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THE DEVELOPMENT OF THE RUBBER INDUSTRY IN WEST AFRICA

M66-1178

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INTRODUCTION

When it is borne in mind that only 5 per cent of natural rubber is consumed in the producing countries and that of the $1,000 million in foreign exchange that the sale of rubber brings in annually these countries must immediately reserve $300 million to purchase rubber goods from industrialized countries, it is easy to see the many advantages that can theoretically be expected from establishing local rubber industries in these countries:

The possible savings in foreign exchange, which would be reserved for purchasing capital goods or other articles essential to economic development;

The possibility of partly replacing the exportation of national wealth in the crude state by sales of processed products, which would earn precious additional foreign exchange;

The contribution to maintaining and raising the level of living in the country by the creation of new jobs.

In 1963 West Africa exported more than $50 million worth of natural rubber and imported, excluding shoes, nearly $30 million worth of rubber goods, see table 1, 80 per cent of this figure being accounted for by tyres and tubes. Parallel to this, the direct consumption of rubber in the sub-region was insignificant and practically confined to a few shoe factories. In 1964 with the commencement of tyre production in Nigeria, the sub-regional balance of trade distinctly recovered, as the imports of this country, which represented 30 per cent of the West African total, fell sharply from £3,623,000in 1963 to £2,369,000 in 1964. With the progressive increase in the output of the two Nigerian factories, the situation will further improve, but there will nevertheless remain a considerable sub-regional deficit in rubber manufactures, and once the Nigerian market is saturated the positive balance of trade will continue to fall unless new local factories are rapidly established.

TABLE 1

Balance of trade in rubber manufactures and natural rubber between West Africa and the OECD countries in 1963

	IMPORT		EXPORT	
	Rubber manufactures SITC No. 62	Incl. rubber tyres and tubes SITC No. 629.1	Natural rubber SITC No. 231.1	
	($1,000)	($1,000)	($1,000)	Tons
Mauritania	554	224		
Senegal	2,225	1,611		
Mali	819	768		
Niger	113	-		
Upper Volta	876	798		
Guinea	291	-		
Sierra Leone	1,385	888		
Liberia	1,100	662	22,395	41,888
Ivory Coast	5,049	4,570		
Ghana	4,524	3,486	237	436
Togo	638	300		
Dahomey	589	536		
Nigeria	8,062	6,797	30,425	61,807
	26,225	20,640	53,067	104,131

Source: Statistical Bulletin of the OECD.

NB: Import prices are f.o.b. and export prices c.i.f., except for exports to Canada and the United States.

I. CONDITIONS FOR INDUSTRIALIZATION

In practice, various limitations, due both to local economic conditions and the special characteristics of the rubber industry will restrict the number of countries that might establish new rubber-products industries, and the possibilities for industrialization will largely depend on whether or not a certain number of factors are favourable.

Are the markets large enough to justify establishing factories of an economic size? Not very much reliance will be placed on export outlets that the young national industry could reasonably expect to obtain only if the availability of local resources on advantageous conditions exercised a really decisive influence on the production cost of manufactures. Such reliance may be possible in the case of nitrogenous fertilizers, phosphatic fertilizers or paper pulp for example. Competition from synthetic rubber and the higher productivity of factories in the industrialized countries will on the other hand be a severe handicap for the rubber industry.

Within the sub-region everything will depend on the acceptable level of profitability. Without dwelling further on the large number of countries interested in the question, and thus the variety of economic interests at stake, it will merely be recalled that any project established on a multinational or sub-regional basis will have to aim at obtaining production costs that would allow selling prices comparable with those of imported products.

Is the capital ratio[1/] compatible with the legitimate desire of leaders of developing countries to give priority to those capital investments that will create the largest number of jobs at the lowest cost? Without doubt this is not an absolute rule, e.g. certain industries that are competitive in exports, but disregarding it has in the past given rise to so many bitter reflections, which have even cast doubt on the validity of certain outside opinions, that it becomes daily more important to emphasize that costly projects subordinating economic interests to political, i.e. non-technical considerations, have only a prestige value.

1/ The ratio of the capital investment to the annual output.

Is the value added achieved by the manufacture of interest?

A mere mentioning of the present foreign exchange cost of imports of manufactures is inadequate for an appreciation of the advantages of local manufacture. A factory that would require:

Supplementation of local supplies of rubber by using large quantities of imported products: synthetic rubber required for technical reasons, carbon black, artificial or synthetic textiles, metal products;

Costly capital investment for imported equipment;

Advanced technology reflected in the payment to a foreign company of heavy dues for technical assistance or necessitating the presence of large numbers of expatriate personnel, and consequently giving only a relatively slight net gain in foreign exchange; such factories could not compare, from the point of view of local economic advantage, with installations that needed small capital investments and that could consume more local raw materials.

The economic activity of the country in which the plant is set up, assessed by means of several indices: total and per capita industrial output, the turn-over of the industrial sector, the number of wage earners, the income of households, the proportion of monetary income in the income of households etc., will logically influence the location and structure of the new industries, which will tend to be set up in countries offering the most favourable conditions for a rapid growth of industrialization. In view of the conditions under which these indices are established and the fact that definitions may vary from one country to another and that it is often difficult to establish correspondence between different monetary zones, they should of course not be regarded as absolutely reliable, and it will generally be quite sufficient to note only the trend that they indicate.

The development of industrialization supposes the previous development of the communications network and transport facilities in the sub-region.

It is characteristic to point out that it is at present more convenient and less expensive to send tyres from France or Algeria to the Ivory Coast or Senegal rather than from Nigeria, although that country is so near; also, despite the fact that customs duties of neighbouring countries are often zero, almost all Nigerian exports of tyres go outside the sub-region. On the other hand, with the development of transport towards the countries of the interior, the latter will be able to pay less for imports and to sell their own products more easily; the income of the population will rise, it will be possible to establish new crops for export, and economically viable local industries will emerge as the logical extension of agricultural development.

Availability of energy: The manufacture of one kilogramme of rubber goods doubtless does not consume an enormous amount of energy: approximately 1.5 kg. of coal equivalent, about one third of which is in the form of electric energy, but the latter should not be too expensive as the growth of industrialization in general and consequently that of the rubber industry in particular would otherwise be hampered.

Is government policy favourable to the establishment and normal operation of industrial enterprises? In particular, fiscal or Customs facilities granted to projects should be a just compromise between the requirements of the government and those of the industrialists. In cases where the latter have already made an exceptional effort to rationalize and organize their manufacturing methods so as to remain competitive with imported products in a narrow market, the government ought to beware of jeopardizing this effort by means of unsuitable regulations that would make it impossible for the enterprise to obtain the necessary resources for its financing plans: inadequate Customs protection, establishment of competitive investments, any freezing of prices, heavy taxation, obstacles to the free circulation of the raw materials essential for maintaining the quality of national production, the absence of a flexible temporary import system for exporting industries etc. The local capital invested would by the way be the first to be affected by this situation; incapable of self-reconstitution, it would

a fortiori be incapable of increase and thus of generating the development of the economy, which is the role it should play. The fact that in the last resort it is always the local communities that assume the risk of this type of operation is one further reason for governments to beware of ill-considered intervention.

Availability of raw material: The industrialization projects of the developing countries are usually based on raising the average unit value of local raw material such as ore, hydrocarbons, agricultural products that are available both on advantageous conditions and in universally acceptable qualities. The case of the rubber industries is quite different because natural rubber encounters competition from the synthetic product both in price[1/] and quality, quite apart from the fact that the various producers of natural rubber, small holders on one hand, large plantations on the other, are very unequally placed with regard to such competition. Factories that concentrate entirely on a national domestic market and are energetically supported by appropriate Customs policy may perhaps ignore such competition in so far as the general interest is thereby served. From the multinational or sub-regional point of view there will have to be adjustment of the policy of consuming nationally produced goods at any price if it is desired to avoid jeopardizing the competitiveness of certain sub-regional manufactures. As an example, according to a report of the IBRD, tyres for touring cars would at the moment cost 30 per cent more in Nigeria than in a European factory. Without doubt the use of natural rubber is not the only factor responsible for this state of affairs - although, still according to the IBRD report, tyres for heavy vehicles, in which for technical reasons large quantities of natural rubber are used, would cost almost the same as in Europe - but the discrepancy between the corresponding selling prices and those for import into neighbouring countries will certainly be too large for such products to

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1/ For information, in 1964 the French tyre industry consumed 78,000 tons of natural rubber at an average price of 2,650 francs per ton and 77,000 tons of synthetic rubber at an average price of only 2,200 francs per ton.

be accepted solely because of sub-regional solidarity.

Availability of personnel: The general problem is to ensure the greatest possible use of personnel without previous qualifications in the operation and management of the installations and, as far as possible, in their planning and construction. In particular, the participation of local technicians in the planning and implementation of a project, which is so valuable as the germ for later economic development, is still the exception rather than the rule; however, it would be more frequent if the governments concerned would take into account more systematically the advantages and possibilities of training offered by various specialized bodies operating abroad.1/ Without doubt more Africans tend to favour the legal, administrative or political professions rather than technical or administrative professions applied to industry but if the local authorities realized more clearly the often paradoxical nature of the contradiction between the desire to industrialize and the absence of interest on the part of the local élite for careers in industry and commerce, this would often suffice to persuade them to try to correct a tendency that is contrary to the general interest.

Taking figures from the industrialized countries as a basis, the rubber industry requires on the average, considering complicated and simple products together, 1 supervisor for 13 workers and clerks; this figure of 13 may reach and even exceed 20 in the case of simple products. These ratios are relatively high, but they might nevertheless be considerably reduced if workshops constructed in African countries were less intensively mechanized - manual weighing of ingredients, non-mechanical handling, finishing operations preferably carried out by hand - but the actual number of supervisory staff would not thereby be reduced. The creation of rubber industries will therefore suppose an effort to train technicians that will be all the more marked as the latter will normally be also responsible for training their own factory labour.

1/ The Institut français du caoutchouc Paris and the Institution of the Rubber Industry issue diplomas certifying very complete theoretical and practical training for various technicians in the rubber industry.

II. PROSPECTS FOR RUBBER CONSUMPTION IN WEST AFRICA

Working method

Various methods can be used to predict the development in the consumption of a chemical product like rubber:

Opinion sampling consists in discussing with industrial experts the future demand and the factors that may influence it; the investigator then works out his forecast in terms of the opinions gathered;

Empirical forecasting is based on the projection of past trends; for short-term forecasting, drawing tangents to a curve with a very small radius of curvature may be enough but generally it is necessary to use more complex growth curves;

Historical analogy deduces the development of one product from that of a similar known product at a comparable stage of its development;

Analysis of final outlets reconstitutes total needs on the basis of individual needs surveyed in the various sectors of use;

The establishment of a correlation between the demand for a product and one or more independent variables provides the investigator with an objective method for assessing the market provided that he can predict the behaviour of the independent variable with some degree of accuracy.

The first method is very simple, but weighing optimistic and pessimistic opinions one against the other does not necessarily lead to a reliable forecast. Moreover, it will have to be used with even greater caution in developing countries where the interaction of economic and political factors is not always conducive to facilitating the expression of objective opinions or sometimes even of any opinions whatsoever.

The second method implicitly supposes that the future is merely an extrapolation of the past, which, in our case, will lead to a series

of conclusions that will be manifestly erroneous or unusable. As an illustration one can quote the drop in Ghanian imports of automobile tyres since 1961 - 1961, 181,455 tires; 1962, 176,000; 1963, 140,502; 1964, 160,778 - or the relative stability of the figures for Senegal. The method also supposes the existence of sufficient quantities of statistical data, which is not the case, either for certain countries like Guinea or for products other than tyres, imports of which are moreover still relatively low.

Without even refering to the low degree of industrialization of the sub-region, the use of the third method, that of historical analogy, which would be interesting in the case of a new type of synthetic fibre, for example, can scarcely be envisaged in the case of rubber. When it is applied to finished products that are already well established, which is the case with almost all rubber goods, the fourth method does in principle provide results that are more exact than methods based on over-all estimations of the market. Its disadvantage is that it would require a considerable volume of analytical work including a very careful survey of many existing or potential consumers in fourteen countries and, in the absence of corresponding previous work, would include other market studies: cars, bicycles, shoes, industrial equipment etc. As such a volume of work is manifestly incompatible with the very short time allotted to this study, this method will not be expected to yield either accurate or detailed results, which in any case would not have any more meaning after ten years or so. It will make possible, however, on the basis of the data available, a partial rearrangement of the results supplied by the last method quoted.

Experience shows that there is a satisfactory correlation between the annual per capita income and the per capita consumption of a large number of products: plastics, textiles, paint etc. If x and y are respectively per capita income and consumption, and a and b are two

constants[1/] (b: coefficient of elasticity), it is approximately true to say that $y = a\,x^{b}$ or $\log y = \log a + \log x$ and that the scatter of points around the curve can generally be explained by considerations peculiar to each country: the inadequacy of local production, excessive customs protection, the influence of the physical features of the country, for example, on the development of certain types of transport, etc.

It will be noted that these correlations are normally valid only for groups of products, all textiles and not only natural fibres, for example, so that even the approximate results of the previous method will be of the greatest interest in difining the probable share of the various markets. Figure 1 gives a graph established for rubber on the basis of consumption noted in 24 countries in which the annual per capita income ranged from $230 to more than $2,000 (1959).

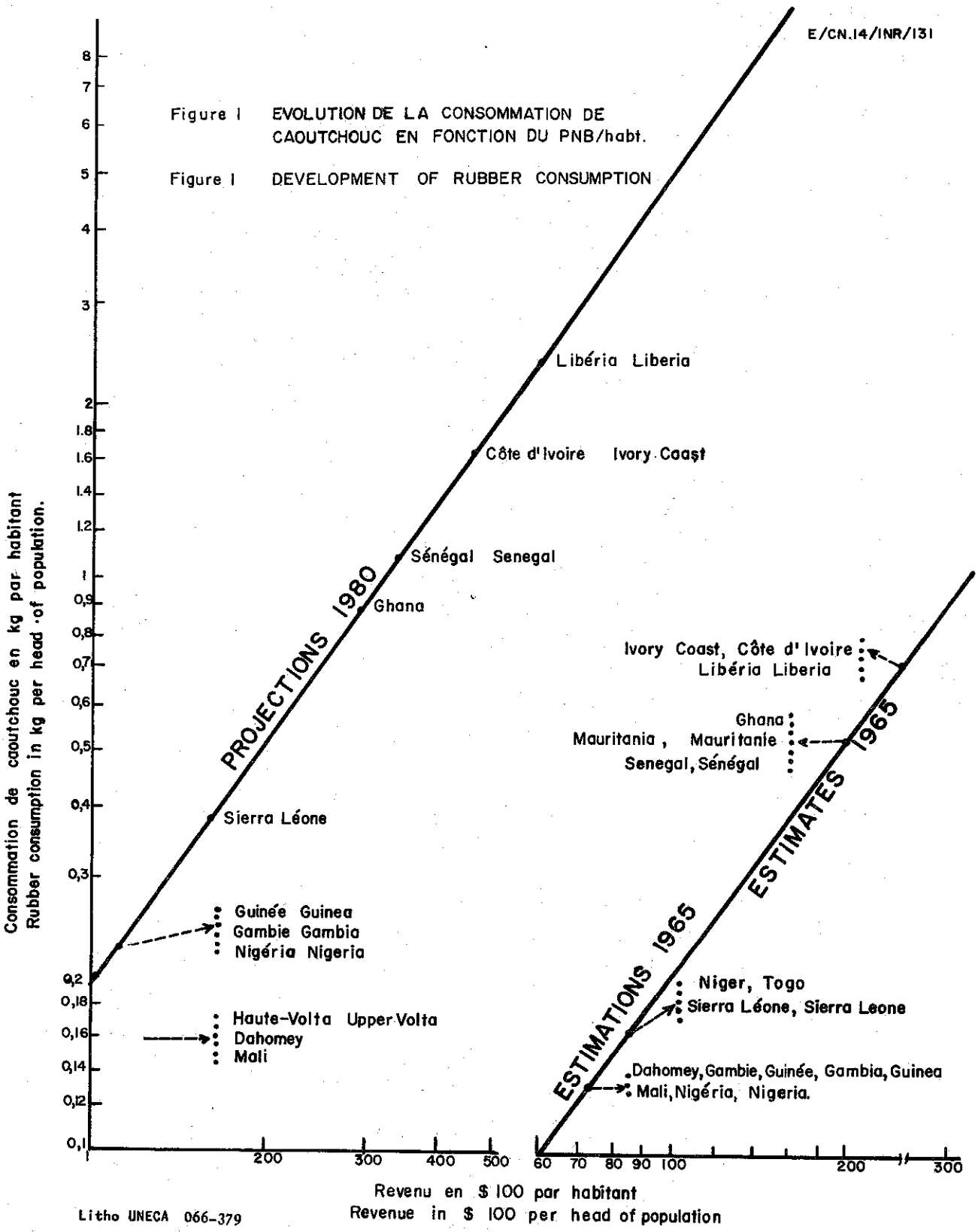
1/ a and b can be deduced from the following relations:

$$b = \frac{n \sum \log x \,.\, \log y \;-\; \sum \log x \,.\, \sum \log y}{n \quad (\log x)^2 \quad - \quad (\log x)^2}$$

$$a = \frac{\sum \log y \;-\; b \sum \log x}{n}$$

Figure I EVOLUTION DE LA CONSOMMATION DE CAOUTCHOUC EN FONCTION DU PNB/habt.

Figure I DEVELOPMENT OF RUBBER CONSUMPTION



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Present consumption of rubber

It is proposed to estimate over-all consumption in two ways: on the basis of imports of finished products supplemented by an estimate of local output and on the basis of the gross national income.

In 1964 the tonnages imported by the French-speaking countries, except Guinea, were:

	tons
Ivory Coast	4,370
Senegal	2,628
Upper Volta	1,068
Mali	786
Togo	480
Niger	457
Dahomey	360
Mauritania	291
Total	10,340 tons

By value Ghana and Nigeria imported in the same year $6,160,000 + 6,630,000 = $12,790,000, corresponding to a tonnage of finished products of the order of 12,790,000 ÷ 1.30 = 9,800 tons.

On the basis of previous imports it will be seen that the four other countries of the sub-region had total imports of the order of $3,500,000 or 2,700 tons of finished products.

Assuming an average rubber content of the order of 55 per cent, the tonnage of rubber contained in the approximate figure of 22,800 tons of imported articles would be 22,800 x 0.55 = 12,500 tons. To this tonnage of rubber will be added the domestic consumption of Nigeria estimated at 2,500 tons (tyres for automobiles and cycles, retreading, shoes) as well as 3,000 tons of products imported as parts of the vehicles, foot-wear etc., which would give a figure of 18,000 tons for sub-regional consumption in 1964.

TABLE 2

Population and gross national product in West Africa

	Population		GNP				Per capita GNP in $	
	Million inhabitants		Crude annual growth rate	$million		Percentage annual growth		
	1965	1980	1965-80	1965	1970	1965-80	1965	1980
Dahomey	2.35	3.35	2.3	163	344	5.1	69	103
Gambia	0.32	0.49	2.8	23	54	5.9	71	110
Ghana	7.74	12.13	3.0	1,565	3,487	5.5	202	287
Guinea	3.48	5.03	2.5	252	562	5.5	72	112
Ivory Coast	3.83	5.38	2.3	953	2,446	6.5	249	455
Liberia	1.05	1.24	1.1	263	726	6.9	250	585
Mali	4.58	6.48	2.3	327	657	5.8	71	101
Mauritania	0.74	0.89	1.3	142	340	6.0	192	382
Niger	3.27	4.67	2.4	296	708	6.0	90	152
Nigeria	58.00	91.00	3.0	4,272	10,060	5.9	74	110
Senegal	3.47	4.63	2.0	700	1,560	5.5	202	337
Sierra Leone	2.71	3.66	2.1	228	593	6.6	84	162
Togo	1.64	2.37	2.5	143	332	5.8	67	140
Upper Volta	4.78	6.41	2.0	224	662	7.5	47	103

Source: ECA Statistics and Demography Division

The second estimate of rubber consumption in the sub-region will be obtained by plotting on the graph in figure 1 the per capita GDP's of the various countries covered in table 2; the 1965 estimates were provided by the ECA Statistics and Demography Division. Except for the Upper Volta, where the per capita GDP is $47, the countries of the sub-region have been divided into four groups:

Dahomey, Gambia, Guinea, Mali, Nigeria (per capita GDP $69 - 74)

Niger, Sierra Leone, Togo ($84 - 90)

Ghana, Mauritania, Senegal ($192 - 202)

Ivory Coast, Liberia ($249 - 250)

The corresponding mean per capita consumption : 0.128, 0.160, 0.52 and 0.70 kg give an over-all consumption of the order of 20,000 tons.

It is obviously not justifiable to conclude that these two figures are absolutely accurate merely because they agree fairly well - the 1964 figure of 17,300 tons obtained by the first method would give roughly 18,800 tons for 1965, and it is reasonable to assume that Ghana had dropped back 1,000 tons - especially when it is remembered that both methods include a number of approximations. It will merely be assumed that in 1965 sub-regional consumption of rubber was not very far from 20,000 tons.

Future demand for rubber

In 1964, seven countries, the United States, Japan, the United Kingdom, the Federal Republic of Germany, France, Italy and Canada, representing only 15 per cent of the world's population, alone consumed 3,535,000 tons of rubber or 79 per cent of world consumption. There is nothing astonishing in that when one considers two facts:

The rubber industry is based on a whole complex of scientific and technical knowledge and requires an amount of capital that is not normally available outside the industrialized countries. In 1963, French industry alone, which is after all very modest in relation to

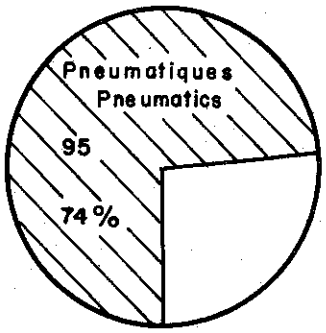
the powerful American industry had already made 356 million francs' worth of productive investment alone, that is to say the equivalent of the cost of more than 15 superphospate plants with a capacity of 120,000 tons per year, including the manufacture of the necessary sulphuric acid. Secondly the automobile industry, whose development is a measure of a country's standard of living, is the main customer for the rubber industry, see table 3, and most of the remainder of the tonnage consumed is absorbed by the industrial sector.

With 20,000 tons in 1965, the West African share of world consumption was still very low. To obtain an estimate of sub-regional consumption in the coming 15 years, the correlation illustrated by figure 1 will again be used, the projections of table 2 being taken as the value of per capita GNP in 1980. This shows that at this date the sub-region could consume 60,000 tons of rubber including 20,000 tons for Nigeria and 20,000 tons distributed half and half between Ghana and the Ivory Coast, a tonnage that corresponds to an annual growth rate slightly below 8 per cent. If one banks on the effect of a fairly rapid development in local production, which to some extent generates its own momentum, there is some justification in hoping for a considerably higher rate, of the order of 9 per cent, for example, corresponding to a total rubber consumption of the order of 72,000 tons in 1980. For the rest of the study, a consumption by this date of approximately 65,000 tons will be adopted.

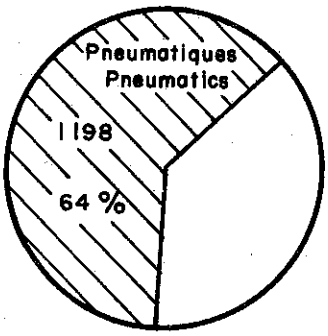
Tableau 3
Table 3

Part de l'industries des pneumatiques dans la consommation de caoutchouc(millier de tonnes, en 1964)
The share of the pneumatics industry in rubber consumption(thousands of tons, in 1964)

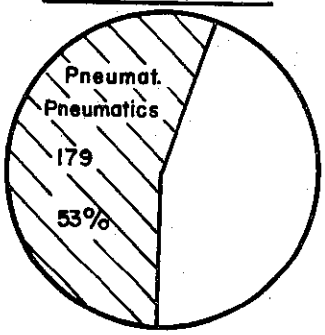
Canada



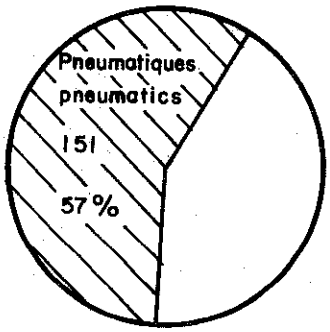
Etats-Unis
United States



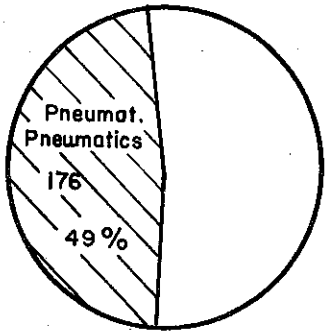
Royaume-Uni
United Kingdom



France



Japon
Japan



III. THE AUTOMOBILE TYRE INDUSTRY

Tyres for motor vehicles

The number of motor vehicles in the sub-region, including motor cycles, was of the order of 340,000 in 1963, see table 5. Nigeria has the largest number, with 92,078 vehicles, followed by Ghana, Senegal and the Ivory Coast with 50,830, 47,000 and 43,170 respectively. The fleets of the other countries, which are distinctly smaller, range from about 1,000 vehicles in Gambia and Mauritania to 19,300 in Guinea. So far, the rate of increase in this vechicle fleet, which is linked to the development of the economic situation, has varied quite considerably from country to country. For instance, the market of Senegal, which expanded between 1959 and 1962, relapsed to below the 1962 level in 1963 and 1964. In the Ivory Coast, on the other hand, despite the considerable drop in 1962, which apparently resulted from a decrease in the purchasing price and the tonnage of coffee and cocoa sold, the number of vehicles more than doubled between 1960 and 1694, see table.4.

TABLE 4

Development of the motor vehicle fleet in the Ivory Coast

	Private cars	Coaches buses	Lorries	Tractors	Special vehicles	Trailers, semi-trailers	Total
1960	11,454	185	10,100	729	215	485	23,168
1961	15,526	256	25,564	1,112	269	797	30,524
1962	18,953	308	14,014	1,280	314	977	35,846
1963	23,771	357	15,789	1,598	364	1,291	43,170
1964	28,074	414	18,675	1,973	413	1,648	51,197

Source: Directorate for statistics

Data as divergent as these prompt one to use more general economic indicators to determine the future development of such fleets. A graph of the correlation between annual income and the number of cars per head, see figure 2,[1/] indicates that the latter figure is multiplied by approximately 2.2 when the per capita income rises from $97 to $152. Bearing in mind a population increase of 148 ÷ 98, i.e. 151 per cent, the vehicle fleet in the sub-region will therefore increase by 332 per cent in 15 years, or slight more than 8 per cent annually. This figure will be adopted as a basis for calculation.

If the Nigerian market for tyres in 1965 is assessed at 280,000 and if it is assumed that the other countries imported approximately 600,000 in 1965, see table 6 for 1964 imports, then the sub-regional market was 880,000 tyres in the same year. Applying an annual growth rate of 8 per cent it would therefore reach:

1,900,000 tyres in 1975; and

2,800,000 tyres in 1980.

Assuming that 52 per cent of the products were intended for light vehicles, with 5.7 kg of rubber per tyre and 1.3 kg per inner tube, and that the remaining 48 per cent was for articles with 20 kg of rubber per tyre and 3 kg per inner tube, the corresponding consumption of rubber, for equal amounts of inner tubes and tyres would be:

798 x 23 + 1,102 x 7 = 26,100 tons in 1975;

1,176 x 23 + 1,624 x 7 = 38,400 tons in 1980.

Compared with countries like France, the United Kingdom or Germany, which, with distictly smaller populations than those of the sub-region,

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1/ It will be noted in passing that the sub-region is on the whole much over-capitalized in relation to the average per capita income. This leads one to think that the number of vehicles giving normal service differs considerably from the fleet surveyed.

consume 20 to 25 times more tyres, the needs of the sub-region are obviously very low and would at present be satisfied by the output of one small European plant producing 3,000 tyres per day; however, there are already two production centres in the sub-region, both in Nigeria: Dunlop in Lagos and Michelin at Port Harcourt and Ghana is planning a third.[1/]

From a strictly sub-regional point of view, the chapter on the development of the tyre industry in West Africa could be closed here, recommending - with particular regard to the fortunate influence that an increase of capacity would not fail to have on present domestic costs of production as well as in the incomparably smaller amount of investment needed for mere expansion - that Nigeria be finally entrusted with supplying all the sub-region with tyres.

It is, however, practically certain that so inflexible an interpretation of the aims of sub-regional economic co-operation would not receive the support of the rest of the sub-region and that the programme would above all appear as the easy way out, merely confirming the de facto lead of one group to the detriment of the clear interests of the others. Such a recommendation would in any case be justified only if the conclusion of the analysis outlined in the chapter on conditions for industrialization, when applied to the tyre industry, should prove unfavourable to the establishment of new plants. That aspect will therefore be examined below:

From the point of view of the market: With annual capacities of 150,000 tyres per year, the Nigerian factories would already, thanks to the high percentage of tyres for heavy vehicles, just reach the threshold of profitability in European terms. Taking local operating conditions into consideration, their costs of production will not bear comparison with those of a European plant. Without even mentioning the unfavourable effect of using natural rubber almost exclusively, the reasons for that state of affairs are not far to seek: labour is perhaps much cheaper but its lower productivity will be reflected both in a partial cancellation

1/ Of fairly small size: 90,000 tyres and 90,000 inner tubes per year in two-shift operation.

TABLE 5

West African vehicle fleet

Country	Year	Total	Private vehicles	Commercial vehicles	Buses	Motor cycles	Tractors	Trailers	Other
Ivory Coast	1963	43,170	23,771	15,789	357		1,598	1,291	364
Dahomey	1965	12,972	6,896	4,572	93	1,004	197	129	63
Gambia	1963	3,200	1,000	1,700*		500			
Ghana	1962	50,830	25,179	13,364	3,125	3,513	1,688	908	2,835
Guinea	1963	19,300	7,000	11,000*		1,300			
Upper Volta	1963	11,149	4,079	5,450*		1,620			
Liberia	1965	11,822	6,581	3,698	1,243	300			
Mali	1963	14,000	6,300	2,700*		5,000			
Mauritania	1963	4,178	1,114	3,016*		48			
Niger	1963	5,375	3,500	1,500*		375			
Nigeria	1963	92,078	48,267	23,962*		19,849			
Senegal	1963	47,000	30,000	17,000*					
Sierra Leone	1963	14,074	8,987	4,617*		470			
Togo	1965	10,589	4,541	5,365	88	244	201	77	73
		339,737							

* Total of commercial vehicles and buses

Sources: Data supplied by ECA.

Figure 2

Corrélation entre le PNB et le nombre d'automobiles par habitant

Correlation between GNP and the number of motor vehicles Per head of population

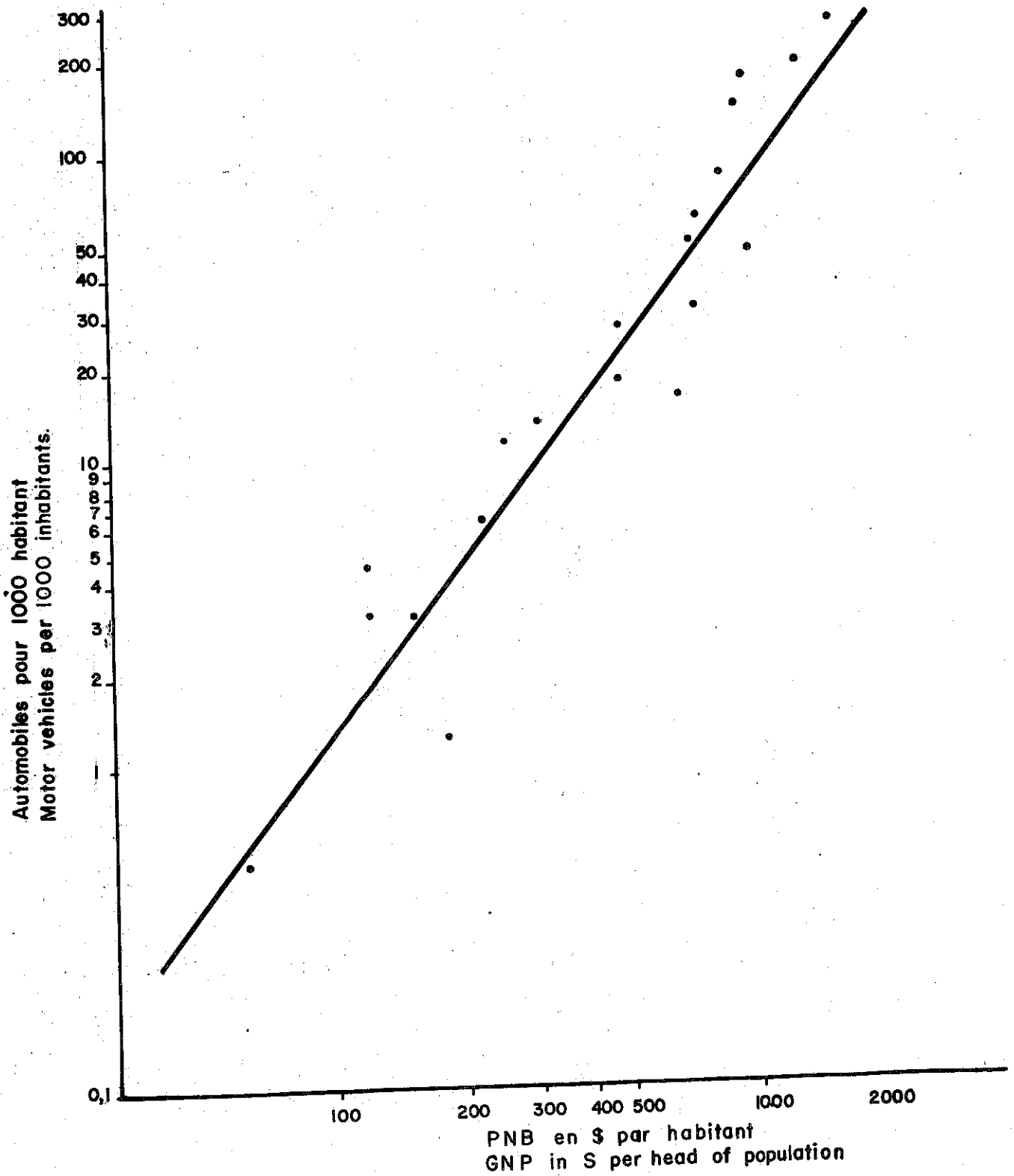

TABLE 6

Sub-regional imports of tyres in 1964

	Tyres			Inner tubes		
	Motor cycles, cars 629-110/120	Lorries, buses 629 130/140	Tractors, public work machines 629-150	Motor cycles, cars 629-110/120	Lorries, buses 629-130/140	Tractors, public works machines 629-150
Nigeria	66,977	33,024	6,285	41,296	7,021	4,810
Ghana	62,795	90,728	7,255	28,736	40,653	1,963
	2 - 15 kg	15 - 70 kg	> 70 kg	0.5 - 2 kg	2 - 5 kg	> 5 kg
Ivory Coast	83,702	55,540	9,646	95,051	21,968	8,500
Senegal	35,613	28,597	3,151	55,253	16,402	1,144
Upper Volta	9,200	5,651	127	8,872	843	4,545
Niger	843	2,516	220	4,935	2,146	690
Dahomey	9,541	3,195	622	8,493	2,342	534
Togo	~ 5,000	~5,000	30	~10,000	1,000	1,000
Mauritania	~ 200	~1,000	~2,000	~ 2,000	~2,000	~300
Mali	10,853	10,223	1,038	23,438	6,799	399
Guinea	20,000 (?)	12,000 (?)	-	-	-	-
Liberia(1963)	<.....	37,000	.....>	<.....	25,000	.....>
Gambia	2,843	710	-	2,030	382	6
Sierra Leone	22,860	13,622	840	26,627	11,415	667

of this advantage and in a less satisfactory utilization of equipment, leading to an increase in maintenance and depreciation costs; high salaries for expatriate personnel; equal production capacity but higher capital investment - transport and insurance of equipment, more expensive assembly, speciall equipment for tropical climates, etc. Although one cannot hope to compensate for these handicaps merely by increasing production capacity, it is not unjustifiable to hope that they will be partially offset by attaining the European profitability threshold and to consider that a minimum capacity of 1,000 tyres per day, that is to say more than 600,000 tyres per year for the two Nigerian factories, would be more in conformity with sub-regional economic conditions.

Taking into account the predicted needs of West Africa, there will therefore be plenty of opportunity from 1969-1970 onwards for establishing production capacity equivalent to that of Nigeria outside that country.

Amount of capital investment per job created

A tyre factory has one characteristic disadvantage, the large amount of machinery required, and one special advantage, the relatively low level of mechanization.

For example, a European factory producing 2,000 tyres per day in three shifts uses the following plant:

2	Banbury mixers	700,000 francs each
12	Mixing mills	220,000 "
4	Extruders	150,000 "
1	Calender machine	500,000 "
1	Spreader	400,000 "
30	Tyre presses	150,000 "
2	Bead wire machines	120,000 "

This is undoubtedly costly equipment, and some of the most expensive items are over-sized with a view to future expansion of capacity. Moreover, as has just been seen, a much higher total capital investment is needed in Africa for equivalent output.

The favourable element is the relatively low degree of automation in manufacture; a European factory producing 2,000 tyres per day may employ 500 workers not counting office staff and supervisors. Without doubt there has been some development over the last fifteen years: in 1951 it took 2.8 man-hours to make a tyre in the United States as against 8 in France and these figures now seem to have fallen to about I and 3, respectively. As a result of the less intensive mechanization of some workshops or processes, as well as of the lower productivity of local labour, a small factory in West Africa producing only 500 tyres per day can employ more than 500 persons. If the corresponding investments are assessed at 45 million francs, the cost per job created comes to 90,000 francs. Compared to the low figures for many processing industries, this is a great deal. In relation to those in the great chemical industry, for example, it is not high and easily acceptable by a country that has already progressed far on the road of industrialization.

Value added

The following is an approximate breakdown of the mean cost of production of a tyre in the sub-region:

Raw materials and miscellaneous purchases	70 per cent
Labour	11 per cent
Depreciation	10 per cent
Overheads	9 per cent

The first item may be broken down in turn as follows:

Rubber	45 per cent
Textiles	30 per cent
Carbon black	10 per cent
Ferrous metals, miscellaneous	15 per cent

It is obvious that such an industry would be of limited interest to a country that had to import all the raw materials. If one adds the fact that most of the depreciation covers imported equipment and that the technical assistance expenses - expatriate personnel and dues-

will absorb a by no means negligible share of the personnel expenses and overheads, the minimum condition would therefore be that countries setting up such industries should produce natural rubber. That is the case with the Ivory Coast and Ghana, in which countries one might envisage the establishment of two new tyre factories intended for a multinational market. Without doubt Ghanaian rubber production is still very low but the development prospects for such production, see Annex I, combined with the existence of a large domestic market, militate in favour of the future extension of the small factory being constructed.

IV. BICYCLE TYRES

In the industrialized countries, the tonnage of rubber consumed in the manufacture of bicycle tyres is low compared with that absorbed by the automobile industry; it is of the order of only 5-6 per cent in France and Japan for example.

The picture will be different in the developing countries, where the bicycle is the first means of transport available and only a very low proportion of the population can afford any kind of transport; there are 0.04 bicycles per head of the population in India and apparently about 0.03 in West Africa, as compared with 2.4 cars per head of the population in the United States. Power-assisted bicycles with a low capacity, less than 50 cc, which are sturdy, very manoeuvrable and reasonable in price, are also enjoying very great popularity among African town-dwellers, if one can judge from the increase in imports of motor cycles in the sub-region, mainly machines of less than 50 cc.

About 2.3 million tyres were imported into the sub-region, excluding Nigeria, in 1964, see table 7. Imports do not seem to have increased during the past year, which leads one to suppose, bearing in mind the assessment of the Nigerian market at 2.5 million tyres in 1965, that the sub-regional market has not yet passed the threshold of 5 million. If it is assumed that a tyre weighing 700 grammes includes 55 per cent rubber, that a tube of 200 grammes includes 70 per cent, and that the need for tubes is as great numerically as that for tyres, this corresponds to about 2,500 tons of rubber, or 12-13 per cent of the total absorbed by the sub-region in 1965 - compare this figure with India's 12 per cent in 1960.

In the absence of accurate information on the development of the number of bicycles and replacement indexes in the sub-region, one would obviously be tempted to adopt a fairly high growth rate for future consumption of tyres, of the order of 12 per cent, for example. With only passing reference to the previous comment on the value to be placed on opinion surveys, it will merely be said that the great

discrepancy between this rate and the incomparably smaller rate expected by certain suppliers in a few large consumer countries prompts one rather to adopt a figure approximating to the mean increase in rubber consumption, or 8 per cent. This would therefore give:

10,500,000 tyres in 1975;

15,700,000 tyres in 1980.

Assuming equivalent quantities of tubes this would correspond to the following tonnages of rubber:

5,500 tons in 1975;

8,200 tons in 1980.

Adopting the lowest profitability threshold generally quoted for this type of manufacture - up to 1,000 tyres and 1,000 tubes per day - the size of the market would make it possible to envisage a fairly wide distribution of small factories in the sub-region.

Such a recommendation, inspired by the present level of imports of certain coutries, see table 7, would not be realistic. In the first case, because, in some cases, with small additional capital investment the two Nigerian factories are quite suitable for supplying at least the local market, that is to say, approximately 50 per cent of the needs of the sub-region. Then, because, operating conditions of the Nigerian factories being incomparably more favourable and in view of the present level of import prices, it is greatly feared that an output of 1,000 tyres per day - compare the 30,000 tyres per day of a European factory - would be too low to make it possible to follow market prices.

The only reasonable attitude, if one desires also to avoid the pitfall that an attempt to be competitive at all costs would be reflected in considerable decreases in quality, is either to combine the manufacture of bicycle tyres with that of other products when the output envisaged is low or to produce relatively large amounts when there is no such combination; this is perfectly compatible with market prospects.

If the first solution were adopted, bicycle tyres would be manufactured in the automobile tyre plants of the Ivory Coast and Ghana and perhaps, following the example of Kenya, in the large Bata shoe factory in Senegal. However, that procedure would not necessarily serve the best interests of all parties. The particularly favourable consumption prospects in a country like the Upper Volta, which is already one of the largest consumers in the sub-region and whose per capita GDP will probably have the largest growth in the sub-region between 1965 and 1980, might seem to be a reason for intensifying its industrialization and for recommending the establishment there, as from 1970, of the second sub-regional factory for bicycle tyres and tubes. It is true that the country does not produce rubber and that there is no immediate prospect of its producing the wire necessary for the manufacture of tyres, but the economic characteristics of bicycle tyre manufacture are also, from the point of view of the unit cost of jobs created and value added, much more favourable than those of automobile tyres.

TABLE 7

Imports of bicycles and motor cycles tyres and tubes in 1964

	Tyres		Tubes	
	Value ($1,000)	number (1,000)	Value ($1,000)	number (1,000)
Nigeria	1,086	1,459	444	1,794
Ghana	194	297	73	362
Ivory Coast	632	796	194	617
Senegal	204	292	66	209
Upper Volta	472	600	220	600
Mali	156	120	58	215
Dahomey	78	91	24	47
Togo	40	45	23	44
Niger	16	11	2	7
Mauritania	-	-	1	3
Sierra Leone	20	28	10	45
Liberia (1963-motor cycles and bicycles)	-	1	1	4
Guinea	-	?	-	?
Gambia	-	6	-	6
Total	3,746			3,953

V. RETREADING

The possibility of obtaining good quality retreaded tyres is still not universally acknowledged; such scepticism can only be explained by the mediocrity of the small-workshop techniques that developed after the end of the last war. Provided the casing is in good condition, a utility vehicle tyre can be retreaded twice and a large aeroplane tyre up to four times.[1/]

Owing to the difficulty of balancing reconditioned tyres, retreading the tyres of fast touring cars is not recommended, but there remains the large market of possessors of old or light cars and that of drivers who are in less of a hurry or who have less money to spend. The percentage of re-usable casings will, no doubt, be lower in the sub-region than in an industrialized country with an extensive network of tarred roads, and the utility vehicle fleet will, thereby, be subjected to incomparably more severe treatment, making retreading more uncertain. The amount of retreading done in most industrialized countries, see table 8, nevertheless shows that an activity that has not been neglected in countries with the highest standards of living is of indisputable advantage to the sub-region.

1/ It can easily be seen that the larger the tyre, the greater the advantage of retreading.

TABLE 8

Percentage of retreaded tyres to new tyres (about 1963)

	Vehicles	
	Touring cars	Heavy vehicles
Unted Kingdom	47	37
Ireland	60	40
Italy	40	70
United States	50	50
Fed. Rep. of Germany	45	40
France	15	50

There are already many retreading workshops in the sub-region, including nine in Nigeria, two each in Ghana and Liberia, and one each in the Ivory Coast and Senegal; the increase in the number of motor-vehicles will automatically entail the establishment of new workshops, the number and capacity of which will mainly depend on the local conditions prevailing at the time. As quite a large amount of rubber might be consumed in retreading - 9 per cent of the total consumption of the tyres sector in India in 1960, at least as much in West Africa in coming years - it is essential for the sub-region to produce all the camel-back it needs. Existing tyre factories, or those to be set up, are of course quite suitable for supplying most of this, but it is not out of the question and would even be desirable for certain retreading workshops to extrude their own camel-back and take advantage of this fact to develop other extruded or moulded products, such as articles for industrial use, soles, heels, etc., which it would not have been economic to produce in isolation.

VI. INDUSTRIAL RUBBER

Two features of industrial rubber[1] are the extreme diversity of the articles manufactured and the large number of enterprises engaged in their manufacture. In France, for example, there are approximately 300 enterprises, the staffs of which range from about 10 to 5,000. Most of the small enterprises have a perfectly valid place in this complex. They usually specialize in small and medium production runs, which would only burden the overheads of larger companies; moreover, the fact that the manufacture of rubber goods is in general a highly specialized process, does not encourage the consuming industries to develop production of such articles for themselves.

Owing to the great diversity of products, knowledge of the total consumption of rubber in a given country cannot give an indication of the competitiveness of any particular article. The most characteristic example is the footwear industry, whose rubber consumption in 1963 was as follows:

56,000 tons in Japan;

7,000 tons in Canada;

7,000 tons in France.

However, the total consumption of rubber in Japan was only 50 per cent above that of France, and that of Canada was only one third.

1. The footwear industry

On the whole, the footwear industry is a large consumer of rubber. In 1963, the French and Japanese industries respectively absorbed 11 and 17 per cent of the total consumption of rubber, or 19 and 35 per cent of the consumption of the tyre sector alone. In India, the market for footwear includes only 20 per cent of the population, but the industry absorbed 13 per cent of the country's rubber consumption in 1961.

1/ A term covering all non-tyre products.

In West Africa, where the net imports rose to almost 15 million pairs in 1964, local production is still distinctly inadequate to meet demand, and the future consumption of rubber by the footwear industry will depend both on the speed with which the sub-region industrializes and on the proportion of rubber goods in the footwear market.

There is no doubt of the advantage of rapidly establishing a sub-regional industry. The industry in question would involve simple manufacturing processes particularly suited to the skill of the available labour force. Only small capital investments are necessary for the manufacture of plastic footwear at most 1 million francs for 600,000 pairs per year - those required for the production of leather or rubber footwear are higher, but the cost per job created is less than half and the value added is distinctly higher, quite apart from the fact that the plastics have to be imported and moreover represent 70 per cent of the cost of production of the finished goods.

The future of rubber footwear, mainly canvas and rubber shoes, however seems to be fairly limited owing to the exceptional popularity of plastic footwear, which is often sold at very low prices, fr CFA 150, and can be manufactured with a very low capital outlay. The import statistics of the sub-region group articles of plastics and rubber goods together, see table 9, but owing to the distinction made by neighbouring countries (Congo, Chad, Gabon, etc.), it can be concluded that plastic footwear makes up most of this category. We also have the conclusions reached in a special analysis of the development of needs in the Ivory Coast. It is considered that by 1970, the demand for leather shoes - fashion shoes imported from Europe and utility type shoes or sandals supplied by Senegal would rise from 800,000 pairs in 1960 to 1,700,000 pairs, including 500,000 imported pairs. The demand for rubber footwear, which is of interest to the fraction of the population with middle-level incomes, would rise from 326,000 pairs in 1960 to 850,000 in 1970, whereas needs for plastic footwear would rise from 2,060,000 pairs in 1960 to 6 million in 1970.

The over-all demand in the sub-region, of the order of 35 million pairs in 1965, should reach 75 million by 1975 and 110 million by 1980, assuming an annual growth rate of 8 per cent. Assuming that 30 per cent of such footwear would directly or indirectly absorb 160 grammes of rubber per pair, of the order of 3,200 tons would be directly consumed in 1975 and 4,800 in 1980.

2. Miscellaneous articles for bicycles and cars

Numerous articles of rubber are consumed by the automobile industry: weather-seals for doors, windows, and wind screens, pedal covers, wind-screen wiper blades, shock absorbers, weather shields for quarter vents, floor mats, etc, most of which might be produced locally both for the needs of assembly workshops and for vehicle maintenance. At the rate of 15 kg of rubber for every new vehicle, the corresponding consumption of rubber might attain 400 tons in 1975 and 700 tons in 1980.[1/] This figure will have to be increased by 10 per cent to take into account needs for bicycles and motor cycles.

3. Articles in foam latex

The main markets for foam latex are cushions for furniture or automobiles, pillows, mattresses, and carpet underlays.

Considering the level of industrialization and the average standard of living in the sub-region, there is doubtless not much hope of a large market for these articles, which only the better off strata of the population will be able to afford, but the great simplicity of their manufacture, combined with the possibility of purchasing locally the concentrated latex[2/] that accounts for half of the cost of production, forbids us to neglect the eventuality of such manufacture in zones with a sufficient rate of urbanization, see table 10.

1/ No allowance is made for consumption in respect of accumulators, the cases of which are now hardly ever made of ebonite.

2/ This would require merely the previous purchase of centrifuges by some of the plantations in the sub-region.

TABLE 9

Sub-regional imports of the main types of footwear

(million pairs in 196

	Rubber or plastics	Leather uppers	Rubber and cloth
Ivory Coast	1,553,903	1,144,207	213,676
Senegal	119,882	371,325	13,266
Upper Volta	200,537	69,917	90,000
Niger	110,474	19,662	65,616
Togo	197,873	115,000	19,000
Dahomey	165,644	148,545	29,000
Mali	197,238	64,392	20,836
Mauritania	-	-	-

	Rubber soles and uppers	Leather, rubber or plastic soles
Nigeria	1,815,256	1,987,328

		Mainly textile	Leather or mainly leather uppers
	111,415	107,829	1,136,634

	All types
Sierra Leone (1962)	480,000
Liberia	2,004,700
Guinea (1961)	717,000
Gambia (1963)	417,000

A small plant for the manufacture of cushions or mattresses does not require any of the heavy apparatus used in working dry rubber, e.g. masticators, sheeting mills, calender machines, presses, etc. In the Dunlop process, the latex is simply beaten to a foam in mixer-beaters, cast into moulds, removed, washed and dried. The process, of course, requires some care and skill, so, if necessary, initial capacities of 50-100 tons a year can be regarded as satisfactory, four countries should be able to develop such production progressively: Nigeria, Ghana, Senegal and the Ivory Coast.

TABLE 10

Rate of urbanization - 1963

Country	Rate of urbanization	Country	Rate of urbanization
Senegal	23	Sierra Leone	7
Chana	17	Guinea	6
Liberia	12	Mauritania	5.5
Ivory Coast	12	Mali	5.5
Dahomey	10	Niger	2.5
Nigeria	10	Upper Volta	2
Gambia	9		

Note:

For Nigeria, only towns with more than 20,000 inhabitants were considered as against more than 10,000 for the other countries.
These rates must be interpreted with caution, if it is desired to link them to the level of economic development, because of the existence of relatively large numbers of urban unemployed and the customary predominance of activities in the tertiary sector over industrial activities.

4. Belting

A distinction is made between conveyor belts and transmission belts.

Conveyor belts consist of a carcass, generally textile, that gives resistance and rigidity, covered by a rubber wear layer. Their manufacture includes highly technical operations: pre-drying and frictioning of the textiles and cables, applying the rubber cover by means of calender machines, vulcanization in a discontinuous or continous press, joining the ends, finishing. The capital investment is considerable - a vulcanization press for 2 m width belting costs nearly 1 million francs and can only pay its way in a large market, which will appear very slowly at sub-regional level.

Flat transmission belts also require considerable capital investment, and in any case their use is decreasing.

V-belts, which make it possible to set pulleys close together require a very sophisticated production technique. In a conventional type one will find for example: in the broad part cotton cord clad with a mixture of high elasticity and low hardness; in the narrow portion a harder mixture, which improves flexibility and absorbs shock, the whole being covered by a carefully frictioned textile coating. The motor vehicle fleet of the sub-region would no doubt represent a market of some size, but, without even referring to the elaborate technical nature of the manufactures, the diversity of dimensions encountered would be a negative factor militating against the profitability of any manufacturing projects in the near future.

5. Tube and hose

Tube proper or hose made entirely of rubber is a simple article without any carcass obtained by extrusion and vulcanized in autoclaves. The manufacturing process is not complicated, but the markets are restricted so that the production of tube could only be considered when combined with other manufactures.

Hose includes not only rubber but some textile components - canvas, braided yarn - or metal components - braided wire, spirals, bowden wire - which strenghten its resistance. There are very different types, according to the nature, the flow, pressure and temperature of the fluid, and these are manufactured by several conventional methods: vulcanization in a lead sheath, vulcanization in presses, the rod or mandrel process, etc. Large production runs of small-dimension hose, such as watering hose and compressed air hose, are manufactured by the lead sheath process; the textile elements are made by braiding machines and laid on the inner core extruded in lengths of up to 200 metres; a sheath of lead is applied by means of a lead press; the hose thus sheathed is wound on a drum, vulcanized in an autoclave and the lead sheet is then split to recover the metal. In the rod or mandrel process the hose is first of all threaded on to a mandrel and then after laying the braid and the outer cover it is wrapped on a machine with three rollers before being vulcanized. This technique is mainly used for large diameter hose, e.g. for the decanting of hydrocarbons, or for hose that must have special properties, e.g. ability to withstand high pressures.

At sub-regional level there is probably a fairly large consumption of hose, but it scarcely seems possible to consider manufacturing hose in the immediate future for several reasons: the great diversity of articles, the elaborate manufacturing technique, the very keen competition from plastics for numerous uses, not to mention the frequent use of synthetic rubber.

6. Cable insulation

Formerly used in the manufacture of most wire and cables for domestic installations and numerous industrial cables, natural rubber and SBR rubber are now used practically only for making certain flexible cables for household appliances. Their electrical and thermal properties

7. Over-all prospects for the industrial rubber industry

The industrial articles, except footwear, consumed in the sub-region probably contained a little over 2,000 - 2,200 tons of rubber in 1965, almost exclusively indirect consumption. On the basis of an annual growth rate of 8 per cent, one can estimate consumption at about 5,000 tons in 1975 and at about 7,000 tons in 1980. On the assumption of a West African Market in which each country would be prepared to give priority to sub-regional producers the consumption targets adopted for a sub-regional industry will be at least 40 per cent of these tonnages in 1975 and 70 per cent in 1980.

VII. THE ECONOMIC INCIDENCE OF INDUSTRIALIZATION

The influence of the development of the rubber industry on the sub-regional economy will be illustrated by means of a certain number of data: gross sales prices value added created, number of jobs created, amount of capital investment.

Gross sales prices

The predicted consumption of rubber in 1980 will be distributed approximately as follows:

automobile tyres and tubes	38,400 tons
bicycle tyres and tubes	8,200 tons
retreading (12 per cent of the tyre sector)	5,300 tons
footwear	5,300 tons
industrial rubber	7,100 tons
	64,300 tons

In 1963, with a rubber consumption of 268,000 tons in France, including reclaimed rubber, and a gross sales price of 3,451,000 francs 1 kg of rubber content corresponded to gross sales of $2.60. A mean of $2.90 will be adopted for the sub-region. Since the manufacture of footwear is being dealt with in a separate study, this paper will consider only sales to manufacturers who have no mixing plant, for example manufactures of leather footwear, and sales to shoe repairers. These will be assessed at 1,000 tons, which gives the following gross sales figures:

$ 120,000,000 in 1975

$ 174,000,000 in 1980.

Value added created in the sub-region

Such value added will be defined as the difference between the above gross sales and the sum of the following items:

The value of the articles that are still imported, minus, where appropriate, the value of exports to countries outside the sub-region;

Purchases of raw materials outside the sub-region;

An estimate of the amount of money that can be repatriated as technical assistance and miscellaneous financial charges; it will be supposed that all money available for self-financing will be reinvested locally.

As from 1975 the sub-region should be able to satisfy 95 per cent of its needs for tyres, 100 per cent for articles used in retreading, and 90 per cent for footwear. For industrial rubber, the 40 per cent level should be attained in 1975 and the 70 per cent level in 1980. Imports would therefore further rise to about $12 million in 1975 and $14 million in 1980.

Imports of raw materials will cover:

Butyl rubber for tubes of motor vehicles, i.e. 3,800 tons costing $2.3 million in 1975, 5,600 tons costing $3.4 million in 1980;

In the form of synthetic products, a minimum of 20 per cent of the tonnage of rubber consumed for light vehicles, or 1,260 tons in 1975 and 1,800 tons in 1980 with values $550,000 and $810,000 respectively;

A percentage assessed as at least 90 per cent in 1975 and 70 per cent in 1980 of the other raw materials needed, carbon black, natural or synthetic textiles, chemicals, ferrous metals, etc., with a value estimated at $15 million in 1975 and $18 million in 1980.

If one adds an estimated 6 per cent of the gross sales to take into account technical assistance costs and miscellaneous financial charges, i.e. $7.2 million in 1975 and $10.4 million in 1980, the value added created in the sub-region would finally attain the following figures:

$80 million in 1975

$ 127 million in 1980

Jobs created

In an industrialized country the tonnage of rubber treated annually per worker is over 6 tons for tyres and over 2.5 tons for industrial rubber. It can be estimated that the average output of the sub-region is less than half of these figures; however, it must rise, here as elsewhere, to ensure the competitiveness of the products. As targets for 1980 tonnages near 4 tons per worker for tyres and 1.5 for industrial rubber will be adopted, which correspond to the additional employment of:

17,000 persons in 1980, including 650 technicians, engineers and supervisory staff;

13.000 persons in 1975, including 500 technicians, engineers and supervisory staff.

Amount of capital investment

The vast majority of the capital investment will be devoted to the manufacture of tyres and tubes for motor vehicles: four plants producing 700,000 tyres per year each in 1980 would cost $80 million. For bicycle tyres, the hypothesis of four plants producing 4 million tyres per year each will be adopted, three being combined with factories for motor vehicle tyres and one being confined solely to bicycle tyres; the corresponding investment would be $7 million. As the products are not very complicated, the capital investment for the production of articles for retreading on footwear and industrial rubber should not exceed $15 million by 1980, it being assumed that rational use of second-hand equipment would make possible a considerable reduction in this amount. Assuming a capital investment of about $10 million for retreading proper, the total capital investment would finally be $112 million in 1980, not counting the working capital fund and of the order of $160 million including the working capital fund, as well as local expenditure on buildings, Customs duties, labour for assembly work, etc., of the order of $40 million.

If the amount of capital investment already made in the sub-region is assessed at $25 million, the timetable of additional capital investment might be as follows:

$64 million by 1975;

$87 million by 1980.

CONCLUSION

Apart from the low volume of exports of canvas and rubber shoes by Senegal, there is at present no trade in rubber goods within the sub-region. Assuming a sub-regional market with optimum fluidity, which was the basic hypothesis that the authors were instructed to take, and assuming that all political, economic or technical measures necessary for the normal functioning of this market are taken in good time - see in particular chapter I on the authors' reservations with regard to the present state of communications and transport - the sub-region could be supplied as follows:

Automobile tyres and tubes: Up to 95 per cent of the needs would be exclusively supplied by Nigeria, the Ivory Coast and Ghana, which would export almost one third of their output;

Bicycle tyres and tubes: Different but equally feasible solutions can be envisaged, as suggested in chapter 4. For example, as above, the producers of automobile tyres might be the sole suppliers. Or, a solution more in line with the interests of the countries now less favoured from the point of view of industrialization, Nigerian production might be confined to the domestic market, the needs of the other countries in the sub-region being supplied by the Upper Volta. Or also any interim solution providing not only for production by the Upper Volta but also one or two additional plants, say in Senegal and Ghana, but in this case practically confined to the respective domestic markets;

Retreading: Plants in the sub-region would obtain their supplies either from tyre factories in Nigeria, the Ivory Coast and Ghana and, if appropriate, the Upper Volta except for those that also engage in the production of industrial rubber;

It has been stated that by 1980 the sub-region could satisfy 90 per cent of its needs for footwear and 70 per cent of its needs for industrial rubber, but this production will be very unequally distributed. It will be mainly concentrated in the three countries of Nigeria, the Ivory Coast and Ghana, which together absorb two-thirds of the total consumption of rubber; the development of local production in the other countries will depend more on the initiative of private entrepreneurs than on the actual size of the market; small-workshop processing of 30 tons of rubber per year may be

viable in cases where an industrial plant of 100 tons per year would hardly, if at all, be so.

Tables 11, 12 and 13 on West African trade in 1964, 1975 and 1980 sum up the effect that developing the sub-regional rubber industry would have on the structure of supplies in West Africa. The tables, which follow the pattern given to the experts, were prepared on the simplest hypothesis of a concentration of all production of automobile and bicycle tyres in Nigeria, the Ivory Coast and Ghana and assuming that exports outside the sub-region are insignificant. The scope for exports to East Africa, Southern Africa, North Africa or outside the African continent will without doubt be extremely small, but there is reason to think that the Central African sub-region will for a fairly considerable time yet remain an importer of the most elaborate rubber manufactures, chiefly automobile tyres. The part of this market accessible to West African producers, who are normally less competitive than European manufacturers, will above all depend on the extent of the preferential measures that importing countries would be prepared to take in favour of African products[1/]. Strictly as an indication and on the basis of a Central African market equivalent to one third of the West African market, it is recalled that the gross sales of the West African rubber industry, mainly tyres for lorries, would grow by an additional 6 to 7 per cent if West African producers could obtain 30 per cent of the market for tyres in Cameroon, the Equatorial Customs Union and the Congo (Kinshasa).

1/ Taking into account where applicable the possibility of processing Cameroonian or Congolese rubber in West Africa.

TABLE 11

West African trade in 1964

($ million)

Exporting countries \ Importing countries	Dahomey	Gambia	Ghana	Guinea	Ivory Coast	Liberia	Mali	Mauritania	Niger	Nigeria	Senegal	Sierra Leone	Togo	Upper Volta	Other	Total exports	W. African exports	Grand totals
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x
Ivory Coast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x
Nigeria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,2	0,2	-	x
(16) Overseas	0.5	0.1	6.2	0.4	5.6	1.7	1.0	0.5	0.5	6.6	2.7	1.3	0.7	1.2	x	x	x	29
(17) Total imports	0.5	0.1	6.2	0.4	5.6	1.7	1.0	0.5	0.5	6.6	2.7	1.3	0.7	1.2	x	x	x	29
(18) W. African imports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	x	x	x	0
(19) Output	0	0	0.5	0	2	0.3	0	0	0	7.2	8	0.1	0	0	x	x	x	8.1
(20) Total supply	0.5	0.1	6.7	0.4	5.6	2.0	1.0	0.5	0.5	13.8	2.7	1.4	0.7	1.2	x	x	x	37.1
(21) Exports	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	x	x	x	0.2
(22) Domestic consumption	0.5	0.1	6.7	0.4	5.6	2.0	1.0	0.5	0.5	13.6	2.7	1.4	0.7	1.2	x	x	x	36.9

Horizontally: (17) = (18) + (16)
(20) = (21) + (22)
(19) = (20) - (17)

TABLE 12

West African trade in 1975

($ million)

Exporting countries \ Importing countries	Dahomey	Gambia	Ghana	Guinea	Ivory Coast	Liberia	Mali	Mauritania	Niger	Nigeria	Senegal	Sierra Leone	Togo	Upper Volta	Overseas	Total exports	W. African exports	Grand totals
Ghana	0.3	0.1	-	0.6	-	1.6	0.5	0.5	0.5	-	1.5	1.2	0.4	0.3	[illegible]	7.5	7.5	x
Ivory Coast	0.1		-	0.7	-	0.5	0.8	0.6	0.7	-	2.8	0.2	0.1	1.5	[illegible]	8.0	8.0	x
Nigeria	0.9	0.1	0.1	0.7	0.3	2.8	1.0	0.9	1.3	-	4.6	2.5	0.9	0.4	[illegible]	16.5	16.5	x
(16) Overseas	0.1		2.2	0.3	1.9	0.6	0.2	0.2	0.2	4.1	1.2	0.5	0.2	0.3	x	x	x	12
(17) Total imports	1.4	0.2	2.3	2.3	2.2	5.5	2.5	2.2	2.7	4.1	10,1	4.4	1.6	2.5	x	x	x	44
(18) W. African imports	1.3	0.2	0.1	2.00	0.3	4.9	2.3	2.0	2.5		8.9	3.9	1.4	2.2	x	x	x	32.0
(19) Output		0	26.8	0.1	26.1	0.5	0.1	0	0.2	52.9	1.0	0.2		0.1	x	x	x	108
(20) Total supply	1.4	0.2	29.1	2.4	28.3	6.0	2.6	2.2	2.9	57.0	11.1	4.6	1.6	2.6	x	x	x	152.0
(21) Exports	0	0	7.5	0	8.0	0	0	0	0	16.5	0	0	0	0	x	x	x	32.0
(22) Domestic consumption	1.4	0.2	21.6	2.4	20.3	6.0	2.6	2.2	2.9	40.5	11.1	4.6	1.6	2.6	x	x	x	120

Horizontally: (17) = (18) + (16)
(20) = (21) + (22)
(19) = (20) - (17)

TABLE 1 }

West African trade in 1980

($ million)

Exporting countries \ Importing countries	Dahomey	Gambia	Ghana	Guinea	Ivory Coast	Liberia	Mali	Mauritania	Niger	Nigeria	Senegal	Sierra Leone	Togo	Upper Volta	Other	Total exports	W. African exports	Grand totals
Ghana	0.5	0.1	-	0.9	-	2.5	0.7	0.8	0.8	-	2.0	1.5	0.6	0.5	x	10.9	10.9	x
Ivory coast	0.1	0.1	-	1.0	-	0.6	1.2	0.8	1.0	-	4.6	0.2	0.1	2.3	x	12.0	12.0	x
Nigeria	1.2	0.1	0.6	1.1	0.6	3.9	1.4	1.3	1.8	-	6.1	4.0	1.3	0.5	x	23.9	23.9	x
(15) Overseas	0.1		2.5	0.3	2.3	0.7	0.3	0.3	0.3	4.7	1.4	0.6	0.2	0.3	x	x	x	14.0
(17) Total imports	1.9	0.3	3.1	3.3	2.9	7.7	3.6	3.2	3.9	4.7	14.1	6.3	2.2	3.6	x	x	x	60.8
(18) W. African imports	1.8	0.3	0.6	3.0	0.6	7.0	3.3	2.9	3.6		12.7	5.7	2.0	3.3	x	x	x	46.8
(19) Output	0.1	0	38.9	0.2	38.2	1.0	0.2	0	0.3	78.5	1.8	0.4	0.1	0.2	x	x	x	160.0
(20) Total supply	2.0	0.3	42.0	3.5	41.1	8.7	3.8	3.2	4.2	83.2	16.0	6.7	2.3	3.8	x	x	x	220.8
(21) Exports	0	0	10.9	0	12.0	0	0	0	0	23.9	0	0	0	0	x	x	x	46.8
(22) Domestic consumption	2.0	0.3	31.1	3.5	29.1	8.7	3.8	3.2	4.2	59.3	16.0	6.7	2.3	3.8	x	x	x	174.0

Horizontally: (17) = (18) + (16)
(20) = (21) + (22)
(19) = (20) - (17)

ANNEX I

THE PROSPECTS FOR NATURAL RUBBER IN WEST AFRICA

I. Economic aspects of rubber plantations

To obtain a better picture of the advantage of studying prospects for natural rubber in the world in general and in West Africa in particular, it seems logical to recall some economic characteristics of rubber plantations.

The fact that the establishment and operation of a plantation requires a large capital investment is not peculiar to rubber. One peculiarity, however, is the fact that the capital required is relatively high and that the return is slow. By a singular coincidence the cost of a European plant for synthetic rubber is of the same order of magnitude as that of a plantation. In Africa at the moment the cost of setting up plantations is of the order of 10,000 francs per hectare, and this capital does not begin to yield income until after six or seven years, while it takes at least ten years to obtain the full output level from which profits become satisfactory. Venturing into rubber growing therefore supposes, both for individuals and communities, that there is at the outset large financial support and that this support lasts long enough to ensure maintenance and operation of the plantation until complete maturity.

The future competitiveness of natural rubber as against synthetic rubber will mainly depend on the yield per hectare that can be achieved. While yields of 200 - 250 kg per hectare were considered normal in 1920, present average figures are 1,200 - 1,500 kg in the large plantations in South-East Asia and 1,300 kg in the Firestone plantations in Liberia. The yields on small holdings, which still supply tonnages of rubber equivalent to those of the large plantations but have approximately twice the area under production, are unfortunately much lower: of the order of 450 kg per hectare as against an average of 900 kg for large plantations. From a study by the Rubber Research Institute

of Malaya[1] the authors have made a breakdown of the cost of production of natural rubber, excluding taxes and export dues, depreciation, administration and sales costs, which gives a good picture of the influence of yield on the cost of production:

Tapping and collection	46.6 per cent
Plantation maintenance	12.9 per cent
Production overheads	25.7 per cent
Treatment of latex	10.7 per cent
Package and dispatching costs	4.1 per cent
	100.0 per cent

An improvement in yield does not affect the last two items but greatly influences the first three, which constitute 85 per cent of the cost of production. According to the RRIM, the mean reduction of the total fob costs of production would be 0.18 francs per kg over a range of yields of 500 - 1,240 kg per hectare and for an annual increase of 112.5 kg per hectare.

It is also necessary to emphasis the importance of the labour item in the cost of production of rubber. Whereas a synthetic rubber plant producing 40,000 tons per year requires only 160 workers, office staff and technicians, a plantation of identical capacity would employ 22,000 persons. On the basis of one man for every 4 acres (tapping, collection and treatment) the small holdings give employment to more than 1,700,000 persons and probably provide 8 - 9 million with a living. The social incidence of rubber cultivation therefore requires no comment.

Exports of rubber give many producing countries an appreciable part of their foreign exchange income: of the order of 60 per cent for Malaysia, Indonesia and Viet-Nam, and 30 per cent for Liberia and Thailand. Interesting prospects are therefore open to African countries new to rubber cultivation; this activity would also give them an opportunity to diversify their agricultural production, which is generally subject to considerable market fluctuations.

1/ Journal of the Rubber Research Institute of Malaya, Vol. 18 (1964), pp. 51-56.

II. The rise of rubber cultivation in West Africa

At the beginning of the century, 40 per cent of world production of rubber was of African origin, whereas South-East Asia provided only 5 per cent. African production was exclusively based on wild rubber, and plantations of Hevea brasiliensis were still at the experimental stage, e.g. a British pilot plantation in Liberia in 1904 and German plantation experiments in Cameroon during the World War I.

These attempts were continued between the two wars and in 1945 Africa was able to produce more than 50,000 tons of a mixture of wild and plantation rubber. Since then, output has incessantly grown and from 1950 to 1964 its average annual growth rate was 8 per cent, as against 1.4 per cent for world production, see tables 1 and 2.

TABLE 1

Development of world and African production of natural rubber

Year	World production (t)	Growth rate	African production (t)	Growth rate
1950	1 860 000	-	55 250	-
1951	1 885 000	+ 1 %	72 000	+ 30 %
1952	1 790 000	- 5 %	73 500	+ 2 %
1953	1 730 000	- 3 %	78 500	+ 7 %
1954	1 810 000	+ 5 %	82 750	+ 5 %
1955	1 920 000	+ 6 %	98 750	+ 19 %
1956	1 887 500	- 2 %	113 500	+ 15 %
1957	1 902 500	+ 1 %	116 250	+ 2 %
1958	1 940 000	+ 2 %	123 250	+ 7 %
1959	2 040 000	+ 5 %	141 750	+ 15 %
1960	1 985 000	- 3 %	146 000	+ 3 %
1961	2 087 500	+ 5 %	138 250	- 5 %
1962	2 120 000	+ 2 %	145 750	+ 5 %
1963	2 055 000	- 3 %	150 500	+ 3 %
1964	2 232 500	+ 9 %	159 750	+ 6 %

TABLE 2

Net rubber exports of African countries

	Liberia	Nigeria	Ghana	Congo	Cameroon	Central African Rep.	Ivory-Coast	Other African countries	Total for Africa
1950	31 121	13 410	260	8 087	1 585	180		607	55 250
1955	38 741	30 375	250	25 671	3 489	164	-	100	98 750
1956	39 750	38 122	321	32 014	2 933	233	-	150	113 500
1957	38 894	39 542	331	33 763	3 051	516	-	50	116 250
1958	42 378	41 062	433	34 526	3 878	901	-		123 250
1959	43 704	53 205	574	39 511	3 895	785	-		141 750
1960	47 619	58 528	780	34 995	4 522	564	-		147 000
1961	40 554	54 857	408	37 066	8 507	523	100		142 000
1962	44 675	59 131	342	36 936	7 856	680	150		149 750
1963	40 689	63 207	338	36 996	9 066	961	500		151 750
1964	41 893	71 099	335	33 250	8 770	972	1 528		157 750

Source: Rubber Statistical Bulletin.

Liberia was for a long time the leading African country in the cultivation of Hevea. The first concession of the Firestone Plantation Co., whose 12 million trees constitute today the largest single plantation, dates from 1926 and its success encouraged the spread of plantations in Liberia, almost 3,700 now being in production. From 1949 onwards, five other foreign companies in turn set up new plantations. The importance of rubber in the Liberian economy, however, has steadily decreased since the rise of iron ore. Only ten years ago, it provided three quarters of export revenue and one third of the budget revenue came from taxes paid by Firestone. While its importance has declined, rubber is nevertheless an essential factor in the prosperity of Liberia, since it still provides almost one third of export revenue, and since 39,000 of the 90,000 wage - earners in the country are employed in its production.

From 1959, however, Liberia lost its leading place to Nigeria, whose output, which was 13,000 tons in 1950, was to multiply five times between 1950 and 1964 and whose contribution to African output was to rise from 25 to 45 per cent over the same period. Owing to a most fortunate diversification of local agricultural production, rubber contributes only a modest share in percentage but a by no means negligible share in absolute value to the country's exports; in 1963, £11,788,000 out of £189,699,000 total exports. Rubber cultivation in Nigeria differs from that in the other African countries in the clear preponderance of small holders, the area of whose plantations was 103,000 ha in 1960, out of a total of 120,000.

The Ivory Coast was a very late comer to rubber cultivation. An Institut de récherches sur le caoutchouc en Afrique (the first IRCA) was set up in 1941 at the instance of the French authorities, who were concerned by the development of the situation in the Far East, but it was not until the more recent events in what was formerly Indochina that companies from that area took a genuine interest in the French-speaking countries of Africa. The Compagnie des cultures d'Extrême-Orient et d'Afrique, which changed its name in 1957 to the Compagnie des caoutchoucs du Pakidié (CCP), set up a first plantation of 400 ha between 1953 and 1956. In 1956 was established the SAPH (Societé Africaine des plantations d'hévéas), a group of five companies from former Indochina in which the Government of the Ivory Coast took out a 51 per cent majority holding in December 1964; the second IRCA was also set up in 1956 and began to establish its first plantations in 1957. At the end of 1964 the area planted exceeded 11,000 ha distributed between the CCP (2,700 hectares), the SAPH (8,200 hectares) and the IRCA (250 hectares).

Output which was very low at the outset - 82 tons in 1961 and 205 tons in 1962 - rose rapidly to 400 tons in 1963, 1,805 tons in 1964, and 3,200 tons in 1965; apart from the older installation of the CCP, there are two very modern SAPH treatment plants for processing the latex into granulated and coagulated rubber.

III. Prospects for the production of natural rubber in the world and in West Africa up to 1975

It is important to emphasize that such forecasts will deal only with the theoretical potential supply and not output proper, which might be considerably different from that. In fact, it is considered, see table 3, that world supplies of natural rubber will be adequate for known needs at least until 1975 so that without even mentioning the other external factors, including political circumstances, that are capable of influencing actual output, a very unfavourable development of market prices, for example, might bring about a distinct reduction in the tonnages marketed by planters and particularly by small holders.

TABLE 3

Market for natural rubber in 1970 and 1975

1,000 tons

	1970	1975
Imports of the Eastern bloc countries and China	575	675
Consumption, rest of the world	2,100	2,275
Total needs	2,675	2,950
World supplies (including slaes of stockpiles)	2,800-3,000	3,125-3,375

Source: International Rubber Study Group (IRSG)

Usually, assessing the potential for the first six years after the base year involves the least risk of error, because it is in principle enough to plot year by year the areas planted or replanted. Taking political developments in certain producing countries into consideration may, nevertheless, lead us to introduce fairly considerable corrections. The estimation of the theoretical potential beyond 1970-1971, which depends on areas that have not yet been planted or replanted and that

will not be so until after 1965-1966, seems much more uncertain. In addition, who can predict with certainty how the economic and political situation will develop by 1975-1980 and what comparative technical progress will be made in natural and synthetic rubber as well as how markets will evolve?

According to the IRSG, see table 4, world production of rubber might rise from 2,125,000 tons in 1962 to 2,675,000-2,875,000 tons in 1970 and to 3,125,000-3,375,000 tons in 1975. As is to be expected, West African output should grow more rapidly than the average, practically doubling over 13 years (1962-1975) as against an increase of only 50 per cent for all producing countries together.

The output of Nigeria should remain the largest in the sub-region at almost 120,000 tons in 1975 through the implementation of a large-scale planting programme. In addition to the areas that an IBRD report expects to be planted in the period 1962-1965, namely:

22,000 acres in the Eastern Region, including 9,000 in small hodings;

6,000 acres in the Western Region;

there will be added between 1965 and 1968:

51,000 acres in the Eastern Region, including 16,000 in small holdings;

12,000 acres in the Western Region, including 2,000 in small holdings;

15,000 acres in the West-Central region, including 4,000 in small holdings.

The export possibilities for rubber would thus be doubled by 1975 but, as is noted in the IBRD report, technical and commercial necessities will perhaps impose more limitations than financial resources.

In Liberia, while many trees in small holdings are 30 or 40 years old and more than 1,000 farms have been temporarily closed down since 1963 because of the fall in world prices and the increases in labour costs, Firestone has undertaken a large-scale modernization programme since 1960-1961. Trees 25 years old are being replaced by high yield

plants, giving more than 2,000 lb per acre as against 1,000 lb at the moment, and an improvement in productivity will make it possible to employ only 1 worker for every 7 or 8 acres as against 1 for every 5 acres at the moment.

However, the most spectacular development will incontestably be that of the Ivory Coast, and the estimates in table 4, which combines the output of the Ivory Coast with that of other distinctly less productive African countries, such as the Central African Republic and Ghana, seem to be too low. As the Government of the Ivory Coast wishes to diversify local production, and in particular exportable agricultural production, as much as possible - it is pointed out by the way that the country at present derives 75 per cent of its export revenue from sales of cocoa and coffee alone - it attaches the greatest importance to the development of rubber production. To the existing 11,000 ha of plantation will be added 15,000 ha in 1970 and then 20,000 ha between 1970 and 1975; output would reach more than 12,000 tons in 1970 and more than 16,000 tons in 1975, the potential corresponding to 45,000 ha of plantations being of the order of 75,000 tons. More optimistic forecasts mention 18,000 tons from 1973, taking into account IRCA and other small producers as well as the State and Promoci plantations - 500 ha in 1964-1965 and 500 ha in 1964-1966. Moreover, an upward revision of the 35,000 ha target is not out of the question.

The seven-year development plan of Ghana for 1963-1970, while mentioning the necessity of limiting new expansion made with governmental help, owing to the uncertain development of the rubber market, has, nevertheless, provided for a fairly considerable development of the area planted. From 1963-1964 to 1964-1970 the areas planted should increase from 18,000 acres, i.e. 11,500 for the private sector and 6,500 for the public sector, to a final figure of 35,000 acres. If the yields obtained are satisfactory Ghana would, therefore, be able to meet its own needs in about 1975.

TABLE 4

Theoretical world supplies of rubber in 1970 and 1975
(1,000 tons)

	Past figures				Estimated theoretical supplies	
	1962	1963	1964	1965	1970	1975
States of Malaysia						
Estates	439	459	478	481	575-625	700-750
Small holdings	312	329	347	380	425-475	550-600
Total	751	788	825	861	1 000-1 100	1 250-1 350
Sabah	22	21	23	24	35-40	50- 60
Sarawak	44	45	45	40	45	45
Total for Malaysia	817	854	893	925	1 080-1 185	1 345-1 455
Indonesia — Estates	206	205	219		240-250	250-275
Small-holdings	465	368	419		485-495	500-525
Total	671	573	638	690	725-745	750-800
Thailand	192	187	218	213	240-260	280-300
Ceylon	102	103	110	116	135-145	155-165
Viet-Nam	74	71	73	61	85- 95	100-110
Cambodia	41	40	45	48	60- 70	70- 80
India	31	37	44	49	60- 70	75- 85
Burma	12	13	12	12	10	10
Other Asian Countries and Oceania	11	12	12	13	20	20
Liberia	45	40	42	48	55- 65	70- 80
Nigeria	59	63	72	69	95-105	110-120
Cameroon	8	9	9	10	15	20
Congo	37	37	33	20	40- 50	60- 70
Ivory Coast and other African States*	1	2	3	3	10 (15*)	15 (22*)
Total for Africa	150	151	159	150	215-245	275-305

TABLE 4 (cont'd)

Theoretical world supplies of rubber in 1970 and 1975

(1,000 tons)

	Past figures				Estimated theoretical supplies	
	1962	1963	1964	1965	1970	1975
Brazil	21	20	28	29	30	35
Other Latin American states	7	7	7	7	10	10
Total output, rounded	2125	2075	2250	2325	2,675-2,875	3,125-3,375
Stockpiles	66	94	101	120	120**	-
Total supplies (rounded)	2200	2175	2350	2450	2,800-3,000	3,125-3,375

Source: IRSG

* Figures between parenthesis indicate the maximum tonnage in the expert opininon.

** Considered as a maximum by the IRSG working party.

ANNEX II

PROSPECTS FOR THE PRODUCTION OF RECLAIMED RUBBER

The use of vulcanized waste in the manufacture of new articles is an operation almost as old as the rubber industry itself. Without going back to the 1850's, when old shoes and boots were re-used, it will be recalled in passing that the American output of reclaimed rubber in 1920 was 75,000 tons, or nearly 40 per cent of the tonnage of new rubber used, and that this succes was due not only to the irregular supply of the natural product and the advantageous cost of the reclaimed product, but also to the various technical advantages presented by use of the reclaimed product, which have been accentuated by a constant improvement in reclamation techniques.

Despite the sever competition prevailing today between natural and synthetic products, the output of reclaimed rubber has remained relatively stable for several years and is about 260,000 tons per year in the United States, 38,000 tons per year in Great Britain, and 32,000 tons in France. This stability is probably due to regular supply of good quality waste, e.g. tyres and inner tubes, and to the technical advantages inherent in partial use of the reclaimed product.

The future of reclaimed rubber will be closely conditioned by many factors: sufficient supply of good quality stock, which necessitates sorting by original elastomers, the adaptability of the reclamation processes to the development in composition and structure of tyres or to the emergence of new techniques for the utilization of rubber, the possibility of recovering textile fibres, the constant increase in manufacturing costs, etc.

In the case of West Africa, the most important problem will incontestably be that now facing countries such as Australia, South Africa or India, in which the dominating factor is the cost of collection and transport of waste to the reclamation plant.

It seems that by 1980 only Nigerian consumption, which will be more than 20,000 tons at that date, will justify the establishment in the south of the country and not before 1975 of a small reclamation plant with an initial capacity of the order of 1,000 tons per year.