CHAPTER II

RUBBER AND RUBBER INDUSTRY:
A LITERATURE REVIEW

This chapter follows on the introductory and provides a review of rubber and rubber industry, in order to understand the relevance of the topic of research in historical, analytical and policy perspectives. The entire chapter is built around materials gathered from various sources and records, most importantly from some of the web sites, which could be quickly and usefully accessed for getting descriptions and information. The discussion is in two parts. The first part, by way of informing, has some information garnered from literature on the kinds of rubber. The second part is the review of literature available on hand.

Natural Rubber

Rubber is obtained from the milky juice from the latex of various erect or climbing woody plants in the tropics or sub-tropics. Most of the rubber plants belong to the Moraceae, Euphorbia Creae and Apocunaceae families. Though several species are available as sources of rubber, Hevea brasiliensis supercedes all others. The cultivated Hevea tress, the so-called plantation rubber, furnished about 98 per cent of the supply. Rubber is the most recent of the major crops of the world. The industry is little more than a century old, and cultivation has been carrying on for about 80 years or so.
The latex occurs as latex tubes vessels found in various parts of the plant. Generally, the commercial rubber is obtained from the lower part of the stem of the tree. Latex is a gummy white liquid full of minute globules. It is a mixture of water, hydrocarbons, resins, oils, proteins, acids, salts, sugars and caoutchouc (Poh, 1990).\footnote{Poh, 1990}

A small genus of trees is distributed, chiefly, in the Amazon region of South America. One species of Hevea Brasiliensis, the source of Para rubber, has been introduced into India and been cultivated as a plantation crop. It is a large tree attaining a height of 10 to 30 metres more than a girth of 2.3 metres. The stem is smooth, straight generally and branched up to a considerable height, with a much branched-leafy canopy. It is considered indigenous to the Amazon valley of Brazil, Venezuela, Peru, Equador and Colombia (Jain, 1992b).\footnote{Jain, 1992b}

The rubber plantation industry in South East Asia dates back to 1876. In India, rubber plantations were first started in Kerala State in 1905. Since then many other areas have been brought under rubber cultivation. Rubber cultivation thrives in the tropical belt of the Equator, in which the climate is warm, humid and equable and the temperature ranges from 74° F to 95° F. It requires a well distributed rainfall of about 70 to 100 inches per annum.

In South India, the plantations are located mostly in areas with a prolonged dry season and severe South West Monsoon. The temperature ranges from 60° F to 95° F and there is a large variation between the winter and summer temperatures. Rubber plantation thrives best in deep, well-drained, loamy soils. The soils of the rubber plantations of South India are
red lateritic or clayey loams. The soils are generally deep and well-drained. They are fairly rich in nitrogen, but poor in mineral constituents.

Kerala, according to Philip (1996), is the most suitable area in India for rubber cultivation. The yields here can be good as it is in Malaysia as the soil conditions are better than elsewhere in the country. In his opinion, Kerala has about 500,000 ha of paddy lands, of which 250,000 ha can be converted into rubber plantation. In India, a new development in rubber cultivation is the value of rubber timber. One ha of land can have 400 trees, which can be slaughter-tapped and the tree cut and replanted.

Rubber is one crop which could be gainfully cultivated in Goa rather extensively in areas with good soil depth and light irrigation potential (Narayanan, 1989). Economics of rubber cultivation reveals that a ha of plantation could ensure a net return of Rs. 15,000 to Rs. 20,000 per annum, even from moderately yielding plantations. In Goa, as in Kerala, it is one of the highly labour intensive agricultural vocations.

Rubber is a long duration tree crop that stays on the ground for several years. The economic life of the rubber tree is 30 to 35 years. A newly opened jungle is considered to be the most suitable for rubber cultivation. The area to be planted is cleared of the jungle by cutting down the undergrowth and felling the trees. The cleared area is then lined and marked and terraces prepared. Provision is made for roads and drainage.

**Tapping**

Para rubber is valued for the latex obtained by tapping, that is, opening up the latex vessels situated in the bark with a sharp incision on the
main trunk. When the vessels are cut, the latex flows out, quickly at first, then slowly, and finally coagulating on the cut surface. The tree is left to rest after each cut for varying periods according to age, climate and the condition of the tree. When the tree is tapped again, the coagulated latex or 'plug' from the old cut surface is removed and a thin strip of bark is cut off. During the first tapping only a small amount of viscous latex exudes. The flow increases with each successive tapping. The cuts being opened are always at an angle to the horizontal. Usually, the cut extends half way around the trunk, but quite a few may completely encircle it (Jain, 1992b).

Yield and Production Potential

The average yield of latex per acre in India from unselected ordinary seedlings is 150 kg. The yield from bud grafted trees, of approved clones and from clonal seedlings of approved percentage, is twice as much or more and has been obtained with improved planting materials in India. According to Cyriac (1987), the main factors of production are: area under rubber, new planting and replanting, planting materials, cultural practice and tapping system, and price. There is possibility to step up productivity substantially as a result of the popular use of high yielding varieties, widespread use of fertilisers based on soil and leaf analysis, application of yield stimulants and rainguarding, reduction of immaturity period by adopting modern planting techniques and better exploitation and processing practices.

In the 1980s, rubber plantation industry has recorded all round progress: area under rubber increased from 262,000 ha in 1979-80 to 440,000 ha in 1989-90. Production of rubber more than doubled from 148,470 tonnes to 297,300 tonnes during the same period. Productivity,
measured in terms of yield per ha per year, improved from 771 kg to 1030 kg during the period. Growth rate in production surpassed all major crops in the country recording 9.8 per cent growth during the Seventh Plan Period (Menon and Unni, 1990: 7).²

Latex

Fresh latex is usually milky white in colour. The latex drawn from the tree which has been rested for sometime is yellow. The latex obtained from tapping is essentially a colloidal suspension of rubber particles in an aqueous serum (see Nair, Varghese, and Mathew, 1988).³

After the latex has been collected a little ammonia or some other anticoagulant is added to keep it liquid until it reaches the mill, where it is concentrated or made into sheet rubber. This is accomplished by cleaning the latex and pouring it into large pans; a coagulant such as formic acid or acetic acid is added and in a few hours a mass of soft rubber results. Blocks of this are washed and run between rollers to form sheets. These are smoked and bailed for shipment (see Butkus, 1992).⁴

Other types of crude rubber may be prepared. Warm rubber consists of irregular work like pieces cut from sheets with a pair of shears. Crepe rubber is made by passing the washed, breached and coagulated latex through a creping machine, which turns out long and thin perforated strips of rubber, on the preparation of sprayed rubber latex. It is dropped on whistling desks and little particles of rubber are thrown off. Any moisture quickly evaporates. This kind of rubber is exceedingly pure and clean.⁵
According to Mahajan and Ghatge (1983)⁹, direct modification of natural rubber latex offers a cheap and simple method for producing commercially useful materials. Dramatic changes in the physical properties of natural rubber have been achieved by inducing reaction in the latex stage, that is, epoxidation. When epoxidation is carried out in a specified manner, it is possible to obtain material that range from rubbers to hard plastics and from resilient to highly damped materials, with improved oil resistance to ozone cracking.

Thermoplastic Natural Rubber

By thermoplastic rubber, we mean the class of materials to which combine the physical properties, to vulcanized rubber with easy processing characteristics of thermoplastics. They do not need to be compounded or vulcanized and their main advantages are in the lower capital cost of processing machinery, lower labour requirements and better material utilization service scrap and rejects can be recycled.

There is an increasing demand of this thermoplastic rubber in rubber industries as a route to high-speed production techniques while the plastic industry alone shows interest in them because of rubber’s high impact and strength (International Rubber Study Group, London 1981)¹⁰.

Guayule Rubber

Guayule rubber is a kind of desert shrub which can be grown in arid lands for extracting rubber from it and also for prevention of advancing deserts towards the cities. The efforts have been made in Mexico to grow this type of rubber. Some work has been done on this at Ahmedabad. Rubber
is contained only in the stem, roots and branches of the guayule plant. The latex is found in the individual rubber cells, which are not inter-connected, and therefore the latex does not flow like it.

The Guayule plant grows up to 90 cm to 1 metre. It has a strong taproot and is known to have gone as deep as 6 metres in the plant’s native habitat. The Guayule grows best in temperature between 90° F and 100° F. However it can survive temperatures up to 120° F, although temperatures below 15° F are injurious to the plant. The Guayule thrives in climates where the change from one season to another is gradual.

In its native habit, a Guayule is confined to slopes and grows only where the ground is stony. Within its native, the plant needs well-drained and aerated soils. The plant can however survive on heavy soils. The Guayule is ready for harvest after three to four years of growth. At the second harvest, the plants are pulled off along with the roots. The harvested plants are packed into bails and transported to the extraction unit. It is best to extract the rubber as early as possible after harvest. So, that high money and high molecular weight of rubber is obtained. The discovery of the synthetic rubber led to the decline in Guayule cultivation (Jain, 1992b)\(^2\) and its industrial use. However, the energy crisis promoted rethinking by many Governments.

**Specialty Rubber**

There are several special purpose synthetic rubbers – presently not manufactured in the country. They are essential and, except for butyl rubber,
mostly required by the medium and the small-scale sectors. These rubbers are at present imported (Jain, 1992b)².

The already established Pilot Crud factory, the pilot latex centrifuging unit being set up and the Central Experiment Station, Chettackal would serve as research demonstration and training centres in processing technically specified rubber latex concentrates. The Rubber Research Institute of India helps to develop know-how for producing specialty natural rubber. They have special applications in the rubber industry, saving in cost, processing time and energy. These fetch a better price than conventionally processed raw rubber. The import of this would be replaced by specially processed natural rubber, which would result in foreign exchange savings to the country. In order to popularise the use of specialty rubber, they have to be produced on a pilot plant scale and released to the industry for consumption. The pilot factory established is as follows (Table 2.1):

Table 2.1: Pilot Factories Established

<table>
<thead>
<tr>
<th>Pilot Factory</th>
<th>Year of Selling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Graft Rubber</td>
<td>1990 – 91</td>
</tr>
<tr>
<td>3. Epoxidised Natural Rubber</td>
<td>1992 – 93</td>
</tr>
</tbody>
</table>

Source: Rubber Statistical News, Kottayam 1999¹²

Synthetic Rubber

Just like the role of natural rubber in the manufacture of rubber goods is indisputable, and its use inevitable, so it is true for synthetic rubber too. Although the first ever synthetic rubber was produced to duplicate the
natural rubber, since then it has always played a supplementary role, especially in India to balance the overall demand-supply position of rubbers and to keep pace with the world's technological developments (Jain, 1992b)².

Though the plantation industry and the Rubber Board are against synthetic rubber, their position in regard to it cannot be accepted. It is because it would not only inflict untold difficulties but would jeopardize the growth of the rubber consuming industries, putting back the clock of progress. So far, it has not achieved much, adding to the mounting scarcity and cost of raw materials, resulting in stiff consumer resistance for finished goods. It was expected that towards the close of the century, all types of synthetic rubber would be manufactured in India. They are SBR, PBR, NBR, EVA, EPDM, CPE, BU tyre, and VP latex.

The synthetic rubbers like silicone, viton, and hyplaon are highly specialised and used in relatively smaller quantities. As demand for them increases, there is need for them to be imported at nationalised, reduced rates. The total consumption for the latest years is as follows in Table 2.2:

There are tremendous prospects for the rubber industry, if the natural rubber plantation industry should not worry on the export position of synthetic rubbers, for the industry's envisaged growth rate of 10 per cent would lead to higher consumption, equally of natural rubber as well as synthetic rubber.

When the first successful synthetic rubber appeared on the scene, the experts predicted that natural rubber would soon drop out of sight, But this
has not happened (Larsen, 1980). Synthetic rubber has however been assigned a supplementary role and it has played so without any threat whatsoever so far to the natural rubber. As such, the plantation industry should welcome its expansion without hesitation. After all, it is the health of the rubber consuming synthetic rubber manufacturing industries, for their prospects and progress are interdependent and mutual.

Table 2.2: Rubber Consumption for the Latest Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-99</td>
<td>Natural rubber of all types</td>
</tr>
<tr>
<td>1998-99</td>
<td>Synthetic rubber of all types</td>
</tr>
<tr>
<td>1998-99</td>
<td>Reclaimed rubber</td>
</tr>
</tbody>
</table>

Source: Rubber Statistical News, Kottayam 1999

Reclaim Rubber

In the opinion of Kavishvar (1985), rubber reclaiming industry in India is hardly two decades old. Reclaiming is essentially depolymerisation without removal of combined sulphur whereby the vulcanized rubber loses its elastic properties and becomes less resistant to compression, stretching and swelling.

The commercial and descriptive definition of reclaimed rubber is that it is a product resulting from the treatment of the ground, vulcanized rubber scrap. It is made by the application of heat and chemical agents to the prepared scrap followed by intense mechanical working, whereby a substantial de-vulcanization or regeneration of the rubber component to its
original plastic state is effected. This permits the product to be compounded, processed and re-vulcanized.

Reclaim rubber prepared from discarded rubber products and rubber scrap, is used alone or in admixture with raw rubber in the manufacture of heels, soles, mechanical rubber goods, tyres and adhesives for use in fabric dipping, carpet backing, and flooring. Hard rubber is used for battery containers, tubes and rods (Azad, 1991)\textsuperscript{14}.

Although the world’s rubber reclaiming industry is 140 years old, the Indian Rubber Industry has hardly a history of two decades. Before the 1960s, only a couple of large companies were importing reclaimed rubber in India. The picture has, however, changed rapidly and, in the 1970s, a dozen companies were manufacturing reclaimed rubber. Today, even small-scale manufacturers know reclaim process. Sixty to seventy per cent of the new polymer is used by the tyre industry. Hence, the largest single type of scrap available for the reclaim industry is the automobile tyres. More than 90 per cent of reclaim produced in India is manufactured from the tyre waste. Hence, the commonly known ‘Rubber – Reclaim’ is mostly a whole tyre reclaim that is produced from a whole automotive tyre. Reclaim finds a way in rubber compounding mainly as a process aid and not as a cheapening agent. In the mixing stage, it shortens breakdown and mixing time, reduces power consumption and lowers the mixing temperatures.

It helps improving the quality and the productivity thereby reducing, indirectly, the cost of production. Its direct cost reduction, due to its low price, needs no explanation.
Thus, reclaim rubber becomes a very valuable compounding ingredient prudently used; it helps in great cost reductions without affecting the quality requirements of the product. Reclaim, in fact, is a unique rubber substitute to which there is no substitute.

**Rubber in India: A Review**

At the turn of the century, it is indeed a matter of concern for the entire rubber industry in India that the natural rubber (NR) production has not been able to grow at the pace at which the consuming industry has been growing (Rubber India Editorial, October 1995). The gap has been widening year after year and with the expected growth in the consuming industry. The gap would be much more alarming by the turn of the century, with about 200,000 tonnes of deficit of new chapters. This calls for broad-basing rubber plantation to all non-traditional areas and the consuming industry be allowed to set up plantations in these areas.

Marathukalam (1985), in his paper on Natural Rubber: Crop Improvement in India, writes that several methods are being adopted for developing improved clones. Foremost among them is that of hybridisation involving the crossing between desirable clones. In the opinion of Davies (1987), natural rubber outlasts steel. It is because it has high energy storage capability, can provide vastly different stiffnesses in different directions, load/deflection characteristics can be non-linear, lighter or no lubrication needed, do not rust or corrode, and electrical properties can be varied, can accommodate misalignment, and forming to irregular surfaces (Larsen, 1980).
Major Areas of Rubber Production in India

Traditionally, rubber was grown mainly in the state of Kerala and Kanyakumari district of Tamil Nadu. This was forced and stretched onto other states and Union Territories having areas suitable for its adoption. It is because for production, traditional areas were inadequate to meet the increasing demand. They are Karnataka, Tripura, Assam, Meghalaya, Mizoram, Manipur, Island Goa, Maharastra and Orissa. There are potential areas in the states of Andhra Pradesh, Madhya Pradesh and West Bengal, for growing rubber (Table 2.3). All these can be categorized as traditional areas and non-traditional areas.

Table 2.3: Traditional Areas of Rubber Production

<table>
<thead>
<tr>
<th>States/ Union Territories</th>
<th>Areas of Production (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tripura</td>
<td>13,190</td>
</tr>
<tr>
<td>Assam</td>
<td>5,430</td>
</tr>
<tr>
<td>Meghalaya</td>
<td>5,230</td>
</tr>
<tr>
<td>Manipur</td>
<td>665</td>
</tr>
<tr>
<td>Mizoram</td>
<td>810</td>
</tr>
<tr>
<td>Arunachal Pradesh</td>
<td>35</td>
</tr>
<tr>
<td>Nagaland</td>
<td>945</td>
</tr>
</tbody>
</table>

Source: Rubber Statistical News, Kottayam 1999

Position of India in the World

India is now the fourth largest producer of natural rubber in the world, next to Malaysia, Indonesia and Thailand (Sharma, 1995). However, our share of world production is only around 6 per cent. With regard to productivity, India has attained a remarkable position of being the second among the leading rubber countries, as shown in Table 2.4 below.
Table 2.4: Production and Yield of rubber Producing Countries 1987

<table>
<thead>
<tr>
<th>Country</th>
<th>Area (in '000 ha)</th>
<th>Prod. (in '000 tonnes)</th>
<th>Yield (in tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>1,904</td>
<td>1,581</td>
<td>1,232</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3,007</td>
<td>1,190</td>
<td>661</td>
</tr>
<tr>
<td>Thailand</td>
<td>1,217</td>
<td>933</td>
<td>776</td>
</tr>
<tr>
<td>India</td>
<td>398</td>
<td>227</td>
<td>944</td>
</tr>
<tr>
<td>China</td>
<td>514</td>
<td>140</td>
<td>733</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>205</td>
<td>122</td>
<td>732</td>
</tr>
</tbody>
</table>

SOURCE: Rubber Statistical News, Kottayam 1999

Assuming India can have cultivation of 1 million ha, at least 750,000 ha will be yielding areas and the balance could be in various stages of replanting (Philip, 1996)³.

**Position of Natural Rubber in the Country**

Growth of rubber plantations in India has been dramatic. As on March 31, 1999, there are over 400,000 ha planted with rubber. With Kerala accounting for 87 per cent of the area, the rest is shared by Tamil Nadu 4 per cent, Tripura 3 per cent and other states and Union Territories, 3 per cent (Sharma, 1995)⁷. With an average yield of 2,000 kg per ha, producing 1.3 million tonnes of NR per year meeting the entire demand of the country and sparing at least half a million tonnes for export (Philip, 1996)³.

**Major Rubber Products and its Location**

The Indian rubber goods producing industry found its roots in 1922, eight decades ago in West Bengal, when the first ever rubber factory was established to produce rubberized fabrics. Since then, the industry has grown at a tremendous rate particularly after independence (see Philip, 1980)¹⁹. The
rubber consumption is a yardstick to measure the growth of the industry, and according to that, from a meagre amount of 23,000 tonnes in 1951, it has, within five decades, reached over 500,000 tonnes in 1995 (Sharma, 1995; Narayanan, 1994). It has, today, 38 tyre units, over 300 medium scale units and about 5,000 small-scale units, besides several hundreds of tiny units. They manufacture over 30,000 rubber products, ranging from tiny teats and balloons to aero-tyres and parts for aircrafts and space crafts and catering to the needs of all the three wings of defense, namely, army, navy and the air force (Viswanathan, 1985).

Tyres are manufactured for the air force and the road transport besides consumers and industrial products to keep the movements of humans, materials and machinery smooth and efficient in the country. The tyre sector produces all kinds of tyres, namely, auto tyres, new matic as well as radials. From a total of 7.8 million tyres in 1980, the production has reached 17.4 million tyres and 12.6 million tubes in 1990-91. It was estimated that by 1994-1995, there would be a demand for about 29 million tyres for domestic and export markets. This was exceeded in a fair measure by the demands reported (Chaudhary, 1995).

The Non-Tyre Sector

It comprises the medium scale, small scale and tiny units. It produces high technology and sophisticated industrial products. The small-scale sector accounts for over 50 per cent of production of rubber goods in the non-tyre sector. According to the rubber consumption, the automotive tyre sector is the single largest sector, accounting for about 46 per cent of the consumption
of natural and synthetic rubbers, followed by cycle tyres and tubes (13 per cent), footwear (11 per cent), belts and hoses (8 per cent), caneback (7 per cent) and foam products (4 per cent). All other remaining rubber products put together account for 11 per cent of the consumption (Damani, 1990).

Other Products

Latex gloves offer tremendous opportunities in the present day world. Ouseph (1989) has shown that the situation has thrown up tremendous opportunities for latex goods producers. Malaysia, Japan, Thailand, Philippines and China all have set up plants to produce them. Latex gloves protect the hands from pollution and at the same time keep materials from contamination by human touch. They are generally used in industries, houses and in hospitals. Surgical gloves are sophisticated among them.

Quality Management

Quality management within a latex laboratory and production facility can be divided into three important areas, namely, supplier quality programme, compounding and laboratory process control, and production or manufacturing process control (Butkus, 1992: 21). These three areas give a framework for latex quality management.

Export Marketing of Rubber Products

Jain (1992a) suggests that Indian industry in general is in a better situation as far as licensing and controls are concerned. Export of rubber goods from India started some 35 years ago but in the last few years the growth in exports has been very appreciable. Tyre sector is the one, which is
able to produce good quality tyres. India does produce a proven quality. The Indian rubber good manufacturers try to adhere to the international specifications but they are outwitted by other producers who do not worry about the standards.

Footnotes


15. Rubber India Editorial.


