigid foam is under consideration ; main outlets insulating materials to be used in both sectors of transport and building.

4. PRICES

- Raw materials

  Mix to be processed : $ 1,270/ton

- Products (average prices)

  flexible foam for mattresses : $ 1.65/Kg
  Waste foam (flocks) about $ 0.65/Kg

5. MANPOWER

6 men

MINUTES OF THE MEETING

of the 20th September 1971

Company visited : BATA - RUFISQUE - SENEGAL

Persons met : MM. BUENO, POULET

Company created in 1940 - Tannery, manufacture of shoes made of leather, rubber and plastic.

1, EQUIPMENT (plastics processing)

- 4 injection moulding machines for shoe manufacture. Total capacity 3,600,000 pairs a year. Each machine is able to produce between 90 and 160 pairs of shoes per hour. These 4 machines were built by BATA (Vernon-France)
- 2 small injection moulding machines for ornament manufacture.
- compounding equipments
  - . The moulds are imported
  - . This equipment works 24 hours per day (4 shifts, 6 hours each)

2. RAW MATERIALS

- All the raw materials are imported. The factory processes 1 100 tons of PVC compound, containing 40 percent of resin and 45 percent of plasticiser.
- small quantities of polyethylene and nylon are consumed for ornament manufacture.
- Rubber : natural, 70 t per year (imported from Ivory Coast) ; synthetic, chiefly SBR, 56 t per year (imported from Europe)

3. PLASTICS PRODUCTS

- Various types of shoes are produced :

production in the last years has been as follows :

Years	1969	1970	1971(est.)
plastic shoes (pairs)	1,920,000	2,100,000	2,300,000

- The production meets the needs of Senegal ; a small part is exported to Mauritania.

4. PRICES

- Raw materials
  The prices are quite variable and heavily depend on packaging
  Average freight rate from Europe to Dakar $ 13/ton

- Products
  Pair of shoes (average) $ 0.60

5. UTILITIES

- The factory consumes electricity and cooling water
- The cost of electric power is $ 45/1000 KWH for 2500 KVA
- Cooling water used is town water at $ 0.25/m^3 . This water is recirculated.

6. MANPOWER

- 970 men, of which foreign : 20
- Technical courses are organised in the factory
- Training is provided by BATA group

7. GENERAL INFORMATION ON PLASTIC SHOE MARKET

- The plastic shoe consumption in Senegal is estimated at an average 1.2 pairs of shoes per inhabitant and per year.
- The sales of plastic shoes are mainly determined by variations in the standard of living, which in turn is closely dependent on crops. During the years with good climatic conditions, the standard of living rises and a part of plastic shoes is replaced by more expensive rubber and leather shoes.

MINUTES OF THE MEETING

of the 21th September 1971

Company visisted : OPAM (Office des Produits Agricole du MALI) BAMAKO-MALI

Persons met : MM YORODIALLO, BADRA

OPAM is in charge of the conditioning, storage and distribution of agricultural products of Mali, except for groundnuts , cotton, and the products of the Office of Niger.

1. DISTRIBUTION AND PACKAGING OF CEREALS

The main cereals distributed are sorghum, rice, paddy. At present time, 18,000t of sorghum and 13,000t of rice per year are shipped to GAO area. More than 20,000t of cereals are sent to BAMAKO. All these cereals must be packed in sacks. Furthermore, due to the lack of storage equipment, autoconsumption has also to be packed.

The current needs of sacks amount to 500-600,000 pieces per year. The sacks presently used are imported sacks made of jute. Each of them holds 100Kg and weights1Kg. The price is $ 0.65 per sack. Each sack is reused three times as an average.

The OPAM would prefer to use sacks holding 50Kgs each in order to make the handling easier.

The other main consumers of sacks in Mali are SOMIEX to pack groundnuts and the Office du Niger to pack paddy. There is a project for the manufacture of 3 million sacks in Mali. Part of these sacks would be made of dah ; the remainder would be made of imported polypropylene strips - 2 500t at the beginning of the production. The share of sacks made of dah would increase with the quantity of dah produced in Mali. Presently, this production is 500 t per year.

It should be noticed that dah and polypropylene strips will be woven by the same machine.

2. DISTRIBUTION AND PACKAGING OF FRUITS AND VEGETABLES

The main fruits and vegetables distributed are mangoes, melons, pimentos.

These products are exported to Europe by plane and to Dakar and Abidjan by railway and road.

At present time, 150 to 200 t are exported to Europe and 100 t to Dakar and Abidjan.

The exports to Europe are expected to reach 500 t in 71/72.

These products are packed in cardboard boxes and in wooden packing cases imported. Annual consumptions are respectively 110.000 and 10.000 pieces.

The cardboard boxes holding 6 kg and 10 Kg cost $ 0.32 to $ 0.57.

MINUTES OF THE MEETING

of the 21st, 23rd and 24th September 1971

Organization visited : Direction des Industries BAMAKO, MALI

Person encountered : Mr. KHADER

Mr KHADER gave the ONUDI team the list of industrial installations (and projects) and the Investement Code.

The following precisions are obtained :

1. INDUSTRIAL INSTALLATIONS AND PROJECTS

- MALI PLASTIQUE is the only plastics processor in Mali. This company has a project of bottle manufacture.
- Another company manufacturing vinegar has submitted a similar project.
- There is a program approved by the Governement for the manufacture of bags made of dah in Mali.
  The factory will produce canvasses, ropes and strings - 2,630t of dah will be used.
- There is a long term project of complex fertilisers manufacture. The output would be 15,000t per year.
  The implementation of such a production depends on the erection of the Guina Dam on the Senegal river and on the production of low cost electricity (about 0.5. ¢/KWH)
- The Comptoir Franco-Guinéen is only a transit company ; its project of textile manufacture in Mali has been refused by the Malian Governement
- BATA submitted a dossier about shoes manufacture refused by Malian Governement in order to avoid competition with the local leather industry.

2. INVESTMENT CODE

There are three classes of industry in Mali:

- ordinary class corresponding to investments under $ 110,000. Such industries are exempted from customs duties on equipment for six months.
  Furthermore, the general Code of taxes exempts them from paying taxes on benefits for five years.

- common class corresponding to investments in the range of $ 110,000 to $ 1,100,000. Such industries are exempted from customs duties, on equipment and raw materials for ten years. They are exempted from the taxes on benefits for five years.

- privileged class corresponding to investments over $ 1,100,000
  They have the same advantages as the industries in the common class. Furthermore, they have the guarantee that their taxation will remain fixed, even in the case of prices increase. They can profit by low cost of energy : about ¢ 6 par KWH.
  The Governement guarantees the payment of the loans granted to these industries.

3. OTHER LOCAL CONDITIONS

- Utilities

Industrial electricity is distributed by high voltage lines in BAMAKO
A transformer can be rented from "Electricité du Mali". The cost of electricity including taxes is : ¢ 7/KWH.
Water costs ¢ 14/m^3 in the BAMAKO area.

- Manpower

The following table gives the order of magnitude of salaries in Mali.

chief of production	$ 90 per month
foreman	$ 75 per month
specialist	$ 85 per month
skilled worker	$ 60 per month

worker	$ 25
helper	$ 15

Considering holidays, social charges, and taxes, the total charges to be paid by the company amount to 25 percent of the salaries.

MINUTES OF THE MEETING

of the 23rd September 1971

Organisation visited : UNICOOP (Union Nationale des Coop.) BAMAKO-MALI
Person encountered : Mr. AMANOU TRAOURE

UNICOOP is a public company in charge of the importation and distribution of some products in MALI. UNICOOP has 2 distribution stores in BAMAKO and SIKASSO.

The main products commercialized by UNICOOP are the following :

- building materials
- hardware
- household goods
- vehicles

As far as plastics household goods are concerned, UNICOOP has not imported since 1969. The stocks are not exhausted.

The total quantity of products imported by UNICOOP is 100-200t per year. These products come from Dakar and Abidjan.

MINUTES OF THE MEETING

of the 24th September 1971

Company visited : MALIPLASTIQUE - BAMAKO - MALI
Person encountered : Mr THIAIS

Company created in 1965 - Plastics processing
Main products : shoes, bottles, hose, monofilaments.

1. EQUIPMENT

- 6 injection moulding machines mainly for shoe manufacture.
  Total capacity : pairs per hour 630
- 1 blow moulding extruder for bottle manufacture
  Capacity per hour 450
- 1 blow moulding extruder for film manufacture (just installed)
  screw diameter : 40 mm
  output from 2 to 9 Kg per hour.
- 2 extruders for hose manufacture
- the moulds are imported
- this equipment is used 16 hours per day.

2. RAW MATERIALS

All the raw materials are imported.

The factory processes 20t of PVC compound per month. All the raw materials are transported from Europe to Abidjan by boats and from Abidjan to Bamako by trucks.

The PVC compound is wrapped into three bags : polyethylene film, bituminous paper and jute.

The jute bags are reusable for packaging the products of the factory.

3. PRODUCTS

The production of the factory is :

- bottles 300,000 per year weighing 35 g each
- shoes : about 2,000 pairs per day weighing 0,4Kg each as an average
- flexible hoses 20,000 metres/year, mainly 18-23mm
- PVC monofilaments 5 tons per month

The production of polyethylene films (1) and rigid PVC tubing for electric wires will begin this year.

4. MAIN CUSTOMERS

The shoes are distributed by three dealers. The main customers of bottles is the edible oil manufactures of KOULIKORO.

5. PRICES

- Raw materials
  PVC compound ₵ 0.53 Kg ex factory France (5-10 t delivery)

(1) Width 40cm ; adviseable thickness from 20 to 200 microns.

Transportation cost from factory (France) to Abidjan : $ 18 per ton.

- LD polyethylene $ 0.32/Kg CIF ABIDJAN
- GARBEL $ 0.40/Kg CIF ABIDJAN
- Products
  . PVC bottles ¢ 8 each
  . Shoes $ 1 per Kg (factory)

6. UTILITIES

The factory consumes electricity and cooling water.

The average cost of electricity is ¢ 8.0 per KWH for 52 KVA. The production of electricity is not allowed.

Cooling water : the price is ¢ 10 per m^3
Facilities for recirculation are under construction.

7. MANPOWER

50 workers - 2 foreigners

8. GENERAL INFORMATION CONCERNING THE MARKET

The national production of plastics goods must compete with illicit imports from Ghana (shoes)

In the field of household goods, the local production has even been stopped by such a competition.

9. TRANSPORTATION OF EQUIPMENT

The production equipment has been transported by boat from Europe to Abidjan and by trucks from Abidjan to Bamako. Transport cost from Paris to Abidjan of a machine for shoe manufacture weighing 9 tons has been in 1970 about $ 1,100.

The breakdown of this cost is :

Transportation PARIS-MARSEILLES	$ 240
Maritime freight	$ 570
Insurances	$ 130
Transhipment cost, miscellaneous	$ 160

MINUTES OF THE MEETING

of the 24th September 1971

Organisation visited : SOMIEX - BAMAKO - MALI

Person encountered : Mr MOUSSA

SOMIEX is the largest public company in charge of the importation and the distillation of several products in Mali. SOMIEX has 49 distribution stores in the country.

1. MAIN PRODUCTS COMMERCIALIZED

The main products imported and distributed by SOMIEX are :

- Sugar : 30,000t per year of which 5-6,000t as powder
  - . sugar in powder is packed in cotton bags
  - . sugar in loafs is packed in jute or sisal bags
  - . sugar in lumps is packed in cardboard boxes
- Salt : 18-20,000t per year
  - . salt was formely packed in jute bags. Now it is packed in polyethylene films
- Flour : 9,000t per year - packed in cotton bags
- Edible oil : 2,500t packed in metal barrels
- Tea : 800t per year in wooden boxes with inner lining of polyethylene film
- Cement 50,000t per year imported before start up of the local factory ; now entirely produced in Mali. Packed in kraft paper bags.

2. ACTIVITY IN THE PLASTICS FIELD

Before the start up of the factory of MALI PLASTIQUE, SOMIEX imported plastic goods, mainly household goods and shoes. The production of MALI PLASTIQUE is not commercialized by SOMIEX. This fact and the illicit imports of plastics products from Ghana led SOMIEX to cease their activity in the plastics field since 1966.

3. BAGGING

SOMIEX has the monopoly of the importation and distribution of bags in Mali.

The present total needs are estimated at 1,400,000 bags per year (total value $ 550,000)of which 250-300,000 in sisal .

The total needs of the"Office du Niger" are 140,000 bags.

The jute bags are imported from India and Pakistan.

4. ACTIVITY OF SOMIEX IN PACKAGING

SOMIEX distributed the imported products in their original packaging.

The company replaces only the damaged bags. The main deterioration occurs in the case of cement bags. Recently a lot of 20,000 paper bags was brought at ¢ 9 per bag CIF Dakar.

5. TRANSPORTATION

60 percent of the imported products comes from Dakar by railway ; 40 percent of the imported products comes from Abidjan by railway up to Wrangolo, and then by trucks.

The transportation costs from Dakar to Bamako and from Abidjan to Bamako are about the same. This is due to the saturation of railway traffic between Dakar and Bamako. The duration and the cost of the warehousing are high. The time of delivery from Dakar to Bamako is presently three to four weeks.

MINUTES OF THE MEETING

of the 24th September 1971

Company visited : MALILAIT - BAMAKO - MALI

Person encountered: Mr TRAORE

MALILAIT is engaged in the collection and processing of milk and in the distribution of dairy products in the Bamako area.

1. PRODUCTION

- Pasteurised milk. Presently 3,500 litres per day. Possible expansion to 20,000 l according to market needs.
- Rennet : 1000 litres/ d for next year
- Yogurt : 500 pots per day - 125cc each
- Green cheese 500 pots - 200g each
- Ice cream : 1000 pots per day 10 and 20 cl each. The production would reach 200 per day next year.
- Butter : 400 boxes per day - 250g each
- MALILAIT is considering the production of cream.

2. PACKAGING

- Pasteurized milk is packed in small bags containing: 1 litre, 1/21, or 1/4 l eacn. These bags made of polyethylene film are rectangular.

  There are 2 filling machines ; one uses bags imported from Abidjan and made by ALLIBERT the other one manufactures itself the bag from polyethylene film imported from Abidjan (ALLIBERT)

The problems occuring when using bags are :

- the possible contamination of the milk by oozing ink
- the bad protection against UV rays during the hot season
- Yogurt

  Yogurt are packed in polystyrene pots imported from Abidjan (ALLIBERT). Losses are important : 15-20 percent of the total. The reason is that these pots do not resist strongly when filled by product at 45°C.

- Green cheese and ice cream
  They are packed in polystyrene pots
- Butter
  Butter is sold in polystyrene boxes

3. PRICES OF PACKAGING

- small bags for milk, delivered BAMAKO

  1 l = ₵ 0.8

  1/2 l = ₵ 0.6

  1/4 l = ₵ 0.4

- small pots for ice cream

  20 cl = ₵ 2.0

  10 cl = ₵ 1.5

- The price of the polyethylene is not known as yet because the production of the corresponding machine has not reached industrial scale.

4. FUTURE EXPANSION OF THE FACTORY

The future expansions of the factory will be done with the same type of packaging in view.

Plastic bottle use is not taken into consideration because of its high price

5. NATIONAL MARKET OF DAIRY PRODUCTS

A new centre will be installed in SEGOU (250 Km from Bamako). The production would be 1,500 l of milk per day.

In the other areas of MALI the manufacture of concentrated or powdered milk will be preferably considered.

The total market of MALI for butter is presently estimated at 120 tons per year.

MINUTES OF THE MEETING

of the 27th September 1971

Company visited : F.A.P. - DAKAR - SENEGAL

Person encountered : Mr. M. ALASSANE

Company created in 1968 - Plastics processing
Production : shoes, household goods, handles and corners for suitcases, toys, combs.

1. EQUIPMENT

- 2 injection moulding machines :
  - 1 ECKERT ZIEGLER 250 g per shot
  - 1 BILLION 150 g per shot
- 1 injection blow moulding machine BILLION
- 1 injection moulding machine for shoe manufacture with 10 mould holders - Capacity 400-450,000 pairs per year
- Another similar machine will soon be installed, with the same capacity
- The moulds are imported
- All this equipment works three shifts per day

2. RAW MATERIALS

All the raw materials are imported. The factory processes :

LD and HD polyethylene	: 60 tons per year
Polystyrene	: 60 tons per year
Polypropylene	: 10 tons per year

The PVC compound for shoe manufacture has been processed for six months - Quantity to be processed at full capacity 200-300 tons - K value : 70 (before it was 60-65).

3. **MAIN PRODUCTS**

The main products manufactured are household goods and shoes

4. **PRICES**

Raw materials

LD polyethylene	$ 250 per ton CIF DAKAR - Sold by Hoechst
HD polyethylene	$ 370 per ton CIF DAKAR - Sold by Hoechst
High impact polystyrene	$ 370 per ton CIF DAKAR - Sold by Hoechst
Standard polystyrene	$ 280 per ton CIF DAKAR - Sold by Hoechst
PVC compound	$ 390 per ton CIF DAKAR - Sold by HUls
Polypropylene	$ 470 per ton CIF DAKAR - Sold by HUls

Shoes
- large size $ 0.55 ex factory
- small size $ 0.4

Household goods : $ 1.1 to $ 1.3 per kg ex factory (ex blend LD and HD polyethylene : 50/50)

5. **UTILITIES**

The factory consumes electricity and cooling water. Electricity is bought at 6600 V. The factory has its own transformer 160 KVA (100 used). The price of electricity is $ 40 per 1000 KWH. If bought at 220 V, the price would be $ 100 per 1000 KWH.
Cooling water used is town water at $ 0.22 per cubic metre. This water is recirculated.

6. **MANPOWER**

10 permanent workers excluding supervision
12 non permanent workers

7. **GENERAL INFORMATION ON MARKETS**

Although plastic shoe consumption has reached a rather high level in Senegal - 1.3 pair/year per inhabitant as an average - a large development is expected in this field - 2 to 3 per inhabitant - due to the low prices of such products and to the change of fashion.

At present, plastic household goods hardly compete with hardware. But they have a better future.

The products of the factory are mainly consumed in Senegal. A small share is directly exported to Abidjan ; another small share is exported through the dealers in Mauritania.

Household goods and plastic shoes have to compete with the products imported tax free from Abidjan.

6. MISCELLANEOUS

The following taxes apply to imported materials :

- fiscal duty : 5 percent
- duty for statistics : 4 percent
- contractual tax : 2.1 percent
- taxe on added value : 13.5. This is recovered by deducting it from the 9 percent tax on added value on the product

The taxes on imported equipment - except for moulds-amount to 30 percent (13.5 percent being recovered). The taxes on imported moulds are about 53 percent (13.5 percent being recovered).

The cost of transportation of a 6 tons machine from Marseilles to Dakar amounted to $ 550 in 1970.

MINUTES OF THE MEETING

of the 28th September 1971

Company visited : SAPROLAIT - DAKAR - SENEGAL

Person encountered : Mr. BAREILLES

SAPROLAIT created in 1950 is engaged in the processing of milk, the packaging and the distribution of dairy products, mainly in the DAKAR area.

1. PRODUCTION

- Pasteurized and sterilized milksmainly made from imported powdered milk (1). Quantities depend on seasons : 10,000 l per day as an average. The works is able to process 100,000 l of milk.
- Yogurt
- Cheeses
- Milk sweets
- There is not production of butter
- The factory works either 10 hours or 16 houes per day, according to the seasons and to the needs of the market.

2. PACKAGING

- Milk

The pasteurized and the sterilized milksare both packed in various containers : glass and plastic bottles, plastic bags, wax coated paper boxes - according to the demand of the market.

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(1) However small quantities of milk are bought on the local market at ₵ 15 per l.

Plastic packaging consists of polyethylene bottles and small bags made from imported polyethylene film.

Capacity of these packages : 1 l, 1/2 l or 1/4 l
Weight of polyethylene bottles : 1 l : 42 g ; 1/2 l : 25 g.

- Yogurts and other dairy products

  They are mainly packed in thermoformed polystyrene pots

- In the field of packaging, SAPROLAIT is considering the manufacture of various hollow articles such as mineral oil cans, and others containers e.g. jerry cans if the needs of market are important enough to economically justify this type of production. For example, the mould for 5 l jerry can manufacture costs $ 5500.

3. PACKAGING EQUIPMENT

- 3 blow moulding extruders - BM 40 BM 02 - Screw diameter Ø 40 mm

- All this equipment is able to produce :

  . either 6000 PVC or LD polyethylene bottles per hour
  . or 4000 HD polyethylene bottles per hour

4. RAW MATERIALS FOR PACKAGING

All the raw materials are imported (EEC countries) - 10 tons delivery. The factory processes :

- LD and HD polyethylene	400-600 kg per day	(150 t per year)
. polystyrene, PVC	200 kg per day	(60 t per year)

- LD and HD polyethylene are used as blend 50/50 for bottle manufacture.

5. PRICES OF PACKAGING

1 l polyethylene bottle ₵ 7
1/2 l polyethylene bottle ₵ 5
1/4 l polyethylene bottle ₵ 3.5

Milk is sold ₵ 30 per litre in retail shops ; 3.5 ₵ less when sold in film bags.

6. UTILITIES

- The factory consumes electricity and cooling water (7-10 litres for 1 l. of processed milk)
- The cost of utilities is said about 20 percent higher than indicated in "Coût des facteurs au Sénégal - SONEPI"
- Electricity is partially bought at 6600 V costing $ 38 per 1000 kWh, partially bought at 220 V costing $ 58 per 1000 kWh (Electric power : higher than 500 kWh)
- Cooling water used is town water at $ 0.25 per cubic meter. This water is recirculated.

7. MANPOWER

- 100 men of which 15 employed in packaging activity
- foreign : 6
- current salary of a unskilled worker $ 55-70 per month
  current salary of a foreman worker $ 150-160 per month

8. MARKET OF DAIRY PRODUCTS

Generally speaking, concentrated or powdered milk - imported or locally produced - heavily competes with the milk sold in bottles. Condensated milk is sold for instance ₵ 23 (for 1 l of reconstituted milk).

Furthermore concentrated and powdered milks have good consumer acceptance.

Nevertheless a development of demand of milk in bottles can be expected on the local market.

On the export market too - mainly Ivory Coast, Mauritania and Cameroun - a development of the sales is expected. These exports seem hindered to some extent by the duty on export : 5.75 percent ad valorem.

MINUTES OF THE MEETING

of the 29th September 1971

Company visited : **WEHBE - DAKAR - SENEGAL**

Person encountered : **Mr. WEHBE**

WEHBE (created in 1950) is mainly engaged in the manufacture, the packaging and the distribution of biscuits, and the distribution of various food-stuffs : soft drinks and sweets.

1. PACKAGING

- The biscuit production, previously packed in Kraft paper bags is now all packed in polyethylene bags. The latter method gives a better barrier against moisture and wastes; prices are about the same as for paper bags.

- The manufactured biscuits are packed in small bags of polyethylene films. These small bags are packed in large bags containing 20 kg of biscuits. All these bags are manufactured by the company from imported polyethylene.

- Another packages are considered for the wrapping of new assortiments of biscuits : for instance, thermoformed polystyrene, cellophan or polyethylene film.

- About 1/3 of polyethylene bags production is sold to some local customers for the packaging of flour, powdered sugar, salt, grinded coffee, pesticides.

- A big development of the needs of polyethylene bags is expected, related with the next development of the biscuits production (2,600 tons in 1970). In fact, the capacity of biscuits production is going to treble.

2. PRICES OF PACKAGING

. $ 0.75 per kg for small bags (thickness 100 μ or less)
. $ 0.12 a bag containing 20 kg of biscuits (thickness 150 μ)

By comparison :

¢ 0.4 for a paper bag containing 250 g
¢ 2.0 for a paper bag containing 2 kg

3. PACKAGING EQUIPMENT

- 1 blow moulding extruder - Screw diameter ø 85 mm
- Another is to be bought (for small packaging only) - Screw diameter ø 40
- Equipment for bag printing (4 colours)
- Packaging is automated

4. RAW MATERIALS (for packaging film)

- Quantity
  Only LD and HD polyethylene are used for packaging in the plant.

- 360 tons of polyethylene were used in the plant (in 1970) of which 2/3 of LD polyethylene, 1/3 hd polyethylene - HD polyethylene gives a better resistance to tearing

- Prices
  . HD polyethylene ¢ 35 per kg
  . LD polyethylene ¢ 33 per kg
  . Delivery to the factory by 20, 50, or even 100 tons lots

5. UTILITIES

Electricity
- for peak hours $ 38 per 1000 kWh
- for regular consumption hours $ 35 per 1000 kWh
- power consumption 40.000 kWh per month

Water
- ¢ 13 per cubic meter

6. GENERAL INFORMATION ON MARKETS

- Almost all the biscuit production of the factory is sold on the local market. However, some quantities are sold in neighbouring countries : Mauritania and Mali.
  Duty on biscuit exports is reportedly hindering the development of such exports.

- A development of the sales of plastic bags to the other customers out of the factory is expected.

7. MANPOWER

250 people of which 35 in the packaging activity.

MINUTES OF THE MEETING

of the 29th September 1971

Company visited : SEIB - DAKAR - SENEGAL

Person encountered : Mr. BOULANGER

The company was created in 1921, initially to produce electricity in DIOURBEL. Later, SEIB manufactured edible oil, vinegar, bleaching liquid. The activity of the company in the plastics field began in 1967, by the manufacture of bottles for packing their production. The production is located in DIOURBEL.

1. **EQUIPMENT** (For Plastics activity)

   2 Blow moulding extruders Cotel et Fouche
   Capacity about 3,000,000 bottles per year each. This equipment works 3 shifts per day, 6 or 7 days per week.

2. **RAW MATERIALS**

   The raw materials used are HD and LD polyethylene :
   50 tons/year HD polyethylene, 100 tons/year LD polyethylene.

3. **PRODUCTS**

   The total production is 4,500,000-5,000,000 bottles per year plus some winchesters. The bottles for vinegar contain 90 cl. They are made of LD polyethylene. The bottles for edible oil contain 1 l. They are made of a mixture of LD and HD polyethylene. The bottles for bleaching liquid contain 90 cl. They are made of HD polyethylene.

4. **UTILITIES**

   The factory produces its own electricity and still provides the city of DIOURBEL with electricity.

5. MANPOWER

For its plastics activity the company employs 1 specialist, 1 mecanician and 1 worker for 300 bottles per hour.

6. INFORMATION ON THE PLASTIC BOTTLE MARKET

Before entering the bottle manufacturing field the company used recovered mineral water bottles. A part of the edible oil produced is still packed in glass bottles. A part of the customers prefer glass bottles because of lower cost. All the other Senegalian edible oil manufacturers : Lesieur, Petersen, [illegible], produce plastic bottles.

Vinegar and bleaching liquid, that are relatively expensive products, are very sensitive to the variations of standard of living.

The total sales of edible oil, vinegar, bleaching liquid increased by 30 % from 1967 despite the bad climatic conditions of 1969 and 1970.

Vinegar is exported in bottles to Ivory Coast, Liberia, Gabon, Togo.

Edible oil is exported to Europe in tanks of 500 tons each.

MINUTES OF THE MEETING

of the 29th September 1971

Company visited : CAOUTCHOUC ET PLASTIQUES - DAKAR - SENEGAL

Person encountered : Mr. FURIOSI

The company, created in 1954 is engaged in the processing of some plastic semi-products and the distribution of a large range of rubber and plastic products.

1. SALES OF PRODUCTS

- PVC flooring in tiles or rolls. Imported from France (GERFLEX). About 25 tons per month
- Polyurethane flexible foam bought by P.E.S. (for mattress);rubber foam
- Laminates (imported)
- Glues and sizes (imported)
- Small plastic bags. They are made from polyethylene film (sheath) supplied by SIMPA. About 1-1.5 ton per month.
  These small bags are sold on the basis of $ 0.90 per kg. For instance, a bag 10 x 15 cm is sold ¢ 0.5 a piece.
- PVC covering CORDOUAL type . Bought F.O.B. FRANCE 27 ¢ per kg (second choice)
- Polystyrene foam. About 80 cubic metres per month (density : 15 kg per cubic meter).
  The blocks of polystyrene foam are cut by the company for use as insulating material in the building (ceiling) and the freezing industry
- Household goods imported from Ivory Coast (ALLIBERT) 10 percent cheaper than from Europe
- The production of leather-like PVC covering has been considered (in association with ICOTAF)
- Occasionally, few quantities of black polyethylene film are sold for agricultural use (banana plantations, reservoirs).

2. EQUIPMENT

- 5 machines for cutting polystyrene foam
- 3 machines for cutting rubber foam
- 6 machines for manufacturing bags from polyethylene film
- 1 machine for manufacturing tarpaulins from wide polyethylene film

3. MANPOWER

- 20 permanent workers, of which foreign : 2
- 10 non permanent workers

4. MARKETS

No spectacular development of the sales of the main products - i.e. PVC flooring, polystyrene foam - is expected in the next coming years. However, a better expansion is foreseen for polyethylene bags.

MINUTES OF THE MEETING

of the 30th September 1971

Company visited : SOFARMEX - DAKAR - SENEGAL

Person encountered : Mr. MICHELON

The company created in 1970 is engaged in the processing of polystyrene foam : blocks, sheets.

1. PRODUCTS

- Blocks and sheets of polystyrene - Densities : 15, 20, 25, 30 and 35 kg per cubic metre. The main type produced is 15 kg per cubic metre.
- Production 100 cubic metres per month ; it will soon reach 250 cubic metres.

2. EQUIPMENT

- All the equipment is produced locally
- It consist of :
  - . 1 boiler
  - . 1 preexpander
  - . 2 bins
  - . 1 mould
  - . cutting equipment
- Total capacity is 250-300 cubic metres per month on the basis of 8 working hours per day. It would reach 800 cubic metres by the addition of another mould.

3. RAW MATERIALS

All the polystyrene processed is imported from West Germany (HOECHST) and the Netherlands (BASF).

4. PRICES

- Raw materials : prilled polystyrene ¢ 75 per kg by lots of 5 tons CIF DAKAR
- Products
  Polystyrene foam in blocks, sheets :
  . Density 15 kg per cubic meter : $ 40
  . Density 20 kg per cubic meter : $ 55
  . Density 25 kg per cubic meter : $ 70
  . Density 30 kg per cubic meter : $ 85

5. MANPOWER

4 permanent workers

6. MARKETS

The company supplies about 80 percent of the Senegalian market in polystyrene foam. The remainder is imported.

The main applications are in the building and industrial fields (ceiling, insulating, freezing). The packaging field has been considered but given up because of the high investments required.

7. EXPORTS MARKETS

- The company exports some blocks to Mauritania. The cost of transportation by trucks from Dakar to Nouakchott is $ 26 per cubic metre
- Mali has important needs mainly for the freezing industry but exportation is very difficult for lack of wagons.

8. FUTURE DEVELOPMENT OF ACTIVITY

The production of PVC compound - 200-300 tons per months - is under consideration.

MINUTES OF THE MEETING

of the 30th September 1971

Organization visited : HYDRAULIQUE - DAKAR - SENEGAL

Persons met : Messrs. BA, FALCOZ

Important needs of pipes will appear in Senegal in the next coming years, for sewage, water distribution and irrigation.

- The main outlet for PVC pipe will be for sewage. The program will depend on the financing possibilities. PVC pipe will be preferred because of its possible use for low difference of level and high resistance against corrosion.
- In the case of water distribution, the outlets appear less important and will depend on the expansion of cities.
- At present time all the metal, asbestos-cement and PVC pipes are imported.
- Seven main projects for sewage are considered :
  - . Saint Louis
  - . Louga
  - . Thies
  - . Kaolak
  - . Diourbel
  - . Tambacounda
  - . Ziguinchor
- A possible use of PVC pipe can be seen for irrigation of the future sugar-cane fields considered in Richard Toll (1000 ha).

MINUTES OF THE MEETING

of the 1st October 1971

Company visited : S.E.N.A.C. - DAKAR - SENEGAL

Person encountered : Mr. DEBLANC

The company is engaged in the manufacture and the distribution of pipes and other articles made of asbestos-cement (Licence : ETERNIT)

1. PRODUCTS

- Low pressure asbestos-cement pipes mainly used for sewage. Diameter ∅ 80, 100, 125, 150 and even 200 mm. Annual output : 300 t. The company meets the needs of 80 percent of the Senegalian market for this type of pipes.

- Various articles in asbestos-cement

2. PRICES OF PRODUCTS

Asbestos cement pipes, 3 metres long in the following diameters ∅ : 80, 100,125 and 150 mm ; retail prices, respectively : $ 3.80, 4.70, 6.10, 7.35 (gross profit : about 30 percent).

3. MARKETS

- the current annual demand of the Senegalian market in asbestos-cement pipes for sewage (low pressure) is estimated at 350-400 tons.

- all the higher pressure asbestos-cement pipes used in SENEGAL are imported (PEYRISSAC).

- the same is true for PVC pipes - Annual imports : 100 tons

- the main future outlet of PVC pipes is seen for water supply and, to a lesser extent, sewage and water distribution

4. FUTURE DEVELOPMENT OF ACTIVITY

- The company is considering the manufacture of PVC pipes and fittings, taking into account the estimated Senegalian market in the next coming years : 280 tons per year. Diameter Ø : up to 200 mm
- The considered plant will be able to supply the markets of Senegal, Mali and Mauritania. The factory will only work 8 hours per day.
- The prices of PVC pipes would be about the same (or less) as asbestos cement pipes.
- Installation of a small plant for PVC pipe manufacture (Diameter 45 mm - Outlet : irrigation) is also considered by "Compagnie Sucrière du Sénégal" at Richard Toll.

MINUTES OF THE MEETING

of the 1st October 1971

Company visited : ICOTAF - DAKAR - SENEGAL

Person encountered : Mr. DENOY

ICOTAF is a subsidiary of the French textile company SCHAFFER. ICOTAF was created in 1951. The company spins and weaves cotton.

1. PRODUCTION CAPACITY

ICOTAF has two manufactures : in RUFISQUE and in PIKINE.
The production capacity of the factory located in RUFISQUE is 7.0 millions metres per year (80 cm).
The production capacity of the factory located in PIKINE is 2.4 million metres per year (140 cm).

2. PRODUCTION

The company produces 50 different types of fabric. At present time, the production is 6 million metres per year in RUFISQUE and 2 million metres per year in PIKINE. In Rufisque 1 million metres per year are made of fibrane and sold to the flour millers for bag manufacture.

3. SPINNING AND WEAVING INDUSTRY IN SENEGAL

There are three companies involved in this field :

.ICOTAF processing 2,000 tons/year of cotton
.Société Textile Sénégalaise processing 1,500 tons/year of cotton
.Cotonnière du Cap Vert processing 500 tons/year of cotton

4. ORIGIN OF THE COTTON

Before 1950, the cotton processed by ICOTAF came from the Office du Niger. Now, it comes from Senegal and is distributed by the CFDT. A very small quantity is imported from EGYPT for thread manufacture ; the price of EGYPTIAN cotton is 2.5 times the price of Senegalian cotton because of better quality.

5. OUTLETS OF THE PRODUCTION

In 1951, the company produced only 4 qualities of fabrics for the whole market of former French West Africa. Only 25 % of the production was sold in Senegal. After 1957, the market became practically limited to Senegal and the company increased the number of types produced up to 50. The competition with the fabrics made in Hong Kong, Taiwan, and Korea, is very hard.

6. ACTIVITIES IN THE FIELD OF SYNTHETICS - POSSIBLE OUTLETS

The company will install equipment to weave polyester-viscose and polyester cotton yarns. The capacity will be 300,000 metres of fabric per year (about 100 tons per year) containing 67 % polyester. All the yarns will be imported.

The main customers would be : the administration, the army (10,000 metres per year) the police (10,000 metres per year). The market of polyester is growing fast but penetration is very difficult ; the series needed for Senegal are very small and can be bought at low prices on the remains of the world market. Some series will not exceed 500 metres and cannot be manufactured in Senegal. The most frequently used mixture is and will be cotton viscose.

MINUTES OF THE MEETING

of the 1st October 1971

Company visited : C.G.E.S.(Compagnie Générale des Eaux du Sénégal) DAKAR

Person met : Messrs. KOYAUD, JOLAND

The company is engaged in drinking water distribution in the Cap Vert area. Before 1971 the field of its activity covered all the country.

1. PRODUCTS USED FOR PIPING

- Plastics, mainly PVC Pipe diameters Ø 50 to 100 mm
- Asbestos-cement Pipe diameters Ø 100 to 300 mm
- Cast iron Pipe diameters Ø 250 to 400 mm

2. DEVELOPMENT OF WATER DISTRIBUTION

- Presently the water distribution system consists of 1,000 km of pipes in the Cap Vert area, 300 km in the other areas of Senegal (excluding individual connections). Each year an average of 40 additional km will be installed

- 2,000 to 3,000 flats will be built each year requiring individual water connections.

Share of PVC in piping materials

. The penetration of PVC could be 100 percent in the case of individual connections (an average of 7 metres each. Diameter 20 to 50 mm)
. In the case of water distribution ; the share of the products used is as follows : plastics 50 percent, asbestos-cement 30 percent, cast iron : 20 percent (in terms of length).

3. SEWAGE

The materials utilized for piping in sewage are asbestos-cement, concrete, and, in smaller quantities, PVC.

At present time, the total length of the network is 300 km. Annual extensions will reach 50 km (usual diameters 150 to 250 mm).

4. PRICES

All the pipes are bought in Dakar.

- The prices of cast iron pipes Ø 400 mm is $ 25 per metre.

- Prices of PVC pipes
  Ø 40 mm : $ 0,3 per metre (1968)
  Ø 60 mm : $ 1,8 per metre (1971)
  Ø 80 mm : $ 3,3 per metre (1968)
  Ø 150 mm : $ 6,5 per metre (1968)

- The share of the materials in the water distribution cost is 50-70 percent in the case of water distribution and sewage and 30-50 percent in the case of individual connections

MINUTES OF THE MEETING

of the 2nd October 1971

Company visited : SODEC - DAKAR - SENEGAL

Person encountered : Mr. DUPEYRAT

The company established in Kaolak was created in 1937 for groundnut shelling. In 1947, the company began production of edible oil.

1. PRODUCTION OF THE COMPANY

The company processes an average of 230,000 tons per year of groundnuts (30-35 percent of the Senegalian production). The production of edible oil is 70,000 tons per year. Half of this production is refined locally. About 80 percent of the total production is exported to France. The Senegalian consumption of groundnut oil reaches 40,000 t per year.

2. ACTIVITIES IN THE PLASTICS FIELD

SODEC produces plastic bottles in order to pack a part of the locally consumed production. The annual production is 1.5 million PVC bottles. The equipment consists of 2 blow moulding machines BEKUM able to produce 360 bottles per hour each. The weight of one 1 l bottle is 37 g.

3. MARKETS OF BOTTLES IN SENEGAL

Quantity of edible oil distributed in glass bottles in Senegal (total of industry) :

1967 4 million litres
1968 4.2 million litres
1969 5.6 million litres
1970 6.0 million litres
1971 (est) 7-7.5 million litres

Quantity of edible oil packed in plastic bottles by SODEC :

1967 600,000 l.
1968 750,000 l.
1969 850,000 l.
1970 600,000 l.
1971 (est) 1,000,000 l.

SEIB began production of plastic bottles in 1967 ; PETERSEN is beginning such a production. All of the locally consumed production of LESIEUR is packed in glass bottles.

- The price of a glass bottle in DAKAR is ₵ 12
- The cost of a plastic bottle is ₵ 7
- The quantity of the glass bottles lost by consumers is very low : 0.3 percent
- One liter of edible oil costs the consumer ₵ 36 if packed in a glass bottle and ₵ 46 in a plastic bottle.
- In Senegal, the increase of the cost due to the utilization of plastic bottles is definitely not borne by the distributor because of the low cost of handling.
- The penetration of plastic bottles is expected to reach 50 percent of the total market in bottles.

4. <u>MISCELLANEOUS</u>

- Initially, bottle production was designed taking into consideration the packaging of a part of the export in plastic bottles. This project was given up, mainly because of the importance of the thefts in the port of MARSEILLES
- This explains the installed capacity
- PVC has been chosen because of its lower permeability to air and light. The total quantity consumed will be 60 tons per year. The PVC is supplied by SHELL (France). The price is ₵ 57 per kg FOB FRANCE and 66 ₵ delivered to the factory in Senegal.

The major part of the oil-cakes produced (40 percent of the groundnut weight) is exported in bulk ; a small quantity is exported in woven polypropylene bag.

5. <u>MANPOWER</u>

SODEC employs :

- 500 permanent workers
- 100 additional workers during the groundnut season
- 200-300 non permanent workers

MINUTES OF THE MEETING

of the 30th October 1971

Organisation visited : **Direction des Mines et de l'Industrie - NOUAKCHOTT - MAURITANIA**

Person encountered : **Mr. BABA**

The industrial projects for the 1970-1973 period are :

- a sugar refinery
- a saw mill
- a plaster factory
- a match factory
- a dairy
- a flour mill
- a textile complex

1. TEXTILE COMPLEX

The textile complex would be installed in Rosso. It will process cotton from Mali. The production will be fabrics for the Mauritanian market, and threads to be exported mainly to West Germany.

The utilization of synthetic fibres is not being considered.

The promoter is Agache Willot ; the investment would reach $ 8.000.000.

2. ACTIVITY OF SOMIMA

Somima produces and exports from Nouakchott concentrated copper ore. At present time, the production is 5,000 tons/year ; it should reach 30,000 t/year.

The production is exported in 50 kg bags made of polyethylene and polypropylene.

3. **"CODE DES INVESTISSEMENTS"**

There is a "Code des investissements" in Mauritania. It considers 3 classes of industries. A copy of this code was given by Mr. BABA.

4. **TAXES ON INDUSTRIAL PROFITS**

The taxes on industrial profits are discussed with the Government. They generally reach 20 %.

MINUTES OF THE MEETING

of the 6th October 1971

Organisation visited : HYDRAULIC - NOUAKCHOTT - MAURITANIA

Person encountered : Mr. Roussel

1. WATER DISTRIBUTION

In Mauritania the program of water distribution consists in the installation of 20 km of pipes per year as an average. The diameters range from 60 to 250 mm. The pipes are made of asbestos-cement, cast iron and PVC.

An exceptional project will be implemented in 1972 : the construction of a water distribution line : 60 km from Idini to Nouakchott.

2. SEWAGE

The program consists in the installation of 10 km of pipes per year (diameter 250 mm).

3. IRRIGATION

The program of irrigation will use very few pipes.

4. PRICES

Prices of water :

Nouakchott	\$ 0.44/m^3
Nouhadibou	\$ 0.70/m^3
Rosso	\$ 0.20/m^3

Prices of electricity :

Nouakchott	\$ 0.10/kWh
Nouhadibou	\$ 0.05/kWh

MINUTES OF THE MEETING

of the 6th October 1971

Organization visited : **Amenagement du Bassin du Fleuve - SENEGAL**

Person encountered : **Mr. JOHANY**

- The plan for developing the Senegal River includes the irrigation of a land of 300,000 ha.

  This plan will be gradually implemented from the beginning of the next decade, on the basis of 3-4,000 additional irrigated ha per year. So there are not immediate opportunities, if any, to use piping in this area.

  On the other hand, there are some opportunities to use piping for irrigation in the CASAMANCE basin, especially for high yield crops such as cotton or vegetables.

- The needs in urea fertilizer for all the OERS countries is estimated at 100,000 tons per year at the beginning of the eighties.

MINUTES OF THE MEETINGS

of the 6th and 8th October 1971

Company visited : **SONEPI - DAKAR - SENEGAL**

Person encountered : **Mr. MALHERE**

Some details were given about the following industrial projects :

1. C.G.E.M. - Compagnie Générale des Eaux Minérales

a) Equipment
- Blow moulding extruder SIDEL DSL 1 - 2 moulds for bottles
- Investment : $ 68,000
- Capacity : 1,200 1,5 litre bottles per hour - PVC required for one bottle : 50 g (of which scrap : 2 g)
- 2 shifts of 8 hours

b) Planned production

2nd year (1972-73)	1,170,000 bottles
3rd year	2,160,000 bottles
5th year	2,500,000 bottles

c) Prices
- Cost of one empty PVC bottle ₵ 7,6
- Cost of one full PVC bottle : ₵ 17. ex works - Dealer price : ₵ 18-19 - Retail price ₵ 25.5
- By comparison, retail price of imported mineral water PVC bottles : ₵ 32 and 35.5

d) Markets

Imports of mineral water (millions of litres)

1963 : 3,221
1964 : 2,133
1965 : 2,560
1966 : 2,417
1967 : 1,722
1968 : 2,225
1969 : 2,256
1970 : 2,776 (average unit price ₵ 14 CIF per litre)

2. SENEGAL PLASTIQUE (located at THIES)

This company is engaged in the manufacture of PVC shoes, plastic household goods and toys.

Investments : in 1968 : $ 170,000
in 1970 : $ 60,000
planned : $ 90,000

3. TYRE-PRODUCTS

2 tyre product plants are under consideration :

a) Bicycle tyre products
- Packed plant (Netherlands) to be reinstalled in Senegal
- Planned production : tyres : 1,300,000 pieces per year
tubes : 1,500,000
- 80 percent of this production would be exported to European markets

b) Car and other vehicles tyre products
- General Tyre project - Location : KAOLAK
- Planned output : 70,000 tyres per year
- The profitability of such a project seems doubtful : usually, the minimum economic scale of a tyre plant is 200,000 pieces per year
- Vehicle population increases by about 4,000 per year (gross increase).

4. PAPER PASTE, PAPER

- UNIDO team was given a note concerning this project (plant possibly erected at Richard Toll)

- At present time, a project for fiber board manufacture (from bagasse) is given up.

5. POLYETHYLENE FILM

A project for polyethylene film manufacture has been given up, taking into account the following :

- at present time, this industry works at about 30 percent of its nominal capacity

- this project could to some extent compete with the manufacture of polypropylene woven bags.

MINUTES OF THE MEETING

of the 8th October 1971

Company visited : SOCOSAC - DAKAR - SENEGAL

Person encountered : Mr. BRUNERE

The company is engaged in bag manufacture. It produces bags made of sisal and polypropylene.

1. PRODUCTION CAPACITY

The production capacity is 3,000 t per year of sisal bags and 600 t per year of polypropylene bags (3 eight hours shifts)

2. PRESENT PRODUCTION

- Sisal bags 2,800-3,000 t per year
- Polypropylene bags 400 t per year

3. ORIGIN OF RAW MATERIALS

The sisal is imported from MALI and UPPER VOLTA. This natural fibre will be produced in Senegal. The polypropylene is imported from Europe.

4. EQUIPMENT

For polypropylene processing SOCOSAC has a SAMAFOR extruder - screw diameter 20 mm - able to produce 60 t per month of polypropylene slit yarn. These yarns are processed by 30 looms.

5. MARKET

For sisal bags : packing of groundnuts and paddy. Bags made of sisal are very strong and can be used 4-5 times.

For polypropylene bags : packing of fertilizers (export market), white rice, wheat, salt, sugar (excluding powder), copper ore, powdered fish, sorghum, maize. These bags can be used occasionally in association with paper (wheat flour) or polyethylene film (copper ore).
About half the production is exported.

6. PRICES

Bags made of sisal : $ 0.60
Bags made of polypropylene, holding up to 100 kg (weight 200-220 g) : $ 0.46. These bags must compete with imported jute bags (sorghum) at $ 0,45.
The price of polypropylene is $ 0.45 per kg FOB Europe.

7. MANPOWER

510 men, of which foreign : 7 ; 2/3 for sisal - and 1/3 for polypropylene bag manufacture.

8. TRANSPORT

The bags exported to Nouakchott are transported by boats and by trucks.
The bag exported to Nouadibou are shipped by boat.
The bags exported to Mali travel by train, but, due to the lack of wagons, the time of transportation reaches 2 to 3 months.

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