REPORT OF PROJECT WORK ON

"ANALYSIS AND FORECAST OF NR MARKET"

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that Sri.K.C.Chacko, S4 MBA, SB College, Changanacherry has undertaken and completed a project work titled "Analysis and Forecast of NR market" in partial fulfilment of the fourth semester requirements of his MBA Course of M.G.University under my guidance from 15 November to 31 December 98.

Joy Jacob,
Joint Director(FM).

DECLARATION

I, K.C. Chacko, here by declare that this project report titled "ANALYSIS AND FORECAST OF NR MARKET", prepared and submitted under the guidance of Sri. Joy Jacob, Joint Director, Rubber Board and Sri. Siby Zacharias, faculty member, BIMS, SB College, Changanassery, is my original work in partial fulfillment of the fourth semester requirements of the MBA course under MG University, Kottayam. ID

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CERTIFICATE

This project report titled "Analysis and forecast of NR Market" is a bonafide record of the work done by K.C. Chacko, S_4 MBA, SB college, Changanassery, in partial fulfillment of the fourth semester requirements of the master's degree in Business Administration (MBA) of Mahatma Gandhi University, under our guidance.

Monoo M. John
Head of the Dept.

Siby Zacharias,
Faculty member & Project guide.

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I acknowledge with thanks the services, help and guidance provided by Sri. Joy Jacob, Joint Director, Rubber Board in the design of the study. I also thank all the experts who have co-operated with this project and provided valuable information for making a quantitative forecast of the NR market.

I place on record, the help and guidance by Sri. Siby Zacharias, Faculty member at all stages of the work. The services of Sri. Monoo M. John, Head of the department and other faculty members of the department are also acknowledged with thanks.

I am grateful to the Rubber Board for giving me the opportunity to undertake this course of study and utilizing the library facilities in collecting the secondary data for the project.

K.C. CHACKO.

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INTRODUCTION

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A.1. INTRODUCTION TO THE STUDY

Natural Rubber (NR) market is ever dynamic. NR forms a part of a variety of products that the human population handles in their day to day activities. The dynamic nature of the market is also reflected in the fluctuations in the demand and price of the commodity. The per capita consumption of Rubber (Natural and Synthetic) is considered as a measure of the economic activities of a country.

About a few years ago, the growers as well as the consumers of NR were able to predict the market trends based on their experiences. Now a days any prediction about the market situation has become difficult, even for experts. This has created a feeling of anxiety among the growers due to the uncertainty in the market. The present study is aimed at reducing the anxiety and uncertainty among the growers and consumers by critically exploring the facts which led to the present situation and at creating awareness among them. A realistic approach in projecting the future will help the market participants to make necessary provisions in advance to their advantage.

A.2. SIGNIFICANCE OF THE STUDY

India occupies an important place in the overall economy of the world as the second most populous country. In the Rubber industry also India has a significant position in terms of size. India is the fourth largest in terms of production and consumption of NR. At one time, not so long ago, the NR industry in India was insulated from the world market. This situation has now changed as a result of the opening up of the economy and signing of General Agreement on Tariff and Trade (GATT) and becoming a member country of the World Trade Organisation (WTO).

The market prices of NR grades have been declining since two years and the declining continues even as at the end of 1998. There has been no political

catastrophic or climatic event that came to the wart the global progress of rubber production. The consumption has been increasing in the US and China but decreasing in Japan and Europe and these two nearly balance each other. There has been no major break through any where else. In short, NR market has been pulled down and this is favourable neither to the producers nor to the consumers. The present study explores the factors that caused this down pull of NR market and hence the significance.

A.3. SCOPE OF THE STUDY

The present study is aimed at analysing the market situation by considering the various factors that contributed to the present crisis in NR market. Production and consumption statistics and trends in production and consumption of NR and SR are studied and analysed. Advances in technology in major consuming sectors are considered and the emerging trends in these sectors have been relied up on to forecast the market situation. Primary data colllected by the survey and secondary data available are analaysed critically. A plan of action for the future and provisions for utilizing the opportunities and facing the problems are also considered to arrive at a meaningful conclusion from the study.

A.4. OBJECTIVES OF THE STUDY

The study aims at three main objectives. The first objective is to identify the circumstances that led to the present uncertainty in the market. Identification of the circumstances is best possible by a situation analysis. Situation analysis is a creative process in which an attempt is made to isolate and understand the casual variables influencing the system. An intensive investigation helps to uncover the complicated sequences of influences which interact to produce symptoms.

The second objective is to make a forecast of the market situation for the next decade. One of the most important aspect of decision making is the ability to predict the circumstances that will surround the decision and the situation under which the decision is made. The range of influences that require forecasting is to be considered and classified into functional areas. After all, forecasting is made to improve the accuracy of decision making and not an end by itself.

The third objective is to plan a future course of action. Any forecast is to be followed by plan of action. According to Henri Fayol "forecasting includes both assessing the future and making provisions for it".

A.5. STATEMENT OF THE PROBLEM

The problem for the study can be stated precisely by the following probing statements.

- What are the major influences on the demand and consumption of NR during the past years?
- What is the nature of the present trend in the production and consumption of NR and SR in India and abroad ?
- What more steps are required to be taken for restoring market stability ?

A.6. METHODOLOGY AND RESEARCH DESIGN

Research can be broadly classified into exploratory and conclusive types. Exploratory research is essentially qualitative in nature. Where as conclusive type depends on quantitative measures to arrive at a conclusion. Exploratory research looks for hypothesis and is useful when the perceived problem is much less general.

Exploratory research is also characterised by flexibility where as descriptive studies attempt to obtain a complete and accurate description of the situation.

The problem statements reveal that the problem under study is not very general and is vague in nature. Hence an exploratory research is to be conducted to arrive at hypothesis which needs to be confirmed by a conclusive research. The present study is limited to exploring the facts that underlie and interact with each other to cause the problem. Exploratory research consists of the following steps.

(a)**Situation analysis/Initial analysis**

The objective of initial analysis is to develop specific areas to be explored and which has a bearing on the formulation of hypothesis. With respect to the present study, the initial analysis is aimed to find out the major influencing factors on the demand and consumption of NR using the secondary data available.

(b)**Primary data through survey of experts**

Secondary data can only give information about the past. In order to deal with problems relating to the present and future, primary data need to be collected. For the present study the objectives of collecting primary data are :

- To find out the current trend in the production and consumption of NR
- To get an assessment by the experts as to the present situation and their perception about the causes for the situation.
- To find out the expectation of experts as to the future situation
- Experts views of future provisions to be made for ensuring market stability.

(c)**Data collection method**

The primary data from experts who are experienced and apt to have ideas about the subject can be effectively gathered through personal interview. A semi-structured and undisguised questionaire consisting of open ended questions is attached as appendix (1) to this report. By designing open-ended questions, more information could be gathered as this provides the respondents the freedom to to express their views or opinion on the subject.

(d)**Sample design**

Sample Unit - individual expert

Sample size - 25

Sampling method - judgment sampling

Sample composition - Sample to consist of experts from

- Industry
- Plantation
- Others experts
- R&D
- Dealers

A.7. **LIMITATIONS OF THE STUDY**

Exploratory research has many inherent limitations. The major limitation is that the exploration of facts may not cover all the areas and also not covered in full extent of the areas covered under the study. With respect to the present study, the factors that are influencing the demand and supply of the commodities is explored in a limited manner. There are thousands of products that are made out of NR, SR or both in varying proportions and also in varying proportions with other materials. An exhaustive exploration of the factors influencing all these is impossible within the available time. Only prominent sectors are considered. .

The panel of experts selected for primary data collection is on the basis of judgment and convenience. Due to time constraints, only those experts located in and around Kottayam could be personally interviewed. In the case of other experts mailed questionaire method was adopted for data collection.

The forecast made on the basis of expert panel judgment may not hold good in the long run if some unexpected events happen in the meantime which can turn around the market situation in a totally different way. For example, out break of war can have profound influence on the market situations.

SECTION - B

AN OVERVIEW OF RUBBER MARKET

1. Rubber and Rubber market defined
2. Nature of the demand
3. Rubber types & their supply
4. Major influences on demand
5. Major influences on supply
6. Trade practices

B.1. RUBBER & RUBBER MARKET DEFINED

The term Rubber or Elastomer is used to describe a macro molecular material that returns rapidly to approximately the original dimensions and shape after substantial deformation by a weak stress and release of stress. Such materials are generally long chain molecules known as polymers. The combination of elastic properties and long chain nature of molecules has led to the alternate name elastomers. The class of elastomers consist of both natural and synthetic rubbers. They have been used as engineering materials in tyres, belts, hoses, gloves, condoms and many other products. There are thousands of products, big and small, that use elastomers in different proportions with other materials. Automobile industry alone requires more than 400 items made of rubber. Similarly rubbers find application in almost all areas such as medical, packaging, transportation, construction, electrical and electronics, computer hardware and so on. The per head consumption of rubber is considered as a measure of the economic activities of a country. The per capita consumption in India is 0.70 Kg, which is much below the world average value of 3.0 Kg. The corresponding figures for Japan is 14.6 Kg. & 12.0Kg for the US.

B.2. NATURE OF DEMAND

Rubber is an essential strategic industrial raw material. The demand for the commodity arises essentially from the major end - user industries. One of the major users of rubber is the automobile sector especially in tyres. The demand for tyres originates from the vehicle industry, the growth of which is driven by the increase in population and economic development. Economic development leads to increasing use of cars as the means of personal transport and the use of heavy vehicles to transport the goods used by the society. Hence rubber is an industrial raw material which has a derived demand. It is estimated that about 70% of the total rubber consumption is by the automobile industry alone. Thus any variation in the demand for the automobiles can seriously affect the rubber market.

B.3. TYPES OF RUBBERS AND THEIR SUPPLY

Based on the source of supply, elastomers can be classified into two natural and synthetic. Natural rubber (NR) is obtained from the rubber tree Hevea Brasiliensis as a milky emulsion known as NR latex. It is then coagulated and the solid material separated, washed and dried to obtain crude natural rubber. NR was the only rubber available for more than a century. But the demand for the material outstripped its availability after the second world war and this led to the invention of synthetic rubbers (SR). SR is of petrochemical origin and are prepared by the reaction (polymerisation) of suitable monomers to form polymers. They are usually obtained as water emulsions known as synthetic latex, which also is coagulated and solid material separated, washed and dried to get crude synthetic rubber.

Crude rubbers whether natural or synthetic are plastic like materials that can be deformed at higher temperatures. They are not generally suitable for use in the form they are obtained. The elastic properties have to be developed by incorporating certain additives into the crude rubber followed by vulcanisation.

The structure of NR production is highly concentrated. This is mainly because a tropical climate with moderate rainfall is required for the growth and sustained production of latex. Top three producing countries account for more than 70% of the world output of NR. The first three producing countries are Thailand, Indonesia and Malaysia. India stands fourth with 8.8% of the worlds output of NR. Other important producing countries are China, Srilanka, Vietnam, Nigeria & Brazil.

The five largest producers of SR are USA, Japan, France , Korea and China. These five countries contribute about 58% of the world output of SR. USSR was the largest producer prior to its disintegration in early 1990's. Other producers are Taiwan, Germany, Italy and U.K.

SR producers are able to control output by varying the operating rates when the demand slackens, where as in the case of NR it is not easy to match a change in demand by a corresponding change in supply. This is especially because NR is produced by small holders, who produce over 85% of the world supply in their respective countries. It may happen that a fall in the price of an agricultural product brings about an increase in the output. This is because a fall in price cuts short the farmers income. The grower in turn tries to make up the loss by producing more by extra effort. Thus the supply of the commodity further increases and fall in the price continues for a longer period. Thus the supply of NR can be considered inelastic.

B.4. MAJOR INFLUENCES ON DEMAND

(a) Price

Industrial products are characterised by the inelastic nature of demand. This means that a change in the price of the commodity has little effect on its demand. Rubbers, especially NR is available in different grades with varying price levels according to the quality of the material. When the price rises abnormally, a portion of

the top quality rubber may be replaced by a lower grade in some cases. Thus it is virtually impossible to expand the total demand by lowering the price of a component sold in the industrial market and vice versa.

(b) **Substitutes**

Elasticity of demand for an industrial product depends mainly on the range of available substitutes. The better the substitute available, the more elastic will be the demand for the commodity. If there are absolutely perfect substitutes available, then the demand will be perfectly elastic. The possibility of substitution is greater when there is a wide range of uses to which the commodity can be put. SR and NR are complimentary to each other in the sense that SR can provide some of the properties that are not possessed by NR and vice versa . At the same time, SR can substitute NR in many applications. In some cases, SR is a better substitute for NR and vice versa. There are a vast variety of items and categories of products that use rubber as the basic raw material. Hence the effect of substitution can exert very significant influence on the demand of NR.

(c) **Trade cycle**

Trade cycle refers to the oscillations that take place at a more or less regular intervals between boom and slump. This is not confined to individual prices or particular industry or group of industries. The general price level and the level of economic activities are alternatively raised and lowered over a period varying in length from six to ten years.

During the boom period, economic activities reach a maximum and consumption level demand for products and services also reaches the peak. High demand for products and services in one region gives opportunity for the neighboring

and other regions to provide goods and services by way of exports. The increased level of imports and declining exports lead to deficits and the economy slowly receeds and receesionary trend spreads from one industry to another. Thus different countries will experience different stages of the trade cycle at a particular point of time. Normally a period of six to ten years is required for completing a cycle and the phenomena get repeated.

(d) **Advances in technology**

Engineering application of rubber or any other industrial good is governed by the development and growth of the concerned technology. Rubber technology is a fast growing area as the product manufacturers give atmost priority to the changing needs and aspirations of the end user of the product. As a result more and more new application opportunities arises. Equal emphasis also is given for modifying the existing products and adding innovative features for the product. End result is that the span of life cycle of the products are shortened. This leads to fluctuations in the NR/SR share in the product which reflects in the demand for the commodity. Technology is driven by the ever changing needs and interests of the customer.

(e) **Industrial growth rate**

Rubber is an industrial raw material. Hence demand depends on the growth of industry in general. The change in demand will be more pronounced if the major consuming sector is affected. Part of this can be compensated by a reverse trend in other sectors. During periods of recession, all the industries are depressed simultaneously hence there is a cumulative effect of reduced demand in all sectors. Similarly during the boom period, the demand for goods and services flourishes and records increased growth rate of industry. Growth rate of industrial sector is keenly

monitored by the government for sustained growth of economic activities and growing standard of living of the population.

(f) **Other Influences**

1. *Population growth rate*

Slow down of industrial production only partly explains the weakening of world rubber consumption. While population is the base, it is economy that dictates the pace of the growth of real GDP over the years. Increase in the consumption of elastomer in the Asian region is the result of the economic growth first in Japan followed by Republic of Korea and Taiwan and recently in China and ASEAN countries. It may be noted that China, India and Indonesia account for 64% of the world population. Thus the growth in elastomer demand may be explained by growth of population and economic growth taken together.

(2) Growing nationalism encouraging self-sufficiency

Quite often, when the economy and rubber consumption declines, the share of NR sharply declines in relation to that of SR. This is mainly because it is easier and probably cheaper too, to reduce imports and depend upon the domestically produced item. In the case of NR, major producers are poor consumers and major consumers are importers of NR. When there is a slump in the economic situation of the net NR importing countries, they resort to less of imports and depend on the domestically produced SR. This is particularly true when the firm is vertically integrated.

B.5. **MAJOR INFLUENCES ON SUPPLY**

NR production has many unique features as an agricultural product and an industrial raw material. The production of the commodity is highly concentrated which

leads to high discovery cost and transportation overheads. The cost of production varies from country to country and from producer to producer within the same country. NR production is subject to uncontrollable events like weather and its supply cannot be turned on and off . NR is an agricultural product and more than 85%of the output is by small growers in their respective countries .

The supply of NR is price inelastic and a decline in the price of the commodity may lead to an increase in the output . Similarly an increase in price can lead to reduced output as the farmers tend to keep a portion of their produce in stock to be sold at enhanced price at a later period .

SR is a petrochemical product and its production can be undertaken by establishing production facilities. SRs are used either because they perform better than vulcanised NR or they are lower in price or for both reasons. SR producers are able to control output by varying operating rates based on the demand for the commodity. At present, market share of SR in the world rubber consumption is 60% and remaining 40% is the market share of NR. Major constraints in the production of SR are availability of raw materials and restrictions on its movement. Calamities like war etc. can affect the output.

SR is mainly produced by petrochemical firms with forward integration and tyre manufacturers with backward integration. The world chemical, petrochemical and tyre industries are dominated by less than 10 companies, who account for around 80% of the SR capacity. This means that a large amount of SR produced is consumed by its own producers (captive production). Only 20% of the output is offered to international market. R&D is an important aspect of SR industry that facilitates the creation of new types of rubbers, refinement of production technology and regular improvement in product quality.

B.6. TRADE PRACTICES

SR prices trend to be stable. This is largely because the producing companies control their product, ie, they have a regulated supply. For non captive SR, suppliers quote a price to customers, usually quarterly and depending upon the market situation. SR is sold in a similar system like those of products of chemical and petrochemical industries, ie, directly from producers to manufactures at prices related to a published list.

Trading of NR is in a different way. Since there are very large number of small producers and few number of large consumers, contract pricing or list pricing is not feasible. In India there are more than 9 lakhs of small growers, who account for 85% of the total output. The manufactures need bulk quantities and hence direct supply is not possible. Hence the presence of middle men has become a necessity. Moreover the cost of production varies from producer to producer. All these factors make the distribution of the item a complicated affair.

SECTION - C

ANALYSIS OF RUBBER MARKET

1. Production
2. Consumption
3. NR/SR share in major regions
4. Rubber consumption by type and sector
5. Technological environment
6. Political environment
7. Economic environment

The market situation is analysed on the basis of the statistics on production and consumption available for the year 1996. Market trend also studied on the basis of the comparative statistics for the previous year. Rubber statistics for the year 1996 details are given in appendix - B.

C.1. PRODUCTION

(a) Natural Rubber

The world output of NR during 1996 was 63 lakh MT which shows a growth of 4.3% over the previous year. A region wise analysis shows that in the Asia/Pacific region, which is the strong rubber growing belt, contributing about 90% of the total output, the production growth is 4.9% over the previous year output. Only Malaysia recorded a negative growth of 0.6%. Remarkable growth in the production of NR was achieved by India (8.1%), Thailand (7.7%), Vietnam (7.3%) and Indonesia (5.2%).

In the African region there is net negative growth in production of NR. This is due to the sharp fall in the output by Nigeria (24.9%) and Ghanna (1.1%) despite the marginal growth in the production by Ivory Coast and Zaire.

In the Latin American region comprising of Brazil and Guatemala, there is a net positive growth of 1.9% over the previous year. There is substantial growth in Guatemala (7.4%) despite the fall in production of NR by Brazil (0.7%). Thus different nations and regions have different problems and opportunities that influence the production of NR.

(b) Synthetic Rubber

The world production of SR during 1996 was 97.8 lakh MT. Thus is 2.4% more than the production during the previous year. It may be noted that there was net negative growth in the production by all the major producers of NR. In USA, the

decline in the output was 1.7% and that in France was 5.8%. In Russia there was a 6.6% fall in production over the previous year and in the European Union which is the second largest SR producing block, the fall in the output was 1.1% .

In spite of the fall in the production by the major producing countries, the overall positive growth of output in SR was due to positive contribution from the Asia/Pacific region (10.7%) and Latin American countries (3.6%). In the Asia/Pacific region there was considerable growth in the output of SR in countries like China (12.3%), Republic of Korea (38.9%) and Taiwan (28%). In Japan the increase in output was marginal (1.5%) and India registered a fall in the production at 4.2% lower the previous year.

The production of both NR and SR is concentrating on the Asia/Pacific region. In the case of NR, the region is climatically suitable for the production whereas in the case of SR the industry is being shifted to the region from the West.

C.2. CONSUMPTION

(a) Natural Rubber

The world consumption of NR for the year 1996 was 61.3 lakh MT which is 2.3% more than the consumption during the previous year. The details are given in appendix. A region wise analysis shows that consumption of NR recorded a net negative growth in central and Latin America regions and the European Union. This is in spite of the progress in the consumption registered by countries like Mexico (24.6%), France (3.5%) and Belgium (7.5%).

On the other hand, growth in consumption was recorded by the central Europe, Africa and Asia/Pacific regions. In central Europe, Russian Federation (23.1%) and Poland (14.3%) improved the consumption level over the previous year and the percentage increase in Africa was 9.4% contributed by various African countries except South Africa where there was marginal fall in the NR off take (0.6%).

In the Asia/Pacific region also the growth of NR consumption is significant. Of these, the growth in consumption of NR is a more pronounced in Thailand (12.1%), Malaysia (9.2%), India (8.1%) and Indonesia (6.8%), all constitute the first four of the top producers of NR. China recorded a growth of 2.6% in consumption whereas in Taiwan the consumption declined 6.8% compared to that of the previous year. Thus it can be seen that there is a declining trend in the West and an upward trend in Africa and Asian/Pacific region with an overall net positive growth in NR consumption.

(b) Synthetic Rubber

The world consumption of SR during the year 1996 was 95.6 lakhs MT. Compared to the previous year, there is an increase of 5.2% for the year 96. Except

for African region, all other regions recorded a net upward trend in the consumption of SR. In spite of the net increase in the consumption recorded by the regions, there are some isolated centers where the SR consumption dropped from the previous year level. They include Italy (0.7%), Thailand (5.9%) and South Africa (6.5%). Countries that contributed significantly to the net positive growth in consumption of SR include Republic of Korea (27.6%), China (14.5%) and Taiwan (12%). In India the growth in the consumption was 6.7% over the previous year.

(c) **NR and SR together**

The world production of elastomer (SR and NR) during the year 1996 was 161 lakh MT and the consumption during the period was 156.9 lakh MT. The corresponding figures for the previous year were 155.5 lakh MT and 152.8 lakh MT respectively of production and consumption. This shows an increase of 2.6% in the output and 3.6% increase in the consumption of rubber. The overall picture of rubber consumption shows positive growth in all the regions. Individual nations showed mixed trend with Brazil, Germany, Italy, India and Russia showing declining trend in consumption where as Canada and China shows significant improvement in consumption over the last year.

C.3. NR/SR SHARE IN MAJOR REGIONS

There are many reasons why a country consumes more of a particular type of rubber. The reasons may be either technical, economic or even a technological progress in the NR/SR industries themselves. There can be wide differences in the percentage of NR consumption between countries and regions. For example, the NR consumption in Russia is just 3% of its total rubber consumption whereas it is 84% in

Malaysia. The difference is caused not only by the types of products but also the manufacturing process.

The variation in NR/SR share is more explained by facts such as whether the country is producing either NR or SR, or is located near the countries producing them. NR/SR share cannot be used as a measure of the intensity of NR/SR usage. To measure the intensity of usage of NR a factor called NR preference factor is used.

NR preference factor of a country is the difference of the ratio of NR consumption of the country to the world NR consumption and the ratio of the total rubber consumption of the country to the total rubber consumption of the world.

$$\text{NR preference factor of country A} = \frac{\text{NR Consumption country A}}{\text{World NR consumption}} - \frac{\text{Total rubber consumption country A}}{\text{World total rubber consumption}}$$

NR preference factor is a useful concept that facilities comparison between countries or regions. A positive NR preference factor means that the country is consuming more NR as compared to its ratio of total rubber consumption and vice versa for a negative NR preference factor. The preference factor is affected by the same factors as NR share. It is observed that the radialisation of tyres, increased use of truck tyres and relative increase in the price of SR have resulted in a rise in the NR preference factor in many countries. NR preference factors for major consuming countries and regions are given below. Value inside brackets indicates negative NR preference factor.

NR Preference Factors (based on 1996 figures)

Country	NR Pref. factor
USA	(0.039)
China	(0.025)
Japan	(0.002)
India	0.047
Malaysia	0.031
Korea	0.001
Germany	(0.007)
France	(0.009)
Brazil	(0.004)

Region	NR Pref. factor
North America	(0.042)
Latin American	(0.004)
European Union	(0.046)
Central & other Europe	(0.040)
Africa	0.007
Asia/Pacific	0.125

Region wise figures show that NR preference factor is positive only for Africa and Asia Pacific region. Other regions, with negative NR preference factor, show less preference for NR and prefer to use SR.

C.4. RUBBER CONSUMPTION BY TYPE AND SECTOR

Rubbers are classified into Natural and Synthetic by the nature of origin. NR is consumed in the dry form and in liquid form called latex whereas SR is mostly consumed in the solid form. Consumption of Rubber by type is shown below.

Type of Rubber	Million tons	Percentage
Synthetic Rubber SR	9.2	61.0
Natural Rubber NR		
a) Solid	5.1	34.0
b) Latex	0.8	5.0
Total	15.1	100.0

The above table shows that 61% of the total rubber consumed is SR and NR share of world consumption is 39% only as per 1996 statistics.

NR consumption by type

Type of NR	Millions Tons	Percentage
Dry Rubber	5.1	86.4
Latex	0.8	13.6
Total	5.9	100.0

Sector wise consumption of rubber

	Natural Rubber		Synthetic Rubber		Total	
Sector	Qty. (Million Tons)	%	Qty. (Million Tons)	%	Qty. (Million Tons)	%
Tyre	3.7	62.7	4.7	51.1	8.4	55.6
General Rubber goods	1.4	25.2	4.5	48.9	5.9	39.1
Latex	0.8	12.1	–	--	0.8	5.3
Total	5.9	100.0	9.2	100.0	15.1	100.0

Automobile sector is the single largest sector accounting for lion share of the total rubber consumption. This sector is far ahead of other sectors in the off take of rubber. The above table shows that 62.7% of NR and 51.1% of the SR consumed is by the tyre sector alone. This accounts for more than 55% of the world total rubber consumption.

In the general rubber goods (GRG) sector, which consists of thousands of small and big products, more than four hundred of them are used in vehicles. It is estimated that 15% of rubber consumed by the GRG sector is used for the manufacture of various products and components for the vehicle sector. Thus the consumption of rubber by the vehicle sector becomes 61.4% of the total rubber consumed as shown below.

Sector	Qnty. (Million Tons)	% of total Rubber consumed
Tyre	8.4	55.6
GRG (Automobile sector)*	0.88	5.8
Total	9.28	61.4

* 15% of 5.9

Thus automobile industry is the segment that can cause fluctuations in the consumption level of rubber both natural and synthetic.

C.5. TECHNOLOGICAL ENVIRONMENT

One of the prominent factors that has profound influence on the demand for Rubber is the technology. Rubber technology is a fast growing and developing area. R&D work gets utmost importance by product manufacturing companies and agencies working in the production side. The pace and growth of technology determines the life cycle duration of the products, its modification and incorporation of innovative features. This is especially true for SR, where technology upgradation is synonymous with existence and as a result, new types and blends of SRs are invented for specific and coustomised applications.

(a) Radialisation in tyres.

The three major components of a tyre are the tread, carcass and the side wall. The fourth component is the rubber covered steel bead which keeps the tyre on the wheel rim. Each component has different functions and hence different rubber or rubber compounds are used for each component.

By design, automotive tyres may be classified into cross ply design and radial ply design. Cross ply design is the conventional design. In the radial ply design, the

tread and the side wall have different functions. The side walls are flexible and the deformation on cornering is partially transfered to it.

The carcass (inside section of the tyre) of cross ply tyres are normally made from a blend of SBR and NR. In the case of radial ply tyres, the side wall compound contains a greater percentage of NR. This is because of the high fatigue resistance required by the flexible side walls. Fatigue resistance refers to the capacity of the compounded and cured material to withstand the loss of strength due to repeated flexing actions. Low hysterisis (heat developed per cycle of deformation) high resilience (energy returned per deformation cycle) are the two properties that make NR an unavoidable material in tyre manufacture.

Only a small percentage of NR is used in the treads of passenger cars. The formulation for car tyre tread are normally based on blends of SBR and BR (Poly Butadiene Rubber) approximately in the ratio SBR : BR : : 3 :1. This is because this combination provides best road grip. BR blended with NR in small quantities are also used in the tread for the improved grip at lower temperatures. The percentage of NR used in car tyre tread is just 18% of the compound weight.

Thus radial tyre means smaller tyres but higher proportion of NR in the side walls. In addition high green strength, tack and cohesive properties of NR serve to maintain uniformity during the tyre building and shaping operations. the success of radial tyre lies in its combination of better road holding and improved wear resistance. The percentage of NR in different types of tyres for different vehicle segments is given below.

Percentage of NR in tyres

Vehicle type	% of NR in tyres	
	Radial	Cross ply
Car	39	15
Truck	75	37
Light truck	39	16
High performance	17	

The table shows that radialisation of tyres especially radialisation of truck tryres is crucial in increasing the off take of NR.

(b)**Aspect ratio and high performance (HP) car tyres**

High performance tyres are radial tyres with speed rating. The speed and load ratings are moulded into the side walls. The ratio of the height of the side wall to the width of the tyre is called the aspect ratio. In the normal case, an aspect ratio of 0.8 is maintained and expressed as 80%. In high performance tyres, the aspect ratio is maintained at a lower level of 65% and less. Lower aspect ratio means less height of the side walls and more width of the tread. This gives more brake area and increased safety. Originally, HP tyres were attached top models of most car manufacturers. Now a days manufacturers are going far HP tyres throughout their model range.

(c)**Plus one inch concept**

Under this concept, the rim diameter of the tyre is increased from the conventional dia of 13 inch to 14 inch and the aspect ratio reduced from the conventional 80% to 65%. This modification, however, maintained the rolling circumference at the original level and provided the manufacturers a new marketing opportunity for the top end of their models (better performance and better

appearance). Performance improvements are related to grip and safety and both qualities are favoured by a wider tread area.

The rim diameter is further increased to 15 inch and the aspect ratio reduced to 55% or 50%. This provided still larger areas for bigger braking systems on both front and rear wheels leading to improved braking performance. These modifications led to increased consumption of elastomer per tyre. Currently the use of elastomer in HP tyres with rim diameter of 14 inch and 15 inch is 20 - 30% more than the conventional 13 inch tyre. For these tyres the much widder tread area has meant more use of SR, and the SR industry is the main beneficiary of this development. With larger rim dia, the average weight of the tyre and the rubber content increases.

(d)**Reduced rolling resistance.**

About 60% of the petroleum products used are in the movement of vehicles. The reasons for reducing the rolling resistance is not only to reduce the cost of total fuel usage but also to meet the need to reduce air pollution. The fuel used in overcoming the rolling resistance of car tyres account for about 15% of the total fuel consumption. In the case of heavy goods vehicles (HGV) it is as high as 30%.

Tyre materials are not perfectly elastic. When they are distorted during the rolling process, they generate heat. When a loaded tyre rolls, materials are distorted and power is consumed. A force is needed to keep the tyre rolling and for overcoming the friction offered by the road surface.It is estimated that 10% improvement in rolling resistance would save about 1.5% in fuel.

There is a wide range of variables with regard to vehicle operation that greatly influence the contribution of rolling resistance to fuel consumption. These include such factors as vehicle load, initial tyre pressure, velocity, journey length, ambient temperature, vehicle/suspension alignment, tread depth and road surface. Rolling

resistance of both car and truck tyres took a significant downward step through the introduction of radial ply tyre. Another major factor influencing the tyre rolling resistance is the tyre aspect ratio. Optimum aspect ratio to achieve minimum rolling resistance is between 60 and 65% for car tyres. ie, a rim dia of 14 inch. The strong influence of the road texture on rolling resistance for car and truck tyres suggests that on surfaces which has a coarse macro-structure, a greater portion of energy is lost in compression and adds to rolling resistance. R&D scientists and technologists are striving hard to develop models for overriding the rolling resistance of car and truck tyres.

(e)**Effort to reduce the dead weight of vehicles**

the elastomer consumption in the GRG category is 39% of the total elastomer consumption. Out of this 15% is used in the manufacture of items for the vehicle sector. As the need to reduce the rolling resistance become prominent, many of its components are now being made from lighter materials like Aluminum, thermosetting plastics etc. This helps to reduce the dead weight of the vehicles which directly helps in reducing the rolling resistance. The progress in the R&D work in SR has led to the invention of new types & blends that suits this purpose.

(f) **Latex Products & Penetration of Polyurethane**

A large portion of NR latex has been used for the production of flexible foam. Percentage consumption of concentrated latex the various sectors as follows.

Item	Consumption (%)
Latex foam	49
Dipped goods	44
Other	07
Total	100

Dipped goods include products like gloves, condoms etc. and others included extruded products like elastic threads etc. The primary function of foam latex products is that of a cushioning material for comfort. To this end, it is used in the production of mattresses, automobile seats, furniture cushions, pillows etc. Introduction of polyurethane, a synthetic polymer and its application in the manufacture of flexible foam products has affected the prospects of NR latex foam products. Polyurethane flexible foams are made in automatic machines with high output and low labour and thus cost effective. NR latex foam industry is mainly in the small scale sector and labour intensive, which makes the product less competitive relative to polyurethane foam products. Over the past few years, polyurethane have established increasing use in automobile sector in seating, interior padding etc. In the furniture market also cushioning materials are dominated by polyurethane flexible foams. Thus there is a drop of NR latex consumption by 3% by the foam industry during 96 - 97. However this drop in form sector was almost neutralised by the increased consumption by dipped goods sector. It can also be seen that there is sharp increase in the import of polyurethane during 96 - 97.

C.6. **POLITICAL ENVIRONMENT**

Natural rubber is an agricultural product which has wide application in the industry. In India there are more than 9 lakh small growers who produce more than 85% of the countries output of NR. Similar is the situation in other NR producing countries also. India remained a net importer of Natural Rubber but Union Government followed a policy to protect the interest of the growers of NR by restricted imports and providing incentives & subsidy for producing more for self-sufficiency. The policy of the Government helped sustained growth and remunerative price for the product.

A comparison of the world price and Indian price of the comparable grades of NR shows that the domestic price was higher than the price of the comparable grade in the international market. India Government followed an industrial policy based on socialism and gave importance to the small scale sector. Expect for the tyre units the major consumption of NR is by the small scale sector. Thus the Government policy is vital in the development of rubber producing as well as consuming sectors.

(a)**The Export - import policy**

Export and import of rubber is guided by the Export import policy for 1992 - 97 and in the new EXIM policy for the period from April 97 to March 2002. Natural Rubber is included in the "Negative list of restricted items for imports". NR can be imported under three kinds of licences.

1) NR can be imported against a licence issued by the Government or in accordance with a public notice issued in this behalf. This may be with or without duty as may be fixed by the Government This is usually done when there is a shortage of rubber within the country.
2) NR can be imported against special import licence (SIL) available with big export houses and it is transferable. Besides the prevailing import duty, the imports under SIL attracts premium charged by the export house
3) Import of rubber is also allowed under the Advance Licence (AL) which is issued as an incentive for the export of rubber products. Exporters of rubber products can import the quantity of rubber utilised in the manufacture of the product exported. This licence can be utilized for the import of synthetic rubber or rubber chemicals instead of NR. Import under advance licence is free of duty.

Liberalisation in the Economic Policy and the Signing of General Agreement on Tariff and Trade (GATT) has compelled the Government to follow the terms and

conditions stipulated in such agreements. The farm sector as well as the industrial sector would enjoy reduced protection from the Government.

C.7. ECONOMIC ENVIRONMENT

It is the economy that determines the growth of real GDP. Growth in the industrial production contributes to the growth of economy and hence GDP. GDP growth slowed down in 97 - 98. Since then, the growth rate has more or less stagnated. The industrial sector continues to face demand constraints. Domestic growth is sluggish for the second consecutive year. Projection for industrial growth has been revised to 4% from the estimated rate of 4.5%. The growth rate is excepted to pick up marginally in 1999 - 2000.

The agricultural production is expected to make upward growth from the 1.2% to 1.5% over the previous year. The balance of payment is under pressure as the current account deficit is expected to worsen to around 2.8% of the GDP.

SECTION - D

EMERGING TRENDS

1. Production
2. Consumption

D.1. PRODUCTION

(a) Natural Rubber

The concentrated nature of NR production is slightly distrubed. The percentage of the worlds production of NR by the top three producers - Thailand, Indonesia and Malaysia - has fallen from 80% in 1969 to 73.8% in 1995. This shows that there are prospects of improvement in the supply of NR from smaller producers of NR like Vietnam Combodia and Myanmar. The top three producing countries are also trying to strengthen their rubber cultivation industry. Malaysia hopes to relocate the plantation industry to neighbouring and other countries. Indonesia has ample land and labour for expanding rubber cultivation. Thailand hopes to maintain the No.1 position.

In Srilanka there is a steep fall of 24% in the production during the first half of 1998. This is attributed to bad weather and low price level. Many of the holdings especially owned by the small holders are not being tapped for production because of low price level. An emerging trend in Srilanka is the privatisation of the plantation sector. This sector is viewed as the sector with greatest buoyancy in Colombo stock exchange. Investors see investments in plantation companies worthwhile despite considerable cost. Rubber plantation is viewed as potential producers of both timber and latex. This will add a totally new dimension to the revenue from the plantation industry. These companies also aim at producing specialty rubber for niche markets. Strategic alliance with rubber product industry is another possibility. It is expected that more countries will follow suit.

Another development in the NR production sector is the joint decision of the top three producers to pull out of the International Natural Rubber Organisation (INRO) and set up an alternative group that aims to cut NR production by 20% below world demand. This strategic decision by the top producers who account for more them 70% of the total production can be a pointer to the future supply of NR.

Association of NR producing countries (ANRPC) also has proposed that rubber production be cut back to 20% below the world demand. The association also proposed a new mechanism to stabilize the NR price. This is by setting up of a buffer stock to be used as an instrument of price stabilization.

In Africa, Common Fund for Commodities (CFC) is sponsoring a project for improving the quality of rubber produced in West Africa by producing TSR under the Association of NR in Africa (ANRA). Thailand recently introduced the revised "Thai Specified Rubber Scheme". In India and China the NR production is mainly aimed at internal consumption.

Due to the unprecedented decline in the price of NR in domestic and international markets, a negative mind set has been developed among the growers especially the small holders. As a result, they resort to some desperate measures. These measures include temporary stoppage of production during rainy season, reduced protective treatments against fungal attacks, reduced amount of manuring etc. These steps may lead to a major set back in the longevity of the trees and thus affects long term production estimates. Another desperate measure adopted is the deferring of the replanting of the cleared area. These actions may probably result in a fall in the growth rate in India and other major rubber producing countries.

(b) **Synthetic Rubber**

Synthetic rubber was mainly produced to satisfy the domestic demand. Accordingly, 96% of the world production of SR was consumed by the producer country itself, with only 4% available for international trade. This was the situation during 1960-1987 period. After 1987 SR producing countries started producing more SR and by 1995, about 12.5% of the world output was available for international trade. The high price level of NR and its shortage in the market was one of the reasons for this increased supply of SR in the international market.

Another development in the SR industry is the expansion of SR capacity to non-traditional areas. In Republic of Korea, the increase in production is as high as 39% over the previous years production. Taiwan and China also achieved substantial increase in their output of SR. In Taiwan the increase of output is 28% and in China it is 12%. NR producing countries are also going for enhancing the installed capacity for producing SR. Malaysia and Thailand have already installed additional capacities.

At the same time, the traditional producers of SR have restricted their output. There is an opportunity cost facing the SR as the oil becomes scarce. But the trend in oil sector is indicating that oil prices may remain low for years to come because of the reduction in the cost of production due to technology advances. Cost of exploration and production per barrel has been reduced to US $ 7 for Texas oil. For the Saudi Arabian oil, the cost of production is only US $ 4 per barrel. The reduced price of oil will make SR cheaper. But it is to be seen as to how the situation is handled by the OPEC and petrochemical manufacturers.

D.2. **CONSUMPTION**

The Consumption of NR can be linked to the degree of radialisation in the tyre sector and demanded for the products in the vehicle sector. The process of

radialisation has reached a saturation point in USA and European Union. At the same time, the tyre manufacturing giants are planning to setup production units in the Asia/Pacific region. This means that the demand for NR is likely to increase substantially in this region. The extent of this increase in consumption depends on the extent to which radialisation of truck and other heavy commercial vehicle tyres are effected.

There will be a rapid consolidation of tyre units. The recent take over of Premier tyres Ltd. by the Appollo tyres and Vikrant tyres by J.K Tyre industries indicate this trend. Two multinational tyre companies, Bridgestone and Good year has entered the endegenous market by producing and supplying highly durable radial tyres needed by the Indian automotive consumers. Also global tyre companies like Michelin, Pirelli and Continental are planning to participate in the already competitive Indian tyre market in the near future.

The process of radialisation is likely to be extended to heavy truck tyres also. The durability of radial truck tyres including retreading, regrooving etc. can be 2 or 3 times greater than their conventional cross ply equivalents. Therefore with the acceleration of the process of radilalisation, the replacement market of tyres would be reduced drastically.

The consumer need for environmentally friendly green tyre with attributes of better grip, reduced noise and lower rolling resistance and higher mileage are becoming prominent. Safety of the ride is also a concern for the users in view of the increased rate of road accidents. Use of 15 inch or 16 inch rim dia with lower aspect ratio has become the order of the day.

Another trend is the 'over tiring' of the vehicles especially passenger cars. It has become very common in Europe, North America and Japan to fit tyres with

speed and load index rating more than required by the cars performance and load conditions. A survey conducted in U.K. shows that the share of HP tyres has risen from 50% in 1980 to 80% in 1995. Over the last few years car designers and manufacturers favoured the fitment of HP tyres as it provides greater flexibility with respect to suspension system and overall design of the car chassis.

In the GRG sector NR is replaced by other lighter materials especially in the automotive parts. The invention of many light weight thermosetting plastics and synthetic rubbers like polyurethane are prefered in the effort to reduce the dead weight of the vehicle. The need for lower rolling resistance and fuel efficiency for the owner of the vehicle favour this change.

There has been no great shift from the conventional technology being used in dipping. But a greater awareness about the potential allergy that can be caused by NR latex dipped products has created a sense of anxiety associated with personal safety among the users of gloves, condoms etc. More concern is about the Type IV allergy due to the protein present in the product. Gloves made of SR such as polyurethane are becoming popular in the West because of the protein allergy scare.

Polyurethane has established its share in the foam industry also. Subsequent to the rejection of the material by the western world due to its inherent hazardous and environmentally hostile nature, the commodity is dumped in the East for consumption. Due to the favourable political environment, the commodity is being imported in large quantities by the developing countries. This is likely to affect the consumption of NR latex by the foam industry due to the possible shrinked market for latex foam products.

SECTION - E

ANALYSING THE PRIMARY DATA

1. General assessment of the market
2. Role of SR
3. Technological developments
4. Expert's view of future prospects
5. Government interference and benchmark price

Primary data collected by personal interview method from selected experts are analysed and presented below. The questionaire/interview schedule designed for this purpose is attached as appendix -1.

(a)**General assessment of the NR market situation.**

NR market has been viewed to be unsteady from 1992 onwards with unsteady prices showing unusual ups and downs. Up to 1995 it was the sellers market which turned buyers market afterwards. The reasons for the present market situation are slacknes in industrial growth, the general economic recession prevailing throughout the world and the currency crisis in the South East Asian countries.

Many developing countries were experiencing shortages in foreign exchange since early 1990's and carried high level of external debt. Therefore they had to increase exports. When a number of countries especially the top three producers of NR simulteneously expanded their exports of the same commodity, the international market became flooded with NR, much out of proportion to its demand by net importing countries. This depressed the world market price of NR.

"The current situation is the cumulative effect of industrial and economy recession leading to lack of demand for products and services". Industrial recession leads to slackness in the growth of industries which means lesser output and hence lesser input. This affect the transportation industry and less consumption of truck tyre, which is the major NR consuming product. "The liberalisation policy led to the NR market. integration leading to a synchronisation with the world NR prices. The NR market in India is undergoing a process of getting oriented towards international price and the price variations are only in tune with international market price variations".

The Govt. approach to the situation was also not helpful in controlling the fluctuations in the domestic market. As stated by an expert, "the untimely statements

by the Govt. and other agencies on the procurement of NR" did a lot of damage to the market stability. The statements remained in papers and no action followed. This led to panic selling by the growers.

The experts are optimistic saying that this crisis also would be blown over in due course like the previous instances. The predicted period for a recovery from the present situation ranges from the end of 1999 to the close of 2001 AD. According to some of the experts "any upward trend in price is related to recovery of the richer West". A realistic view expressed by an expert states that "by the end of 1999 or early 2000 may record a mild recovery and 2001 may witness the regain in the growth of industries".

(b)**Role of SR**

In the global scenario, SR is a competetor for NR and pose a threat to its sustained growth of demand. On the Indian situation, SR is neither a completetor nor pose any threat to the demand for NR. This is the general view expressed by the experts.

As there are specific areas of use for NR and SR, they need not be considered as competetors to each other. Moreover NR and SR are used as complementary to each other in most applications in India. "The specific areas where NR is used shall continue to use NR". At the same time, if the price of NR remains higher than SR for a fairly long period, there can be some changes in compound formulations. In India the rubber Industry is mostly geared to large consumption of NR as expressed in a high NR preference factor. Small scale sector which accounts for more than 50% of NR consumed within the country is not likely to change the pattern.

Another view expressed in favour of SR is that SR manufacturing facilities are mainly owned by global manufactures of tyres and about 87% of their total production is captive. This gives added advantage for the global tyre companies in negotiating NR price. Hence international market demand of NR will be influenced by the price, quality and availability of NR. In many applications SR fares better in service performance criteria especially in the automobile vehicle sector. Had the price of NR remained at the 93-94 level, the shift to SR from NR would have been significant especially under situations of improved availability and relatively cheaper prices.

(c) **Technological developments.**

It is a common view expressed that there is substantial improvements in the technology upgradation in the rubber technology in general and the automotive sector in particular. Important and significant upgradation has occured in the tyre sector refered to as radialisation of automotive tyres espacially in passenger vehicles and to limited extent in truck tyres. Radial tyre technology is approaching a saturation point in the western hemisphere and is in the growing stage in the Asia/Pacific region.

There is substantial improvement in the effective life of tyres in terms of original mileage and retreaded mileage. Also the number of retreading on an original casing has also increased. It is estimated that the improvement in the effective life of tyre is somewhere around 15,000 km per tyre.

Synthetic Rubber technology is developing at a faster pace than the NR technology. Apart from the radial tyre technology, there is no notable break through achieved to give a boost in the consumption of NR. But the contributions in the SR technology has led to the invention of many new varieties of SR and blends that suits specific applications and specific needs of customers.

(d)**Expert's view of future prospects**

The experts are sharply divided in their view of future prospects for NR. 60% of the experts, who responded to the survey, are of the view that the future of NR is bright whereas 40% expressed the view that the future is uncertain and none assume that the future will not be bright.

The arguments are substantiated by facts and findings and to support the bright future for NR, they foresee a shortage of NR in the near future. NR being a strategic industrial raw material it cannot be dispensed with. According to them the present situation is due to the effect of the trade cycle which will find solution by itself.

Further more, in India the radialisation of truck tyres is likely to pick up momentum, which will result in increased demand for NR. It is further clarified that the use of NR will be maintained, if not improved, even though the amount of NR used per 1000 Km may come down as a result of the improved life of radial tyre.

Future prospects for NR is uncertain because of the following reasons expressed by 40% of the experts inter viewed. They find that the recessionary trend continues to prevail and no sign of recovery from any part of the world. Major NR producing countries like Thailand , Indonesia and India are striving hard to increase production and productivity. All out efforts are being made by smaller producers like SriLanka and Vietnam to increase the output of NR. The future depends on quality and cost competitiveness and also on the availability of NR in the international market.

(e)**Government interference and benchmark price.**

The views expressed by the experts on the topic of government interference can be classified into three. They are

- Govt. need to intervene
- Govt. need not intervene
- Govt. have little scope to intervene.

Proposals for Govt. intervention includes that of procurement of the estimated surplus quantity and maintaining a buffer stock which shall be rotated every six months or so. He suggests the setting up of a separate company for this purpose and utilizing the services of Rubber marketing Federation and Rubco in the procurement process and direct distribution to the consumers at international price. It is also suggested that the Govt. may formulate schemes for the purchase of surplus NR at a minimum support price and either export or distribute to the bulk consumers at international market price. Union Govt. have made such steps in the cases of other agricultural products like cotton, sugar etc. Yet another suggestion is to further restrict the imports of NR and NR based products into the country by the upward adjustment in tariff rates. At the same time export of NR and NR products are to be encouraged by offering extra incentives.

It is suggested by one of the experts that the best policy would be to leave the market to the economic factors for a natural adjustment in terms of demand and supply. He feels that such a rearrangement would give sustained stability for the market.

According to another expert, the Govt. have little scope to intervene in the NR market. The Govt. is bound by compulsions and commitments that make a strong intervention impossible. As a signatory to GATT and a member of the WTO, the nation has to keep commitments to the international community.

Notification on the bench mark price for NR was not viewed seriously as a means to market intervention. It is only a triggering price and will be effective only if the procuring agencies consider it as a minimum price for procurement. Hence the notification could not influence the market price of NR.

SECTION - F

NR MARKET FORECAST (QUALITATIVE)

F.1. NR MARKET FORECAST FOR THE NEXT DECADE

Based on the observations from the secondary data sources and the data obtained from the primary source of experts, the NR market situation is becoming more and more clear. There are ever so many factors influencing the market and the effect due to each influence changes due to changes in the market environment. The market reaches an equilibrium and attains stability for a period and again the equilibrium is disturbed due to the influence of some other factors or recurrence of an earlier influencing factor and this cycle continues.

As in the case of any other agricultural product, the supply of NR is inelastic. This inelastic nature of supply in the case of perennial products like NR is short term which gets adjusted in the long run because of the restricted potential for increasing production in the short run. NR production is becoming more and more capital intensive, yield will continue to increase while the area under cultivation is likely to decline.

There is an unprecedented decline in the price of NR in the domestic as well as international market and the declining trend continues. This caused to develop a negative mind set among the growers especially small holders in all the major NR producing countries. As a result they resort to desperate measure like stoppage of production during rainy season, early slaughtering of trees, deferred replanting , reduced application of manure and reduced protective treatment against fungal attacks etc. The later two steps may affect the longevity of the trees. These actions will result in a fall in the growth rate initially and a negative growth in the long run. There are three factors that can stop NR from falling short. They are.

- Saturation in elastomer demand in developed countries.
- Substitution effects of SR.
- Increased NR supply from other countries.

Saturation in the demand for elastomers in the developed countries is likely to happen. In fact, rubber consumption in advanced countries continues to decline or growth is stagnated due to saturation in the end use. At the same time, the demand

in developing countries continues to increase by way of increased domestic consumption and export demand. At this stage of the globalisation process, manufacturers from the developed countries move closer to the market and locate more of their production facilities in developing countries for efficient utilization of raw materials and proper control of quality and marketing. Thus Bridgestone and Goodyear has already entered the tyre market. Five more global companies are planning to participate in the Asian tyre market. This confirms that radialisation process will gather momentum in India and South East Asian countries.

The second factor that can stop shortage of NR is the substitution effect of SR. There has been an increase in the volume of SR being traded in the international market. This is evident from the fact that 96% of SR output was captive (to be consumed by the producers themselves) up to 1987, and during 1995 it is seen that only 87.5% of world output of SR was consumed by the producers. Thus the availability has increased. Increased availability may lead to increased substitution of NR by SR because of superior service performance of SR and reduced price level.

The third factor is the possible increase in NR supply from smaller producing countries. There has been a gradual growth in the NR share of output from the smaller producing countries. This means that there is a fall in the NR share of three top producers. The major contribution to this fall is because of the fall in output of NR from Malaysia. The three top producers of NR have already decided to pull out of international NR organisation (INRO) and suggested to restrict NR output to 20% below the world demand. This is an indication of their intentions and they are concentrating on productivity and quality rather than quantity output. The possible increase in output is from countries like Vietnam, Srilanka, Myanmar, Combodia, Bangladesh etc.. The increase in output from India and China are for internal

consumption. Hence it is unlikely that the increase in output from smaller producing countries will compensate that loss of output from the top three producers.

There are some developments that predict an increased consumption opportunity for NR and some other factors show possible reduction or stagnation of Nr off take. The shifting of the center of gravity of rubber manufacturing industry especially tyre industry from West to East (Asia Pacific region) shows the high probability of an increased demand for elastomers in the region. The possibility of radial tyre technology becoming popular for truck tyres provides greater opportunity for NR in the region. The net effect would be an increased consumption of NR in the domestic markets of major NR producing countries and less of NR available in these countries for export.

Thus the contribution to the world market from the major NR producing countries is likely to come down drastically. The probable increase in the supply from smaller NR producing countries would be far from sufficient to fill this gap.

The increased use of polyurethane in the manufacturing of foam products is likely to affect the consumption of NR latex. The use of polyurethane in other sectors like elastic thread etc. depends upon the changes in import tariff effected by the Union Govt. However the impact of this would be marginal on the over all consumption of NR.

The probable market situation is becoming more and more clear as one analyses the primary and secondary data. It is evident that there would be a fall in the overall growth rate in the output of NR. It is reported that there is a decline of up to 30% in the case of replanting area in India during the current year. This will definitely affect the growth rate in the long term. At the same time, the growth rate in the consumption of NR is likely to increases marginally and expect sustained

increase in the growth rate as the economic activities pick up in Asia Pacific region and else where.

The fall in the growth rate of production is likely to exceed the rise in the growth rate in consumption. Thus the production consumption gap will get narrowed in coming years. Even if the changes in the growth rate of production and supply equal each other in opposite directions, there would be shortage of NR in the international market by the end of 2001 or 2002. This will lead to an upward trend in the international market price as early as 2000 AD or even before. As on January 99, the international price is showing this tendency in spite of the lower price level in India.

F.2. JUDGMENT FORECAST OF NR PRODUCTION & CONSUMPTION

Forecast based on personal judgments are often made in making projections. This is purely a qualitative method because the assumptions for the forecast are based on personal judgments and are subjective . Where the date available are not sufficient for a statistical forecast, judgment method can be used. Considering the year 1996 as the base, projections on NR production and consumption are attempted.

(a)NR Production

Average growth rate of NR output for the two years preceding the base year is 5.1 percent (590/5710 x 100/2). The growth of output for the base year is 4.3

percent (appendix2). This shows a decline in the growth rate in NR output. A further fall in the growth rate is expected due to the desperate steps by small holders and the policy decision by the three top producing countries. The impact of these may be reflected in the output growth rate for a period of 5 to 6 years due to the perennial nature of the crop. The growth rate is expected to be as low as 1.5 percent by the year 2003 and there after increasing marginally and attaining a growth rate of 2.3 percent during the year 2006. The anticipated growth rate in the output is the net effect due to the expected fall in output from the top producers and the anticipated rise in output from smaller producers. The details are given Appendix (3.1)

(b)**NR Consumption**

The average growth rate in NR consumption for the two years preceding the base year is 4.5 percent (510/5630 x 100/2). The growth rate for the base year is 2.3 percent. This again shows a decline in the growth rate. The declining trend in growth rate is likely to continue and reach a stagnant growth rate before showing an upward trend. The growth rate in NR consumption may be as low as 1.8 percent during the year 2000 and gradually pick up as the economic environment shows a recovery from the recession and industrial growth rate improves in the Asia Pacific region. It is also expected that the radialisation of truck tyres to attain momentum by the year 2000, which will trigger an upward trend in the consumption of NR especially in the Asia Pacific region. It is expected that growth rate will reach stagnation by the year 2005 at 2.5 percent. The details are given at appendix (3.2)

The world consumption of NR is not to exceed the world NR output at any stage of the forecast period. But the growth in consumption would exceed the growth in output in absolute terms, by the year 2001 and continue to exceed up to year 2006. It is expected that the NR market would become more and more stable as year 2001 approaches.

SECTION - G

RECOMMENDATIONS

RECOMMENDATIONS/PROVISIONS FOR FUTURE

Forecasting is made to improve the accuracy of decision making. Any forecast is to be followed by a plan of action for future and make provisions for it. A qualitative forecast of the NR market is made in the pervious chapter. The salient points that requires attention for future provisions given below.

a) The world is faced with countries reducing production of NR due to various reasons. The possible increase in the output by smaller producers like Vietnam, Srilanka etc. and the increased output from India and China may not be sufficient enough to replace the loss of output from the top three producers of NR.

b) The Asia Pacific region is becoming the center place of intense industrial activities and growth especially in rubber product manufacturing. The consumption of NR in this region would increase drastically. At the same time, the demand for the commodity would remain stagnant in the western half of the globe.

c) The net result of the situations given at (a) and (b) above indicate that NR production growth would fall in the top producing countries and at the same time would consume more of NR. This makes the quantity of NR available with them for export lesser . Additional exports form smaller producing countries may not be sufficient enough to replace this reduction in the NR export from major NR producing countries.

d) As a result, there would be reduction in the availability of NR in the world market, and as the situation continues, the world market would experience a shortage for NR by the end of 2001 or 2002.

The forecast offers opportunity to potential growers of NR by achievements in quality and quantity. India has achieved in terms of productivity and quantity. In fact, India is foremost in productivity of NR by achieving an output of 1549 kg. per hectare during 97-98.

It is the quality that matters

The primary data collected through the survey of experts show that there is agreement among the experts that the quality of Indian NR is much below the quality standards required by the international market. This is especially true for the RSS segment, which constitute the bulk share of NR output from India. The views expressed by the experts as to the reasons for the inferior quality of RSS are

- Lack of facilities for smoking and drying of the sheets
- Trade practices in the primary market.

In the absence of sheet smoking facilities, the small holders dry their sheets in the sun by hanging in air or by spreading on earth surface which leads to dirt contamination. More over, the situation that even the lowest quality sheet can get a price in the market prevents the small holders from taking extra efforts to make a quality product. Further, the disappearance of RSS 5 grade from the trade zone and its clubbing with the off grade to constitute the "ungraded" grade, has helped the dealers and made manipulations easier. At the same time, the small holders were forced to leave the hope of producing a graded quality product. Thus the clubbing process initiated and accelerated the generation of substandard sheets by the small growers, who produce more than 75% of the RSS category.

The 'ungraded' lot in the market also influences the market price of RSS 4. The purchaser or dealer could offer a lowest price for the "ungraded" grade depending upon the demand and supply conditions and the RSS 4 grade offered a premium ranging from Rs. 1.00 to Rs. 3.00 per kg. also depending upon the demand for the grade. Thus the market price for the graded quality also is restricted to some extent by the high volume of the 'ungraded' lot.

Suggested remedies for quality improvement

The survey also could gather information from the experts as to their view of the steps that can favour a change in the quality consciousness among the growers as well as manufacturers of products using NR. There is truth in the statement by an expert that " the manufacturer will purchase and use a product available in the market". This means that as long as inferior material is available in the market at a cheaper rate, the manufacturers will continue to use it to reduce the cost of production but at the expense of quality. The low quality of inputs is the main reason for the low quality of NR products that make them unacceptable to the international community. Hence the first step for improving the quality of NR based products is to make sure that inferior quality NR is not traded in the market.

A similar view expressed by another expert states that sale of 'ungraded' category is to be stopped and the trading of Rubber should be according to the grades only. Rubber sheets below the grade of RSS 5 should be rejected or offered a price just above that of scrap rubber. Another suggestion is that the multiplicity of NR grades should be avoided and suggested a "farmers grade" introduced at par with the specifications prescribed for RSS 5 grade in the green book.

The grading of NR, especially that of RSS, needs a reorientation. Each grade shall be designated for consumption by one or more sectors. This is highly essential and possible also. The licence issuing authority should make sure that the particular sector is issued the licence for purchasing and storing the stipulated grades of NR. Similar standards are to be set up for the dealers also. Differential rate of cess can also be considered for the different industrial sectors based on the quantity and quality of the commodity input or valve addition achieved.

The separation of the off quality sheets and the reinstating of RSS 5 grade for trading will help to check many of the undesirable tendencies and practices in the market. The differentiation of North and South grades within the ungraded lot is one such unhealthy practice. Trading on the basis of internationally accepted standards does not differentiate the product on the basis of origin. The recycling of the off grade sheets for quality improvement will have a multiple effect in the market. The small growers would be motivated to produce quality sheets. It would also facilitate blending with scrap or reprocessed alone to higher grades of TSR, thus contributing to quality upgradation of TSR grades. A substantial quantity of the surplus NR in the market would get purged from the market and the market would attain a refined outlook. Hence this separation and recycling of the off sheets is an inevitable step to start with. Another noteworthy suggestion from an expert is that *grant of subsidy to be linked with productivity and quality of the output.* After all, the objective of giving subsidy is improving productivity as well as quality. Another suggestion for improving quality is to *promote group processing of the small holders crop by setting up common processing facilities jointly by RPS and Rubber Board.* It is observed that most of the low quality sheets originate from the small holders and one best alternative to eliminate such products from the market is not to process these crops into sheets but to field coagulate the latex and process to TSR grades.

Until very recent times, the NR production in India was aimed at attaining self sufficiency in domestic consumption. Hence emphasis was on quantity output. Govt. restrictions on import were stringent and hence the industry consumed what was available in the market. Now the situation has changed. Output exceeded consumption demands, import is made less stringent and so the consumers became selective. As one of the experts has put it "let the growers produce what the consumer wants". It is not the off grade product that the consumers want. Nor it is

the substandard product that the international market wants. *Any additional output in NR is to be for the international market.* There is a standing opportunity waiting for India. Hence grow more rubber, produce more rubber and grab the opportunity.

SECTION - H

CONCLUSION

CONCLUSION

Major NR producing countries are among the world's fastest growing economies and there is an increase in the opportunity cost of producing NR in these countries due to economic growth and industrialisation. This would lead to a decline in the NR out put in these countries. In spite of this, there are prospects of improved NR supply from the smaller producers of NR. But the increase in the supply from the smaller producers of NR might not be sufficient enough to replace the loss in output from the major producing countries.

The world rubber industry would not grow as rapidly as before because of slower economic growth in major NR consuming countries including major industrialised countries. Elastomer consumption is reaching a saturation point. At the same time the rubber consumption is likely to pick up in other regions especially in the Asia/Pacific region as the global giants in tyre manufacture are moving closer to the market and establishing production facilities in the region. So there are plenty of reasons to expect an increase in the off take of NR in spite of the possible stagnation or decline in consumption in developed countries.

Asia/Pacific region is becoming the center of industrialisation by the entry of global giants in the region and establishing manufacturing facilities in the region. As the radialisation of truck tyres gather momentum, there would be an increasing demand for NR in the region, and NR producing countries would consume more and more of its NR production, thus less and less of NR will be available for export from these countries to the world market. The exports from the smaller producing

countries would not be sufficient to replace this gap. Thus there would be a fall in the supply of NR in the international market. This may lead to a shortage for NR in the international market by 2001 or 2002. The increased availability of SR and expansion of SR capacity to non-traditional areas including major NR producing countries are factors that might slow down the long term shortage of NR.

The emerging market situations offer an opportunity for the Indian growers in the long term. India being the fourth largest producer of NR, and having surplus production over domestic consumption, is the most probable candidate to fill the gap caused by the possible fall in exports from the top three producers of NR. But India could not make a meaningful entry into the world market for various reasons like lack of quality surplus, relative higher price in the domestic market etc. In order to make use of the opportunity in the international market the product must conform to the standards of the target market and acceptable to the consumers. Thailand and Africa are already on their way for quality upgradation in TSR. The opportunity by way of export of RSS grades is achievable as more than 90% of the countries production is in the form of RSS. The future of Indian NR depends very much on the efforts taken in this direction.

APPENDIX

PROJECT ON "ANALYSIS AND FORECAST OF NR MARKET.

Exploratory Research - Survey of Experts

Questionaire/interview schedule.

Name of the Expert:

Position:

Place and Date of Interview.

Respected Sir,

Kindly give your comments / remarks on the following points in the space provided. Please use the additional sheet provided, if space is not sufficient.

1. What is your assessment of the present NR market situation in general? What could be the reasons for the present instability of price?

2. How long this trend will continue? Will the market attain stability in the near future?

3. There is a drop in the consumption of NR during the previous years. In your opinion which all products/products catagories might have contributed to this?

4. Do you think that synthetic Rubber is a competetior for NR ? Is SR a threat to NR ? Please give your comments on this.

5. Can a reduction in price of SR or an increase in its availability / supply, affect the NR demand ? If yes, in what way ? If no, why ? Please contribute.

6. Do you notice any change in the technology being used in the manufacture of products used in (1) tyre sector (2) non tyre sector during these years. If yes please indicate the specific category.

7. If there an increase in the effective life of tyres ? If yes, What are the contributing factors ?

8. In international market TSR price is quoted much lower than RSS grade. What is the implication of this trend.

9. How do you see the future prospects for NR ? Is it bright, not bright or uncertain ? Why do you feel like that ? Please contribute.

10 In your opinion, what are the promising areas for increasing the consumption of NR.

11. Maintaining Rubber stock requires high Capital involvement and Export at the present conditions may lead to huge cash losses. What is the way out to handle the accumulating surplus NR.

12. Benchmark price for RSS 4 grade is Rs.34.05 and RSS 5 is Rs. 33.55. In India RSS 5 is treated at par with ungraded category. Do you think that this situation will help the small growers at large, whose product is treated as ungraded (lot) by the dealers ? If yes, How ? If no, what is the remedy for this, in your opinion ?

13. In what way the separation of R S S 5 grade from ungraded category can effect (1) the growers (2) dealers. Please give your views.

14. In your opinion how could the Govt. interfere in the market to attain price stability for NR

15. Do you think that there is shortage of quality NR in Indian market. If yes, What are your suggestions for improving the availability of quality NR in Indian market. If no, why the manufactuers complain of shortage of quality NR in the market?

16. Any other points you want to contribute is welcome.

Thank you for the co-operation.

Leading producing and consuming countries in 1996

Natural rubber production

	World share, %	(1995)
1 Thailand	31.0	(29.7)
2 Indonesia	24.7	(24.4)
3 Malaysia	17.3	(18.2)
4 India	8.7	(8.3)
5 China	6.4	(7.1)
6 Sri Lanka	1.8	(1.8)
7 Vietnam	1.8	(1.7)
8 Nigeria	1.5	(2.0)
9 Côte d'Ivoire	1.4	(1.3)
10 Philippines	1.0	(1.0)

Natural rubber consumption

	World share, %	(1995)
1 USA	16.3	(16.7)
2 China	13.0	(13.0)
3 Japan	11.6	(11.5)
4 India	9.1	(8.6)
5 Malaysia	5.8	(5.5)
6 Republic of Korea	5.2	(5.1)
7 Germany	3.1	(3.5)
8 France	3.0	(2.9)
9 Thailand	2.8	(2.6)
10 Brazil	2.4	(2.6)

Synthetic rubber production

	World share, %	(1995)
1 USA	25.7	(26.8)
2 Japan	15.7	(15.9)
3 Russian Federation	8.0	(8.8)
4 France	6.0	(6.6)
5 China	5.7	(5.2)
6 Republic of Korea	5.3	(3.9)
7 Germany	5.0	(5.1)
8 Taiwan	3.9	(3.1)
9 UK	3.4	(3.4)
10 Italy	3.1	(3.3)

Synthetic rubber consumption

	World share, %	(1995)
1 USA	22.6	(23.6)
2 Japan	11.6	(11.8)
3 China	9.0	(8.2)
4 Republic of Korea	5.0	(4.1)
5 Russian Federation	4.5	(4.6)
6 France	4.5	(4.7)
7 Germany	4.3	(4.6)
8 Brazil	3.1	(3.2)
9 Italy	3.0	(3.2)
10 UK	2.9	(2.5)

Total production

	World share, %	(1995)
1 USA	15.6	(16.4)
2 Thailand	12.2	(11.6)
3 Indonesia	9.7	(9.5)
4 Japan	9.6	(9.7)
5 Malaysia	6.8	(7.1)
6 China	6.0	(5.9)
7 Russian Federation	4.9	(5.4)
8 India	3.8	(3.7)
9 France	3.7	(4.0)
10 Republic of Korea	3.2	(3.1)

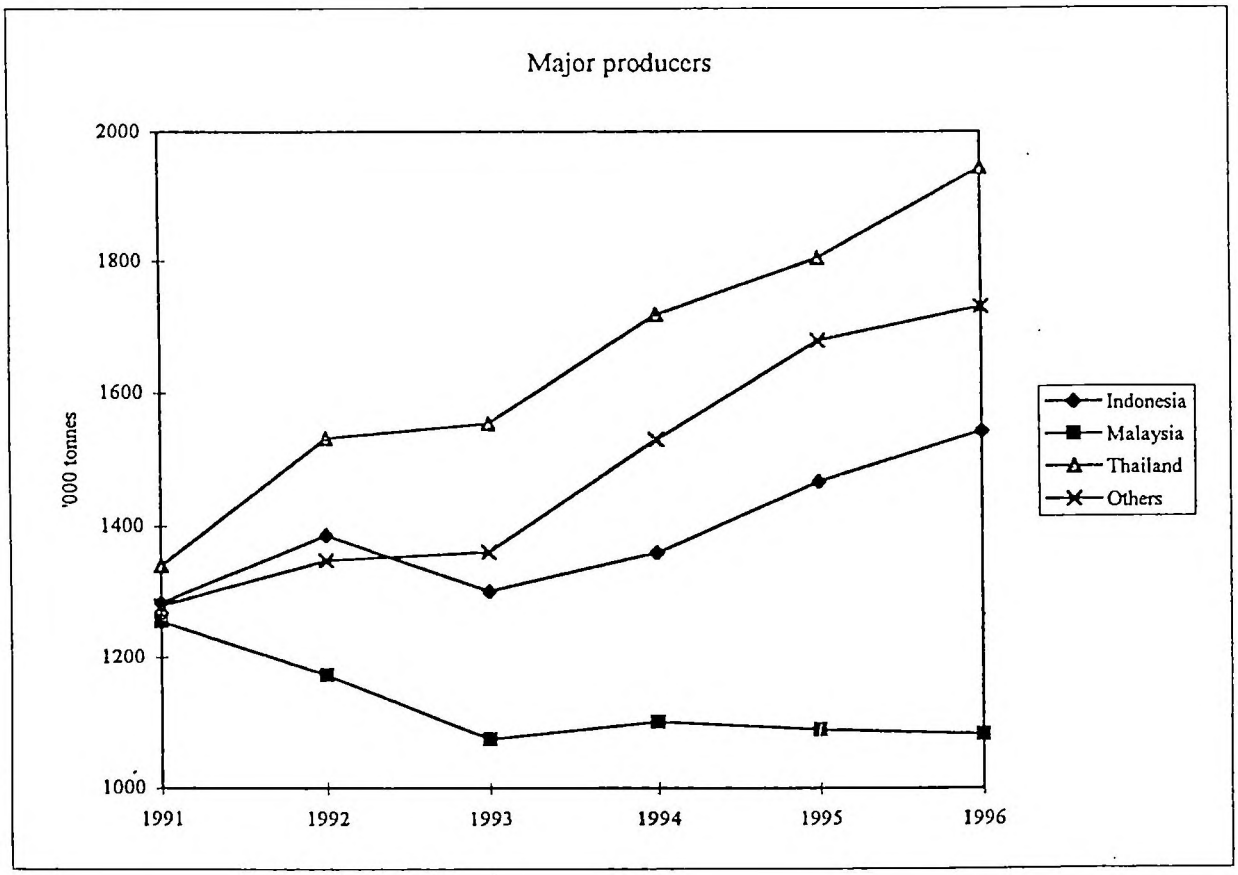
Total consumption

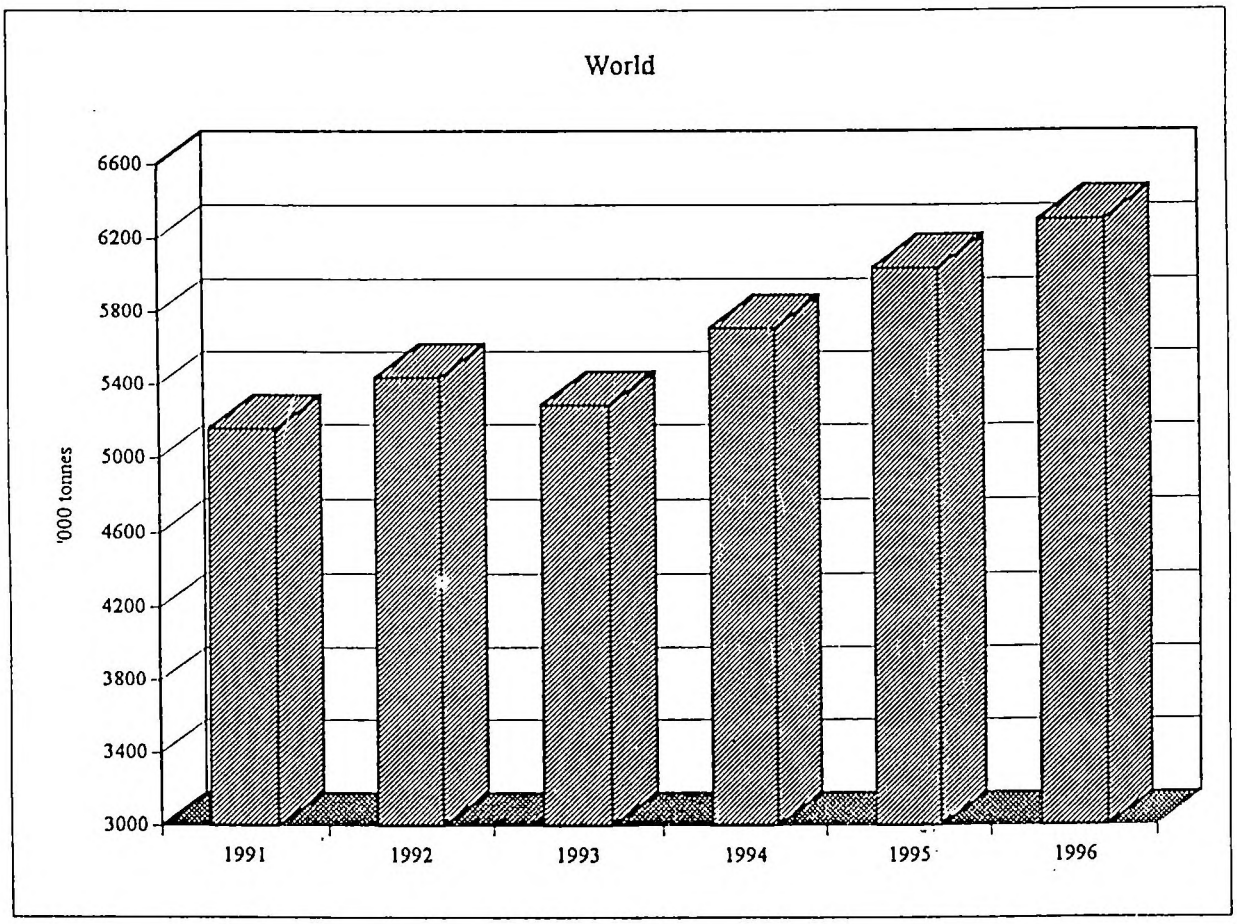
	World share, %	(1995)
1 USA	20.2	(20.9)
2 Japan	11.6	(11.7)
3 China	10.5	(10.1)
4 Republic of Korea	5.1	(4.5)
5 India	4.4	(4.3)
6 France	3.9	(4.0)
7 Germany	3.8	(4.2)
8 Russian Federation	2.9	(2.6)
9 Brazil	2.8	(3.0)
10 Malaysia	2.7	(2.3)

Natural rubber production

	1996	change, %
Brazil	*44.0*	-0.7
Guatemala	*29.0*	7.4
Other Latin America	*18.0*	0.0
Sub-total	*91.0*	1.9
Cameroon	*57.8*	11.4
Côte d'Ivoire	*85.0*	10.4
Ghana	*8.9*	-1.1
Liberia	*14.0*	7.7
Nigeria	*91.0*	-24.9
Zaire	*15.0*	36.4
Other Africa	*8.2*	57.7
Sub-total	*279.9*	-2.9
Bangladesh	*2.8*	16.7
Cambodia	*43.0*	-2.3
China	*430.0*	1.4
India	540.2	8.1
Indonesia	*1543.0*	5.2
Malaysia	1082.5	-0.6
Myanmar	*20.0*	11.1
Papua New Guinea	7.1	9.2
Philippines	*64.0*	7.0
Sri Lanka	112.5	6.4
Thailand	1943.8	7.7
Vietnam	*132.0*	7.3
Sub-total	*5920.9*	4.9
World total	6300	4.3

Natural rubber production

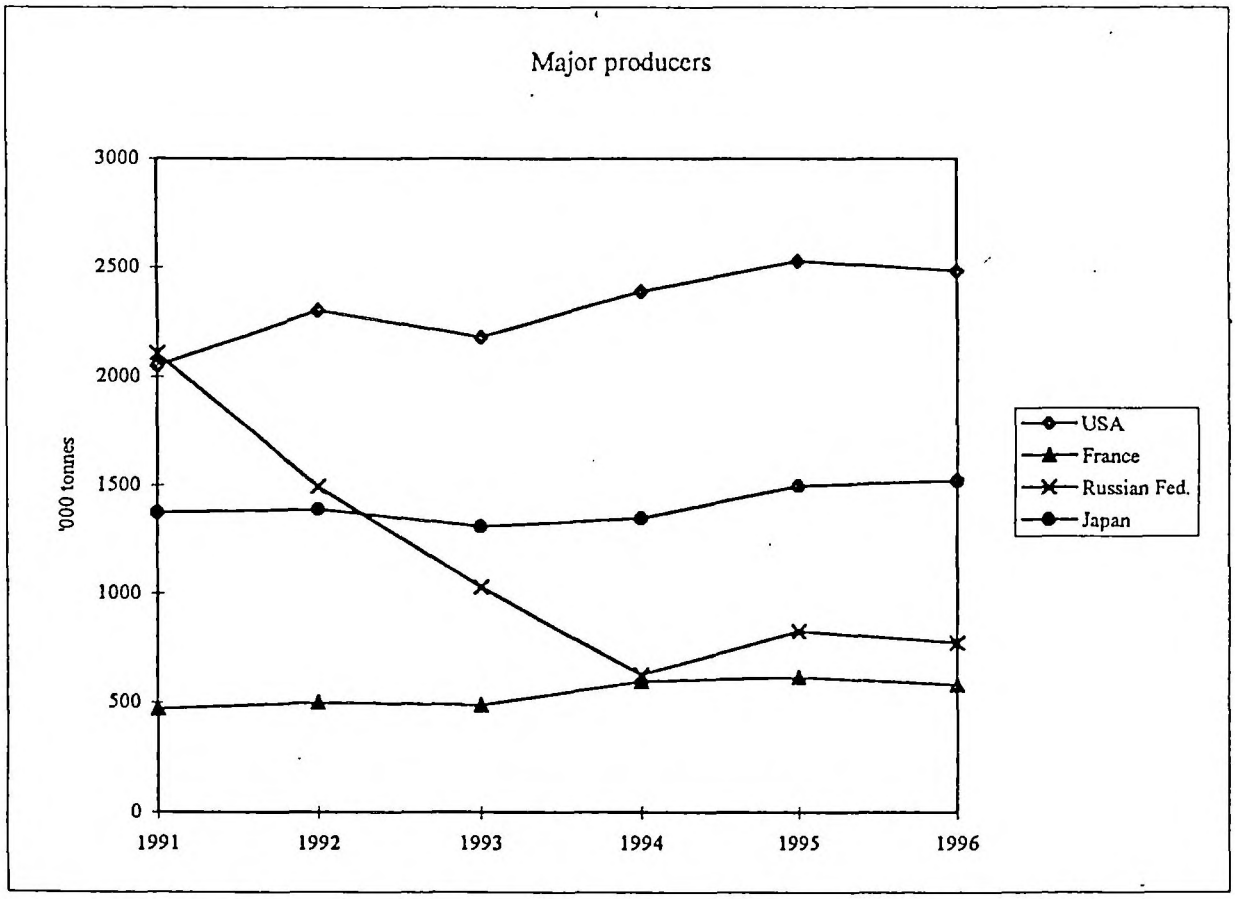


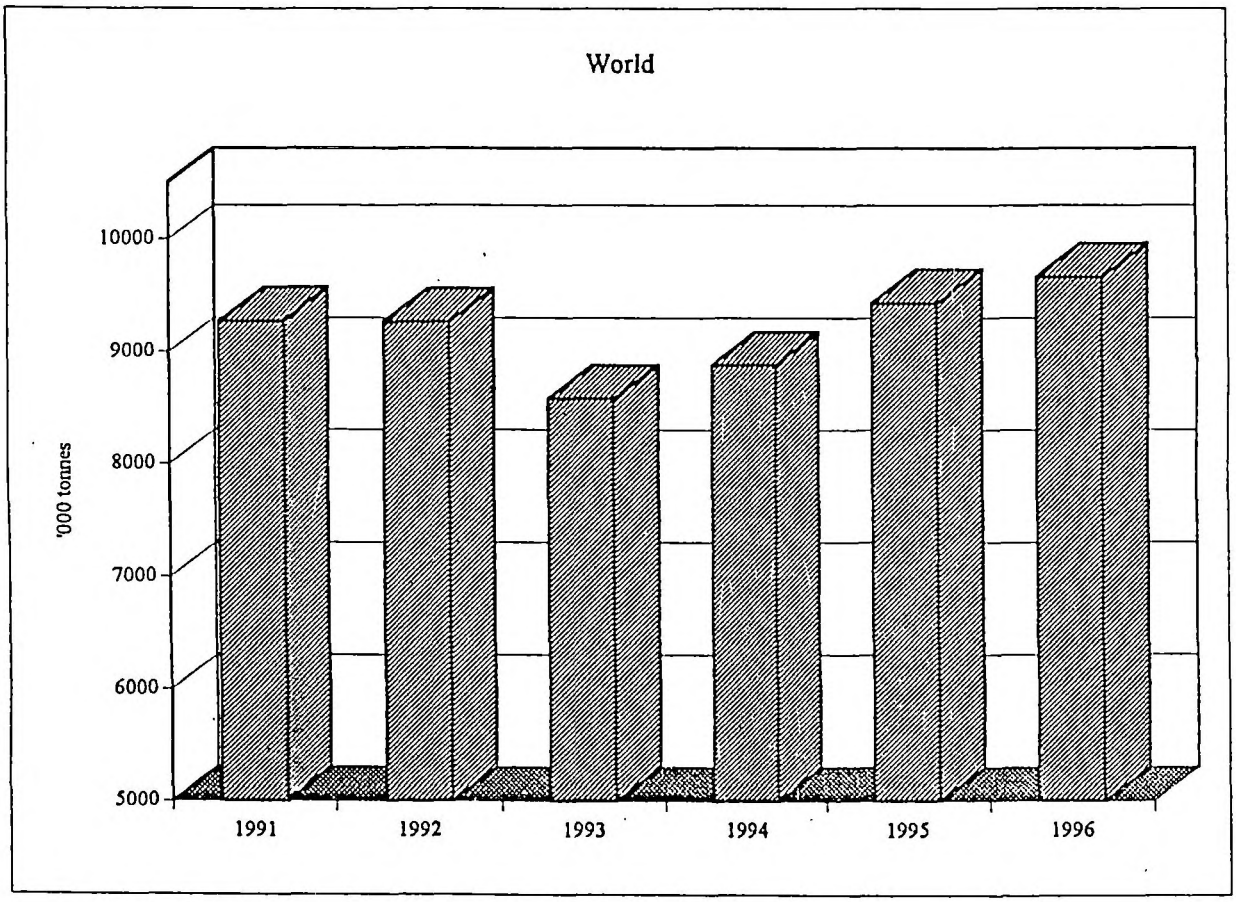


Synthetic rubber production

	1996	change, %
Canada	*220.0*	29.4
USA	2486.0	-1.7
Sub-total	*2706.0*	0.2
Argentina	58.1	7.0
Brazil	*288.0*	0.6
Mexico	*119.5*	9.8
Sub-total	*465.6*	3.6
Austria	*5.0*	0.0
Belgium	*140.0*	5.3
Finland	*36.0*	0.0
France	582.5	-5.8
Germany	485.0	1.0
Italy	303.0	-2.3
Netherlands	*180.0*	-2.7
Spain	*88.0*	2.3
Sweden	*36.0*	0.0
UK	328.3	2.7
Sub-total	*2183.8*	-1.1
Bulgaria	*28.0*	12.0
Czech Republic	*78.0*	0.0
Poland	106.4	1.5
Romania	34.7	-16.6
Russian Federation	775.1	-6.6
Turkey	*49.6*	-6.4
F.R. of Yugoslavia	10.6	-
Other Europe	*48.0*	2.1
Sub-total	*1130.4*	-5.2
South Africa	57.5	1.8
Australia	*48.0*	-0.4
China	553.3	12.3
India	63.7	-4.2
Iran	45.7	-7.7
Japan	1519.9	1.5
Republic of Korea	*516.0*	38.9
Taiwan	*375.0*	28.0
Sub-total	*3121.6*	10.7
World total	9660	2.4

Synthetic rubber production





Rubber consumption

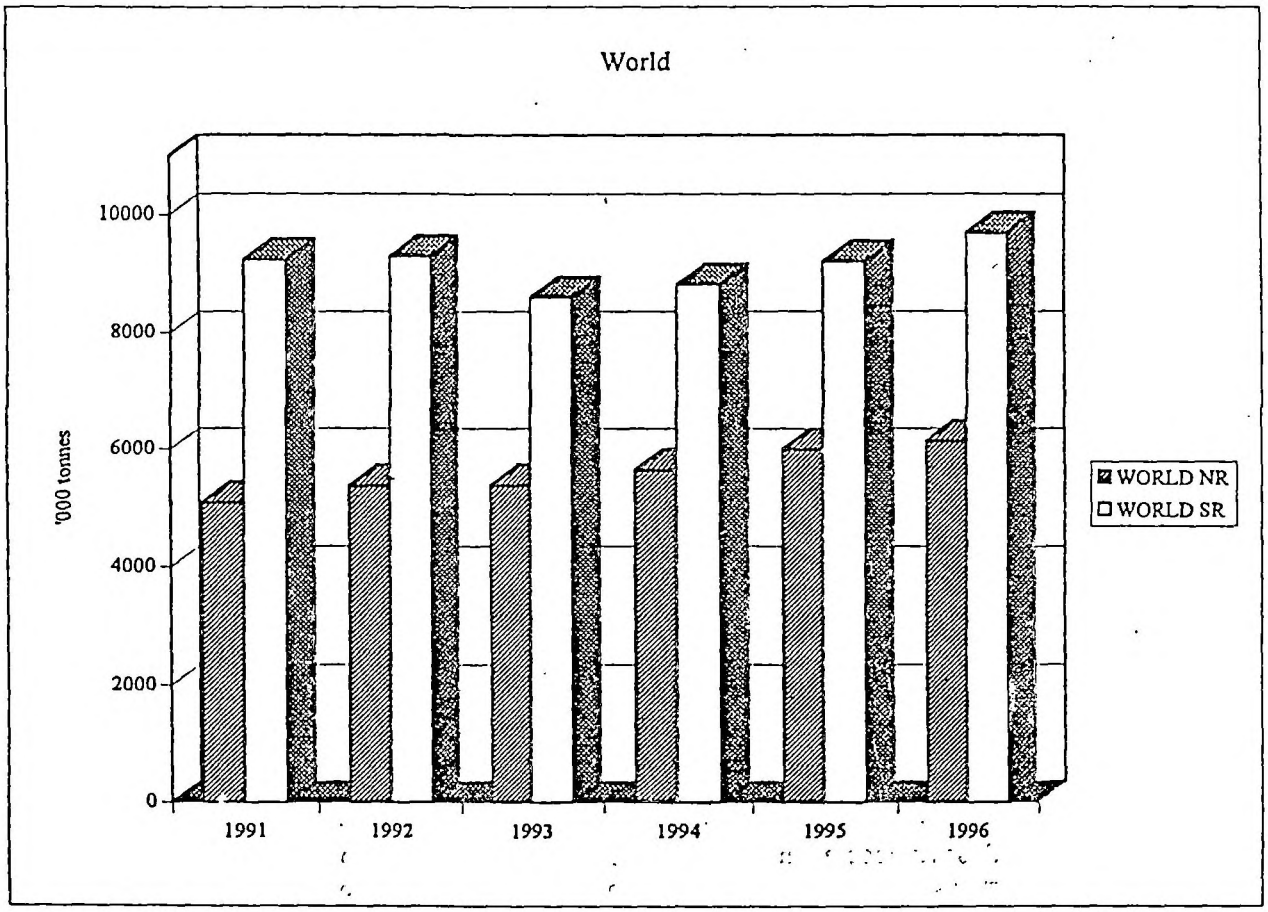
	1996			change, %		
	NR	SR	Total	NR	SR	Total
Canada	119.0	242.0	361.0	-1.7	22.2	13.1
USA	1001.7	2190.3	3192.0	-0.2	0.8	0.5
Sub-total	*1120.7*	*2432.3*	*3553.0*	-0.4	2.6	1.7
Brazil	*145.0*	*300.0*	*445.0*	-6.6	1.4	-1.4
Mexico	*76.0*	*100.0*	*176.0*	24.6	17.2	20.3
Other Latin America*	*125.0*	*215.0*	*340.0*	-6.7	2.4	-1.2
Sub-total	*346.0*	*615.0*	*961.0*	-1.2	4.0	2.1
Belgium/Luxembourg	*43.0*	*103.0*	*146.0*	7.5	0.0	2.1
France	182.2	436.1	618.3	3.5	1.4	2.0
Germany	193.0	416.0	609.0	-8.8	-2.4	-4.6
Italy	100.0	291.0	391.0	-2.0	-0.7	-1.0
Spain	*127.0*	*200.0*	*327.0*	-0.5	2.8	1.5
UK	*111.0*	*277.0*	*388.0*	-5.9	18.9	10.5
Other EU*	*75.0*	*319.0*	*394.0*	-5.1	0.9	-0.3
Sub-total	*831.2*	*2042.1*	*2873.3*	-2.7	2.3	0.8
Belarus	*6.0*	*38.0*	*44.0*	20.0	26.7	25.7
Czech Republic	*30.0*	*64.0*	*94.0*	25.0	6.7	11.9
Poland	*32.0*	84.2	*116.2*	14.3	1.0	4.3
Romania	*16.0*	*50.0*	*66.0*	6.7	-5.7	-2.9
Russian Federation	16.0	438.0	454.0	23.1	3.3	3.9
Turkey	*76.0*	*92.0*	*168.0*	1.3	9.5	5.7
Ukraine	*4.0*	*76.0*	*80.0*	0.0	5.6	5.3
Other Europe*	*58.0*	*161.0*	*219.0*	18.4	-3.6	1.4
Sub-total	*238.0*	*1003.2*	*1241.2*	11.7	3.1	4.6
South Africa	*52.5*	*58.0*	*110.5*	-0.9	-6.5	-3.9
Other Africa*	*93.0*	*61.0*	*154.0*	16.3	0.0	9.2
Sub-total	*145.5*	*119.0*	*264.5*	9.4	-3.3	3.3
Australia	*50.5*	*70.5*	*121.0*	3.1	6.8	5.2
China	*800.0*	*870.0*	*1670.0*	2.6	14.5	8.4
India	558.2	141.6	699.8	8.1	6.5	7.8
Indonesia	142.0	144.0	286.0	6.8	4.3	5.5
Japan	714.5	1124.5	1839.0	3.3	3.6	3.5
Republic of Korea	*319.0*	*485.0*	*804.0*	3.9	27.6	17.0
Malaysia	357.4	*70.0*	*427.4*	9.2	9.4	9.2
Taiwan	*96.0*	*271.0*	*367.0*	-6.8	12.0	6.4
Thailand	173.0	80.0	253.0	12.9	-5.9	6.2
Other Asia*	*252.0*	*233.0*	*485.0*	-3.1	7.9	1.9
Sub-total	*3462.6*	*3489.6*	*6952.2*	4.3	10.1	7.1
World total	6140	9700	15840	2.3	5.2	4.1

* - See page 8 for further breakdown.

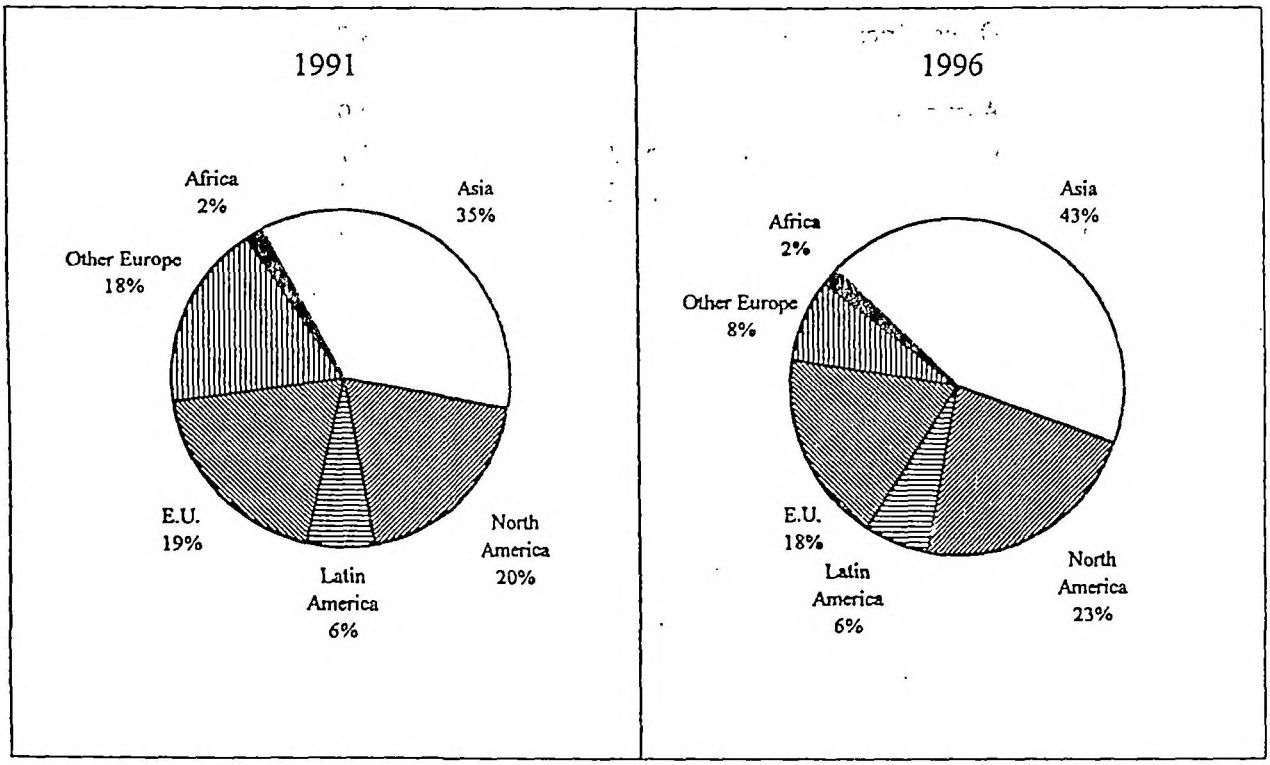
Rubber consumption

	1996			change, %		
	NR	SR	Total	NR	SR	Total
Argentina	31.7	50.6	82.3	10.1	2.4	5.2
Chile	*13.0*	*18.0*	*31.0*	-1.5	-0.6	-1.0
Colombia	*23.0*	*44.0*	*67.0*	-11.2	19.9	7.0
Venezuela	*18.0*	*40.0*	*58.0*	-29.7	-7.0	-15.5
Others	*39.3*	*62.4*	*101.7*	-3.0	-0.6	-1.5
Other Latin America	*125.0*	*215.0*	*340.0*	-6.7	2.4	-1.2
Austria	25.1	*39.2*	*64.3*	-4.2	-13.1	-9.8
Denmark	1.3	13.7	15.0	-23.5	6.2	2.7
Finland	9.7	*54.9*	*64.6*	-14.2	-2.7	-4.6
Greece	*6.3*	*10.3*	*16.6*	-14.9	-16.9	-16.2
Rep. of Ireland	4.0	12.2	16.2	29.0	-14.1	-6.4
Netherlands	11.4	*76.0*	*87.4*	23.9	5.6	7.6
Portugal	11.4	35.7	47.1	10.7	-4.8	-1.5
Sweden	*3.2*	*73.3*	*76.5*	-67.0	12.3	2.0
Other EU	*75.0*	*319.0*	*387.7*	-5.1	0.9	-1.8
Bulgaria	*1.6*	*10.0*	*11.6*	14.3	104.1	84.1
Hungary	7.3	25.5	32.8	10.6	-12.7	-8.4
Norway	0.5	5.2	5.7	0.0	4.0	3.6
Slovak Republic	21.8	25.6	47.4	21.8	-32.5	-15.1
Switzerland	2.4	18.9	21.3	9.1	0.0	0.9
Others	*24.4*	*75.8*	*100.2*	19.6	6.6	9.5
Other Europe	*58.0*	*161.0*	*219.0*	18.4	-3.6	1.4
Egypt	16.8	10.4	27.2	80.6	-18.1	23.6
Morocco	*8.0*	*8.0*	*16.0*	-14.0	-4.8	-9.6
Nigeria	*22.0*	*2.4*	*24.4*	0.0	9.1	0.8
Zimbabwe	*8.0*	*6.0*	*14.0*	50.9	33.3	42.9
Others	*38.2*	*34.2*	*72.4*	12.0	3.0	7.6
Other Africa	*93.0*	*61.0*	*154.0*	16.3	0.0	9.2
Hong Kong	12.5	25.4	37.9	26.3	-0.8	6.8
Iran	*39.0*	*18.0*	*57.0*	-18.8	0.0	-13.6
Israel	*9.0*	*22.0*	*31.0*	0.0	0.0	0.0
New Zealand	6.1	13.2	19.3	0.0	-4.3	-3.0
Pakistan	22.7	13.2	35.9	-3.4	13.8	2.3
Philippines	*31.0*	20.9	*51.9*	-11.4	0.5	-7.0
Sri Lanka	39.9	*4.0*	*43.9*	8.1	0.0	7.3
Others	*91.8*	*116.3*	*208.1*	0.2	16.1	8.5
Other Asia	*252.0*	*233.0*	*485.0*	-3.1	7.9	1.9

Rubber consumption



Rubber Consumption by region



Appendix 3.1

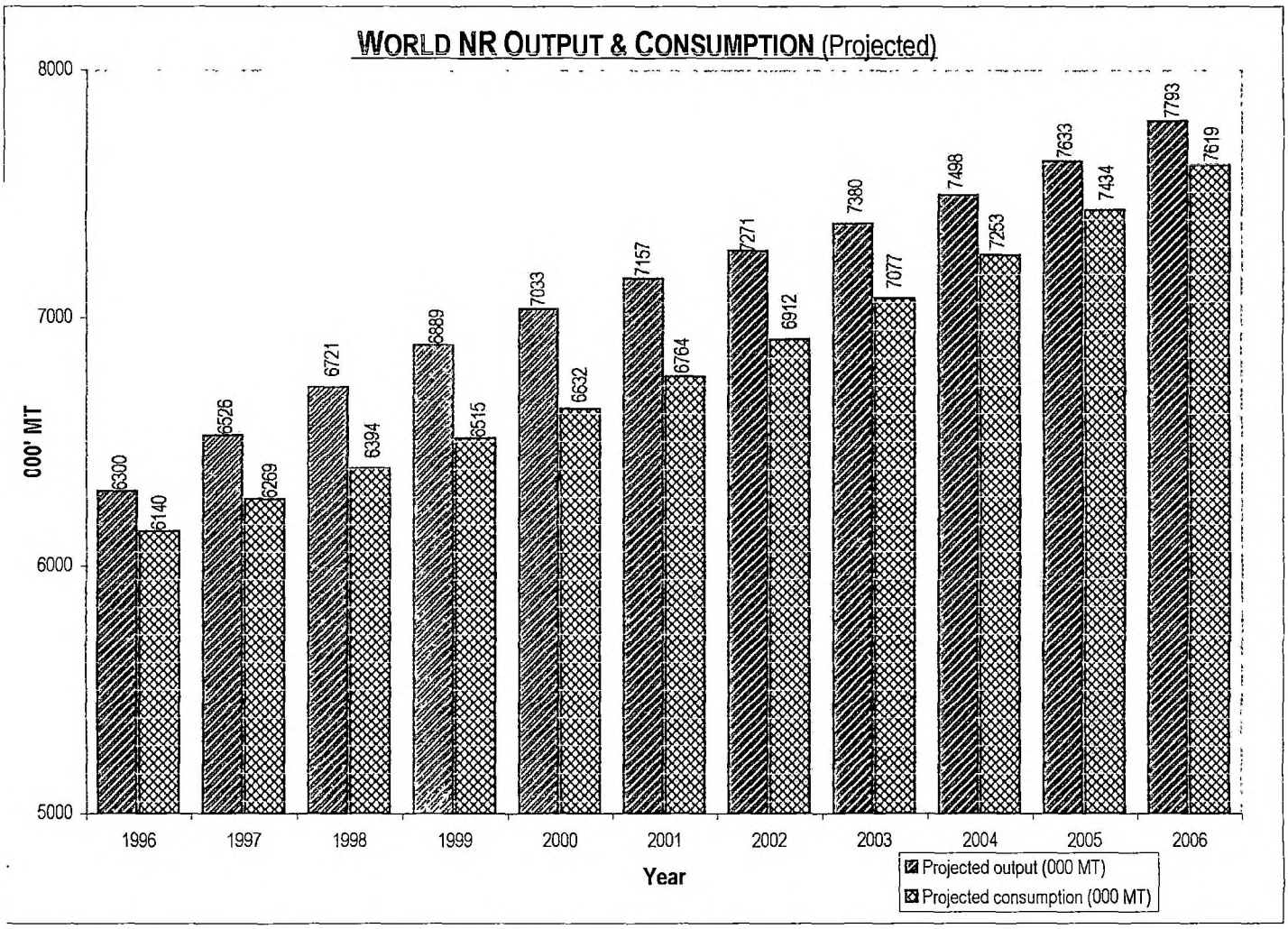
World NR Production (Projected)

Year	Anticipated growth Rate (% over previous year)	Absolute growth (000 MT)	Projected output (000 MT)
1996	4.3	430	6300
1997	3.6	226	6526
1998	3.0	195	6721
1999	2.5	168	6889
2000	2.1	144	7033
2001	1.8	124	7157
2002	1.6	114	7271
2003	1.5	109	7380
2004	1.6	118	7498
2005	1.8	135	7633
2006	2.1	160	7793

Appendix 3.2

World NR Consumption (Projected)

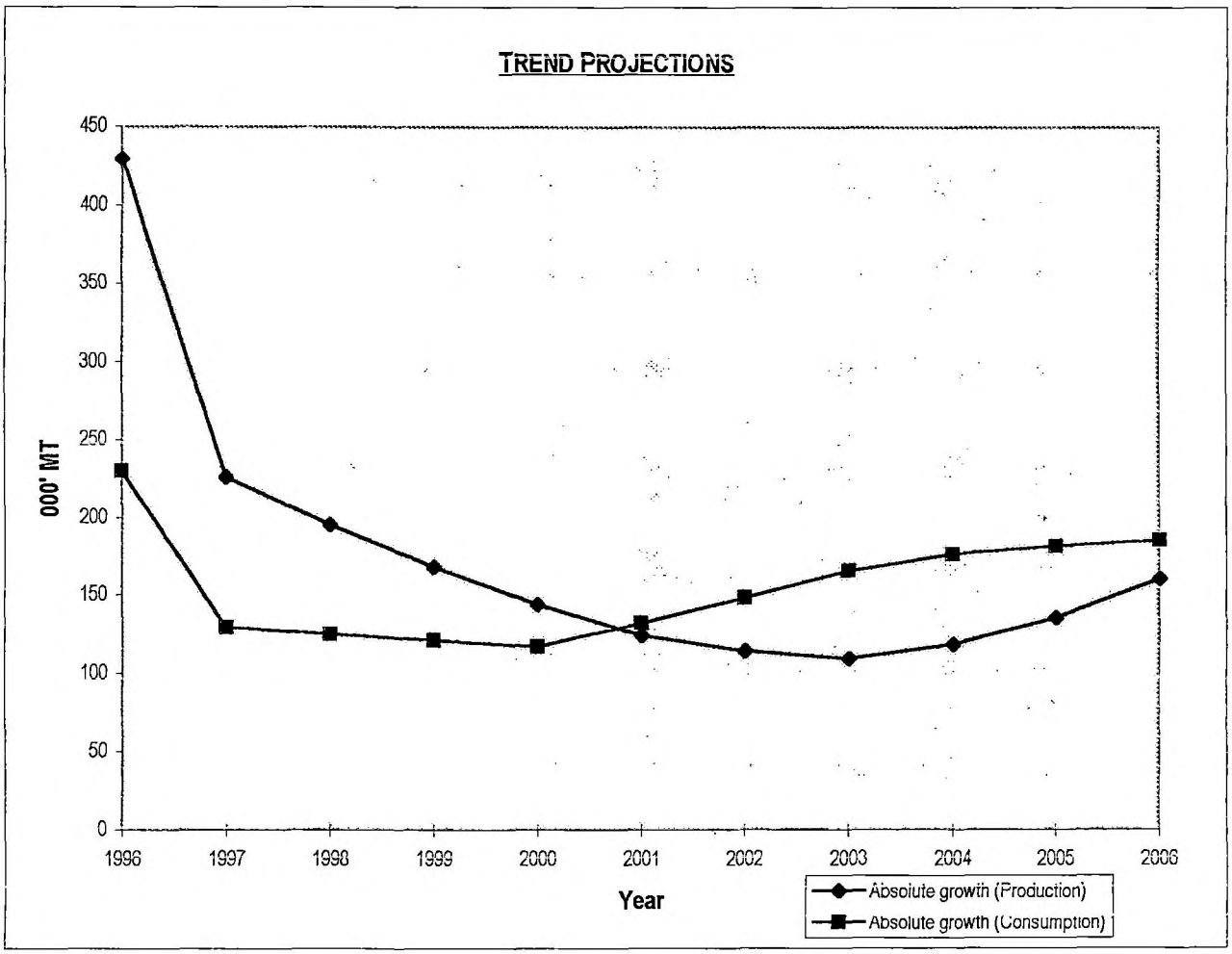
Year	Anticipated growth Rate (% over previous year)	Absolute growth (000 MT)	Projected consumption (000 MT)
1996	2.3	230	6140
1997	2.1	129	6269
1998	2.0	125	6394
1999	1.9	121	6515
2000	1.8	117	6632
2001	2.0	132	6764
2002	2.2	148	6912
2003	2.4	165	7077
2004	2.5	176	7253
2005	2.5	181	7434
2006	2.5	185	7619



Appendix 3.3

Absolute growth (Projected)

Year	Absolute growth (Production) (000' MT)	Absolute growth (Consumption) (000' MT)
1996	430	230
1997	226	129
1998	195	125
1999	168	121
2000	144	117
2001	124	132
2002	114	148
2003	109	165
2004	118	176
2005	135	181
2006	160	185



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