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AN ANALYSIS OF THE ECONOMIC PROSPECTS OF THE RUBBER INDUSTRY

BY

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INTRODUCTION

The science of economics is not such an exact science as the physical sciences, so that only trends and possible courses of action can be determined by study. Also, there are different ways of interpreting data. Therefore, the main purpose of this presentation is to stimulate discussion.

Up to about the second world war natural rubber (NR) held the monopoly of the world rubber market, but due to the growth of the synthetic rubber (SR) industry during and after the second world war, the position of NR in the world market has changed considerably. The severity of competition and the handicaps the NR industry is suffering from, can best be seen by studying the present position of the rubber industry as a whole.

Supply of NR

The supply of NR is determined by (i) the acreage under rubber, and (ii) the yield of rubber per acre.

Acreage under rubber: The total acreage under rubber in 1966 was about 14·5 million acres whereas it was about 11·2 million acres in 1957. During the period 1957 — 1966, a period of ten years, the overall world increase in acreage was about 3·3 million acres (Anon, 1968a). Although the acreage under rubber is still increasing, the availability of suitable land will be a limiting factor in the near future. Further, the cost of reclaiming land and developing them into rubber plantations is high and very few private companies would undertake such expenditure, in view of past fluctuations of prospects for NR and the lengthy initial unproductive period when rubber plants come into bearing (seven years). Thus the possibility of large increases in the acreage under rubber in the near future can be regarded as remote.

Yield per acre: Research workers in the NR growing countries are continuously working on developing new clones which can out-yield the existing clones. Malaysia has put forward claims of having clones which have a peak potential of about 3,500 lb per acre under experimental conditions (Anon, 1968b). In Ceylon there is evidence of clones with potential peak yields of 2,700 — 3,300 lb per acre per year, under experimental conditions (Anon, 1968c). As the present average annual yield per acre for any country is still under 1,000 lb, the possibility of increasing the supply of NR by this means is very great.

The benefit of these new clones, however, can be obtained only if they are planted in replacement of existing clones. Then there is the long unproductive period of seven years. As producers will be reluctant to forego their current incomes completely for such a long period, it is inconceivable that vast areas will be replanted in a short time. Increasing the supply of rubber by planting new high-yielding clones, though possible, is a slow process.

Supply of SR

The supply of SR is determined by : (i) availability of raw materials, (ii) availability of capital, (iii) development of new techniques of manufacture, and (iv) the price of NR.

Availability of raw materials: The raw materials used in the manufacture of SR are normally by-products of the petro-chemical industry. These raw materials are available fairly freely at present, as the consumption of petroleum oils has increased considerably ; but the by-products of petroleum are not used only for the production of polymers ; therefore, there is a possibility of competition for these between different industries.

Availability of capital: Capital is available in most of the developed countries and once a fair profit on investment is viewed as a possibility, capital can be obtained by the formation of limited liability companies or subsidiaries to existing firms with part of the funds contributed by the principal firm.

Development of new techniques: Considerable research is going on in the developed countries in the chemistry and technology of polymers, aimed partly at improving the present techniques of production and partly at developing new and better SRs by new techniques of production. In fact such research had led to the development of "cis-polyisoprene", the SR which has the same chemical composition as NR. New factories have appeared soon after new techniques were developed, thus increasing the supply of SR.

Price of NR: The other important factor determining the supply of SR is the difference in the price of NR and the general purpose SRs. If the price per pound of NR is higher than that of the general purpose SRs, the quality remaining almost the same, cheaper SR will be preferred thus increasing the demand for SR, which will in turn increase the supply.

Total supply of rubber

The total production of rubber from 1956 to 1968 is given in Table 1 (Anon, 1970a). The total production in 1968 was 6·55 million tons, an increase of 111·3% of that in 1956. It can be seen that these data do not represent linear increases over the years, thus the data were treated as if they fitted part of an exponential curve of the equation $Y = A_e\ bx$, the transformed form of which was calculated. The equation is :—

$$Y = 1{\cdot}4751 + 0{\cdot}0643\,x$$

where $Y = \log_e$ (production) and $x =$ year—1962 (Graph 1). The coefficient of determination is 0·98899. This means that a 99% correct forecast could be made using this equation if conditions during the next five to six years were to remain similar to those of the last 13 years. Extrapolating, the forecast of the total production of rubber for 1970 and 1975, is 7·31 million tons and 10·01 million tons, respectively.

WORLD PRODUCTION OF RUBBER (NR + SR) 1956—1968

$\left\{Y = Ae^{bx}\right\}$

GRAPH I

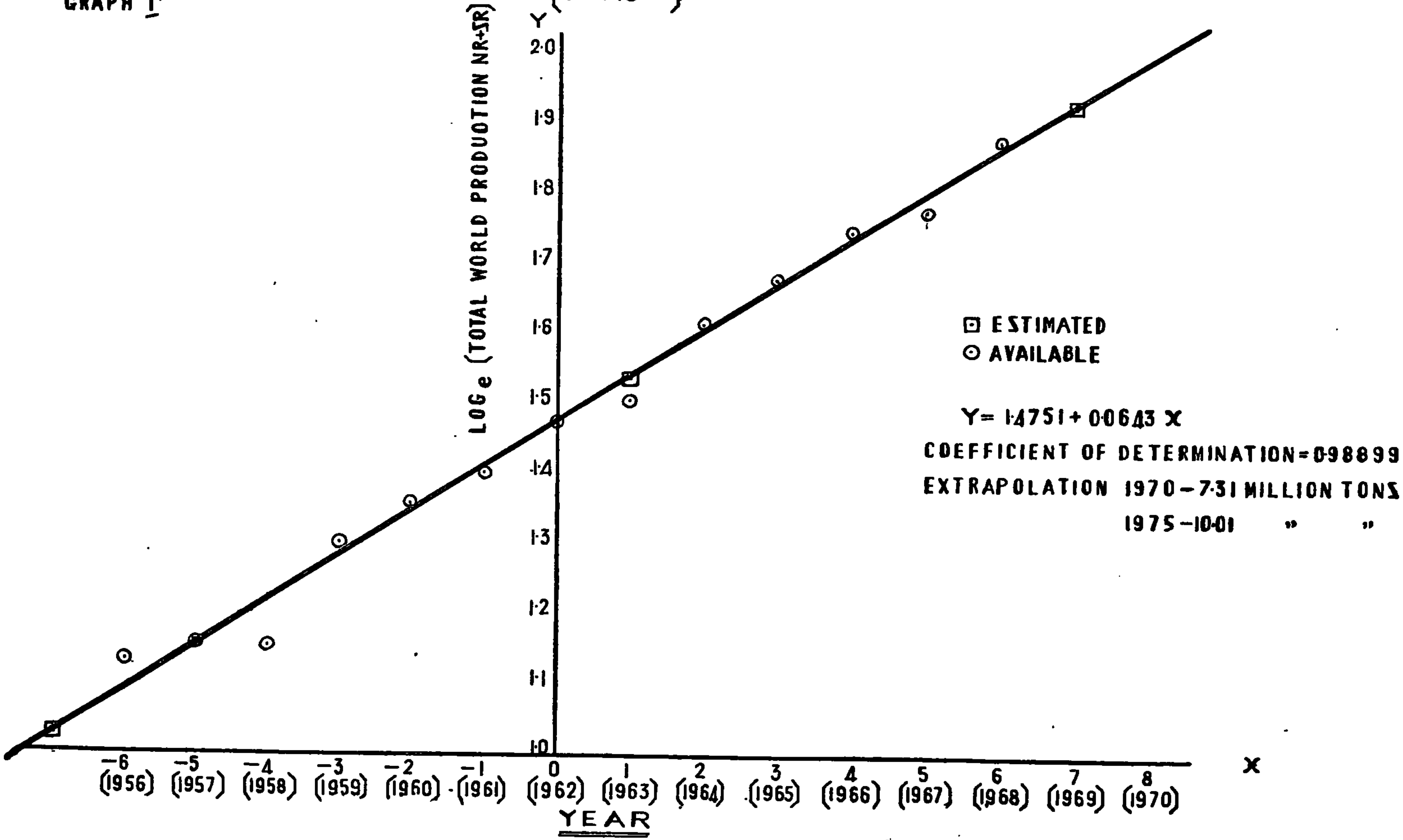


TABLE 1
TOTAL WORLD PRODUCTION OF RUBBER (1956 — 1968)
(million tons)

Year	Natural rubber	Synthetic rubber	Total rubber	Increase
1956	1·89	1·21	3·10	—
1957	1·91	1·26	3·17	0·07
1958	1·94	1·24	3·19	0·02
1959	2·04	1·63	3·67	0·48
1960	1·99	1·89	3·87	0·20
1961	2·09	1·98	4·07	0·20
1962	2·12	2·24	4·36	0·29
1963	2·07	2·45	4·52	0·16
1964	2·24	2·80	5·04	0·52
1965	2·34	3·01	5·35	0·31
1966	2·40	3·34	5·74	0·39
1967	2·45	3·43	5·88	0·14
1968	2·64	3·95	6·55	0·67

Source :— *Rubber Statistical Bulletin.*

Demand for NR

The demand for NR in large quantities first arose after the invention of the pneumatic tyre for the motor car industry. Since then the motor vehicle industry has developed to massive proportions, thus increasing the demand for rubber. The consumption of NR in 1968 was 2·79 million tons, an increase of only 48·3% over that for 1956.

Demand for SR

The demand for SR arose due to uncertainty of rubber supplies, or lack of it, during periods of war. Germany was forced to manufacture a very inferior form of SR at great cost during World War 1, while the U.S.A. was compelled to manufacture the SR known as styrene butadiene rubber (SBR), during World War 2, (Whitby *et al.*, 1954). The SR factories which went out of production after World War 2 were reactivated in 1951 during the Korean war when the demand for rubber increased again. The consumption of SR in 1968 was 3·90 million tons, an increase of 242·1% over that for 1956.

Determinants of the total demand for all rubbers

The determinants of the demand for rubber are : (i) development of the industries using rubber, (ii) development of new uses for rubber, and (iii) the rate of development of under-developed countries.

Industries using rubber: The industry that uses the most amount of rubber is the motor vehicle industry. Rubber is used for the manufacture of tyres, tubes, hose pipes, washers, bushes, cushions and a number of other items. The expansion of the motor vehicle industry will therefore increase the demand for rubber. The rate of production of motor vehicles is increasing rapidly in the Soviet Union and Eastern and South-East Asian countries are starting to assemble motor vehicles. Therefore the main rubber consuming industry is still developing.

New uses for rubber: As a result of the increase in research in rubber technology, new uses are being found for rubber. Among the many uses that rubber is being put to are footwear, cushions and mattresses, surgical gloves, parts of instruments, cable insulations and flooring. Research has also established that rubber can be used in road surfacing, roofs, life rafts, flexible railway couplings, giant rubber fenders for berthing ships and pressureless tennis balls. As these researches are further developed and methods found for economic exploitation, the demand for rubber will increase.

Development of under-developed countries : With economic development and attainment of higher standards of living in under-developed countries, there is a likelihood of an increasing demand for rubber.

An approximate measure of the level of economic development of a country is its per capita gross domestic product (GDP). This was therefore compared with the per capita consumption of rubber of a number of countries for which data were available. The available data were for 1965 (Perera, 1970), which are given in Table 2, which show that the per capita consumption of rubber varies directly with the GDP. To assess the nature of the correlation, the data in Table 2 were plotted in Graph 2 to give a scatter diagram. The equation $Y = a + bx$ where " b " is the regression coefficient and " a " the constant was worked out to fit a straight line graph to the scatter diagram. The test of significance of " b " was also worked out by the analysis of variance. The " F " ratio worked out to 187·44 which is very highly significant as the " F " distribution at the 1% level is only 10·56.

TABLE 2

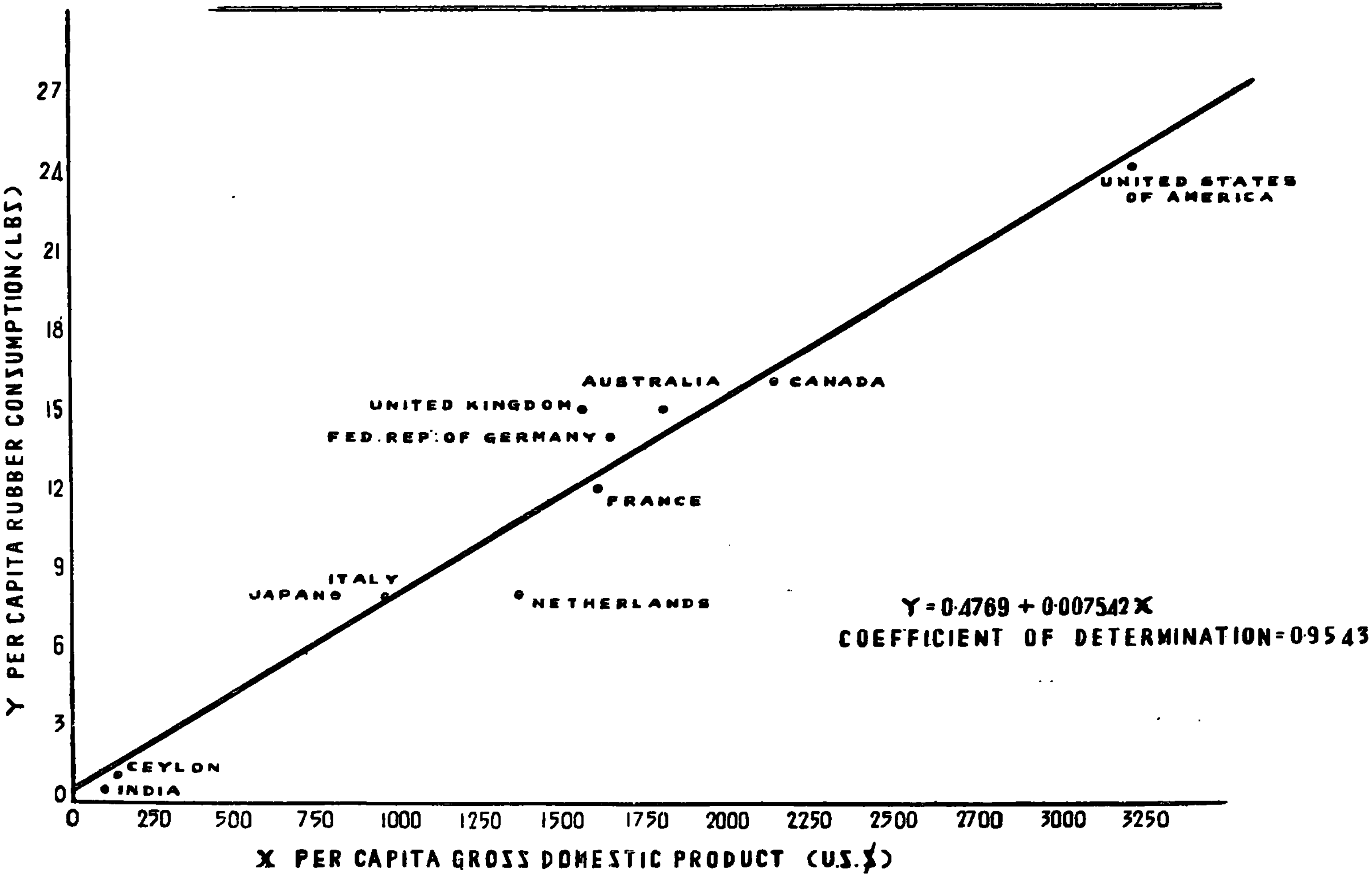
PER CAPITA GROSS DOMESTIC PRODUCT AND THE PER CAPITA RUBBER CONSUMPTION OF ELEVEN COUNTRIES FOR 1965

Country	Per capita GDP	Per capita rubber consumption (lb)
United States of America	3,210	24
Canada	2,155	16
Australia	1,811	15
Fed. Rep. of Germany	1,651	14
France	1,614	12
United Kingdom	1,561	15
Netherlands	1,386	8
Italy	971	8
Japan	813	8
Ceylon	137	1
India	92	0·4

Sources :— International Monetary Fund.
Internationl Financial Statistics — Vol. 21, No. 7, July 1968.
Rubber Statistical Bulletin Vol. 22, No. 11, August 1968.
U.N. Yearbook of National Accounts 1966 and supplement to 1966/67 issues.
Central Bank of Ceylon.

GRAPH II

RELATIONSHIP BETWEEN THE PER CAPITA G.D.P AND THE PER CAPITA RUBBER CONSUMPTION –1965



This indicates that " X", the per capita GDP has a definite relationship with " Y ", the per capita consumption of rubber. The correlation coefficient is 0·9769 while the coefficient of determination is 0·9543. This implies that 95% of the variation in the per capita consumption of rubber is controlled by the per capita GDP. In other words, using the per capita GDP, one would be 95% correct (on the average) in predicting the per capita consumption of rubber.

The quantitative relationship between the per capita GDP and the per capita consumption of rubber could be worked out using the regression equation :

$$\begin{aligned} \text{When } X = 1000,\ Y &= 0{\cdot}007542 \times 1000 + 0{\cdot}4769 \\ &= 7{\cdot}542 + 0{\cdot}4769 \\ &= 8{\cdot}0189 \end{aligned}$$

$$\begin{aligned} \text{When } X = 2000,\ Y &= 0{\cdot}007542 \times 2000 + 0{\cdot}4769 \\ &= 15{\cdot}084 + 0{\cdot}4769 \\ &= 15{\cdot}5609 \end{aligned}$$

$$\text{The percentage increase in Y} = \frac{15{\cdot}5609 - 8{\cdot}0189}{8{\cdot}0189} \times 100$$

$$= 94{\cdot}0526$$

This means that a 100% increase in the per capita GDP results in a 94% increase in the per capita consumption of rubber.

It appears, therefore, that the more developed a country becomes the more rubber will it consume. Developing countries therefore generate a demand for rubber in keeping with their rate of development. If for instance, the per capita consumption of rubber of China, India, and Indonesia were to rise by about 5 lb as a result of development, it would generate a demand of over 3 million tons of rubber as the total population of these countries is approximately 1,500 million. An increase to half the per capita consumption of rubber of the U.S.A. (*i.e.* 12 lb) would generate an additional demand of about 8 million tons. Such a demand however, cannot be generated in a short time, but as these countries develop, the demand for rubber would undoubtedly increase slowly.

Total demand for rubber

The total consumption of rubber from 1956 to 1968 is given in Table 3 (Anon, 1970a). Here too, using the same assumption as for the total production of rubber, the equation for an exponential curve $Y = Ae^{bx}$ in a transformed form was fitted. The regression equation (transformed co-ordinates) is:

$Y = 1{\cdot}4773 + 0{\cdot}0656\,x$, where $Y = \log_e$ (consumption) and X = year—1962 (Graph 3).

The coefficient of determination is 0·9918. This means again that a 99% correct forecast could be made using this equation if conditions during the next five to six years were to remain similar to those of the last 13 years.

Extrapolating, the forecast of the total consumption of rubber for 1970 and 1975, is 7·40 million tons and 10·28 million tons, respectively.

WORLD CONSUMPTION OF RUBBER (NR + SR) 1956–1968

GRAPH III

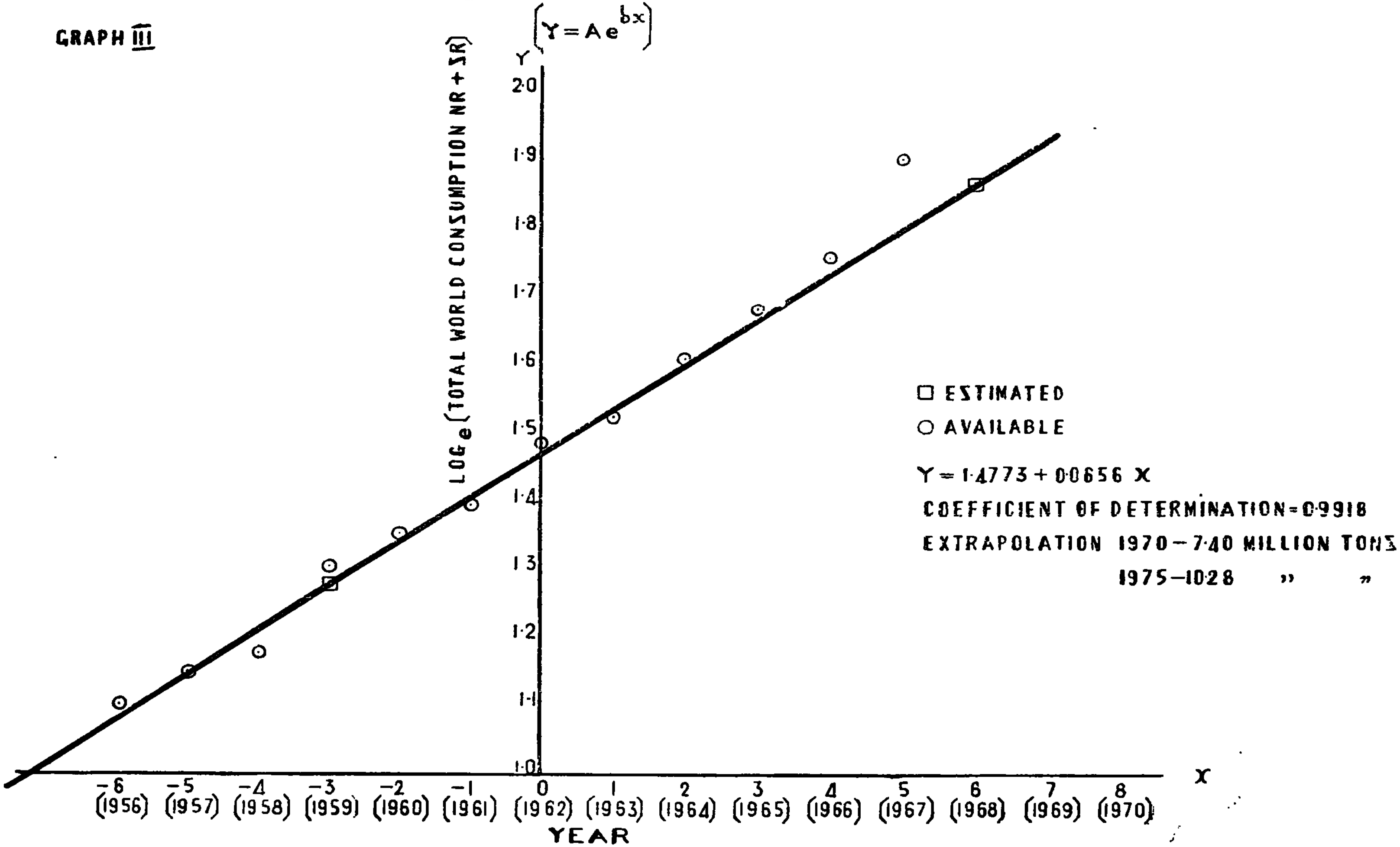


TABLE 3

TOTAL WORLD CONSUMPTION OF RUBBER (1956 — 1968)
(million tons)

Year	Natural rubber	Synthetic rubber	Total rubber	Increase
1956	1·88	1·14	3·01	—
1957	1·90	1·26	3·16	0·15
1958	2·01	1·24	3·25	0·09
1959	2·12	1·57	3·69	0·44
1960	2·07	1·80	3·87	0·18
1961	2·13	1·91	4·04	0·14
1962	2·22	2·17	4·39	0·35
1963	2·23	2·37	4·60	0·21
1964	2·26	2·74	5·00	0·40
1965	2·38	2·90	5·37	0·37
1966	2·55	3·27	5·82	0·45
1967	2·46	3·36	5·82	0·00
1968	2·79	3·90	6·69	0·87

Source :— *Rubber Statistical Bulletin.*

Outlook

On the basis of the above forecasts, a total of 7·40 and 10·28 million long tons will be required in 1970 and 1975, respectively, while a total of 7·31 and 10·01 million long tons will be available in 1970 and 1975, respectively. The projected world demand for rubber is in excess of the projected world supply by 0·09 and 0·27 million long tons, respectively. The excess of demand is only 1·2% and 2·6% of the total demand for the two years 1970 and 1975 respectively.

DISCUSSION

On the basis of these forecasts it appears that all the rubber produced will be consumed during the next five to six years.

The International Rubber Study Group (IRSG) at its twentieth assembly estimated that the world consumption of rubber would be 7·16 million tons in 1969 and 7·47 million tons in 1970. World supplies were estimated at 7·25 million tons in 1969 and 7·66 million tons in 1970 (Anon, 1969). According to their estimates there will be an excess production of rubber in 1969 and 1970 to the extent of 0·09 and 0·19 million tons, respectively (Table 4). The excess for 1970 is only 2·5% of the estimated consumption for that year.

TABLE 4

ESTIMATED SUPPLY AND DEMAND FOR RUBBER
1969 AND 1970 (MILLION TONS)

Type	Production	Consumption	Excess
	1969		
Natural rubber	2·82	2·85	—0·03
Synthetic rubber	4·43	4·31	+0·12
Total	7·25	7·16	+0·09
	1970		
Natural rubber	2·91	2·90	+0·01
Synthetic rubber	4·75	4·57	+0·18
Total	7·66	7·47	+0·19

Source :— Document 21, IRSG Twentieth Assembly, London, July 1969.

The Economist Intelligence Unit (EIU) has also made a forecast of the production and consumption of rubber in 1970 as shown in Table 5 (Anon, 1970b). According to them also there is an excess production of rubber in 1970 of about 185,000 tons (0·185 million tons) which is again only 2·5% of their estimated consumption. Such a small excess of production will not affect the rubber industry adversely, unless the amount of excess increases year by year and builds up.

TABLE 5

EIU ESTIMATED PRODUCTION AND CONSUMPTION OF RUBBER 1970
(THOUSAND TONS)

	Natural rubber	Synthetic rubber	Total
Production	3010·0	4685·0	7695·0
Consumption	2920·0	4590·0	7510·0
Excess production	90·0	95·0	185·0

Source :— *Rubber Trends* (EIU), March 1970.

As the excess production in 1970, according to the estimates of IRSG and EIU, is very small (about 0·19 million tons) and the excess consumption according to this forecast for 1970 is also very small (0·09 million tons), the trend for the future appears to be that, all the rubber produced will be consumed. This means that the price of rubber will not fluctuate very dramatically and could be expected to be more stable for the next five to six years.

The present forecast assumes that political and economic conditions for the next five to six years will be very similar to those that existed during the last decade or so. During the last decade, conditions have not been entirely peaceful. The Middle East crisis and the Vietnam war were present so that unless political conditions deteriorate to a greater extent, in all probability the next five to six years would be similar to the last decade.

If political conditions deteriorate and either a war or a major threat of a war or more aggression starts in other parts of the world, then there will be a sudden increase in the demand for rubber not only for consumption but also for stockpiling purposes. The price of rubber will rise, and the duration of the war will be a period of prosperity for the rubber industry, but with the end of the war, the demand for rubber will drop sharply, while at the same time stockpiles will be released. The supply of rubber will be in excess of demand so that prices will tumble. Producers of rubber will go out of production. It is possible that the NR industry will be adversely affected in the process.

It is necessary at this stage to study the technical qualities of NR and the general purpose SRs to find out whether any one is superior to the other. The important characteristics of NR are its high resilience, high tensile strength, high wear resistance, good chipping resistance, good mixing qualities, raw tack, and low heat build-up.

Styrene butadiene rubber: The general opinion is that SBR is not a satisfactory substitute for NR in all its uses although it may be superior to NR in wear resistance, groove cracking resistance and aging properties. The high heat build-up of SBR however makes it unsuitable for heavy duty tyres (heavy truck and aeroplane tyres).

Cis-polyisoprene : The only SR which closely duplicated the chemical structure of NR is cis-polyisoprene which has however not quite reached the performance of NR in wear resistance, chipping resistance, mixing qualities and raw tack.

Ethylene propylene rubber : The latest of the SRs which can be manufactured at a lower cost than all others is said to be ethylene propylene rubber (EPR). This rubber has superior ozone and weather aging resistance and is very useful for wire and cable insulation, but has the disadvantage of very poor mixing qualities.

It can therefore be seen that there is yet no SR which has all the desirable properties of NR, but any one or other of these desirable qualities can be found in one or the other of the large number of SRs. Thus NR is no more the unique material it was, but is now one form of rubber (with a larger number of desirable qualities and some poor qualities), among a number of different forms of rubbers. In fact the presence of a larger number of desirable qualities may be the only reason why NR is the preferred product yet, even though it is more expensive and is sold on a visual grading system in large clumsy bundles. Also, consumers of rubber do not use any one rubber in any one industry now. Different rubbers, which have the desired characteristics are used in certain tested proportions to get the best blend, having in mind technical and economic considerations. Further, some of the poor qualities of different rubbers can be improved by the use of suitable compounding ingredients. As a result of these, price, consistency of quality, presentation, sales promotion and technical advice to consumers, are the factors that would determine the sale of any general purpose rubber in the future. But in these, NR is at a definite disadvantage.

Suggestions for increasing competitiveness of NR

Quality presentation and price: The first requisite for NR therefore is to change its form of presentation from the present ungainly bundles to attractive polythene-wrapped blocks of 70 lb. Some degree of consistency in quality can be achieved within grades by technically specifying it into standard acceptable grades. Technically specifying existing forms of rubber or the production of new block rubbers (as Malaysia is doing) is therefore essential if the NR industry is to survive. Then NR must become price competitive by replanting regularly with high-yielding clones in order to cut down costs and attracting the buyer into using more NR.

There are however other disadvantages the NR industry is suffering from, such as lack of captive markets, insufficiency of sales propaganda and technical advice to consumers.

Captive markets: The organisation of the SR industry is such that 44 % of the industry is owned by consumers of rubber whereas only about 7 % NR production is consumer-owned. Moreover, a further 42 % of the SR industry is owned by the giant chemical and the petroleum industries (Soysa, 1967). This integration of the SR industry to end-products or back to raw materials, offers them a great advantage for marketing as well as for research and developing improved techniques. The NR producing countries must therefore develop rubber consuming industries for which—

(*a*) technical research into uses of rubber has to be stepped up,

(*b*) personnel have to be trained in technology by providing courses in polymer chemistry and rubber technology in our universities and technical colleges,

(*c*) facilities have to be provided for entrepreneurs,

(*d*) competition from cheap plastic goods has to be reduced by taxation.

The manufacture of rubber goods in the rubber producing countries, in addition to saving foreign exchange from reduced imports of rubber goods, will earn more foreign exchange by the sale of manufactured goods abroad. Further it will provide more employment opportunities for the growing population of the NR producing countries.

Sales promotion and technical advice: The other important handicap the NR industry is suffering from is the inadequacy of sales promotion and technical advice to consumers of NR. In the SR industry large sums of money are being invested in research and development work as well as in sales promotion and technical advice to consumers. Such intensive campaigns could edge out NR further from some of its applications by SR. This must be counter-balanced by more research and similar sales promotion and technical advice to users of NR. Malaysia already has a technical advisory service for consumers. It is therefore desirable that all NR producing countries embark on an intensive campaign of sales promotion and technical advice to consumers on a co-operative basis. The high cost of such a service can then be shared by the NR producing countries based on the percentage of NR produced by each country. In this connection, all NR producing countries should consider the possibility of producing standard natural rubbers (SNR) on an accepted single system of technical specification. This would, of course, make it necessary that all NR producing countries get together, adopt a single system of classification and assure that this is strictly adhered to. If this can be done, the competitive position of NR would clearly be much stronger.

Consequences of excess production of rubber

It has been shown that prices would remain stable during the next five to six years, if almost all the rubber that is produced is consumed. However, the IRSG estimate and the EIU estimate both forecast an excess of production in 1970 of about 0·19 million tons. This amount of excess is too small to affect the price of rubber. But if this excess increases and builds up as the years go by, the future of the rubber industry would be different. Excess production means severe competition for sales. Large discounts will be offered by the SR industry to attract buyers, so that prices will tend to come down and, in addition, there will be unsold stocks. As the prices come down some producers of rubber (NR and SR) will go out of production. As the price of NR is higher than that of SR and as NR production is a labour intensive enterprise, cutting down costs has its limitations, so that it is likely that NR producers will be affected far more than SR producers. Further, NR producing countries depend to varying degrees on this industry for the much needed foreign exchange for the purchase of consumer goods as well as capital goods for their development.

Thus a drop in their foreign exchange earnings will retard their rate of development. Imports by these countries will be on a reduced scale so that exports to these countries too will be affected. The vicious circle will go on.

Remedial measures

The total production of rubber consists of NR and SR. If we look only at the production and consumption of NR for the last ten years as shown in Table 6 (Anon, 1970a), we can see that every year consumption has been in excess of production. This was possible due to the increase in supply from releases of stockpiles. This shows that up to date NR is not produced in sufficient quantity to saturate the market. On the other hand if we look at the total production and consumption of SR for the last ten years (Table 7), we see that in every year there has been an excess of production. For the ten years 1959 — 1968 the total excess was only 0·64 million tons (16·4% of the total consumption of SR for 1968) which is only about two months' stock. In itself this may not affect the rubber industry. If however, this excess builds up, it is dangerous for both the NR and the SR industries. The danger therefore appears to be, the possible excess production of SR.

TABLE 6

TOTAL PRODUCTION AND CONSUMPTION OF NATURAL RUBBER 1956—1968 (MILLION TONS)

Year	Production	Consumption	Excess of production
1959	2·04	2·12	— 0·08
1960	1·99	2·07	— 0·08
1961	2·09	2·13	— 0·04
1962	2·12	2·22	— 0·10
1963	2·07	2·23	— 0·16
1964	2·24	2·26	— 0·02
1965	2·34	2·38	— 0·04
1966	2·40	2·55	— 0·15
1967	2·45	2·45	— 0·01
1968	2·60	2·79	— 0·19
		Total excess	— 0·87

Source :— *Rubber Statistical Bulletin*, February 1970

TABLE 7

TOTAL WORLD PRODUCTION AND CONSUMPTION OF SYNTHETIC RUBBER (1959 — 1968) (MILLION TONS)

Year	Production	Consumption	Excess production
1959	1·63	1·57	+ 0·06
1960	1·89	1·80	+ 0·09
1961	1·98	1·91	+ 0·07
1962	2·24	2·17	+ 0·07
1963	2·45	2·37	+ 0·08
1964	2·80	2·74	+ 0·06
1965	3·01	2·99	+ 0·02
1966	3·34	3·27	+ 0·07
1967	3·43	3·36	+ 0·07
1968	3·95	3·90	+ 0·05
		Total excess	0·64

Source :— Compiled from Tables 1 and 3.

Regulating the production of SR is almost impossible, but it is suggested that an attempt be made by the NR producing countries by forming a NR producers' association to initiate discussions with the International Institute of SR Producers. It must be brought home to the SR producers that any excess production is not only injurious to the NR industry but also to the SR industry. A quota system or any other solution, if it can be worked out, may be able to maintain the stability of the rubber industry and the economic and even political stability of a number of South-East Asian countries.

ACKNOWLEDGEMENTS

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Dr. L. Mullins — A general comment after Mr. A. B. Dissanayake's paper

It is appropriate that as the last paper of this conference an economist should have mentioned what has been the main theme of much of the discussion throughout this conference. If the natural rubber producers ensure that they take full advantage of recent developments in production, presentation and standardisation and ensure that their rubber gets to the consumers in an acceptable form then they can look forward to the future with confidence. It is popular for statisticians to forecast an excess of production of natural rubber. Experience shows that over the years these predictions have proved false. Every pound of natural rubber produced is sold and there is no reason for us to anticipate an excess of natural rubber in 1970. It is more correct to recognize that the supply of synthetic rubber bridges the gap between total rubber requirement and the production of natural rubber.

It is of vital importance that natural rubber should be supported by strong and effective promotion. Here the Malayan Rubber Fund Board already has a technical advisory service spreading over much of the world. This needs enlarging and here I know that Malaysia would welcome co-operation and support from all natural rubber producing countries.