THE ECONOMICS OF RUBBER-BASED INDUSTRY IN KERALA

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Doctor of Philosophy in Economics
under the Faculty of Social Sciences

By

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C E R T I F I C A T E

Certified that the thesis "The Economics of Rubber-Based Industry in Kerala" is the record of bona fide research carried out by Raju K.V. under my supervision. The thesis is worth submitting for the degree of Doctor of Philosophy in Economics.

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D E C L A R A T I O N

I declare that this thesis is the record of bona fide research work carried out by me under the supervision of Dr.Jose T. Payyappilly, Professor, School of Management Studies, Cochin University of Science and Technology. I further declare that this thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title of recognition.

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CHAPTER I

INTRODUCTION

The importance of industrialisation in achieving rapid economic growth has been recognised in India's development strategy ever since the inception of economic planning in the country. Being the secondary sector in the generation of national income, industry contributes significantly to the process of economic development. Extensive debates have taken place on the nature of the industrialisation strategy to be pursued in the economy since Independence. This is reflected in the industrial policy which evolved through the various five year plans and policy resolutions. Stupendous efforts have been made by the government since the commencement of planning and particularly since the 1960s to industrialise the Indian economy and develop the infrastructural base for sustained industrial development. It is difficult to assess the performance of the industrial sector over the past three decades with respect to the broad objectives of industrialisation. However, there are certain areas in which the achievements have been clearly significant.

The spread effect of industrialisation on the one hand, and the locating of the industries in different regions depending on favourable factors specific to those regions on the other, led to the industrialisation of the economy widely and spacially particularly, the backward regions. Further, with the emergence of new centres of industry, the problem of unbalanced regional development has been solved to a great extent in the developed countries and, at least to a limited extent, in the developing countries of Asia, Africa and Latin America (Gupta and Singh, 1978).

Plantations preceded the emergence of the modern factory industry in India. The growth of the urban industrial sector transmits a number of significant dynamic impulses to the agricultural sector. The expansion of industries, accompanied by growing urbanisation, provides a continuously expanding market for various agricultural products. When the stimulus in particular is given to the expansion of certain cash crops, it helps in converting a subsistence peasant agriculture into a commercialised one (Gupta and Singh, 1978). As the forerunners of modern factory industries, the plantations have a definite place in the industrial development of India.

With the emergence of the modern industrial sector large scale capital-intensive industries have come to occupy an important place in the industrial map of India and rubber-based industry

occupies a pivotal position in it. This is evident from the fact that the rubber manufacturing sector is the third largest contributor to the national exchequer by way of taxes and duties.

1.1 Evolution of Natural and Synthetic Rubber

Natural rubber, one of the most valued raw materials, was known to man from very old times. There is evidence that rubber was used at an early period in Ethiopia for making play balls and other objects. From Ethiopia a ball game spread to Egypt and then to Lydians to whom Herodotus attributed its invention (Schidrowitz,1954). Although the great bulk of modern supplies is derived from plantations of Hevea Brasiliensis, rubber is present in a wide variety of trees (RRII, 1950). The name rubber is derived from the quality of the material in rubbing black lead pencil marks out of paper. Joseph Priestly, the British Chemist, is said to have used rubber for this purpose (Schidrowitz, 1952). In 1978 Sir Henry Wickham, defying Brazilian law, removed thousands of seedlings from the Amazon area and planted them in Ceylon. From there the cultivation spread to Southern India and the South East Asian Countries which today hold a virtual monopoly of Natural Rubber (Kulkarni, 1971).

The high price of natural rubber in the rubber boom of 1908-10 provides the immediate impetus for the attempt to provide

a synthetic substitute for the natural material (Audrey Donnithorne, 1958). The second world war provided a massive incentive to developments in synthetic rubber by cutting off the world from South East Asia. The lead in this search was taken by the United States of America, whose efforts have had remarkable success. Today the output of synthetic rubber has assumed dynamic proportions. A wide range of synthetic rubbers of different types is now being produced all over the world.

The conventional raw materials required for manufacturing of synthetic rubber are petrochemicals. Now synthetic rubber competes with natural rubber in the crucial field of tyre manufacturing also. In fact 95 per cent of the total consumption of rubber in U.S.A. are synthetic rubbers. However, the cost of production of synthetic rubber in India remains the highest, because the raw materials used are not the conventional petrochemicals, but alcohol and benzene. Alcohol is produced from molasses and benzene from steel industry.

1.2 Rubber-based Industry in Other Countries - An Overview

Although natural rubber was known to from very old times its industrial use has developed only after the 19th century. The work of two Frenchmen Harrissant and Macgner served to create more attention to the Industrial uses of rubber in 1763 (Schidrowitz, 1952). The first use of rubber was discovered in 1770, ie., it can erase lead pencil marks.

This created a lot of interest in rubber. The greatest name among the early British pioneers in the rubber industry is that of Thomas Hancock - rightly regarded as the father of the industry in Britain. During the period 1819 to 1826 Hancock invented a lot of products based on rubber (Audrey Donnithorne, 1958). By the year 1826 there was a flourishing and varied rubber manufacture in Britain, France and the United States. But all the products were unvulcanised. The manufacture of useful articles from rubber preceded the discovery of vulcanisation by a very considerable length of time. The great inventions which changed the course of the rubber industry was the process of vulcanisation. Charles Goodyear discovered vulcanisation in the year 1839.

The earliest beginning connected with rubber manufacture would, a decade or two ago, have been associated with the names of Goodyear and Hancock, the two geniuses who foresaw the potentialities and initiated the industrial development and manufacture. This led to the vast industry operating throughout the world today, providing so much the comfort and security of mankind. Hancock's company, James Lyn Hancock Ltd., was the first British rubber manufacturing concern. This was founded in 1820. Later, in the second half of the 19th century and during the beginning of the 20th century, a number of rubber manufacturing units were established in Great Britain.

The total number of rubber manufacturing companies in the world runs into many hundreds, of which a high proportion are in U.S.A. The industry showed such phenomenal growth in the U.S.A. that by 1922 that country accounted for almost three quarters of the world consumption of rubber. This situation has changed only after other countries increasingly took up tyre production. The two world wars took rubber industry into new dimensions. Numerous products based on rubber were invented during the period (Bauer, 1948). After the 1950s rubber industr has developed substantially. Rubber-based industries were established in the producing countries also in a large scale during this period. The increase in population also contributed to the increase in production and consumption of rubber.

World production of natural rubber was 3315 thousand tonnes in 1975 (Table 1.1). This increased to 4430 thousand tonnes in 1986. The percentage increase is estimated to be 33.6 Malaysia is the largest producer of natural rubber in the world in 1986. Malaysia produces 34.79 per cent of the total production of natural rubber. Indonesia comes second with a production of 1037.5 thousand tonnes. Share of India in the production of natural rubber is found to be only 4.94 per cent in 1986. Interestingly Malaysia, Indonesia, Thailand, Sri Lanka, India and China together produce 88.36 per cent of the total natural rubber production in the world.

Table - 1.1

Production of Natural Rubber in Major Producing Countries

(in thousand tonnes)

Country	1975	1980	1983	1986
Malaysia	1459.30	1530.00	1563.70	1541.90
Indonesia	822.50	1020.00	997.20	1037.50
Thailand	355.00	501.10	587.20	773.20
Sri Lanka	148.80	133.20	140.00	137.80
India	136.00	155.40	168.00	210.00
China	68.60	113.00	172.40	205.00*
World	3315.00	3850.00	4030.00	4430.00

Note:*: Provisional

Source: 1) Rubber Statistical Bulletin, IRSG, Vol.42, No.5, February, 1988.

2) Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

During the period 1975-86 the production of synthetic-rubber also increased considerably (Table 1.2). From 6850 thousand tonnes in 1975 synthetic rubber production increased to 9210 thousand tonnes in 1986. The percentage increase is worked out to be 34.45. U.S.S.R. is the largest manufacturer of synthetic rubber in the world in 1986. United States comes second, followed by Japan. These three countries together produce 60.21 per cent of the total production of synthetic rubber in the world.

Over the years world consumption of natural rubber has increased appreciably (Table 1.3). The percentage increase in consumption during the period 1975-86 is estimated to be 30.20. United states is the largest consumer of natural rubber in the world. It accounts for 16.99 per cent of the total consumption of natural rubber in 1986. Japan and China occupy the second and third position respectively. India consumes only 5.74 per cent of the total consumption of natural rubber in the world. Eastern Europe accounts for 8.55 per cent of the total consumption of natural rubber. Consumption of synthetic rubber has also increased considerably during the period. The percentage increase during the period is found to be 31.33. As in the case of natural rubber, United states is the major consumer of synthetic rubber in the world. U.S.A. consumes 22.48 per cent of the total consumption of synthetic rubber in the world in 1986.

Table - 1.2

Production of Synthetic Rubber in Major Producing Countries

(in thousand metric tonnes)

Country	1975	1980	1983	1986
U.S.A.	1989.50	2214.80	1987.40	2145.00
U.S.S.R.*	1600.00	2040.00	1970.00	2250.00
Japan	788.70	1094.10	1002.50	1150.10
F.R. Germany	315.90	389.90	418.00	452.50
France	350.40	510.80	514.10	542.10
China	56.70	123.00	167.00	186.60
India	23.00	22.50	31.10	34.80
World	6850.00	8695.00	8335.00	9210.00

Note: * Estimated.

Source: 1) Rubber Statistical Bulletin, FRSG, Vol.42, No.5, February, 1988.

2) Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Table - 1.3

Consumption of Natural and Synthetic Rubber in Major Consuming Countries

(in thousand tonnes)

Country	1975		1980		1983		1986	
	NR	SR	NR	SR	NR	SR	NR	SR
U.S.A.	665.90	1963.70	585.50	1980.00	665.00	1882.50	745.00	2075.00
Japan	285.20	584.80	427.00	885.00	504.00	851.00	535.00	910.00
China*	225.00	55.00[a]	340.00	155.00[a]	365.00	180.00[a]	420.00	260.00[a]
F.R.Germany	197.10	359.90	179.70	421.30	179.50	395.80	198.70	426.00
France	156.20	277.70	187.70	341.90	163.00	276.60	158.70	301.60
India	129.10	32.00	170.80	46.20	205.40	53.00	251.70	69.40
Eastern Europe*	475.00	2000.00	415.00	2560.00	405.00	2500.00	375.00	2800.00
World	3368.00	7028.00	3760.00	8785.00	3995.00	9030.00	4385.00	9230.00

Note: 1) *: Estimated, a: Provisional

2) NR: Natural Rubber, SR: Synthetic Rubber.

Source: Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Eastern Europe consumes 30.34 per cent of the total consumption. However, consumption of synthetic rubber in India is only 0.75 per cent of the total consumption of synthetic rubber. An analysis of the percentage of synthetic rubber to total consumption of rubber in major consuming countries reveals that during the last decade the percentage was between 66 and 77. Consumption of synthetic rubber in Eastern Europe was 88.2 per cent of the total consumption of both the natural and synthetic rubber in 1986. In India the trend is just the reverse. Here, in 1986 only 21.6 per cent of the total consumption of rubber was synthetic rubber. This is mainly because of the abundance of natural rubber in the country.

A study of the estimated per capita consumption of natural and synthetic rubber reveals some interesting facts (Table 1.4). Per capita consumption of natural and synthetic rubber in Japan was the highest in the world in 1985. Its per capita consumption was found to be 12.32 kg. followed by 11.55 kg. of U.S.A. An analysis of the per capita consumption of synthetic and natural rubber reveals that the performance of Japan was really amazing. The per capita consumption of rubber in India was the lowest in the world. India's per capita consumption was only 0.40 kg. in 1985.

Thus the analysis reveals that world production and consumption of natural rubber has increased considerably over

Table - 1.4

Estimated Per Capita Consumption of Natural and Synthetic Rubber (Kilograms)

Country	1954	1960	1966	1969	1975	1981	1985
U.S.A.	7.71	8.76	11.41	13.15	12.31	11.56	11.55
F.R. Germany	3.04	4.77	6.43	8.53	9.01	9.17	10.05
France	3.36	4.85	6.12	7.56	8.22	8.54	8.48
U. K.	5.08	5.74	6.99	8.11	7.82	6.09	6.43
Japan	1.09	2.47	4.43	6.73	7.80	10.94	12.32
China	0.08	0.16	0.26	0.30	0.31	0.38	0.62
India	0.07	0.12	0.18	0.22	0.27	0.33	0.40

Source: 1) Rubber Statistical Bulletin, IRSG, Vol. 42, No. 5, February, 1988.

2) Indian Rubber Statistics, Vol. 18 Rubber Board, Kottayam, 1988.

the years. Countries in Asia are producing more than 88 per cent of the total production of natural rubber in the world. U.S.S.R. is the major producer and U.S.A. the major consumer of synthetic rubber. Estimated per capita consumption of natural and synthetic rubber showed that Japan's per capita consumption is the highest and India's the lowest in the world.

1.3 Kerala's Industrial Structure and Development

Kerala accounts for 1.2 per cent of the total area of the country and accommodates 3.8 per cent of its population. Mounting unemployment and slow pace of capital formation continue to haunt the economy of the state. Kerala fortifies the belief that the proper utilisation of resources as well as the adequate infrastructural facilities play an equally important role in the economic development of the state as the natural resources. Being essentially an agricultural economy industrialisation was very low in the state. Kerala witnessed the emergence of an organised industrial sector only in the middle of 18th century (Tharakan, 1986). It was only in the beginning of the twentieth century that an earnest attempt was made to organise industries in the state. During the 1930's and 1940's, under the auspices of C.P. Ramaswami Iyer, a number of factories were established in the erstwhile State of Travancore. Interestingly this period is considered as the golden age of

industrialisation in the annals of Kerala's history (Aiyer Krishna, 1975).

During the first five year plan although a few industries were started there was less emphasis on industries. The major share in the plan allocation went to agriculture and social services in the first plan. Out of a total capital investment of Rs.30.3 crores only Rs.1.12 crores was alloted to industry. Even in this alloted amount only Rs.50.43 lakhs was utilised (Table 1.5) However, in the second plan industrial development received much attention. Out of the total outlay of Rs. 87 crores, Rs.6.84 crores was alloted to industry. Small scale industries received more importance during the second plan. During the third and fourth plans there was proportionate increases in the allocation of resources to industry. It is to be mentioned that it was during the fourth plan period that Kerala State Industrial Development Corporation was established for promoting large and medium scale industries in the state. Plan allocation of industry during the third plan and fourth plan was Rs.17.19 crores and Rs.22.08 crores respectively. The total outlay during the plan was Rs.170 crores and Rs.258 crores respectively.

Although there was considerable increase in the allotment of industry in the fifth five year plan the percentage share was comparatively lower than the earlier plans. Out of the total

Table - 1.5

Sectoral Outlays and Amounts Utilised by the Industrial Sector During Various Five Year Plans

(Rs. in Lakhs)

Plan	Small Scale Industries		Medium and Large Industries		Mining		Plantations		Total	
	Allo-cation	Expendi-ture	Alloca-tion	Expen-diture	Alloca-tion	Expen-diture	Alloca-tion	Expen-diture	Alloca-tion	Expen-diture
1) First Plan (1951-56)	112	50.43	--	--	--	--	--	--	112	50.43
2) Second Plan (1956-61)	582	425	102	179	--	--	--	--	684	604
3) Third Plan (1961-66)	800	630	454	760	--	3	465	44	1719	1437
4) Yearly Plans (1966-69)	512	551	485	781	17	2	--	--	1014	1334
5) Fourth Plan (1969-74)	1022	1015	1181	1484	5	3	--	--	2208	2502
6) Fifth Plan (1974-78)	1604	1825	4471	3545	79	36	--	--	6154	5406
7) Yearly Plans (1978-79 & 1979-80)	891	2529	3285	4153	51	25	--	--	4227	6707
8) Sixth Plan (1980-85)	4980	4488	10546	11488	150	171	--	--	15676	16147

Source: Rajan,K.R., Industries of Kerala, Vol. I & II, State Institute of Langues,Trivandrum 1987.

outlay of Rs.567 crores only Rs.61.54 crores, ie.,10.85 per cent was alloted to the industrial sector. During the sixth and seventh five year plans there was considerable increase in the total plan outlay. During the sixth plan, out of the Rs.1550.405 crores of state outlay only Rs.156.76 crores, ie., 10.11 per cent, was given to the industrial sector. Plan expenditure in the state for the industrial sector was 8.66 per cent in the first two years of the seventh plan. Thus we can see that only around 10 per cent of the total outlay was given to the industrial sector during the last five year plans. Considering the objectives and needs we can infer that this is not sufficient for the industrial development of the state. Investment in the industrial sector will lead to the formation of more productive capital which, in turn, will generate continuous and steady empl ment as well as higher income, sowing and investible surpluses (Gopalakrishnan, 1978). Being a state characterised by an overgrowing population living on scarce arable land, the problems of unemployment and underemployment follow as inevitable consequences. Hence the need for accelerating industrial development in the state of Kerala can never be overemphasised.

Certain structural changes are discernible in the economy of the state over the years as in the rest of the country. The share of the industrial sector in the state's net domestic product increased from 16.32 per cent in 1970-71

to 20.78 per cent in 1981-82 (Table 1.6). However, in 1985-86 it declined to 19.24 per cent. In the case of India it showed a steady increase in trend during the period. The share of the primary sector for the state, on the other hand, has continued to decline from 49.44 per cent in 1970-71 to 37.41 per cent in 1985-86. The corresponding change for the country has been from 50.14 per cent to 37.73 per cent. Again, the share of the service sector in the state's net domestic product increased from 34.24 per cent in 1970-71 to 43.35 per cent in 1985-86. The increase for the country has been from 30.19 per cent to 40.99 per cent. Thus we can infer that the rate of industrial growth for the state has not been satisfactory when compared to the rest of the country.

An analysis of the state's per capita income shows that per capita income in Kerala continues to remain below the all India average (Table 1.7). While the country's per capita income (at constant prices) increased from Rs.633 in 1970-71 to Rs.801 in 1986-87, that for Kerala increased from Rs.594 to Rs.639 only. This is clearly not a spectacular performance by any standards.

The annual rate of growth of net state domestic product in the manufacturing sector in Kerala and the country as a whole shows that, while Kerala recorded an average annual rate of growth of 3.43 per cent between 1970-71 and 1980-81, the corresponding figure for the country was 4.13 per cent (Table 1.8).

Table - 1.6

Sectoral Distribution of Net National Product and State Domestic Product
(1970-71 Prices)

Sector	Kerala			India		
	1970-71	1981-82	1985-86	1970-71	1981-82	1985-86
Primary	49.44	38.94	37.41	50.14	42.11	37.73
Secondary	16.32	20.78	19.24	19.67	20.88	21.28
Tretiary	34.24	40.28	43.35	30.19	37.01	40.99
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: Statistics for Planning, Directorate of Economics and Statistics, Trivandrum.

Table - 1.7

Growth of Per Capita Income in Kerala and India

Year	Current Prices		Constant Prices (1970-71=100)	
	Kerala	India	Kerala	India
1970-71	594	633	594	633
1975-76	954	1026	610	664
1976-77	1009	1079	592	652
1977-78	1037	1194	583	695
1978-79	1112	1253	590	717
1979-80	1259	1338	606	665
1980-81	1385	1557	621	698
1981-82	1438	1743	622	720
1982-83	1626	1887	616	723
1983-84	1883	2186	608	764
1984-85	2104	2355	625	775
1985-86	2140	2596	646	798
1986-87	2371	2974	639	801

Source: Statistics for Planning, State Planning Board, Trivandrum.

Table - 1.8

Net State Domestic Product - Manufacturing Sector(1970-71 to 1984-85)

(Rs. in lakhs)

Year	Kerala	India
1970-71	15632	461900
1974-75	17214	547000
1980-81	21906	692300
1984-85	21805	867300
Average annual rate of growth(per cent)		
1980-81 over 1970-71	3.43	4.13
1984-85 Over 1974-75	2.39	4.72
1984-85 Over 1970-71	2.41	4.60

Note: All India data are taken from the CSO's National Accounts Statistics (Various issues) and the State-wise data are taken from the CSO's estimates of State Domestic product (various issues).

Source: Basic Statistics Relating to Indian Economy, Vol.I (All India) CMIE, Bombay, August, 188.

From the period since then, until 1984-85, the relative growth rate in Kerala has been much lower, ie. only 2.41 per cent as against 4.60 per cent for the country. Another factor to be mentioned here is that the net domestic product has declined between 1980-81 and 1984-85 by Rs.101 lakhs.

An analysis of the index of industrial production of Kerala and India shows that although industrial production has increased it showed violent fluctuations. During the period 1975-76 to 1981-82 the index of industrial production of Kerala tends to be closer to the all India level. However, after 1981-82 the index of industrial production tends to be much lower than the all India average. According to the annual survey of industries (factory sector) the industrial sector of Kerala comprises of 2598 factories in 1984-85 (Table 1.9). Fixed capital investment in the factory sector was found to be Rs.1276.89 crores in 1984-85. Total employment in the industrial sector of Kerala is found to be 248 thousand persons. However, it is to be noted that the number of work seekers in Kerala in 1987 was 29,51,897. Total output in the factory sector in the state is worked out to be 2569.09 crores and value added 683.00 crores in 1984-85. Although there was an appreciable increase in the above mentioned factors in current prices, when compared to 1973-74 the growth has not been much higher in real terms.

Table - 1.9

Principal Characterestics of the Industrial Sector(factory Sector) in Kerala

(Rs. in lakhs)

Sl.No.	Major characterestics	Unit	1973-74	1980-81	1984-85
1.	Number of factories	Nos.	2608	2926	2598
2.	Fixed capital	Crores	403.72	796	1276.89
3.	Working capital	Crores	123.56	480	573.91
4.	Employees	Nos('000)	239	281	248
5.	Total Emoluments	Crores	72.28	170	256
6.	Total inputs	Crores	388.48	1648	1796.38
7.	Total output	Crores	522.15	2092	2569.09
8.	Value Added	Crores	133.66	390	683.00

Source: Annual Survey of Industries (Factory sector), 1973-74, 1980-81 and 1984-85, Directorate of Economics and Statistics, Trivandrum.

The financial stringency experienced by the state combined with the failure of the power front particularly in the event of monsoon failures are some of the factors which are hampering the economic development in the state. The industrial development in the state, as pointed out by the high level committee, did not receive adequate attention in the development plans (State Planning Board, 1984). There are both demand and supply variables that determine the industrial growth in a region. With regard to the demand, the relatively low per capita state domestic product, at first sight, would present Kerala as an unattractive location for industrial investment. However, because of the high density of population Kerala has a large consumer market and this demand is increasingly met by imports from other states. On the supply side variables like infrastructure, raw materials, labour and other factors are there. Although the state is handicapped by geographical location for metallic mineral resources, there is adequate supply of skilled and unskilled labour and above all it has a well developed social infrastructure and the savings rate is also considerably high.

The reasons for the poor performance are complex and are not, as generally believed, confined to labour troubles and organisational weaknesses (Subbramanian et.al., 1986). The central sector investment in the state has tended to be much lower than what is required to correct the regional imbalances.

The gross fixed capital investment in the central sector industrial units in the state increased from Rs.116 crores in 1970 to Rs.1074 crores in 1987 (Table 1.10). The corresponding increase in the country has been from Rs.3885 crores to Rs.68052 crores. It is to be noted that the state's population in 1986-87 constituted 3.65 per cent of the country's population (projected), whereas the total gross fixed assets in the central sector industries in the state accounted for only around 1.6 per cent of the all India aggregate. The declining trend in the percentage share of the state in the central industrial investments was noticed from 1975 onwards. It came down from 3.24 per cent to 1.58 per cent over the last 12 years.

The national level financial institutions like commercial banks have a very important role in the development of the country. The growth in the deposits of the public sector banks after their nationalisation has been phenomenal. However, there have been wide variation between states in the disbursement of the credit. For Kerala the credit deposit ratio has been declining over the years from 65.8 per cent in 1969 to 63.9 per cent in 1987 and again to 62.1 per cent in 1988 (Table 1.11). As at the end of June 1988 the share of Kerala in the total pool of credit extended by commercial banks for various development activities amounted to Rs. 2388 crores, which would work out only 3.9 per cent of the total bank advance. The total amount of

Table - 1.10

Central Sector Industrial Investment in Kerala

(Investment in Rs. Crores)

Year	Investment (Gross Block) as on 31st March		Percentage of Column (3) to Column (2)
	All India	Kerala	
1970	3885	116	2.99
1975	6242	202	3.24
1980	18161	423	2.33
1985	47323	831	1.76
1986	56806	923	1.62
1987	68052	1074	1.58

Source: Economic Review, State Planning Board, Trivandrum, 1988.

Table - 1.11

Deposits and Credit of the Public Sector Banks

(as at June end and Rs. in Crores)

	State	Deposits			Credit			Credit deposit ratio (per cent)		
		1969	1987	1988	1969	1987	1988	1969	1987	1988
1.	Andhra Pradesh	121	5596	6402	122	4296	5040	100.8	76.8	78.70
2.	Assam	33	1156	1356	13	596	708	39.4	51.6	52.20
3.	Bihar	169	4895	5765	52	1709	2056	30.8	34.9	35.76
4.	Gujarat	401	6581	7620	195	3612	4101	48.6	54.9	53.80
5.	Haryana	49	2027	2386	23	1221	1463	46.9	60.2	61.30
6.	Karnataka	188	4626	5373	143	4195	4876	76.1	90.6	90.70
7.	Kerala	117	3369	3844	77	2152	2388	65.8	63.9	62.10
8.	Madhya Pradesh	107	3859	4535	63	2324	2830	58.9	60.2	62.40
9.	Maharashtra	903	16956	19356	911	13183	13920	100.9	77.7	71.90
10.	Orissa	29	1227	1479	15	1008	1206	51.7	82.2	81.50
11.	Punjab	185	5758	6751	50	2437	2672	27.0	42.3	39.60
12.	Rajasthan	74	2447	2892	38	1523	1766	51.4	62.2	61.10
13.	Tamil Nadu	233	5821	6709	311	5615	6511	133.5	96.5	97.00
14.	Uttar Pradesh	337	10289	12254	154	4512	5331	45.7	43.9	43.50
15.	West Bengal	456	9549	11203	526	4557	5207	115.4	47.7	46.50
	Total major states	3402	84158	97925	2693	52940	60075	79.2	62.9	61.30
	All India	3897	97663	114070	3835	59410	66856	77.9	60.8	58.60

Source: Economic Review, State Planning Board, Trivandrum, 1988.

credit disbursed by the all India financial institutions to the fifteen major states as at the end of March 1987 was Rs.39059.88 crores as against Rs.123 crores in 1969 (Table 1.12). Thus there has been a tremendous growth in the lending activities of these institutions during the last two decades. However, the total contribution of funds by the central financial institutions to industrial sector of the state has also tended to be low at around three per cent of the total for the country at any point of time. Considering the industrial backwardness of Kerala and the chronic unemployment situation, the resources of the banking sector could be drawn upon in a large measure for the rapid development of the state economy. The high cost of production in units with low capacities and low capacity utilisation ratios prove to be a heavy burden on the end use industries which become uncompetitive in world market (Gopalakrishnan, 1978).

The resource constraints of the state have resulted in relatively small outlays for its industrial sector in various five year plans. The allotment of plan outlay to the industrial sector has been comparatively low during the five year plans.

The discussion on the whole leads us to conclude that Kerala is a relatively industrially backward state when compared to other regions in the country. Although the share of secondary sector increased during the 1970s it showed a dismal picture

Table - 1.12

Total Assistance Extended by All India Financial Institutions upto March 1987

(Rs. Crores)

Sl.No.	Major States	Amount	Percentage to total
1.	Andhra Pradesh	3196.47	8.18
2.	Assam	441.12	1.13
3.	Bihar	1510.46	3.87
4.	Gujarat	3962.42	10.14
5.	Haryana	1561.32	4.00
6.	Karnataka	2816.34	7.21
7.	Kerala	1313.93	3.36
8.	Madhya Pradesh	2161.56	5.53
9.	Maharashtra	5661.57	14.49
10.	Orissa	1243.76	3.18
11.	Punjab	1903.93	4.87
12.	Rajasthan	1909.11	4.89
13.	Tamil Nadu	3483.89	8.92
14.	Uttar Pradesh	4240.20	10.86
15.	West Bengal	1898.05	4.86
	Total - Major states	37304.13	95.50
	All India	39059.88	100.00

Source: Economic Review, State Planning Board, Trivandrum, 1988.

during the 1980s. Thus, in order to revitalise the industrial sector a major effort by the state to accelerate industrialisation with a diversified structure is necessary and is an important condition for the economic growth of the state.

1.4 Review of Literature

This section is intended to provide an overview of the available literature on the subject. Although much literature is available on several aspects of rubber cultivation and other related areas, only limited studies are available pertained to the rubber-based industry in Kerala. This is primarily due to the fact that the emergence of the rubber-based industry as a major industry is of recent origin.

1.4.1 Studies on Rubber

One of the earliest and comprehensive studies on rubber was made by Bauer in 1948. The growth of the industry, distribution of area under rubber, establishment of international rubber regulation, plantation labour and prospects of the industry in the world were the main areas of his study (Bauer, 1948). The Plantation Enquiry Commission conducted a study in 1956 on the development of the rubber cultivation in India, capital structure, marketing of rubber, area under small holdings and labour at the

instance of the Government of India (Menon Madhava, 1956). Schidrowitz and Dawson (1954) traced the history of the rubber industry in the world. They examined the origin of the industry, raw materials, scientific and technological developments in the rubber manufacturing industry in the world. The marketing problems of rubber, particularly those of small holdings, were examined by Reddy, an officer of the former Madras Government in 1950 at the instance of the Rubber Board (Reddy, 1950). An Economic study of innovations in British rubber manufacturing was conducted by Donnithorne Audrey in 1958. He traced the developments in British rubber manufacturing industry before 1958 (Audrey Donnithorne, 1958). The Tariff Board (Dey, 195) and its successor the Tariff Commission (Bhat, 1953 and Pai, 1969) had made a number of studies in connection with the fixation of rubber prices. They had primarily dealt with the cost of production of rubber.

Government of India had appointed the Small Holding Economics Enquiry Committee to study the problems of the rubber plantation sector in 1967 (Abdulla, 1968). Although they had studied some general problems connected with the industry, the enquiry was mainly confined to the conditions of the small holders.

Stiefel has made an effort to study the efficiency of sheet rubber marketing system in Thailand in the framework of

the structure-conduct-performance model from the field of industrial organisation. This analysis indicates that government can make competition more workable by measures to increase the producers' bargaining strength to improve the efficiency of the capital market, to encourage standardisation of product quality and by continuing to push feeder roads into remote producing areas to increase the size of effective markets (Stiefel, 1975). The supply response of rubber in Thailand was analysed by Dowling. He concluded that the long run response is fairly elastic and is somewhat higher in the post-war period. However, the short run response is comparatively inelastic (Dowling, 1977).

Kanbur and Morris have made an effort to study the measurement of cycles of natural rubber prices. The principal thrust of the study was to analyse the short term fluctuations in natural rubber prices prevailing in the important markets of the world. The study reveals the existence of cycles of thirty months (Kanbur and Morris, 1980). Daud (1983) illustrates a statistical approach using Box and Jenkins technique to forecast RSSI and RSS2 prices. The technique developed begins with a generalised forecasting model followed by model specification namely, identification, estimation and diagnostic checking. Changes in the derived input demand and cost functions resulting from technological developments in the Malaysian rubber industry were quantitatively assessed by Yee, Longworth

and Strong (1983). The specific objective of the study was to determine the nature and magnitude of shift both in the derived input demand and cost functions associated with different levels of rubber growing technologies. The important indication of the results was that the rate of reduction in unit cost of output resulting from the introduction of the recent high-yielding technologies has been diminishing, given the existing factor prices.

Umadevi (1989) examined the short run and long run response of natural rubber to price movements. The attempt in this study was to fit supply functions for rubber with Indian data. She concluded that the producers are influenced by the past six years' prices in their planting decision and that they positively respond to price. Chew (1984) has made an effort to measure the rate of technological change in Chinese rubber small holdings. In this study technological progress was estimated from a micro economic viewpoint. A Cobb-Douglas production function was fitted to two sets of cross sectional data collected at different points of time. The study shows that the rate of technological progress in rubber small holdings was the capital augmenting type at about 1.2 per cent per year.

Tan Suan (1984) has conducted a comprehensive study on the world rubber market structure and stabilisation. The main

objective of this study was the estimation of an econometric model of the world natural and synthetic rubbers market to explain natural rubber price and consumption share over time. This study has developed a model of the world rubber market with explicit treatment of the synthetic-rubber industry and oil price, the latter being a key variable about which there is great uncertainty. In the case of rubber one must mention the studies of Wharton (1963), Bauer (1959), Chan (1962) and Stern (1965). Their studies pertain to Malaya and they use mainly Nerlovian Partial adjustment model for estimating the supply response of rubber (Nerlove, 1956, 1958a).

George Tharian (1986) has conducted a study on the international commodity agreements, with special reference to natural rubber. He observed that natural rubber price exhibits a higher degree of instability in the international market and this exposes the fragility of the framework in which many of the commodity agreements are operating.

National Council of Applied Economics Research (1980) has made an effort to assess the demand and supply prospects for rubber in the coming decade in India. The demand and supply balance worked out for each of the ten years also takes into account the additional rubber required to maintain the desired levels of stock. Sekhar (1988) examined the natural rubber supply in India upto 2000 A.D. He concluded that the Indian

rubber manufacturing sector is poised to expand at a significant rate in the next two decades and the existing natural rubber output will not be sufficient to meet the requirements of the manufacturing industry.

1.4.2 Studies on Productivity and Capacity Utilisation

In the field of productivity a large number of studies are available. The most famous of them are the Cobb-Douglass production function and the C.E.S. (constant elasticity of substitution) function. The Cobb-Douglass function estimated the marginal product of capital and labour and returns to scale. The C.E.S. function was popularised by Arrow, Chenerry, Minhas and Solow (1961). They estimated the marginal productivity equation for labour to obtain the elasticity of substitution. Here it is assumed that the elasticity of substitution is a constant throughout and that it depends neither upon the volume of production nor on the quality of early factors of production that are already at work. This has led to the derivation of a production function with variable elasticity of substitution (VES), which depends upon the capital-labour ratio. This appears to be more realistic. VES production function derived by LU and Fletcher (1968) assumes that the elasticity of substitution is linearly dependent upon the input ratio. The generalised approach of VES production function with variabl

returns to scale by the use of a composite function has been carried out by Zellner and Revankar (1969).

One of the early studies on Indian manufacturing production function is that of Murti and Sastry (1957) who estimated Cobb-Douglas production function with cross section data for the industrial sector as a whole, as well as for some groups of industries for the years 1951 and 1952. Production function estimated for total industry indicated the constant returns to scale as the sum of two elasticities was not statistically different from unity. Diwan (1967) showed that Indian industries enjoyed large economies of scale. Gujarati and Diwan (1968) also found high economies of scale during the period 1946-58 by using the constant elasticity of substitution production function. Sankar (1970) also found evidence of economics of scale on estimating the constant elasticity of substitution production function for 15 industries covering the period 1953-58 On the study of Indian industries together for the period 1946-1958, Banerji (1971) observed that the evidence regarding returns to scale was not categorical. However, he found statistically significant evidence of increasing returns to scale by estimating the Cobb-Douglas production function with labour and fixed capital as determinants. Quite significant works were carried out by Banerjee (1973, 1974), Goldar (1986) and Gupta (1973),

applying CES production function model in the different areas of applications. Kazi (1978, 1980) and Rajalakshmi (1985a) applied VES production function model for Indian industries.

Several individual industry studies for returns to scale were also conducted in the Indian context. The estimates of returns to scale for individual industries showed considerable variation between different industries. Rajalakshmi (1982) conducted a study on the basic industrial chemicals during the period 1970 to 1980 and concluded that the industry operates under constant returns to scale. Increasing returns to scale was observed by Gupta and Patel (1976) for the sugar industry for the period 1946 to 1966 using time series data. Banerjee (1974) studied cotton textiles and jute textile industries, sugar industry and paper and bicycle industries using time serie and cross section data of states. Cobb-Douglas production was used with state and time dummies. While cotton and jute textile showed constant returns to scale, sugar, paper and bicycles showed increasing returns to scale.

Reddy and Rao (1962) examined the total productivity trends for the period 1946-57 in the large manufacturing sector in India. They concluded that there is a decreasing trend in productivity over the period. Singh (1966) studied the productivity trends and wages during the period 1951-63. He

concluded that the productivity of all the inputs taken together did not show any appreciable rise. He observed that most of the increase in labour productivity is due to the increasing capital intensity. Chatterjee (1973) has made an effort to study the productivity in selected manufacturing industries during the period 1946-1965. The results of their estimate show that there has been a definite improvement in productivity in most of the manufacturing industries, though no consistent or uniform patter is noticed in the individual industries. Alai (1986) studied the trends in productivity growth across large scale manufacturing industries of India during the period 1973-74 to 1978-79. He concluded that there is an increase in the rate of productivit growth of the manufacturing sectors of India during the period. The National Productivity Council (1988) conducted a study to analyse the productivity trends in the non-electrical machinery industry in India. They observed that although labour productivity increased during the period 1973-74 to 1984-85 at low or moderate levels, capital productivity declined at moderate or very high rates.

The efficient working of an enterprise depends upon the maximum possible utilisation of capacity. Better capacity utilisation is regarded as a precondition for accelerating the tempo of industrial growth, improving the rates of return on capital and generating additional resources. According to Budwin

and Paul (1961), capacity in its broadest sense refers to the potential output per unit of time that a plant can yield under given processes and conditions. The studies by Solomon (1963) and Bergstrom (1973) have estimated the extent of underutilisation in some selected industrial units. Solomon uses the work sampling technique for the determination of individual machine utilisation and remarks that many Indian plants can increase their output by 50 per cent with little or no increase of investment in fixed plant. Bergstrom has used the linear programming technique for estimating the maximum capacity of two industrial units. He observed that the capacity utilisation varies between 37 per cent to 54 per cent in the case of two units. Paul (1974) has divided all the factors that can explain underutilisation of capacity into three, as industry characteristics, policy influences and outliers. Mohanti (1980) studied the capacity utilisation in Indian industries and concluded that power shortage, labour unrest, inadequacies of raw material supply, power maintenance and mechanical breakdowns were the major reasons for the underutilisation of capacity. Reddy (1987) has also made an effort to study the capacity utilisation in Indian industry. He observed that steel and paper industries have utilised capacity more than that of paper, newsprint and fertilisers. He concluded that capacity utilisation in consumer goods industries worked at much more than basic and capital

goods industries and suggested that an acceleration of the general growth of the economy can occur only if investments are made in consumer and intermediate goods industries so as to correct the existing structural imbalances.

Thus the foregoing discussion reveals that though there are a number of studies on rubber, so far only little literature is available covering different aspects of the rubber based industry. Hence an effort is made to analyse the differen aspects of industry in the context of the data available with respect to the rubber-based industry in Kerala.

1.5 Statement of the Problem

Rubber-based industry is a strategic industry and is the third largest contributor to the national exchequer to our country. Although Kerala produces 92.1 per cent of the total production of natural rubber in India and has the largest number of industrial units, its consumption of natural rubber is comparatively low.

Rubber manufacturing industry is facing a lot of problem such as marketing of finished products, low capacity utilisation, escalating cost of inputs etc. Thus it will be useful to analyse the problems and development of rubber-based industry in Kerala. The major problems posed in this study are

1) What was the contribution of the rubber manufacturing sector to the industrialisation of Kerala?

2) How far is the rubber manufacturing industry effective in increasing productivity and efficiency of the factors used, namely labour and capital?

3) Whether the trends in input prices are in proportion with the output prices?

4) Whether the individual rubber-based industrial units in the state are functioning efficiently?

These questions need a study of the rubber-based industry in the State of Kerala for getting detailed information.

1.6 Significance of the Study

Kerala is the largest producer of natural rubber in India. Almost 92.1 per cent of the total production of natural rubber is accounted by Kerala. Rubber-based industry in Kerala is comparatively of recent origin. The first rubber-based industrial unit in Kerala was established only in 1935. Since then more than 700 rubber manufacturing units were established in the state. Majority of the rubber manufacturing units in the state were established during the last fifteen to twenty years. Kerala hopes to solve to some extent its problems of unemployment and poverty through the industrial development of

the state. Considering the industrial backwardness and the mounting unemployment rate rubber-based industries have a vital role to play for the industrial development of Kerala. Therefore it is imperative to study about the growth and developmental problems of a new industry, the rubber-based industry, in the State of Kerala. Almost all the previous studies concentrated their effort to study the rubber plantation sector in the state. Thus the present study attempts to analyse the capacity utilisation, productivity, problems and prospects of the rubber-based industry in Kerala.

1.7 Objectives

As mentioned earlier, the main thrust of this study is to analyse the development and problems of the rubber-based industry in Kerala. More specifically the objectives of the present investigation are:

1) To study the growth of natural rubber production and development of rubber-based industry in Kerala.
2) To analyse the input prices and output prices in the rubber manufacturing industry.
3) To analyse the productivity and factor use efficiency in the rubber-based industry.
4) To study the capacity utilisation of the individual rubber-based industrial units in the state.

5) To investigate the functional problems of the rubber-based industrial units.

1.8 Hypotheses

Following are the tentative hypotheses formulated on the basis of the above mentioned objectives.

1) Increase in prices of natural rubber was the major reason for the growth of rubber production in the state.

2) Productivity showed a declining trend over the years in the rubber-based industry in Kerala.

3) Growth in input prices are responsible for the increase in output prices in the rubber manufacturing industry.

4) The capacity utilisation in the individual rubber-based industrial units is low.

1.9 Methodology

This section gives a brief outline of the methodology used in this study. The study is partly descriptive and partly analytical. It is descriptive insofar as it traces the growth and development of the industry at the national and state level. The analysis of productivity is done using production function estimates. In order to study the trends, growth rates and variability of input prices, output prices and production of

rubber various statistical tools such as percentages, ratios, coefficient of variation and exponential functions are used. A sample survey was conducted to analyse the general functional problems of the rubber-based industry in Kerala. Fifty four rubber manufacturing units in the state was selected by using stratified random sampling technique for the above-mentioned purpose. In order to analyse the productivity of the factors of production in the rubber-based industry, secondary data, as given in the annual survey of industries (ASI), was made use of. The data relate to the period from 1973-74 to 1984-85 for the factory sector as a whole. The present study covers only post 1973-74 period mainly because of the reason that the ASI followed the national industrial classification from this year. Data from various sources such as ASI data, Indian Rubber Statistics, annual reports of different companies, publications of th Directorate of Economics and Statistics, Planning Board and Rubber Board were used for the purpose of this study.

1.10 Limitations of the Study

This study has the following limitations: statistics relating to some aspects of the rubber manufacturing industry are scattered and inadequate. Secondly, the manufacturers are not willing to give data on several aspects of their firms. The study is based on a sample. Hence the limitations applicable to any sample survey will also be applicable to the present stud

1.11 Scheme of the Study

For the purpose of analysis the thesis is divided into eight chapters. The first chapter gives a brief introduction, overview of the rubber-based industry in other countries, Kerala's industrial structure and development, review of literature, objectives, hypotheses, methodology and limitations of the study. The second chapter traces the development of rubber-based industry in India.

Growth of rubber production in Kerala is discussed in the third chapter. Fourth chapter examines the development of rubber-based industry in Kerala. The trends and growth rates of input and output prices in the rubber manufacturing industry is discussed in the fifth chapter.

The sixth chapter examines the productivity in the rubber-based industry. The seventh chapter analyses the capacity utilisation and general functional problems of the individual rubber-based units in the state.

The concluding chapter, besides dealing with the summary and findings of the study, highlights some of the suggestions emerging from the study.

CHAPTER II

DEVELOPMENT OF RUBBER-BASED INDUSTRY IN INDIA

Rubber-based Industry in India is a strategic industry and comes under the vital sectors of our national economy. Though rubber plantations in India were started by the beginning of this century, almost the entire production was exported. The end of the first world war marked the beginning of the industry and it was in 1920 that the first rubber plant in the country was established for water proofing of fabrics (Mani Sunil, 1985). Around this time some other rubber manufacturing units were also established. But the first tyre production unit in the country was established by Dunlop at Sahaganj near Calcutta only in 1937. However, it was only after independence that the rubber manufacturing industry got a boost for its development. The demand for rubber goods started growing with the increasing pace of economic development during the first two five year plans.

There are at present 70,000 different products based on rubber (Mathew, 1982). New uses are also being discovered day by day. The industry manufactures items ranging from tiny bushes to giant beltings and simple balloons to sophisticated

aero tyres. In the early stages the rubber goods manufacturing industry's contribution was comparatively smaller. However, after independence the industry made rapid strides, especially during the last two decades and now produces a variety of items to meet the ever-growing requirements from the vital sectors of our economy like transportation, defence, agriculture, health, family planning and so on (Kulkarni, 1987).

Rubber-based industry is the third largest contributor to the national exchequer of our country after steel and textile industries. In 1986 the rubber manufacturing industry contributed Rs.872 crores to the national exchequer by way of taxes and duties. It is estimated that the rubber-based industry produces goods worth Rs.3200 crores annually. Rubber manufacturing industry generates employment to more than 2.5 lakh persons and the capital investment in the industry comes around Rs.1500 crores. India ranks sixteenth among other rubber goods manufacturing countries.

2.1 Growth of Rubber-based Units in India

Remarkable developments in the transport sector gave a boost to the growth of the rubber manufacturing industry in India. In 1965-66 there were only 838 rubber-based industrial units in India (Table 2.1). This has increased to 4009 in

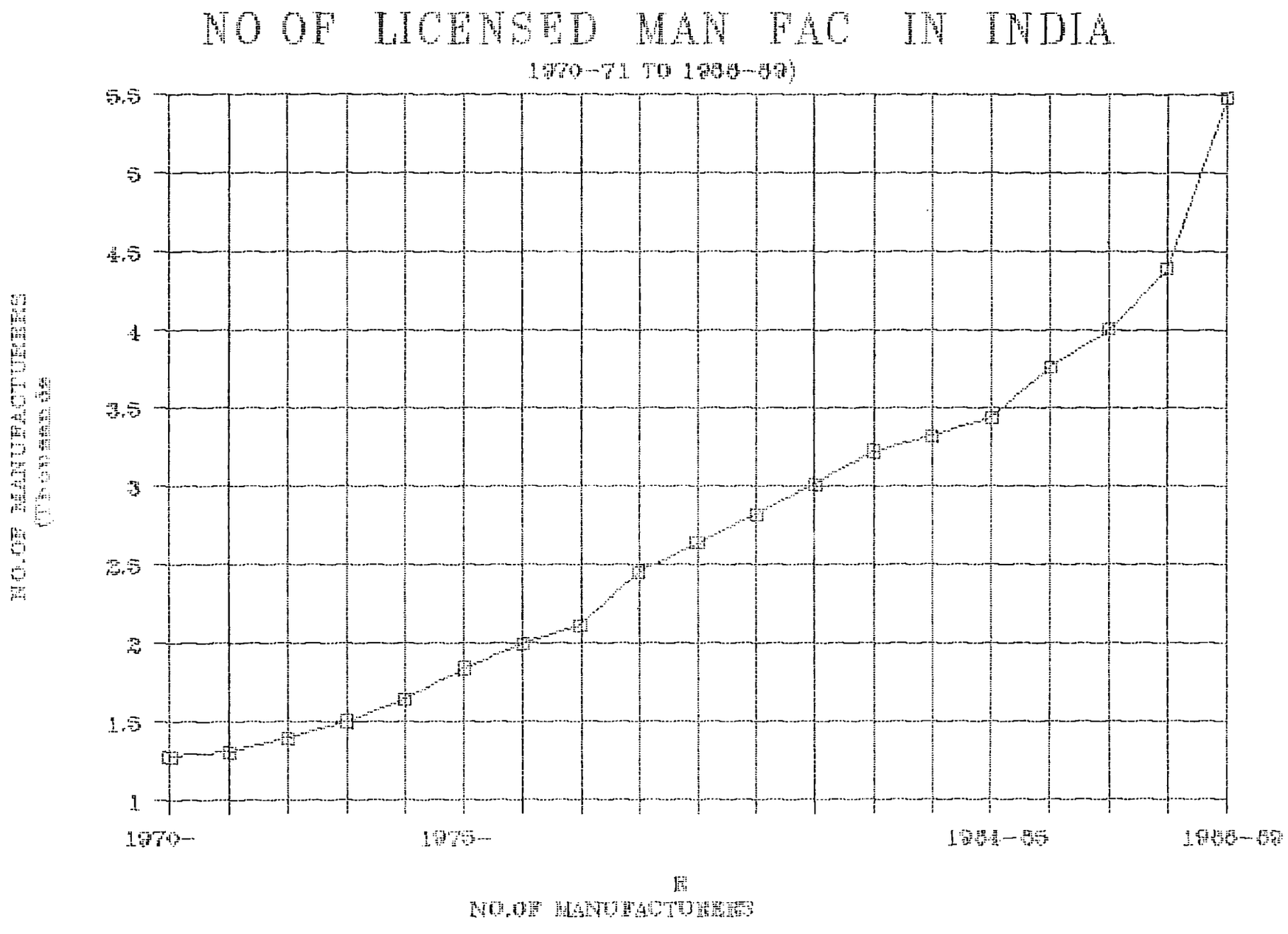
Table - 2.1

Number of Licensed Manufacturers in Different States at the End of Each Year

State/ Territory	1965-66	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Assam		4	5	4	3	3	2	2	3	2	4	2	3	1	2	3	3	2
Andhra Pradesh	8	15	21	30	34	35	42	48	47	55	64	80	83	87	92	107	107	121
Bihar	6	7	10	10	10	20	25	18	19	30	31	29	29	29	30	28	30	34
Delhi	110	153	161	165	169	156	178	205	216	265	272	274	260	308	304	319	326	343
Gujarat	40	78	88	95	104	126	134	136	149	168	173	191	194	222	228	247	262	274
Goa	-	1	1	2	2	3	5	6	4	7	5	6	9	11	9	11	12	15
Kerala	54	119	120	144	152	191	221	248	273	311	331	391	450	490	531	533	599	630
Haryana		65	60	70	82	91	114	129	141	157	171	181	203	204	216	201	213	213
Himachal Pradesh								1	1	4	3	3	3	7		9	9	11
Madhya Pradesh	5	15	14	15	13	15	15	17	19	23	22	24	27	30	33	41	46	54
Tamil Nadu	34	64	59	67	72	88	111	118	139	160	189	212	220	242	253	287	326	358
Maharashtra	162	230	227	239	267	272	280	279	296	337	367	373	386	416	413	427	468	492
Karnataka	7	17	10	26	35	43	51	58	56	68	79	90	100	106	117	132	162	169
Orissa		2	2	6	5	6	2	5	3	5	7	10	11	12	10	11	17	15
Punjab	172	201	184	173	180	192	183	221	245	287	317	339	349	355	341	331	371	397
Rajasthan	7	9	9	12	11	13	16	14	16	21	16	19	24	31	39	42	44	47
Uttar Pradesh	58	103	111	127	128	146	163	182	186	215	242	249	264	270	297	305	352	379
West Bengal	175	198	228	212	238	247	301	314	303	338	345	351	383	402	400	401	413	445
Others	-				1	1	1	2	3	3	2	2	3	3	5	7		10
Total	838	1281	1310	1397	1506	1648	1844	2003	2119	2456	2640	2826	3021	3226	3326	3442	3769	4009

Source: Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Diagram - 2.1


NO OF LICENSED MAN FAC IN INDIA
1970-71 TO 1988-89)
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(Thousands)
5.5
5
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1970-
1975-
1984-85
1988-89
E
NO.OF MANUFACTURERS

1986-87. The percentage increase is worked out to be 378.40, a remarkable progress by all means. Kerala is having the largest number of rubber manufacturing units in India. This is primarily due to the fact that Kerala produces 92.1 per cent of the natural rubber in the country. Interestingly Kerala, Maharashtra, West Bengal, Punjab, Delhi, Tamil Nadu and Uttar Pradesh accounted for 77.4 per cent of the total number of units in 1980-81 and 75.89 per cent in 1987-88. Of this Maharashtra and West Bengal have major contribution of units in the organised sector. States like Kerala, Tamil Nadu, Uttar Pradesh, Maharashtra and Rajasthan registered a higher increase in growth than the overall growth rate.

2.2 Consumption of Rubber

Rubber industry consumes all forms of rubber namely natural, synthetic and reclaimed. The consumption pattern of rubber in the country indicates that natural rubber is the main form of input compared to other polymers. In 1987-88 the share of natural rubber in the total consumption of rubber was 70.98 per cent, synthetic rubber 18.87 per cent and reclaimed rubber 10.15 per cent. In 1975-76 the corresponding percentages were 80.82, 10.28 and 10.90 respectively. Till 1985-86 the consumption of natural rubber has been showing a downward trend, whereas the percentage share of synthetic rubber was increasing.

However, during the last two years natural rubber regained its position by pushing back synthetic rubber to the background. This is due to the fact that natural rubber is easily available in the country, whereas synthetic rubber production is considerably low due to the increase in the cost of raw materials and lack of production facilities in India.

Consumption of natural, synthetic and reclaimed rubber has increased considerably over the last two decades. The major reasons for the remarkable increase in consumption are the growth in the industrial production and the increase in the number of manufacturing units in the country. From 28445 tonnes in 1965-66 the natural rubber consumption increased to 87237 tonnes in 1970-71 (Table 2.2). Consumption has further increased to 257305 tonnes in 1986-87. Synthetic rubber consumption has also increased from a mere 461 tonnes in 1955-56 to 33160 tonnes in 1970-71. In 1986-87 synthetic rubber consumption in the country stood at 71785 tonnes. Reclaimed rubber consumption has further increased to 3835 tonnes in 1986-87. The increase in the consumption over the period 1970-71 to 1986-87 is more vividly brought out by the compound growth rate and is estimated statistically from the following semilog trend equation:

$$\text{Log } C = A + Bt + U \text{ where}$$

C = consumption of rubber

Table - 2.2

Consumption of Natural, Synthetic and Reclaimed Rubber in India

(Metric tonnes)

Year	Natural Rubber	Synthetic Rubber	Reclaimed Rubber
1965-66	63765	21553	9774
1970-71	87237	33160	14348
1971-72	96454	37209	15772
1972-73	104028	33913	14666
1973-74	130302	23921	17784
1974-75	132604	24376	18096
1975-76	125692	32452	19342
1976-77	137623	33701	20957
1977-78	144967	36150	21681
1978-79	164524	40470	26330
1979-80	165245	42488	25660
1980-81	173630	45200	26850
1981-82	188420	46445	28160
1982-83	195545	49600	29190
1983-84	209480	62300	30690
1984-85	217510	65400	34625
1985-86	235440	70035	38215
1986-87	257305	71785	38635

Source: Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Diagram - 2.2

CON.OF NR.,SR.& RR.IN INDIA

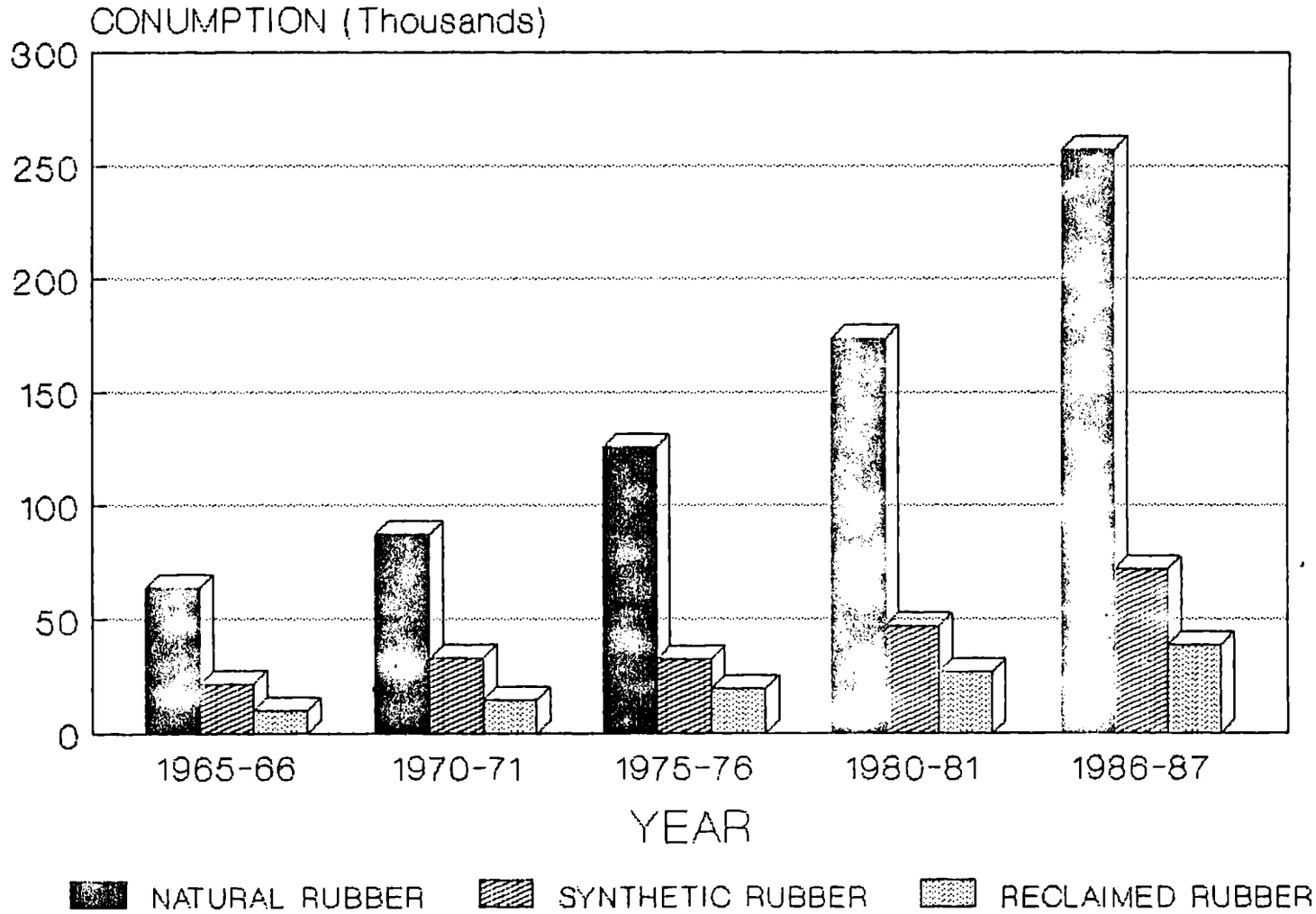
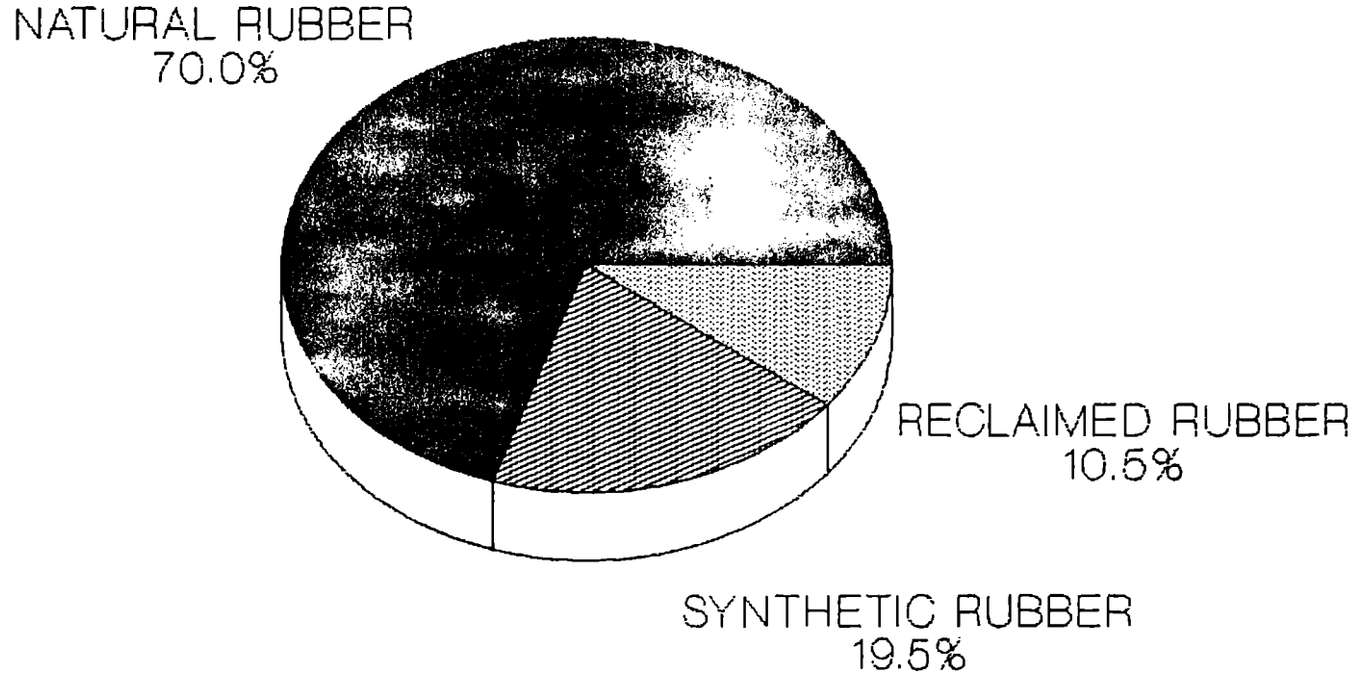


Diagram - 2.3

CONS.OF DIFF. TYPS.OF RUBBER IN INDIA(1986-87)



t = trend in years

A and B are parameters.

U = error term.

The estimated equations are given in appendix (1).

The compound growth rates for natural rubber, synthetic rubber and reclaimed rubber are 6.35, 6.27 and 6.50 respectively. If the above-mentioned growth rates are maintained, in 2000A.D. the consumption of natural rubber, synthetic rubber and reclaimed rubber will be 566891.571 tonnes, 152405.28 tonnes and 88613.52 tonnes respectively. Now let us examine some of the factors which have contributed for the consumption of rubber in the country. We have already mentioned that the increase in the production of natural rubber and industrial production are some of the contributory factors for the increase in consumption of natural rubber in India. This can be substantiated by the following estimated equation:

$$CNR_t = 26733.11^{*} + 0.1829^{***} QNR_t + 398.716^{**} IIP_t + 5522.364^{*} t$$

$$(6682.626)\quad (0.09792)\quad (182.302)\quad (1381.108)$$

$$R^2 = 0.985, \quad \bar{R}^2 = 0.981, \quad F = 284.56$$

---

*: Significant at one per cent level.
**: Significant at ten per cent level.
***: Significant at twenty per cent level.

where CNR_t = consumption of natural rubber in the year t

QNR_t = production of natural rubber in the year t

IIP_t = index of industrial production in India

t = trend in years

The estimated equation shows that the increase in production of natural rubber, increase in the industrial output in the country and technological progress achieved by the industry are some of the factors which are responsible for the increase in the consumption of natural rubber, Index of industrial production and the trend variable are significant at various levels of significance. Further almost 98 per cent of the observations are represented by the estimated equation.

When we analyse the state-wise consumption of rubber we can see some interesting facts: Although Kerala is having

the largest number of manufacturers and 92.1 per cent of the natural rubber production in the country its consumption of natural rubber is found to be only 12.22 per cent of the total rubber consumption in the country in 1986-87 (Table 2.3). The largest consumer of natural rubber in the country is the highest industrialised state in India, namely Maharashtra. This is closely followed by Uttar Pradesh, West Bengal and Punjab. In fact these four states consume 51.40 per cent of the total natural rubber consumption in the country. In the case of synthetic rubber also Maharashtra tops with a consumption of 14312 tonnes in 1986-87. West Bengal, Uttar Pradesh and Tamil Nadu came next. Punjab is the largest consumer of reclaimed rubber in India. Almost 27.49 per cent of the total consumption of reclaimed rubber in the country was in Punjab in 1986-87. Maharashtra and West Bengal occupy the second and third positions respectively.

When we analyse the distribution of manufacturers according to their total consumption we can see that the majority of the units consume below ten tonnes of rubber. In fact in 1986-87, 51.71 per cent of the total number of manufacturers came under this category (Table 2.4). Another 34.80 per cent of the rubber-based units consume less than 10 and 50 tonnes of natural rubber. Moreover, only 1.53 per cent of the total number of units are consuming more than 500 tonnes

Table - 2.3

State-wise Consumption of All Kinds of Rubber

(Metric Tonnes)

State/ Territory	1965-66			1970-71			1975-76			1980-81			1986-87		
	Natural Rubber	Synthetic Rubber	Reclaimed Rubber	Natural Rubber	Synthetic Rubber	Reclaimed Rubber	Natural Rubber	Synthetic Rubber	Reclaimed Rubber	Natural Rubber	Synthetic Rubber	Reclaimed Rubber	Natural Rubber	Synthetic	Reclaimed Rubber
West Bengal	27091	10234	6290	30988	11634	7015	27300	9090	7482	27414	7771	7571	32484	8625	5780
Maharashtra	16018	5886	1809	19696	9897	3231	26400	10668	4612	33119	11678	5748	34462	14312	6265
Tamil Nadu	9889	2768	1188	17548	5966	2628	20900	4140	3526	17050	4961	2472	19965	8295	3245
Punjab				2277	206	269	5743	227	206	13232	1565	2463	30868	2438	10620
	4555	1901	95	4475	2439	139	11110	3109	698	14974	4421	1548	19783	6006	1370
Kerala	3353	517	293	6739	1796	380	9268	1062	1069	19283	4673	2293	31445		3423
Delhi	1076	66	25	1956	199	96	4168	591	196	6311	1372	1071	10743	2290	584
Gujarat	862	70	5	1192	161	45	2138	447	230	3034	560	583	5634	767	412
Uttar Pradesh	444	32	17	1160	153	59	9672	1363	501	22578	4601	2057	34447	8383	3827
	242	72	52	631	609	358	1920	953	644	5770	1944	699	12856	5765	2201
Goa & Daman	N.A.			N.	N.A.		3483	268	78	2409	350	55	1971	707	169
Rajasthan	N.	N.A.	N.A.	N.A.	N.A.	N.A.		.A.	N.A.	5482	2448	59	13780	4883	126
Andhra Pradesh	N.	N.A.								2223	250	186	5380	1249	463
Madhya Pradesh	N.A.	N.A.	N.A.	N.A.	N.A.	N.	N.				N.A.		2043	309	125
Others	215	7		575	98	74	1590	534	100	751	456	45	1444	884	27
Total	63765	21553	9774	87237	33160	14348	125692	32452	19342	173630	47050	26850	257305	71785	38619

Note: 1) N.A.: Not Available.

2) In 1965-66 Consumption of rubber by Punjab and Haryana are clubbed together.

Indian Rubber Statistics, Vol.16, Rubber Board, Kottayam, 1988.

Table - 2.4

Distribution of Manufacturers According to Their Total Consumption

(Consumption in Metric Tonnes)

Year	10 and below	Above ten and upto and including 50	Above 50 & upto & including 100	Above 100 & upto & including 500	Above 500 & upto & including 1000	Above 1000	Total
1966-67							
No. of Manufacturers	676	187	55	45	10	12	985
Consumption							
Natural	2786	3977	3256	8520	3660	46477	68685
Synthetic	179	349	511	1739	1245	19569	23592
Reclaimed	57	146	233	559	1358	8560	10913
1970-71							
No. of Manufacturers	847	280	62	68	13	11	1281
Consumption							
Natural	2168	5862	3407	9597	6138	60085	87237
Synthetic	445	1210	1173	3270	1802	25260	33160
Reclaimed	173	415	399	1666	1953	9742	14348
1975-76							
No. of Manufacturers	1097	503	135	84	10	15	1844
Consumption							
Natural	5133	12127	9178	13425	4830	80999	125692
Synthetic	671	1819	1597	3646	824	23895	32452
Reclaimed	486	1030	628	2168	1450	13580	19342
1980-81							
No. of Manufacturers	1696	817	159	112	18	24	2826
Consumption							
Natural	4202	17016	9944	17783	9674	11511	173630
Synthetic	597	2831	2901	5834	2731	32156	47050
Reclaimed	496	2116	2431	3830	1771	16206	26850
1986-87							
No. of Manufacturers	2073	1395	301	182	30	28	4009
Consumption							
Natural	8607		17874				257305
Synthetic	1325	4238	5128	12053		45185	71785
Reclaimed	888	4237	3641			20740	

Source: Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

of rubber. However, since 1975-76 there has been a gradual increase in the number of units consuming between 10 to 50 tonnes, while there is a fall in the number of units consuming less than 10 tonnes annually.

2.3 Tyre and Non-tyre Sector

Rubber manufacturing industry in India can be divided into the tyre sector and the non-tyre sector. The tyre sector consists mostly large and organised units having technical collaboration or tie-up arrangements with international giants in one form or other. The tyre sector with major 11 companies has a firm footing in the country. The first tyre unit in India was established by Dunlop in 1936. In the sixties seven big multinational companies entered this arena. Later a number of industrial houses showed keenness to enter this field. At present there exists 24 tyre companies, of which 11 are producing a range of tyres including passenger and truck tyres.

The non-tyre sector is dominated by the small scale and the medium size units. As already mentioned, the major products of the tyre sector are automobile tyres and tubes. Besides tyres and tubes the other products manufactured in India are camel back, transmission and conveyor belting, fan belts, industrial V belts, water proof fabrics, latex foam products, dipped goods,

rubber and canvas footwear, radiator hoses, vacuum brake hoses, contraceptives etc.

Consumption pattern of natural rubber by tyre and non-tyre sector shows that in 1985-86 47.9 per cent of the natural rubber consumption was by automobile tyres and tubes (Table 2.5). Cycle tyres and tubes accounted for 12.7 per cent of the total natural rubber consumption in the country. Footwears came next with a consumption of 10.3 per cent. Belts and hoses consumption of natural rubber is found to be 6.6 per cent of the total consumption in the country. Camel back and dipped goods consumed 5.5 per cent and 4.1 per cent respectively. The consumption of natural rubber by the latex foam sector is estimated to be 5.3 per cent. The remaining 7.6 per cent is accounted by other rubber products sectors.

The performance of the rubber-based industry in physical terms during the last decade is quite heartening. Total production of auto tyres accounted to 12096 thousand numbers during 1986 against 5664 thousand numbers during 1975, an increase of 113.56 per cent (Table 2.6). From 5133 thousand in 1975 the output of auto tubes increased to 8438 thousand in 1986. The percentage increase is estimated to be 64.39. During the period 1975-86 the production of bicycle tyres and tubes also increased by 82.49 per cent and 116.14 per cent respectively. The output

Table - 2.5

Consumption of All Kinds of Rubber According to End Products

(Consumption in Metric Tonnes)

Sl.No.	Products	1975-76			1980-81			1985-86		
		NR	SR	RR	NR	SR	RR	NR	SR	RR
1.	Automative tyres and tubes	62115	17751	4887	87295	26598	6061	112831	35757	7381
2.	Cycle tyres and tubes	15979	1056	5414	20664	5346	786	29915	9220	9972
3.	Camel back	5545	2303	682	9130	2484	2005	18047	4092	2943
4.	Footwears	12387	4155	2156	18900	4951	3214	24194	8695	5245
	Belts & Hoses	8943	1494	1342	11812	2034	1885	15570	5122	2856
	Latex foam	2083	--	--	5753	--	--	12396	--	--
7.	Cable & wires	590	300	18	779	435	136	1004	708	259
8.	Battery Boxes	280	561	2275	485	778	3220	890	1128	5720
9.	Dipped Goods	3478	--	--	4945	--	--	9550	--	--
10.	Others	14342	3452	2569	13867	4424	2469	16043	5313	3839
	Total	125692	52452	19842	173630	47050	26850	237440	70035	38215

Note: N.R.: Natural Rubber, S.R.: Synthetic Rubber
R.R.: Reclaimed Rubber.

Source: Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Diagram - 2.4

CONS.OF NR AC.TO END PRDTS.
(1985-86)

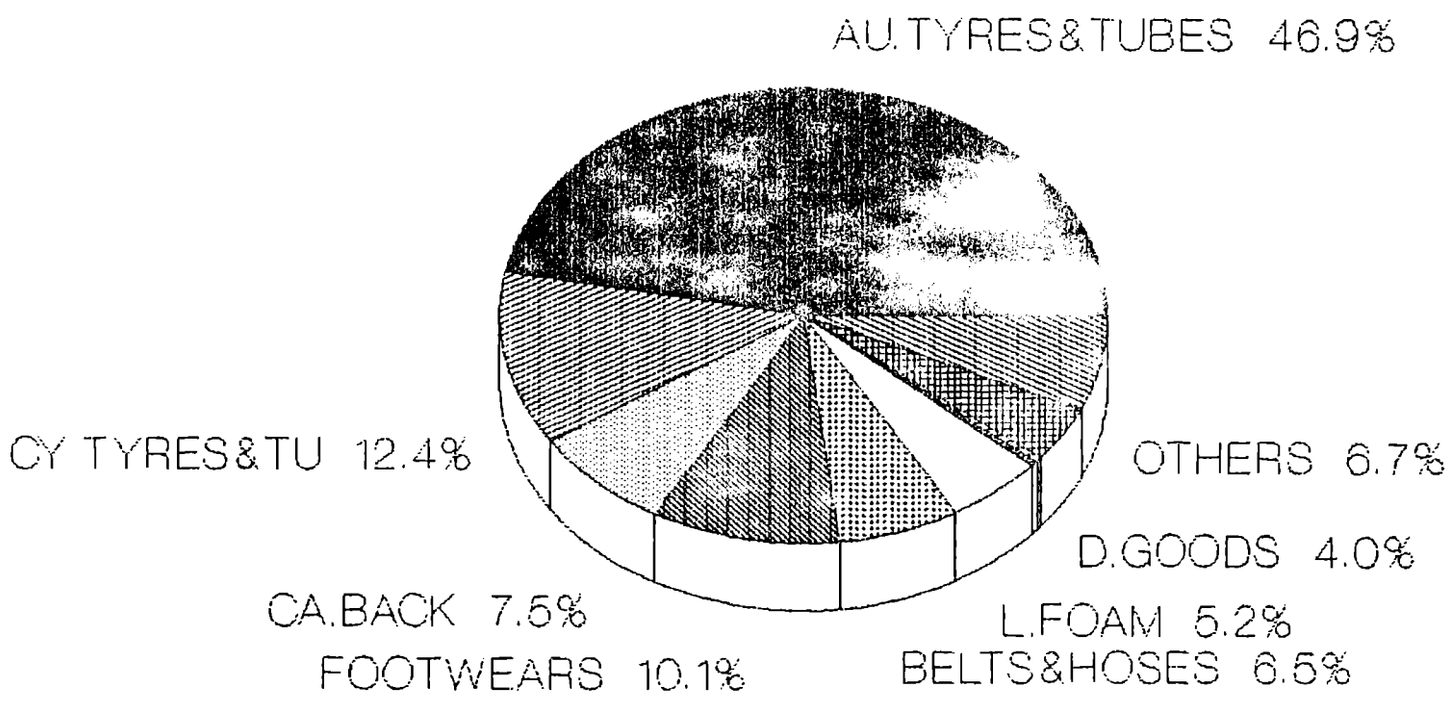


Table - 2.6

Production of Rubber Products in India

Products	Unit	Quantity		
		1975	1980	1986
Tyres	1000 Nos.	5664	8321	12096
Tubes	1000 Nos.	5133	6602	83438
Cycle tyres	1000 Nos.	24525	26746	44755
Cycle tubes	1000 Nos.	16923	11876	36578
Fan belts	1000 Nos.	2520	2170	3321
Industrial 'V' belts	1000 Nos.	4527	8212	12548
Rubber ply transmission and conveyor belting	Tonnes	7420	9080	9574
Radiator Hoses	1000 Nos.	486	327	92
Vacuum brake hoses	1000 Nos.	1545	486	263
Other type of hoses	1000 Mtrs.	5000	4922	5814
Camel back	Tonnes	11853	11507	12728
Rubber Foot-wear	pairs	397	435	421
Water Proof fabrics	1000 Mtrs.	2807	2340	2884
Contraceptives	Million Nos.	178	358	606

Note: 1) In the case of tubes figures of 1986 relate to 1985-86.
2) In the case of cycle tyres and tubes figures of 1986 includes rickshaw tyres and tubes.
3) The above figures relate to organised sector only.

Source: Hand Book of Rubber Statistics, AIRMA, Bombay.

of camel back increased from 1,853 tonnes in 1975 to 12,728 tonnes in 1986. The percentage increase is worked out to be 738. In the case of industrial belts, rubber ply transmission and conveyor belting, rubber footwears, contraceptives and water proof fabrics showed a marked increase in production when compared to 1975. However, the production of radiator hoses and vacuum brake hoses decreased steepily during the perid.

2.4 Fixed Capital, Value Added and Total Output

Under the major group 30 (manufacture of rubber products) the ASI (factory sector) classified rubber industry into three sub-groups viz.,

(i) tyres and tubes (300)

(ii) manufacture of footwear made primarily of vulcanised or moulded rubber (301)

(iii) manufacture of rubber products not elsewhere classified (302).

According to the ASI (factory sector), in 1983-84 the total fixed capital investment in the tyres and tube industries was Rs.372.29 crores (Table 2.7). This was only 1.33 per cent of the total fixed capital investment in the manufacturing sector in the country. In 1984-85 the total fixed capital investment in the tyres and tube industries stood at Rs.325.40 crores. The

Materials Consumed, Total Input and Total Output

(Rs. in lakhs, Numbers in thousands)

Item	1981-82			1983-84			1984-85		
	300	301	302	300	301	302	300	301	302
1. Fixed capital	20670	996	5009	37229	1478	6878	32540	1410	8375
2. Working capital	17656	803	2637	15710	1162	6202	12283	1166	4919
3. Number of Employees	40738	8125	37208	43936	8421	35456	46801	8565	36992
4. Total emoluments	5701	538	2826	7913	680	3412	9688	747	3988
5. Materials Consumed	65053	5631	18986	81720	7758	24636	90452	7900	28985
6. Total input	78568	6485	23587	91948	9091	29521	104573	9257	33955
7. Value added	12005	1148	5941	25956	1631	8525	38464	1870	8505
8. Total output	93301	7783	30183	124288	10934	38907	146688	11340	43650

Note: 300: Tyres and tube Industries, 301: Manufacture of footwear made primarily of vulcanized or moulded rubber, 302: Manufacture of rubber products not elsewhere classified.

Source: Annual Survey of Industries (Factory Sector), Various Issues, Central Statistical Organisation, Government of India, New Delhi.

percentage decrease is worked out to be 12.60. In 1984-85 the total fixed capital investment in the rubber footwear industry and other rubber products sector was Rs.14.10 crores and Rs.183.75 crores respectively. When compared to 1983-84 only the other rubber products sector showed a marked increase in the fixed capital investment. In 1984-85 the total working capital investment in the rubber manufacturing industry showed a decline in trend when compared to 1983-84. In 1984-85 the total working capital investment in the tyres and tube, rubber footwear and other rubber products industries stood at Rs.122.83 crores, Rs.11.66 crores and Rs.49.19 crores respectively. The total number of employees and total emoluments showed an increasing trend in the rubber manufacturing sector. The total number of employees in the tyres and tube, rubber footwear and other rubber products industries in 1984-85 stood at 46801 thousand, 8565 thousand and 36992 thousand respectively. The percentage increase, when compared to the previous year, is estimated to be 16.52, 1.71 and 4.33 respectively. It is to be noted that the total employees in other rubber products showed a decline in trend when compared to 1981-82. As a direct consequence of the increase in the number of employees, total emoluments has increased. Materials consumed and total input also showed a marked increase when compared to the previous years. Value added in the tyres and tube industry and rubber footwear industry showed remarkable increase in 1984-85 when compared to the previous year. The percentage increase

is estimated to be 48.19 and 14.65 respectively. However, value added in the other rubber products sector in 1984-85 showed a slight decline in trend when compared to the previous year and the percentage decrease is estimated to be 0.24. When compared to 1981-82 it showed an increasing trend. In 1984-85 the value added in the tyres and tube, rubber footwear and other rubber products industries stood at Rs.384.64 crores, Rs.18.70 crores and 85.05 crores respectively. The total output in the tyres and tube industry in 1984-85 is found to be Rs. 1466.88 crores. This is a considerable increase when compared to 1983-84. The percentage increase is estimated to be 18.02. The total output of the rubber footwear and other rubber products industry have also increased appreciably and they stood at Rs. 113.40 crores and Rs.436150 crores respectively in 1984-85. The percentage increase, when compared to the previous year, is estimated to be 3.71 and 12.19 respectively.

2.5 Capacity Utilisation

Capacity utilisation is an important indicator to determine the efficiency of the manufacturing industry. The importance of optimum utilisation of industrial capacity can hardly be overemphasised, especially, in a developing economy where the availability of productive resources is acute. Better utilisation of installed capacity in the economy can bring down the

prevailing capital output ratios and capital labour ratios, resulting in more employment, more income and more competitiveness in export markets without much additional capital expenditure.

Now we will examine the capacity utilisation in the major sectors in the rubber manufacturing industry in the country. The average capacity utilisation for the period 1970-85 for rubber and rubber products was around 82 per cent as against the average of 72 per cent for the manufacturing sector as a whole (Centre for Monitoring Indian Economy, 1987). Thus the average capacity utilisation in the rubber-based industry was well above the manufacturing sector as a whole. When we analyse the capacity utilisation of major rubber products sectors in 1988-89 we can see that capacity utilisation in rubber conveyor belting and V and Fan belts was above the installed capacity (Table 2.8). Capacity utilisation in the bicycle tyres and tubes industry and reclaimed rubber sector was 90 per cent of the installed capacity. Capacity utilisation was the lowest in the manufacture of rubber hoses, where only 18.59 per cent of the total installed capacity was utilised. Capacity utilisation in the auto tyres and tube industry was 87.78 per cent and 74.85 per cent respectively. Taking 90 per cent capacity utilisation as a satisfactory average (used as a norm for cost analysis by the Bureau of industrial costs and prices), the capacity utilisation in the tyre industry is low

Name of the Industry	Accounting Unit	1986-87			1987-88			1988-89		
		Installed Capacity	Annual Production	Capacity Utilisation	Installed Capacity	Annual Production	Capacity Utilisation	Installed Capacity	Annual Production	Capacity Utilisation
Auto tyres	Lakh Nos.	160.58	128.75	80.18	160.58	145.37	90.53	182.2	160.00	87.78
Auto tubes		171.45	127.07	74.12	127.66	74.46	74.46	193.73	145.00	74.85
Bicycle tyres		403.03	400.70	99.42	403.03	374.82	93.00	562.00	511.07	90.94
Bicycle tubes		392.72	250.00	63.66	392.72	360.12	91.7	410.00	373.01	90.97
V & Fan Belts		183.71	165.00	89.82	180.71	269.89	149.35	183.71	300.00	163.30
Rubber Conveyor Belting	Tonnes	8910	8613	96.67	8910	10418	116.92	8910	11450	128.51
Rubber Chemicals		36575	20369	55.69	36575	21574	58.99	36575	24000	65.62
Reclaimed Rubber		18365	17631	96.00	18365	16325	88.89	18365	18000	98.00
Carbon Black		154700	96958	62.68	154700	103152	66.68	154700	110000	71.40
Rubber Hoses	Mln. Mtrs.	13.45	6.40	47.58	13.45	2.20	16.36	13.45	2.50	18.59
Rubber Canvas Footwear	Million pairs	71.17	42.58	59.83	77.17	41.08	57.72	71.17	45.00	63.23
Contraceptives	Million pairs	711.30	576	80.98	713.00	794	111.36	1033	890	86.16

Source: Industry News Digest, Vol. 4, No.5, May 1988.

both for auto tyres and tubes and therefore, needs to be improved to make the industry cost effective.

Thus, from the analysis it emerges that the number of manufacturers, consumption of rubber and output of rubber products have increased remarkably over the last two decades. The study reveals that 86.51 per cent of the manufacturers are consuming below 50 tonnes of natural rubber. Capacity utilisation in the major sectors of the rubber industry, in general, is also above the manufacturing sector in the country.

CHAPTER III

GROWTH OF RUBBER PRODUCTION IN KERALA

Kerala was known for its spices and hill products from time immemorial. The cash or commercial crops always had a major share in the agricultural sector of Kerala. The traditional items of export of Kerala in the earlier period comprised mainly of coconut oil, coir and spices like turmeric, cardamom, pepper and ginger. Rubber, coffee, tea and other plantation crops emerged as export items of the state only very lately.

Natural rubber is obtained from the latex of various plants. But Hevea Brasiliensis is the most important species which supplies the natural rubber of commerce today. Rubber plantations were introduced in India by the Europeans. Rubber planting material was brought to India in 1878 from Ceylon. However it was only in 1902 that natural rubber cultivation was started in a commercial scale in the country. Interestingly the first commercial plantations of rubber was started in 1902 by the periyar syndicate at Thattakad near Alwaye in Kerala. The two important factors that were instrumental in the successful introduction of plantation agriculture in the colonial India were British capital initiative along with the favourable

agroclimatic conditions and the availability of cheap land and labour (George Tharian, et.al., 1988). Though rubber planting was taken up on a commercial scale in other parts of the country, it was Travancore which became the leading centre of rubber cultivation. Although rubber cultivation had its start on a plantation scale by British planters, subsequent increase in area under the crop is attributable to the enterprise of a large number of Indian propreitory planters belonging to the former native states of Travancore and Cochin, who came into the field later (George Tharian, et.al., 1988). The importance of rubber in the Kerala economy also arises from the fact that the share of rubber in the total area under the four major plantation crops of the state (rubber, coffee, tea and cardamom) is estimated to be 66.93 per cent and its share in the total cropped area in the state is 11.40 per cent during 1985-86. Although started in a modest scale, rubber plantations in Kerala have recorded a phenomenal growth after the post-independence period.

Rubber plantations in India consist of organised and unorganised sector. The organised sector comprises well organised estates and the unorganised sector represents thousands of small holders. Rubber plantations of over 20.23 hectares (50 acres) under a single ownership is treated as

estates and those whose area range upto 20.23 hectares are treated as holding. The rubber plantation industry is predominantly of the small holders which accounts for more than 80 per cent of the area and almost 75 per cent of the total production of natural rubber in the country.

3.1 Total Supply of Rubber

As already mentioned rubber production has increased substantially during the last two decades. In 1953-54 the production of natural rubber in Kerala is estimated to be 19759 tonnes (Table 3.1). This was 91.53 per cent of the total rubber production in India. Production had further increased to 23175 tonnes in 1960-61. The percentage increase is estimated to be 17.28 per cent. From 50495 tonnes in 1966-67 natural rubber production increased to 139349 tonnes in 1976-77. But interestingly in 1977-78 production of natural rubber decreased to 135709 tonnes. This is mainly due to a decrease in the average yield per hectare of rubber during 1977-78. In 1978-79 also production of natural rubber showed a declining trend. During the period 1967-68 to 1981-82 there was a setback in the growth rate indicated during the period 1947-48 to 1966-67. The setback was mainly due to the steep fall in the planting tempo during the period 1971-72 to 1977-78. Since the rubber tree takes about seven years to start giving

Table - 3.1

Production of Natural Rubber in Kerala and India

(Production in metric tonnes)

Year	Kerala	Index (1970-71 = 100)	India	Index (1970-71=100)
1955-56	21680	24.99	23730	25.75
1960-61	23175	26.71	25697	27.88
1965-66	46953	54.11	50530	54.82
1970-71	86773	100.00	92171	100.00
1971-72	95499	110.06	101210	109.81
1972-73	105934	122.08	112364	121.91
1973-74	117211	135.08	125153	135.78
1974-75	121558	140.09	130143	141.20
1975-76	128769	148.40	137750	149.45
1976-77	139349	160.59	149632	162.34
1977-78	135907	156.62	146987	159.47
1978-79	123677	142.53	135297	146.79
1979-80	136609	157.43	148470	161.08
1980-81	140320	161.71	153100	166.10
1981-82	139435	160.69	152870	165.85
1982-83	152662	175.93	165850	179.94
1983-84	162212	186.94	175280	190.17
1984-85	172092	198.32	186450	202.29
1985-86*	184563	212.70	200465	217.49
1986-87*	202129	232.94	219520	238.17

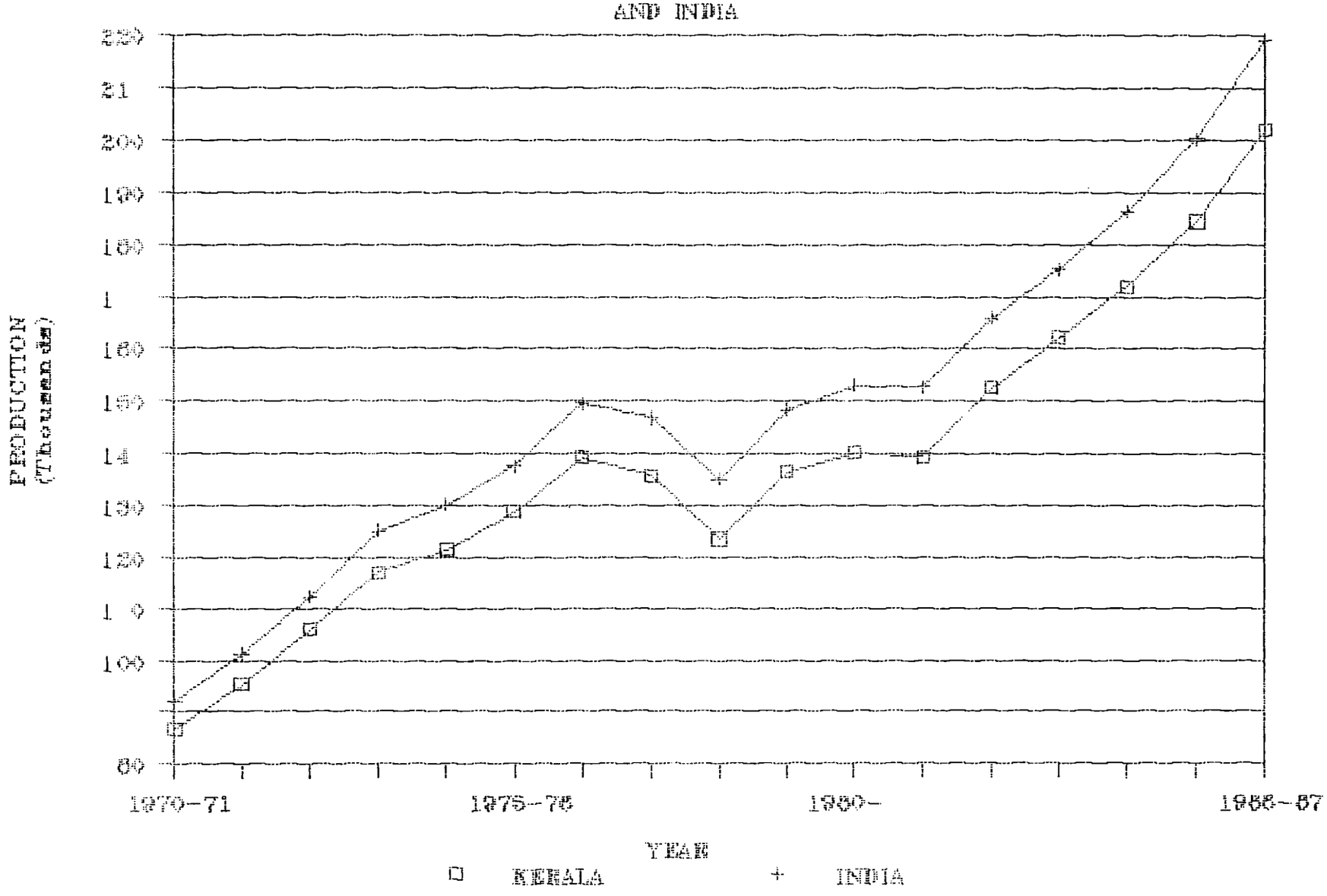
Note: *: Provisional.

Source: Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Diagram - 3.1

PRODUCTION OF NATURAL RUBBER IN KERALA

AND INDIA



yield the fall in growth rate of area during the period 1971-72 to 1977-78 resulted in a depression in growth rate of production during the period 1977-78 to 1981-82. There was also an industr wide strike of plantation workers in 1978-79. This also resulte in a decrease in production in 1978-79. However after 1981-82 rubber production showed an upward trend. From 181180 tonnes in 1981-82 rubber production increased to 218750 tonnes in 1986-87. This was 91.2 per cent of the total natural rubber production in India. The compound growth rate in rubber production during the period 1970-71 to 1986-87 is worked out to be 4.27 per cent (Appendix.1). If this growth rate is maintained natural rubber production in 2000 A.D. may be worked out to be 324713.24 tonnes. Another important positive factor which played a crucial role in the increase in rubber production in the initial phase of the industry was the favourable price.

Now we will examine the various factors which contributed to the growth of rubber production in the state. Fitting supply functions to perennial crops particularly in underdevelop countries is now fairly well-known. As the long run elasticities of perennial crops involve taking into consideration past prices or expected prices, most of the studies use the distributed lag model techniques. In the short run producers can adjust the supply only within their existing productive capacity. The following functional form is used to estimate

the output response of the cultivators:

$$Q_t = f(P_t, P_{t-1}, Y_t, Y_{t-1}, S_t, R_t)$$

where Q_t = production of natural rubber in the year t

P_t = price of natural rubber in the period t

P_{t-1} = lagged price of natural rubber

Y_t = current yield per hectare of natural rubber

Y_{t-1} = lagged yield per hectare of natural rubber

S_t = total stock of natural rubber in the year t

R_t = average annual rainfall in the period t.

The estimated equations are presented in table 3.2. In all the output response equations coefficient of determination is quite high. F values are also significant in all the equations. Estimated equations show that it is the current price rather than the lagged price which is more significant in determining the output response. Thus we can infer that the producers adjust the supply by increasing the tapping days by using rain guards and other measures. Further the coefficient of the rainfall variable in the output response equation is comparatively low. Coefficient of the current yield and lagged yield per hectare also turned out to be significant. It is also noticed that coefficient of total

Table - 3.2

Results of the Estimated Output Response Equations

(Dependent Variable Q_t)

Equation	Constant	P_t	P_{t-1}	Y_t	Y_{t-1}	R_t	S_t	R^2	R^{-2}	F	Short run elasticity
1.	-117332.159*	12.1023***	1.2112	309.216*				0.953	0.942	87.87	0.0974
	(7238.258)	(6.6992)	(14.7882)	(51.1836)							
2.	26534.99**	45.4181***	6.7541	--		--	1.2823*	0.885	0.8585	33.35	0.3656
	(11403.14)	(23.8651)	(26.030)				(0.4866)				
3.	-77598.71*	26.12447*			198.7672*		0.8112*	0.959	0.949	23.39	0.21
	(6806.911)	(6.3552)			(40.8533)		(0.2383)				
4.	-119771.00*	13.8062****		174.3303***	126.5848***	--	0.2330	0.969	0.9587	93.77	0.111
	(6145.480)	(8.4467)		(87.7268)	(51.7669)		(0.3619)				
5.	81534.31*	55.5772*		--			--	0.749	0.732	44.76	0.447
	(15692.61)	(8.3091)									
6.	96891.72*	53.7125*		--		-5.30168	--	0.756	0.740	46.48	0.432
	(16019.73)	(8.9879)				(8.4590)					

Note: * Significant at one per cent level.
** Significant at five per cent level.
*** Significant at ten per cent level.
**** Significant at twenty per cent level.

Source: Computed from Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

stocks also shows a positive relationship and significant at one per cent level. The price elasticity of supply is obtained by multiplying the price coefficient by the ratio of the mean of price and mean of output. Elasticity estimates show that although price elasticity is positive in all the equations it is less than unity.

3.2 Yield Response

The average yield per hectare of natural rubber has increased appreciably over the years. In 1953-54 the average yield per hectare was as low as 321 Kg. (Table 3.3). It has increased to 354 Kg. per hectare in 1960-61. The percentage increase is worked out to be 10.28 during the period. Productivity has further increased to 609 Kg. per hectare in 1969-70 During the 1970's also yield per hectare showed an increasing tendency. In 1976-77 productivity has increased to 806 Kg. per hectare. Interestingly from 1976-77 to 1981-82 average yield per hectare showed a marginal decline in tendency. In 1986-87 productivity of natural rubber in Kerala reached an all time high of 924 Kg. per hectare. The compound annual growth rate during the period 1970-71 to 1986-87 is estimated to be 1.77 per cent (Appendix 1).

Now let us examine the major contributory factors for the increase in yield during the period 1970-71 to 1986-87.

Table - 3.3

Average Yield per Hectare of Natural Rubber in Kerala and India

(Yield per hectare in Kilograms)

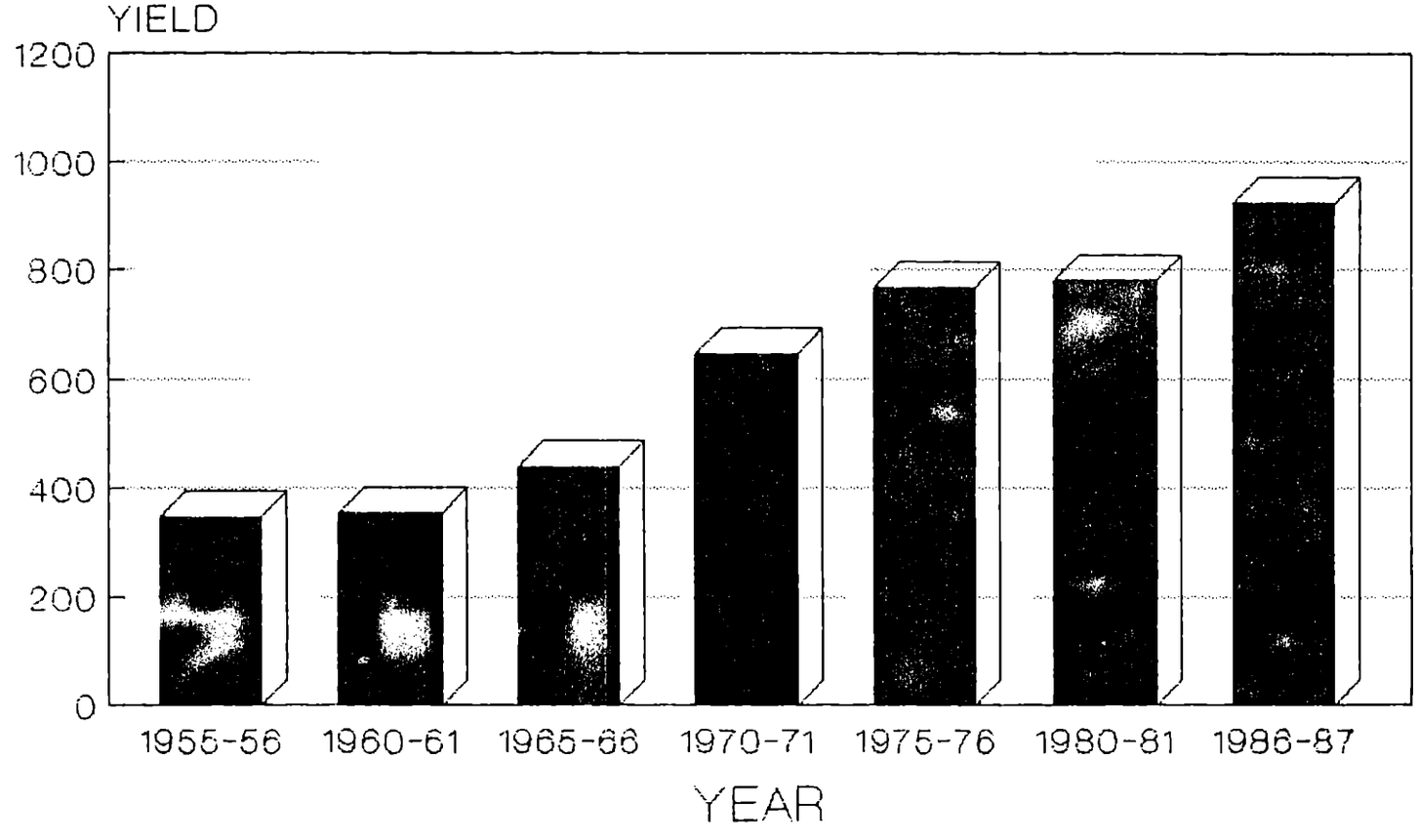
Year	Kerala	Index (1970-71=100)	India	Index (1970-71=100)
1955-56	347	53.63	353	54.06
1960-61	354	54.71	365	55.90
1965-66	440	68.01	448	68.61
1970-71	647	100.00	653	100.00
1971-72	673	104.02	678	103.83
1972-73	721	111.44	725	111.03
1973-74	750	115.92	756	115.77
1974-75	755	116.69	762	116.69
1975-76	768	118.70	772	118.22
1976-77	802	123.96	806	123.43
1977-78	764	118.08	770	117.92
1978-79	698	107.88	711	108.88
1979-80	764	118.08	771	118.07
1980-81	780	120.56	788	120.67
1981-82	770	119.01	779	119.30
1982-83	828	127.98	830	127.11
1983-84	864	133.54	857	131.24
1984-85	890	137.56	886	135.68
1985-86*	897	138.64	898	137.52
1986-87*	927	143.28	926	141.81

Note: *: Provisional.

Source: Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Diagram - 3.2

AVG.YLD.PER HR.OF RUBBER IN KERALA



We know that in the short run, producers can adjust the supply only within their existing productive capacity. Cultivators may adjust the yield in response to short run, price expectations through more intensive cultivation. The biological nature of rubber production requires at least one year to change the yield through cultural and manurial practices. The lag between fertiliser application and its effect on yield varies from one to three years. In the present study a model of the Nerlovian type has been used in the simplest form to analyse the farmers yield response to price movements. The yield response model is developed based on the following relation.

$$Y_t^* = a_o + a_1 P_{t-1} + U_t$$

$$(Y_t - Y_{t-1}) = r\,(Y_t^* - Y_{t-1}) \quad , \; o < r < 1$$

$$Y_t = b_o + b_1 P_{t-1} + b_2 Y_{t-1} + V_t$$

where $b_o = a_o r$, $b_1 = a_1 r$,

$b_2 = 1 - r$ and $V_t = r U_t$

The following functional relation is used in the study:

$$Y_t = f(P_t, P_{t-1}, Y_{t-1}, R_t, t, TA_t)$$

where Y_t^* = desired yield per hectare of natural rubber

Y_t = average yield per hectare of natural rubber in Kerala during the period t

P_t = current price of natural rubber

P_{t-1} = lagged price of rubber

Y_{t-1} = lagged yield per hectare of rubber

R_t = average rainfall during the period t

t = trend in years

TA_t = tappable area during the period t

b_i = regression coefficients

V_t = error term.

The estimated yield response equations show that lagged price has got a bearing on the cultivators' yield response decisions (Table 3.4). This supports our earlier observation that farmers use fertilisers and other pest control measures to increase productivity. Although the coefficient of the rainfall variable shows the right sign its value is comparatively low. This may be due to the fact that in recent years cultivators are using

Table - 3.4

Results of the Estimated Yield Response Equations

(Dependent Variable Y_t)

Equation	Constant	P_t	P_{t-1}	Y_{t-1}	R_t	t	TA_t	R^2	R^{-2}	F	Short run elasticity
1.	320.1252*	--	0.06339	0.585114	-0.01767	--	--	0.9299	0.9137	57.48	0.0828
	(25.4886)		(0.0249)	(0.13798)	(0.01395)						
	179.8320*	--	0.12742*	0.84814*	-0.0294	-10.1582	--	0.936	0.915	43.88	0.1664
	(22.8529)		(0.03849)	(0.17857)	(0.02376)	(8.9736)					
3.	294.3142*	--	0.07494*	0.5455*	--	--	--	0.903	0.889	65.16	0.0979
	(26.0321)		(0.02367)	(0.1373)							
4.	271.2949*	-0.0627	0.12876***	0.58887**	--	--	0.00001	0.918	0.891	33.59	0.1682
	(25.8955)	(0.04905)	(0.04507)	(0.22924)			(0.001)				
5.	638.9327*	--	0.15059***	--	--	--		0.7938	0.78	57.75	0.1967
	(36.6899)		(0.0782)								
6.	644.3074*	--	0.079657****	--	--	6.89357****	--	0.81560	0.789	30.96	0.1040
	(35.9058)		(0.05834)			(5.04684)					

Note: * Significant at one per cent level.
** Significant at five per cent level.
*** Significant at ten per cent level.
**** Significant at twenty per cent level.

Source: Computed from Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

rainguards to increase the tapping days during the rainy season also. Lagged yield emerged as an important variable in the yield response equation. The yield elasticities with respect to lagged price is positive. However their values turned out to be less than unity.

3.3 Growth of Area Under Natural Rubber

Area under natural rubber in Kerala has increased appreciably during the last three decades. Area under natural rubber was 78457 hectares in 1955-56 (Table 3.5). It has increased to 122628 hectares in 1960-61, ie. an increase of 56.29 per cent. From 122628 hectares in 1960-61 it further increased to 154878 hectares in 1965-66. During 1970's also area under rubber plantations has increased considerably. From 187762 hectares in 1970-71, area under rubber increased to 219866 hectares in 1980-81. This was 91.04 per cent of the total area under rubber in India. The area under rubber cultivation in the state in 1986-87 stood at 337700 hectares. Thus we find that during the period 1970-71 to 1986-87 a spectacular increase in area under rubber had taken place. The increase in the area over the period is more vividly brought out by the compound growth rate. The compound growth rate is estimated to be 3.89 (Appendix 1).

Table - 3.5

Area Under Natural Rubber in Kerala and in India

(Area in Hectares)

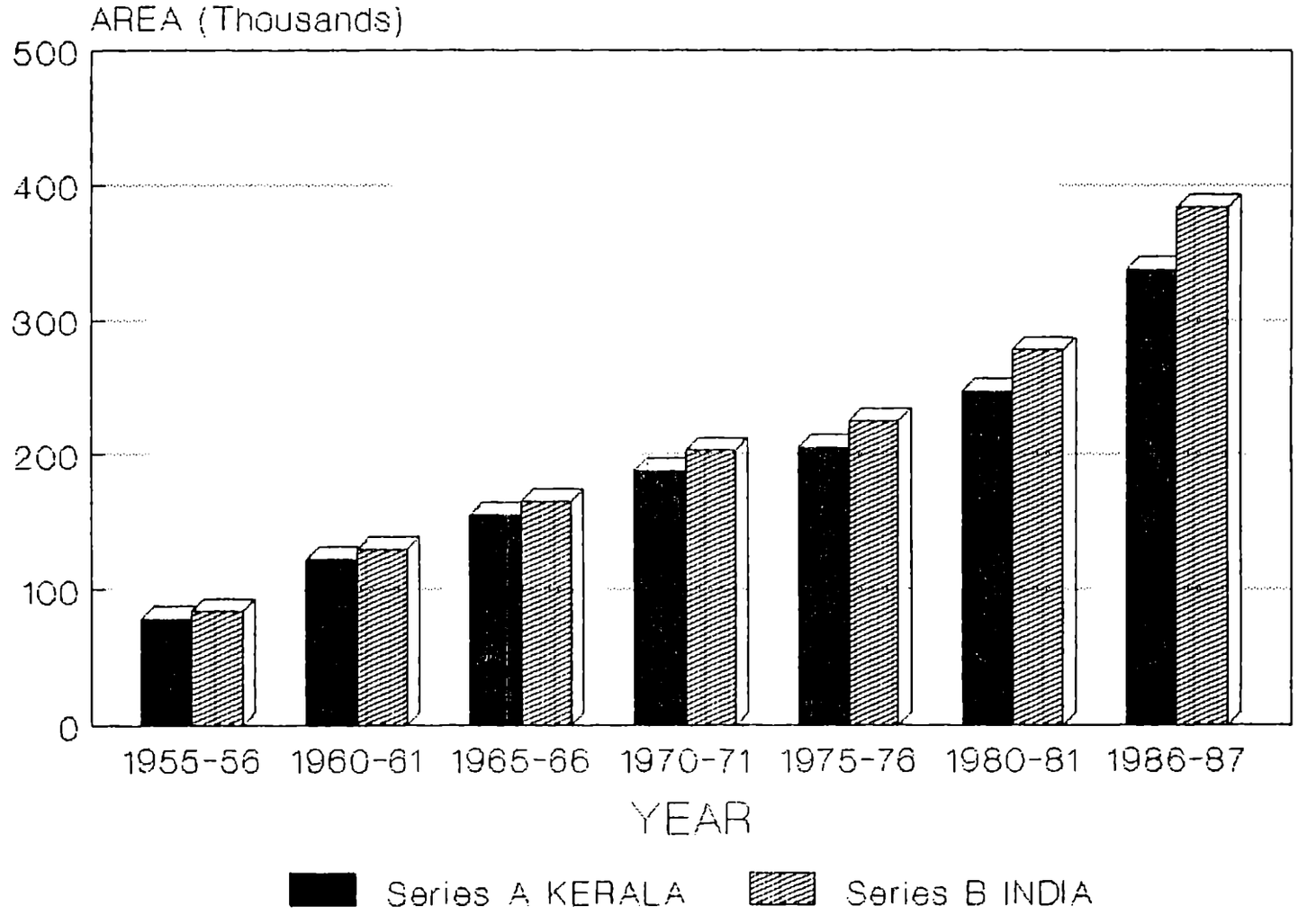
Year	Kerala	Index (1970-71=100)	India	Index (1970-71=100)
1955-56	78457	41.79	83867	41.29
1960-61	122628	65.31	129905	63.96
1965-66	154878	82.49	164713	81.10
1970-71	187762	100.00	203098	100.00
1971-72	191351	101.91	208781	102.80
1972-73	195493	104.12	213112	104.93
1973-74	199604	106.31	217540	107.11
1974-75	202318	107.75	221265	108.94
1975-76	205383	109.38	224428	110.50
1976-77	209723	111.70	230563	113.52
1977-78	219414	116.86	245200	120.73
1978-79	221823	118.14	249250	122.72
1979-80	232250	123.69	261495	128.75
1980-81	247180	131.65	278057	136.91
1981-82	262600	139.8	295543	145.52
1982-83	278050	148.09	313223	154.22
1983-84	294290	156.74	331767	163.35
1984-85	311982	166.16	351850	173.24
1985-86	326710	174.00	369348	181.86
1986-87*	337700	179.86	384000	189.07

Note: *: Provisional.

Source: Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Diagram - 3.3

AREA UND.NR.IN KRLA.& INDIA



Now let us examine some of the factors which are responsible for the remarkable increase in area during the period 1970-71 to 1986-87. It is believed that plantation crops in general are likely to have a low price elasticity of supply at least in the short run, because once the perennial crops are planted their output cannot be always withheld or stored. It has been conclusively established through several studies that there is a positive supply response to price incentives in underdeveloped countries. However, the magnitude of the farmers' response to price may vary with the nature of crop and between different regions of a country or state. This emphasises the need for regional studies or supply response of different crops.

There are two distinct approaches for analysing the acreage response in the case of farm commodities. The first is called as the traditional price lag model which assumes that the farmers instantaneously and fully adjust their acreage allocations in response to changes in lagged prices. The second is called adjustment lag model often referred to as Nerlove model. In the Nerlove model endogenous variable appears in a lagged form as an independent variable. This results in biased estimates to a certain extent. In order to avoid the problem of multicollinearity Fisher suggested a method of constructing a compound variable which incorporates

a lagged weighting scheme. In the present study Fisherian model also is used to analyse the acreage response.

3.3.1 Nerlove Model

Nerlove starts with the proposition that normal price expected in future depends on what prices have been in the past. Hence the lagged independent variables are introduced. He defined a long run acreage response function in the following manner:

$$A_t^* = a_o + a_1 P_{t-1} + V_t \qquad \text{——————(1)}$$

where A_t^* = desired long-run acreage

P_{t-1} = lagged price

V_t = error term.

a_o and a_1 are the constant and coefficient respectively. Again it is related with the actual acreage by assuming that in each period the actual area under crop is adjusted in proportion to the difference between the long run desired level of area and actual area under the crop in question.

$$A_t - A_{t-1} = r\,(A_t^* - A_{t-1}) \qquad \text{——————(2)}$$

$$o < r < 1$$

where r is the Nerlovian coefficient of adjustment. Substituting the value of equation (1) into equation (2) and solving for A_t we get

$$A_t = b_o + b_1 P_{t-1} + b_2 A_{t-1} + U_t \qquad \text{———(3)}$$

where $b_o = a_o r$, $b_1 = a_1 r$

$b_2 = 1 - r$ and $U_t = rV_t$.

Equation (3) is the reduced form and its parameters can be estimated by the use of ordinary least squares. However, more independent variables can be incorporated in the model. The short run elasticity (SRE) and long run elasticity (LRE) can be obtained by using the following relations:

$$SRE = a_1 \frac{\bar{P}_{t-1}}{\bar{A}_t} \quad \text{and}$$

$$LRE = \frac{b_1}{1 - b_2} \frac{\bar{P}_{t-1}}{\bar{A}_t} \quad \text{where}$$

$\bar{A}_t$ and $\bar{P}_{t-1}$ are the averages of the variables.

Bateman (1965) has also developed a supply response model in line with the Nerlove model. This was developed to explain the supply of cocoa in Ghana and can be presented as

$$A_t = a_o + a_1 \bar{P}_t + U_t \qquad \text{———— (4)}$$

where $\bar{P}_t$ is the average expected future real price. Bateman then argues that movements in actual producer price affect the farmers' expectations of the future. The formulation adopted is the Nerlovian price expectations model.

$$(\bar{P}_t - \bar{P}_{t-1}) = r\,(P_t - P_{t-1}) \qquad \text{(5)}$$

$$0 < r < 1$$

Equations (4) and (5) can be combined to eliminate the price expectational variables which are not observable. The estimating equation obtained is given by

$$A_t = a_o\, r + a_1\, r\, P_1 + (1 - r)\, A_{t-1} + V_t$$

where $V_t = U_t - (1 - r)\, U_{t-1}$

The functional form used in the present study is given below:

$$A_t = f\,(P_t, P_{t-1}, S_t, A_{t-1}, Y_{t-1}, R_t, t)$$

where

A_t = area under natural rubber

A_{t-1} = lagged area under natural rubber

P_t = current price of natural rubber

P_{t-1} = lagged price of natural rubber

S_t = total stock of natural rubber in the period t

Y_t = yield per hectare of natural rubber

Y_{t-1} = lagged yield per hectare of natural rubber

R_t = average rainfall during the period t

t = trend in years.

As already mentioned, in the Nerlove model lagged area appears as an independent variable. In this model there is a chance of getting biased estimates. Grilliches (1976) suggested an alternative by the use of two stage least squares (TSLS). That is first regress A_t on P_t then add P_{t-1}, P_{t-2} and so on as long as regression coefficients make sense, then regress A_t on P_t and A_{t-1} (ie. the estimated A_{t-1} which gives the highest R^2 and significant estimates).

3.3.2 Fisher's Model

We had estimated the acreage response with the help of Nerlovian model (TSLS). But it has been found that in such a model multicollinearity presents a problem. The usage of the

independent variables this way causes P_t, P_{t-1} etc. to be linearly related. Fisher suggested a method of constructing a compound variable which incorporates a lagged weighting system following a simple linear lag scheme. In the present study a declining weights specification was used. Under this specification the cultivators are assumed to form their expectation as to future prices on the basis of current prices and past prices with declining weights. This is particularly important in the case of rubber because rubber tree matures after five to seven years. A long run and short run response are implied since the effect of a given price in one period is assumed to be distributed over more than one subsequent period. The Fisherian models worked out here are given below:

1) $PZY_2 = 1/3\ (2P_t + P_{t-1})$

2) $PZY_3 = 1/6\ (3P_t + 2P_{t-1} + P_{t-2})$

3) $PZY_5 = 1/15\ (5P_t + 4P_{t-1} + 3P_{t-2} + 2P_{t-3} + P_{t-4})$

4) $PZY_7 = 1/28\ (7P_t + 6P_{t-1} + 5P_{t-2} + 4P_{t-3} + 3P_{t-4} + 2P_{t-5} + P_{t-6})$

Here the price variables have been formed as a weighted sum of

current and past with declining weights. Area under rubber cultivation A_t was regressed on this price variable. In the Fisherian model the long run elasticities are derived by multiplying the price coefficients by the respective ratios of the means of price and means of total area under rubber cultivation. The short run elasticities in these cases is obtained by multiplying the long run elasticity by the respective weight (< 1) attached to the current price in the coefficient of the compound price variable.

3.3.3 Empirical Results

All the price variables considered had the expected signs for their coefficient (Table 3.6 and 3.7). Nerlovian and Fisherian models showed that for eight year lags there exists positive price coefficient (Table 3.8). This reveals that farmers are aware of the price changes and they do take into consideration all these aspects in their planting decisions. Coefficient of lagged area is found to be positive in all the equations. Although the coefficient of rainfall variable shows the right sign in almost all the equations it is found to be statistically not significant. The trend variable is positive and significant in majority of the estimated equations. Elasticity estimates are found to be less than unity in majority of the equations.

Table - 3.6

Results of the Acreage Response Equations

(Dependent Variable A_t)

Model	Form of price coefficient	Constant	Price coefficient	A_{t-1}	t	R^2	R^{-2}	F	Short run elasticity	Long run elasticity
a) Nerlove (2SLS) (Seven year lag)	1) P_t (Eight year lag)	11874.37* (2706.297)	19.8301* (4.3474)	0.9032* (0.0413)		0.997	0.996	1329.33	0.093	0.961
	2) P_t (Eight year lag)	43621.90* (2679.62)	11.0472**** (7.221)	0.7540* (0.1444)	2895.60 (2688.40)	0.997	0.995	775.44	0.0518	0.211
b) Nerlove(2SLS) (Six year lag)	1) P_t (Seven year lag)	-11664.58* (2827.476)	19.7371* (4.5486)	0.904496* (0.04325)		0.997	0.996	1329.33	0.0926	0.9696
	2) P_t (Seven year lag)	52549.44* (2623.665)	8.32797**** (5.6389)	0.71264* (0.13295)	3737.647*** (2469.344)	0.998	0.997	1164.33	0.04	0.136
c) Nerlove(2SLS) (Five year lag)	1) P_t (Six year lag)	11265.15* (3466.926)	19.2952* (5.6198)	0.90823* (0.053499)		0.995	0.994	796.0	0.0905	0.986
	2) P_t (Six year lag	69594.12* (2843.635)	2.9491 (8.7105)	0.63481* (0.13118)	5341.679 (2415.256)	0.997	0.995	775.44	0.0138	0.0379

Note: *: Significant at one per cent level.
****: Significant at twenty per cent level.

Source: Computed from Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Table - 3.7

Results of the Acreage Response Equation

(Dependent Variable A_t)

Model	Form of price coefficient	Constant	Price coefficient	A_{t-1}	t	Y_{t-1}	R^2	R^{-2}	F	Short run elasticity
a) Nerlove (OLS)	1. P_{t-1}	26942.69	10.4279***	0.93023*	994.3215***	-26.7029	0.997	0.996	997.00	0.0409
		(3019.38)	(6.5793)	(0.071626)	(608.6585)	(23.1088)				
b) Simple expectations	2. P_{t-1}	10684.20*	15.8415**	0.95289*	--	- 7.3551	0.997	0.996	1440.11	0.0621
		(3207.32)	(6.0376)	(0.07465)		(21.0783)				
	P_{t-1}	143162.60*	104.59*	--	--	--	0.934	--	211.82	0.41
		(13304.50)	(7.186)							
c) Logarithmic function (Nerlove)	P_{t-1}	0.11789*	0.04107**	0.9585*	--	--	0.996	0.995	1699.70	0.041
		(0.00588)	(0.01896)	(0.0512)						

TABLE 3.8

Results of the Acreage Response Equations

(Dependent Variable A_t)

Model	Form of price Variable	Constant	Price Co-efficient	t	R_t	R^2	R^{-2}	F	Short run elasticity	Long run elasticity
Fisher										
Declining weight specification	1) PZY_7	140147.930* (4528.210)	98.53243* (21.37123)	2923.974 (2183.269)	--	0.9924	0.991	587.61	0.393	0.098
	2) PZY_7	137313.251* (4711.988)	94.31963* (23.4841)	3441.374**** (2453.654)	1.56893 (2.81042)	0.993	0.990	378.29	0.376	0.0941
	3) PZY_5	151759.920* (6294.569)	63.52002** (24.61662)	6188.406** (2629.979)	--	0.985	0.982	295.5	0.268	0.892
	4) PZY_5	146148.96* (6463.733)	57.96746** (26.39328)	6935.876** (2887.51)	2.7883 (3.8118)	0.986	0.981	187.81	0.245	0.081
	5) PZY_3	167755.062* (7873.043)	23.27403 (23.16969)	10368.05 (2544.92)	--	0.979	0.974	209.79	0.1034	0.0517
	6) PZY_3	158004.9561* (7923.366)	17.60208 (24.08377)	11229.26* (2719.699)	4.3509 (4.6222)	0.979	0.971	124.32	0.0782	0.039
	7) PZY_2	175714.363* (8263.126)	6.213366 (21.14735)	12175.95* (2354.971)		0.975	0.969	175.5	0.0282	0.019
	8) PZY_2	163825.200* (8183.467)	0.3716 (21.625)	13106.45* (2485.10)	5.1756 (4.773)	0.978	0.970	118.55	0.0017	0.0013

Note: * Significant at one per cent level.

** Significant at five per cent level.

**** Significant at twenty per cent level.

Source: Computed from Indian Rubber statistics, Vol.18, Rubber Board, Kottayam, 1988.

Thus the study reveals that short term output response is mainly affected by current price rather than lagged price. In the case of long run acreage response cultivators are influenced by the past eight years' prices in their planting decision and they positively respond to price. Coefficient of price variable in the yield response equation shows that cultivators are aware of the price changes and furthermore that they take such factors into consideration by applying more yield-increasing inputs. Thus the increasing prices might have accelerated the planting of rubber in new areas and substitution of other crops by rubber.

In short we can say that rubber production in Kerala has increased considerably during the last three decades. Favourable price was one of the major reasons for the increase in rubber production in the state.

CHAPTER IV

RUBBER-BASED INDUSTRY IN KERALA

Although rubber cultivation in Kerala was started by the beginning of the century, the rubber-based industries in Kerala started only around 1935. The rubber plantation industry has recorded a phenomenal growth during the post independence period and is characterised by an upward trend in production and area. The increase in rubber production in the state was one of the major reasons for the development of rubber-based industry in Kerala.

4.1 Growth of Rubber-Based Industrial Units

Five decades have passed since rubber-based industry started production in Kerala. The first one was the Trivandrum Rubber Works which was started in 1935. In 1964-65 there were only 43 rubber manufacturing units in the state as against 818 units in India (Table 4.1). It had increased to 109 units in 1968-69. This was 9.36 per cent of the total rubber-based units in India. In the subsequent years also the number of licensed manufacturers in the state had increased remarkably. In 1973-74 10.09 per cent of the total licensed manufacturers were in Kerala

Table - 4.1

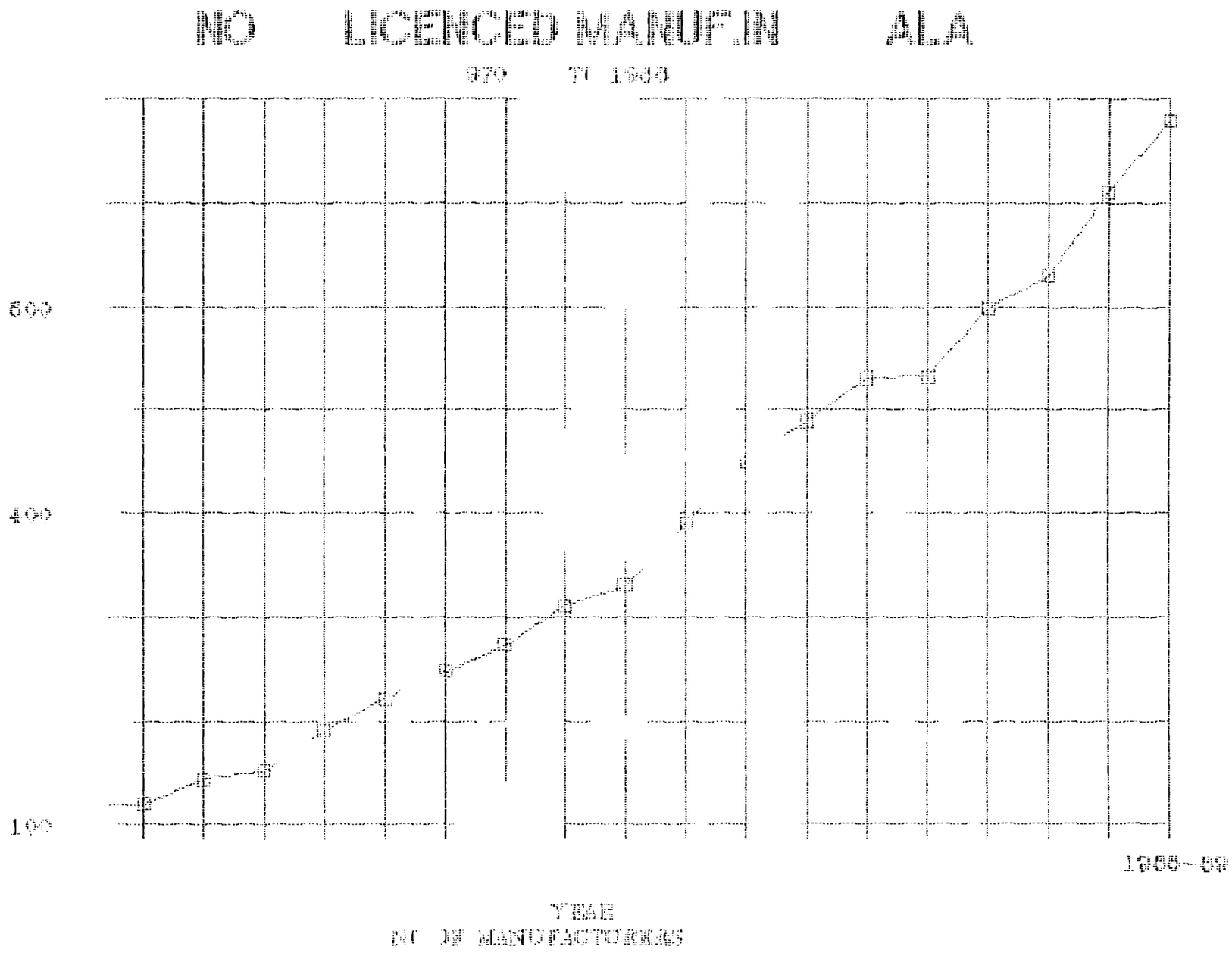
Number of Licensed Manufacturers in Kerala at the End of Each Year

Year	Kerala	India
1965-66	54	838
1970-71	119	1281
1971-72	120	1310
1972-73	144	1397
1973-74	152	1506
1974-75	191	1648
1975-76	221	1844
1976-77	248	2003
1977-78	273	2119
1978-79	311	2456
1979-80	331	2640
1980-81	391	2826
1981-82	450	3021
1982-83	490	3226
1983-84	531	3326
1984-85	533	3442
1985-86	599	3769
1986-87	630	4009
1987-88	711	4393
1988-89*	780	5486

Note:* Provisional.

Source: Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Diagram - 4.1


NO LICENCED MANUF.IN ALA
600
400
100
1960-69
TIME
NO OF MANUFACTURERS

This was only a marginal improvement when compared to 1968-69. In 1975-76 there were 221 licensed manufacturers in Kerala. Interestingly in 1973-74 Delhi, Maharashtra, West Bengal and Punjab had more licensed manufacturers than Kerala. In 1975-76 only West Bengal and Maharashtra were ahead of Kerala. From 248 in 1976-77 the number of licensed manufacturers in Kerala has increased to 391 in 1980-81. During 1985-86 the number of licensed manufacturing units in the state further increased to 599. The total number of units in India during the year was found to be 3769. In 1986-87 there were 630 rubber manufacturing units in Kerala. This was 15.72 per cent of the total rubber manufacturing units in the country. In 1988-89 there were 780 rubber manufacturing units in the state. The compound annual growth rate in the number of manufacturing units during the period 1970-71 to 1988-89 is estimated to be 11.42 per cent. This is a considerable increase by all means. Out of the 780 rubber manufacturing units 182 units are rubber band manufacturing units, 179 are tread rubber manufacturing units and 168 are footwear manufacturing units. Only 12 units are manufacturing tyres, tubes and flaps.

4.2 Consumption of Rubber

As already mentioned Kerala produces 92.1 per cent of the total natural rubber in India. Although consumption of

natural rubber in the state has increased appreciably over the years the share of Kerala in the total consumption in the country has been low. In 1965-66 the consumption of natural rubber in Kerala was 3353 tonnes (Table 4.2). This was only 5.25 per cent of the total consumption of natural rubber in India. Consumption of natural rubber further increased to 5443 tonnes in 1967-68. However, in 1969-70 consumption has decreased to 4922 tonnes. In 1971-72 the consumption of natural rubber in Kerala further increased to 7868 tonnes. This was only 8.15 per cent of the total consumption of natural rubber in India. In the subsequent years also the consumption of natural rubber in Kerala has increased considerably. In 1975-76 the consumption of natural rubber in Kerala was estimated to be 9268. However, it was only 7.19 per cent of the total natural rubber production in Kerala. The consumption of natural rubber decreased to 8735 tonnes in 1976-77. In 1977-78 consumption of natural rubber almost doubled when compared to the previous year. Subsequent years also showed an increase in the consumption of natural rubber. In 1986-87 consumption of natural rubber in the state stood at 31445 tonnes. This was only 12.22 per cent of the total consumption of natural rubber in India. The compound annual growth rate in the consumption of natural rubber in the state during the period 1970-71 to 1986-87 is worked out to be 11.08 per cent.

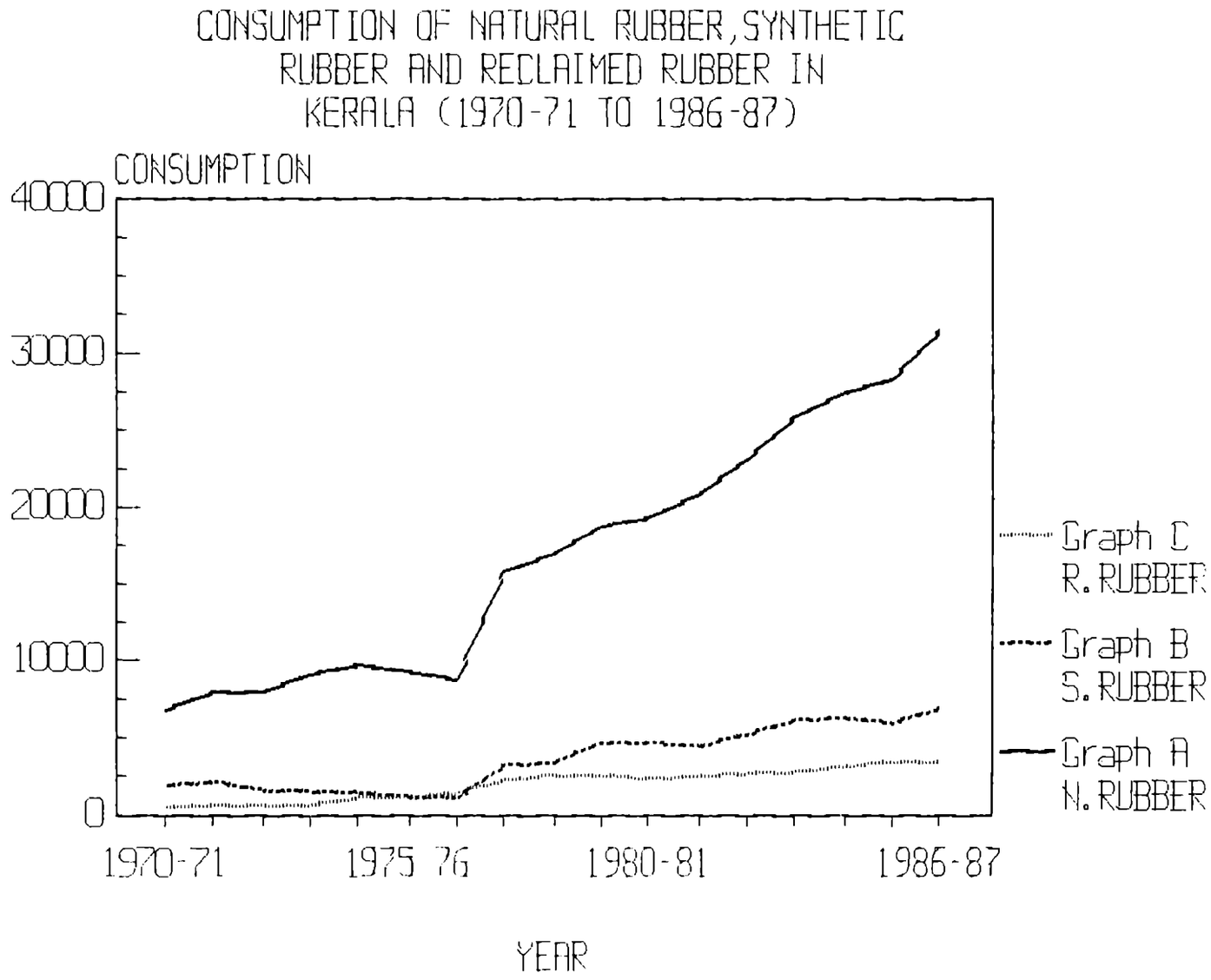
Table - 4.2

Consumption of Different Kinds of Rubber in Kerala

Year	Natural Rubber	Synthetic Rubber	Reclaimed Rubber	Total
1970-71	6739	1798	380	8917
1971-72	7868	2115	560	10543
1972-73	7913	1547	526	9986
1973-74	9035	1423	610	11068
1974-75	9690	1380	977	12047
1975-76	9268	1062	1069	11399
1976-77	8735	1036	1395	11166
1977-78	15732	3102	2153	20987
1978-79	16905	3297	2533	22735
1979-80	18785	4626	2526	25937
1980-81	19283	4605	2293	26181
1981-82	20819	4329	2451	27599
1982-83	23129	5191	2640	30960
1983-84	25811	6088	2660	34599
1984-85	27420	6197	3007	36624
1985-86	28341	5896	3375	37612
1986-87	31445	6872	3423	41740

Source: Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Diagram - 4.2


CONSUMPTION OF NATURAL RUBBER, SYNTHETIC RUBBER AND RECLAIMED RUBBER IN KERALA (1970-71 TO 1986-87)
CONSUMPTION
40000
30000
20000
10000
0
1970-71
1975 76
1980-81
1986-87
YEAR
Graph C
R. RUBBER
Graph B
S. RUBBER
Graph A
N. RUBBER

Now we will examine some of the reasons for the increase in the consumption of natural rubber in the state. We have noticed that the increase in the number of manufacturing units, production of natural rubber and industrial production are some of the causes for the increase in rubber consumption in Kerala. This can be substantiated by the following estimated equation:

$$CNR_K = -18561.453^{*} + 0.14898^{*} Q_t + 101.2863^{**} IIP_K$$
$$(3010.633) \quad (0.04755) \quad (40.7092),$$
$$R^2 = 0.885, \quad \bar{R}^2 = 0.868, \quad F = 53.77$$

where

CNR_K = consumption of natural rubber in Kerala.

Q_t = production of natural rubber in Kerala

IIP_K = index of industrial production in Kerala.

Empirical evidence supported our observation that increase in natural rubber production and industrial output have significant influence on the increase in consumption of natural

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*: Significant at one per cent level.
**: Significant at five per cent level.

rubber in the state. Coefficient of determination also turned out to be high. The foregoing analysis reveals that there has been an appreciable progress in the consumption of natural rubber in the state during the last two decades. However, the progress was much below the expected level. Although Kerala produces 92.1 per cent of the total natural rubber in the country it consumes only 14.93 per cent of the total production of natural rubber in the state.

The consumption of synthetic and reclaimed rubber has also increased over the years (Table 4.2). The consumption of synthetic rubber in 1965-66 was only 517 tonnes. This has increased to 1798 tonnes in 1970-71. Synthetic rubber consumption has further increased to 6872 tonnes in 1986-87. This was 9.57 per cent of the total synthetic rubber consumption in the country. The compound annual growth rate in synthetic rubber consumption during the period 1970-71 to 1986-87 is estimated to be 15.07. Reclaimed rubber consumption has also increased considerably during the period under study. From a mere 293 tonnes in 1965-66 reclaimed rubber consumption increased to 380 in 1970-71. In 1986-87 reclaimed rubber consumption in the state stood at 3423 tonnes. This was 8.86 per cent of the total consumption of reclaimed rubber in the country. The annual compound growth rate in reclaimed rubber consumption during the period 1970-71 to 1986-87 is found to be 13.24 per cent.

The total consumption of all kinds of rubber stood at 8917 tonnes in 1970-71. It increased to 20987 tonnes in 1977-78. From 22735 tonnes in 1978-79 the consumption of rubber further increased to 34559 tonnes in 1983-84. The consumption of all kinds of rubber in 1986-87 stood at 41740 tonnes in 1986-87. The percentage growth rate when compared to 1970-71 is found to be 368.09. When we take the share of natural rubber in the total consumption of all kinds of rubber (Natural, synthetic and reclaimed rubber) we can see that 75.57 per cent was accounted by natural rubber alone in 1970-71. Share of synthetic rubber and reclaimed rubber in the total consumption of all kinds of rubber was found to be 20.16 per cent and 4.67 per cent respectively in 1970-71. In 1986-87 share of natural rubber, synthetic rubber and reclaimed rubber in the total consumption of all kinds of rubber is found to be 75.34 per cent, 16.46 per cent and 8.20 per cent respectively. Thus we can find that in 1986-87 natural rubber maintained its share when compared to 1970-71.

Besides tyres and tubes, the other important rubber products manufactured in the state are tread rubber, footwear, latex foam products, rubber band, rubberised coir products, balloons, rubber thread, automobile components, contraceptives and toys. As already mentioned, there are at present 70,000

Table - 4.3

Total Number of Licensed Rubber Manufacturing Units and their Licensed Quantity of Consumption of Natural Rubber in 1988-89

Sl.No.	Production group	No. of Units	Licensed quantity of consumption
1.	Adhesive	7	126
2.	Dipped goods	19	122
3.	Foam products	52	2014
4.	Footwear	168	6509
5.	Gloves	20	395
6.	Hoses	3	426
7.	Latex thread	23	426
8.	Moulded and extruded goods	40	929
9.	Rubber bands	182	1628
10.	Rubberised Coir and Jute Woolen products	29	1801
11.	Surgical and pharmaceutical goods	1	860
12.	Tread Rubber	179	10411
13.	Tyre, tube, flaps	12	16413
14.	Others	45	6521
15.	Total	780	48581

Source: 1) Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

2) Hand Book of Rubber Statistics, AIRMA, Bombay, 1989.

different products based on natural rubber. New uses are also being discovered day by day. However, out of 70,000 different products only a few are produced in Kerala (Mathew, 1982).

As already mentioned there were 780 rubber manufacturing units in Kerala in 1988-89. In the case of licensed quantity of consumption of natural rubber, tyres and tube industries accounted for 33.78 per cent of the total consumption of natural rubber in the state in 1988-89 (Table 4.3). Tread rubber units accounted for 21.43 per cent of the total consumption of natural rubber. These two sectors together accounted for 55.22 per cent of the total licensed quantity of natural rubber consumed in the state. Although rubber band manufacturing sector is having the largest number of units it consumes only 3.35 per cent of the total consumption of natural rubber in the state.

4.3 Fixed Capital, Working Capital, Number Employed, Wages and Salaries, Materials consumed, Total Input, Total Output and Value Added

Annual Survey of Industries (factory sector) classified rubber-based industry into three sub-groups viz.

1) Tyres and tube industry.

2) Manufacture of footwear made primarily of vulconised or moulded rubber.

3) Manufacture of rubber products not elsewhere classified. However in the case of Kerala the second and third groups are combined together.

Fixed capital investment in the tyres and tube industry has increased from Rs.186.12 lakhs in 1973-74 to Rs.2762.46 lakhs in 1979-80 (Table 4.4). It showed a declining trend afterwards and stood at Rs.1726.18 lakhs in 1984-85. This was only 1.35 per cent of the total fixed capital investment in the state. It is to be noted that its share was only 0.46 per cent in 1973-74. Thus we can see that fixed capital in the tyres and tube industry has increased at an annual compound rate of 28.16 per cent. It is to be mentioned that increase in fixed capital investment in constant prices (1970-71) is comparatively low. Fixed capital investment in the other rubber products sector has increased from Rs.336.99 lakhs in 1973-74 to Rs.1237.83 lakhs in 1984-85 (Table 4.5). Share of other rubber products sector in the total fixed capital investment in the state in 1973-74 was found to be 0.84 per cent. This has increased slightly to 0.89 per cent in 1984-85. The compound annual growth rate in fixed capital investment in the other rubber products sector during the period 1973-74 to 1984-85 is worked out to be 10.45 per cent. When we take the rubber-based industry as

Table - 4.4

Fixed Capital, Working Capital, Wages and Salaries to Employees, Number Employed, Materials Consumed, Total Inputs, Total Output and Value Added in the Tyres and Tube Industry for the Years 1973-74 to 1984-85.

(Value in lakhs)

Year	Fixed Capital	Working Capital	Wages and Salaries	Number Employed	Materials Consumed	Total Inputs	Total Output	Value added
1973-74	186.12	125.37	50.74	1300	1087.18	1107.71	1531.69	423.86
	(151.69)	(89.74)	(37.63)		(778.223)	(792.92)	(1478.47)	(409.25)
1974-75	231.67	638.61	209.81	1920	1415.23	1505.44	2110.51	514.86
	(148.13)	(365.13)	(120.063)		(809.17)	(860.74)	(1542.77)	(376.66)
1975-76	381.06	656.53	240.97	1880	1913.72	2097.04	2749.28	605.24
	(220.78)	(379.50)	(133.27)		(1106.20)	(1212.16)	(1772.59)	(390.23)
1976-77	441.79	719.22	186.07	1215	1361.27	1546.84	2035.66	522.21
	(259.73)	(407.26)	(114.77)		(770.82)	(875.90)	(1312.48)	(336.69)
1977-78	551.50	558.06	238.52	1787	1224.34	1410.00	1957.81	510.35
	(319.53)	(300.36)	(148.05)		(658.96)	(758.88)	(1273.79)	(532.04)
1978-79	542.05	464.67	201.65	2067	1016.43	1148.45	1563.39	368.65
	(294.75)	(250.09)	(119.19)		(547.06)	(618.11)	(861.37)	(203.11)
1979-80	2762.46	969.65	312.21	2272	2481.06	2837.89	3988.59	835.56
	(1279.51)	(445.61)	(168.44)		(1140.19)	(1304.18)	(1847.42)	(387.01)
1980-81	2544.46	1405.46	277.89	2213	2943.63	3299.01	4047.85	432.74
	(1062.85)	(546.23)	(135.19)		(1144.05)	(1282.165)	(1605.65)	(171.65)
1981-82	2370.19	1168.53	297.94	2116	3412.62	3948.42	4544.82	277.28
	(894.074)	(415.40)	(124.75)		(1213.16)	(1403.63)	(1561.74)	(95.28)
1982-83	2224.27	1441.85	437.82	2545	5136.10	5776.02	9171.61	3046.82
	(794.67)	(499.43)	(174.42)		(1779.04)	(2000.70)	(2907.01)	(965.71)
1983-84	2020.00	1676.34	492.08	2723	4672.32	5390.19	7225.87	1469.89
	(698.00)	(530.49)	(165.42)		(1478.86)	(1705.76)	(2221.98)	(452.00)
1984-85	1726.18	1339.63	412.47	2282	4643.72	5402.67	6461.56	728.31
	(568.57)	(395.38)	(128.82)		(1372.26)	(1596.53)	(1874.55)	(211.29)

Figures brackets

Annual Survey of Industries (factory sector), Directorate of and Statistics, Trivandrum.

Diagram - 4.3

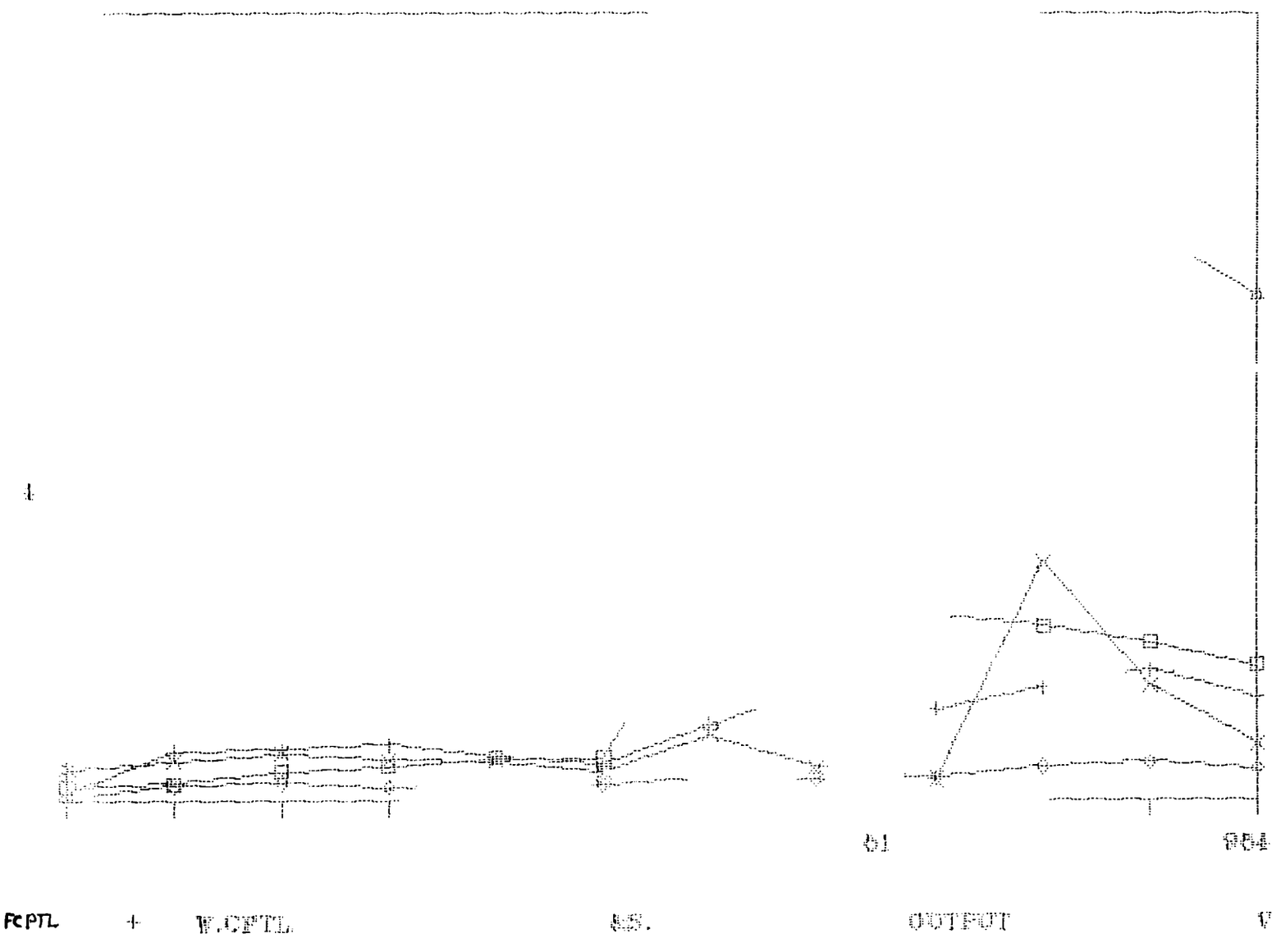


Table - 4.5

Fixed Capital, Working Capital, Wages and Salaries to Employees, Number Employed, Materials Consumed, Total Inputs, Total Output and Value Added in the Other Rubber Products Sector for the years 1973-74 to 1984-85

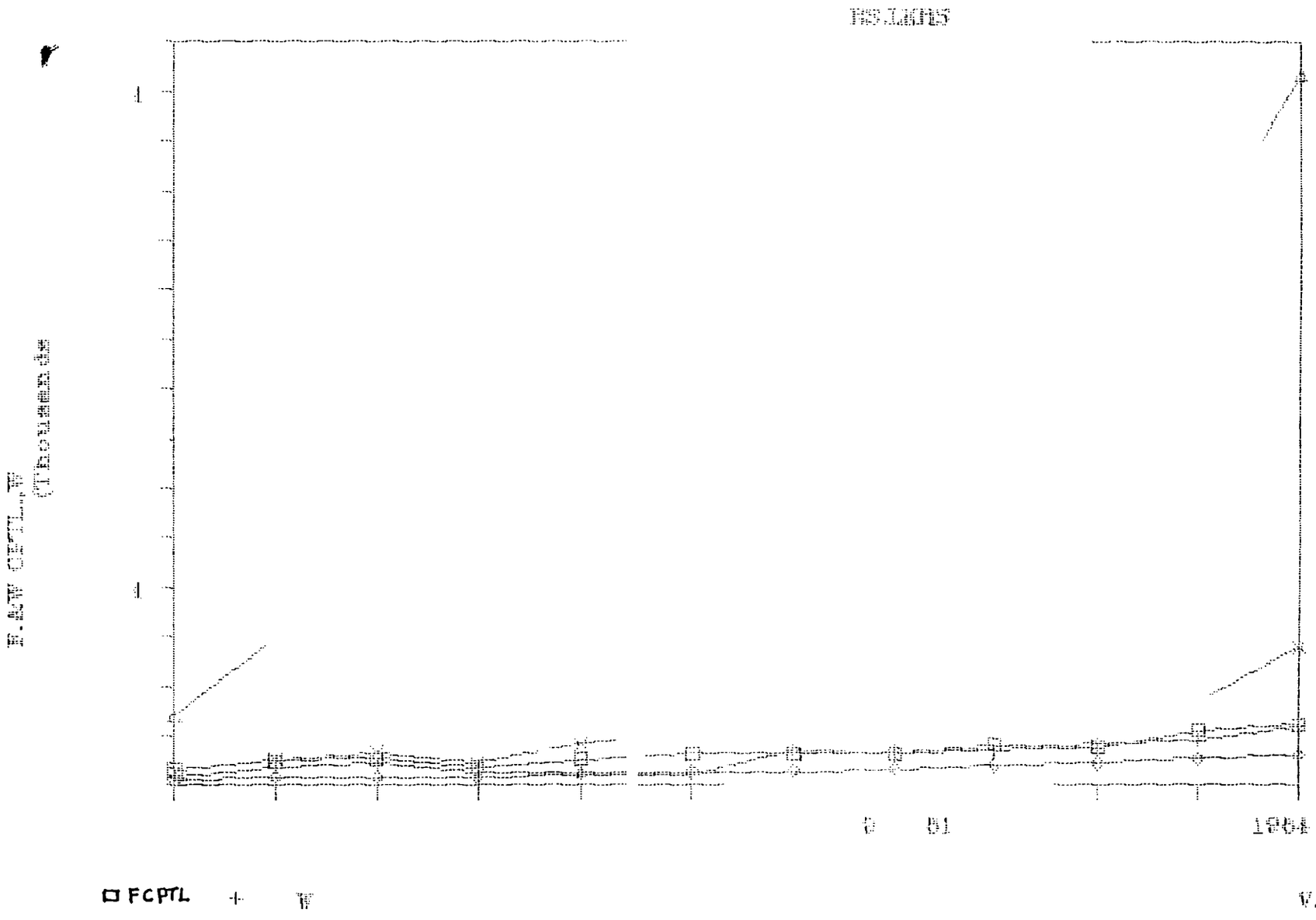
(Value in lakhs)

Year	Fixed Capital	Working Capital	Wages and Salaries	Number Employed	Materials Consumed	Total Inputs	Total Output	Value added
1973-74	336.99	175.95	116.65	3599	1079.96	1116.03	1411.92	295.89
	(274.65)	(125.95)	(86.50)		(773.06)	(798.88)	(1340.85)	(280.97)
1974-75	494.17	377.23	173.00	3687	2329.94	2383.23	2958.20	521.68
	(315.97)	(215.68)	(99.00)		(1332.16)	(1362.62)	(2113.00)	(372.63)
1975-76	559.20	438.47	175.68	3971	2577.80	2845.58	3590.38	684.07
	(323.93)	(253.51)	(97.16)		(1490.06)	(1644.84)	(2288.32)	(435.99)
1976-77	378.57	267.84	156.27	4084	2325.81	2548.82	3145.07	449.16
	(222.56)	(151.66)	(96.39)		(1317.00)	(1443.27)	(2000.68)	(285.73)
1977-78	519.12	276.19	237.35	4745	2612.08	2921.80	3819.61	831.79
	(300.76)	(148.65)	(147.32)		(1405.86)	(1572.55)	(2434.42)	(530.14)
1978-79	650.01	228.04	265.68	7158	3395.11	3776.54	4895.01	1023.94
	(353.46)	(122.73)	(157.03)		(1827.29)	(2032.58)	(2691.04)	(562.91)
1979-80	642.57	717.56	277.94	4525	4375.92	4848.39	6720.46	1791.75
	(297.62)	(329.76)	(149.95)		(2010.99)	(2228.12)	(3127.25)	(833.76)
1980-81	641.81	653.13	331.58	5351	5614.36	6305.45	7685.94	1295.14
	(268.09)	(253.84)	(161.31)		(2182.03)	(2450.62)	(3089.20)	(520.55)
1981-82	814.96	695.90	414.14	5585	6031.75	6850.49	8532.66	1543.30
	(307.42)	(247.39)	(173.4)		(2144.24)	(2435.30)	(3003.40)	(543.22)
1982-83	768.04	833.87	461.82	5359	8353.46	9130.23	11031.55	1780.93
	(274.40)	(288.84)	(183.98)		(2893.47)	(3162.53)	(3603.90)	(581.81)
1983-84	1119.94	924.97	552.53	5629	8390.07	9108.73	10947.83	1697.41
	(386.99)	(292.71)	(185.74)		(2655.06)	(2882.51)	(3457.94)	(1536.14)
1984-85	1237.83	1202.23	623.40	4959	10640.58	11417.69	14360.77	2799.79
	(407.72)	(355.27)	(194.61)		(3144.06)	(3374.02)	(4282.96)	(835.01)

Note: Figures deflated values (1970-71 prices).

Source: Annual Survey of Industries, (Factory Sector), Economic and Statistics, Trivandrum.

Diagram - 4.4



a whole we can see that fixed capital investment has increased from Rs.523.11 lakhs in 1973-74 to Rs.2964.01 lakhs in 1984-85 (Table 4.6). Share of the rubber-based industry in total fixed capital investment in the state has increased from 1.30 per cent in 1973-74 to 2.32 per cent in 1984-85. The annual compound growth rate in fixed capital investment during the period is estimated to be 19.72 per cent.

Working capital investment has also increased appreciably over the years. From Rs.125.37 lakhs in 1973-74 working capital investment in the tyres and tube industry increased to Rs.1339.63 lakhs in 1984-85. The compound annual growth rate during the period is found to be 11.84 per cent. Share of tyres and tube industry in the total working capital investment in the state has increased from 1.01 per cent in 1973-74 to 2.33 per cent in 1984-85. Working capital investment in the other rubber products sector has increased from Rs.175.95 lakhs in 1973-74 to Rs.1202.23 lakhs in 1984-85. The compound annual growth rate during the period is estimated to be 15.31 per cent. Other rubber products sector's share in the total working capital investment in Kerala has increased from 1.42 per cent in 1973-74 to 2.09 per cent in 1984-85. It is to be mentioned that although working capital investment in the other rubber products sector has increased considerably in current prices, the increase was comparatively low in real terms. In the case of rubber-based industry as a whole the working capital investment has increased from Rs.301.32 lakhs in 1973-74 to Rs.2541.66 lakhs

Table - 4.6

Fixed Capital, Working Capital, Wages and Salaries to Employees, Number Employed, Materials Consumed, Total Inputs, Total Output and Value Added in the Rubber-Based Industry for the Years 1973-74 to 1984-85

(Value in lakhs)

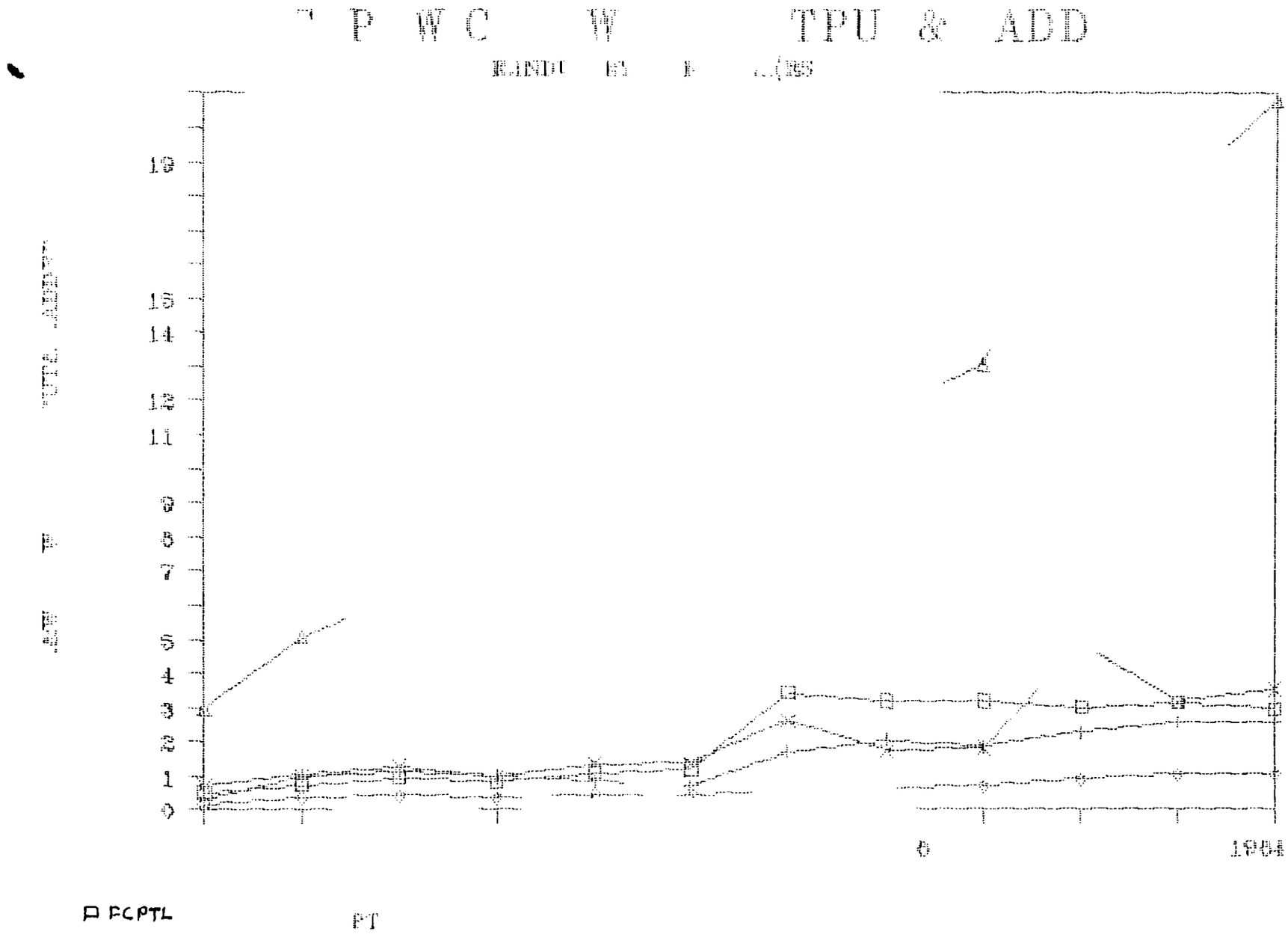
Year	Fixed Capital	Working Capital	Wages and Salaries	Number Employed	Materials Consumed	Total Inputs	Total Output	Value Added
1973-74	523.11	301.32	167.39	4899	2167.14	2223.74	2943.61	719.75
	(426.34)	(215.69)	(124.13)		(1551.283)	(1591.80)	(2819.32)	(690.22)
1974-75	725.84	1015.84	382.81	5607	3745.17	3888.67	5068.71	1036.54
	(464.10)	(580.81)	(219.063)		(2141.33)	(2223.36)	(3653.77)	(748.99)
1975-76	940.26	1095.00	416.65	5851	4491.52	4942.62	6339.66	1289.31
	(544.71)	(633.01)	(230.43)		(2596.26)	(2857.00)	(4060.91)	(826.22)
1976-77	820.36	987.06	342.34	5299	3687.08	4095.66	5183.73	971.37
	(482.29)	(558.92)	(211.16)		(2678.27)	(2319.17)	(3313.16)	(622.42)
1977-78	1070.62	834.25	475.87	6532	3836.42	4331.80	5777.42	1342.14
	(620.29)	(449.01)	(295.37)		(2064.82)	(2331.43)	(3708.21)	(862.18)
1978-79	1192.06	692.71	467.33	9225	4411.54	4924.99	6458.40	1392.52
	(648.21)	(372.82)	(276.22)		(1374.35)	(2650.69)	(3552.41)	(766.02)
1979-80	3405.03	1687.21	590.15	6797	6856.98	7686.28	10709.05	2627.31
	(1577.13)	(775.37)	(318.39)		(3151.08)	(3532.30)	(4974.67)	(1220.77)
1980-81	3186.27	2058.59	609.47	7564	8557.99	9604.46	11733.79	1727.88
	(1330.94)	(800.07)	(296.50)		(3326.08)	(3732.78)	(4694.85)	(692.20)
1981-82	3185.15	1864.43	712.08	7701	9444.37	10798.91	13077.48	1820.58
	(1201.494)	(662.79)	(298.15)		(3357.40)	(3838.93)	(4565.14)	(636.50)
1982-83	2992.31	2275.72	899.64	7904	13489.56	14906.25	20203.16	4827.75
	(1069.07)	(788.27)	(358.40)		(4672.51)	(5163.70)	(6510.91)	(1547.52)
1983-84	3139.94	2601.31	1044.61	8354	13072.39	14498.92	18173.70	3167.30
	(1064.99)	(823.20)	(351.16)		(4133.92)	(4588.24)	(5679.92)	(988.14)
1984-85	2964.01	2541.86	1035.87	7241.	15284.30	16820.36	20822.33	3526.10
	(975.99)	(750.65)	(323.43)		(4516.64)	(4970.55)	(6157.51)	(1046.30)

Figures in the brackets are deflated

Annual Survey of Industries
Trivandrum.

Directorate of Economics and Statistics,

Diagram - 4.5



in 1984-85 at a compound annual growth rate of 16.56 per cent.

Employment in the factory sector in Kerala has not exhibited a substantial growth in the last two decades. The majority of the factory units in Kerala are small scale units employing less than 20 workers. If the number of factories providing employment to less than 100 workers are taken together as a single size group we can find that over 92 per cent of the factories commands 75 per cent of the total average daily employment. If more than 1000 workers in a factory is taken as a criterion for classifying it as a big factory it is seen that only 0.5 per cent of the factories come under this category and their share of employment is 12.2 per cent. The total number of employees working in the factory sector in the state during 1973-74 was 239297. This has increased to a mere 247788 in 1984-85 and the percentage increase is estimated to be 3.35 per cent. Average daily employment in the tyres and tube industry was 1300 persons in 1973-74. This was only 0.54 per cent of the total employment in the factory sector. In 1984-85 there were 2282 persons employed in the tyres and tube industry and the industry's share was 0.92 per cent of the total employment in the factory sector. The annual compound growth rate during the period is found to be 5.37 per cent.

From 3599 in 1973-74 total number of employees in the other rubber products sector has increased to 4959 in 1984-85 at a compound annual growth rate of 3.88 per cent. Share of the other rubber products sector in the total factory employment in the state has increased from 1.50 per cent in 1973-74 to two per cent in 1984-85. When we consider the rubber-based industry as a whole in the state we can find that total number of employees has increased from 4899 in 1973-74 to 7241 in 1984-85 at an annual compound growth rate of 4.28 per cent. Share of the rubber-based industry in the total number of employees in the factory sector in the state has increased from 2.05 per cent in 1973-74 to 2.92 per cent in 1984-85.

Wages and salaries disbursed to the employees has also increased over the years. From Rs.50.74 lakhs in 1973-74 total emoluments given to the employees in the tyres and tube industry has increased to Rs.412.47 lakhs in 1984-85. The annual compound growth rate is estimated to be 14.27 per cent. Share of the tyres and tube industry in the total emoluments given to the employees in the factory sector in the state has increased from 0.70 per cent in 1973-74 to 1.61 per cent in 1984-85. Total wages and salaries disbursed to the employees in the other rubber products sector increased from Rs.116.65 lakhs in 1973-74 to Rs. 623.40 lakhs in 1984-85. The increase in growth rate can be more vividly depicted by the compound growth rate. The

compound growth rate is estimated to be 15.65 per cent. Share of the other rubber products sector in the case of total emoluments disbursed to the employees in the factory sector in the state has increased from 1.61 per cent in 1973-74 to 2.43 per cent in 1984-85. When we take the rubber-based industry as a whole we can see that the total emoluments disbursed has increased from Rs. 167.39 lakhs in 1973-74 to Rs.1035.87 lakhs in 1984-85 at an compound growth rate of 14.65 per cent. Share of the rubber manufacturing industry in the case of wages and salaries disbursed to employees in the factory sector in the state has increased from 2.32 per cent in 1973-74 to 4.04 per cent in 1984-85.

Materials consumed in the tyres and tube sector and other rubber products sector were Rs.1087.18 lakhs and Rs.1079.96 lakhs respectively in 1973-74. This has increased to Rs.4643.72 lakhs and Rs.10640.58 lakhs respectively in 1984-85. The compound annual growth rate during the period 1973-74 to 1984-85 is estimated to be 15.74 per cent and 20.04 per cent respectively. In the case of materials consumed share of tyres and tube industry and other rubber products sector in the total factory sector in the state is found to be 3.05 per cent and 7.00 per cent respectively in 1984-85. When we consider the rubber manufacturing industry as a whole we can see that materials consumed have increased from Rs.2167.14 lakhs

in 1973-74 to Rs.15284.30 lakhs in 1984-85 at an annual compound growth rate of 18.27 per cent. Share of the rubber-based industry in the case of materials consumed in the total factory sector in the state is worked out to be 10.05 per cent in 1984-85.

Total inputs in the rubber-based industry has also increased appreciably over the years. From Rs.1107.71 lakhs in 1973-74 total inputs in the tyres and tube sector has increased to Rs.5402.67 lakhs in 1984-85. In the other rubber products sector total inputs have increased from Rs.1116.03 lakhs in 1973-74 to Rs.11417.69 lakhs in 1984-85. The compound annual growth rate during the period in the above sectors are found to be 16.69 per cent and 20.49 per cent respectively. Share of the tyres and tube industry and other rubber products sector in the case of total input in the factory sector in the state have increased from 2.85 and 2.87 respectively in 1973-74 to 6 and 6.36 respectively in 1984-85. Total inputs in the rubber-based industry has increased from Rs.2223.74 lakhs in 1973-74 to Rs.16820.36 lakhs in 1984-85 at an annual compound growth rate of 18.90 per cent. It is to be mentioned that share of the rubber-based industry in the case of total inputs in the total factory sector in the state has increased from 5.72 per cent in 1973-7 to 9.36 per cent in 1984-85.

Total output has also increased considerably over the years. From Rs.1531.69 lakhs in 1973-74 total output of the tyres

and tube industry has increased to Rs.6461.56 lakhs in 1984-85 at an annual compound growth rate of 16.01 per cent. Total output of the other rubber products sector has increased from Rs.1411.97 lakhs in 1973-74 to Rs. 14360.77 lakhs in 1984-85. The compound annual growth rate is estimated to be 20.17 per cent. According to the annual survey of industries (factory sector), during 1984-85 the respective shares of the various rubber products in Kerala as a proportion of total national production were tyres and tubes 4.40 per cent and other rubber products sector 26.12 per cent. It is significant to note that according to ASI, only the other rubber products sector has made a steady increase in its national share during the years. Share of tyres and tube industry and other rubber products sector in the total factory sector in the state is worked out to be 2.93 per cent and 2.70 per cent respectively in 1973-74. In 1984-85 share of these sectors in the total factory sector is worked out to be 2.52 per cent, 5.59 per cent respectively. Total output of the rubber-based industry has increased from Rs.2943.61 lakhs in 1973-74 to Rs.20822.33 lakhs in 1984-85 at a compound annual growth rate of 18.43 per cent. Share of the rubber-based industry in the total factory sector in the state has increased from 5.60 per cent in 1973-74 to 8.11 per cent in 1984-85. It is to be noted that share of rubber-based industry in the total national production stood at 10.32 per cent in 1984-85.

Value added which is the value of the product that is created in the factory showed a fluctuating trend over the years. Value added in the tyres and tube industry stood at Rs.423.98 lakhs in 1973-74. This was 3.17 per cent of the total value added in the factory sector in 1973-74. Value added in the tyres and tube industry increased to an all time high of Rs. 3046.82 lakhs in 1982-83. However in 1984-85 it stood at Rs.728.31 lakhs, which was only 1.07 per cent of the total value added in the factory sector. The annual compound growth rate in value added during the period 1973-74 to 1984-85 is found to be 6.69 per cent. It is found that share of the tyres and tube industry in Kerala was 1.89 per cent in 1984-85 when compared to the total value added in the national level. Value added in the other rubber products sector increased appreciably during the period under study. In 1973-74, value added in the other rubber products sector stood at Rs.295.89 lakhs which was 2.21 per cent of the total value added in factory sector in Kerala. Value added has further increased to Rs.2799.79 lakhs in 1984-85, which was 4.10 per cent of the total value added in the factory sector in the state. The increase in value added can be more clearly brought out by the compound growth rate. The compound annual growth rate during the period is worked out to be 19.14 per cent. It is noted that share of the other rubber products sector in Kerala was 26.99 per cent

in 1984-85, when compared to the total value added in the national level. Total value added in the rubber-based industry as a whole has increased from Rs.79.75 lakhs in 1973-74 to Rs.3528.10 lakhs in 1984-85 at an annual compound growth rate of 15.01 per cent. Share of the rubber-based industry in the total value added in the factory sector in Kerala has decreased from 5.38 per cent in 1973-74 to 5.17 per cent in 1984-85. When compared to the total value added in the rubber-based industry in India, Kerala's share was found to be 7.22 per cent in 1984-85.

Thus the above discussion shows that although Kerala is having the largest number of rubber-based industrial units in India its consumption of natural rubber is comparatively low. Total employment in the rubber-based industry has increased only marginally during the period under study. Although fixed capital investment, working capital,materials consumed, total inputs and total output of the rubber products sector have increased over the years, the increase has been considerably low in real terms. Value added in the tyres and tube industry showed wide fluctuations during the period under study. It is to be noted that only the share of the other rubber products sector showed an increasing trend both in the state and national level during the period under study.

CHAPTER V

TRENDS IN INPUT AND OUTPUT PRICES

Economic literature makes a distinction between two types of price changes, one cost-determined and the other demand-determined. Generally speaking, changes in the prices of raw materials inclusive of primary foodstuffs are believed to be demand-determined and changes in the prices of finished goods to be cost-determined (Kalecki, 1971). In recent years policies designed to promote economic development have been seriously considered by most developing countries and are characterised by the development of major sources of foreign exchange earning. A more stable price will reduce the risk and uncertainty costs and make the marketing system more efficient.

The pricing of raw materials have, however, to be seen explicitly within the specific features of their market structure and in the light of the condition on the demand and supply side. In India supply conditions are identified as essential reasons for the difference in price changes (Pandit Som Nath, 1982). The structure and behaviour of prices denote the nature, composition and magnitude of prices. Price mechanism is the medium through which the desires of consumers are

transmitted to producers. If the commodity in question is durable there is an added dimension in the pricing of it, viz., the role played by inventories in explaining price movements. This factor has to be incorporated while defining or rather spelling out the conditions on the demand and supply side.

The level of agricultural prices in an eaconomy influences a number of aspects of the economy. The relative prices among individual commodities influence a shift from one commodity to another. The relative price level between the agricultural and non-agricultural sectors determines the terms of trade between these sectors and hence influences the movement of resources from one sector to the other. While analysing agricultural price it is also possible to analyse the changes in price levels at different levels of the market with a view to understand the changes in market structure and marketing margins Agricultural prices are quickly responsive to demand and supply conditions. Since agricultural output constitutes half of the national product the general price level is mostly determined by the behaviour of agricultural prices. Due to market imperfections in underdeveloped countries the effect of price signals gets considerably weakened, resulting in either time lags in response or differential magnitudes of responses. Price policy inevitably is a part of the overall economic policy. Price policy in conjunction with policies on other aspects such

as input supply, marketing of output, research and extension influence the modernisation process, especially through the adoption of improved technology. The objective of agricultural price policy is to achieve price stability without destabilising the total revenue of the farmer and provide a price support which would be economic to the farmers as well as to agro-based industries and at the same time safeguard the interests of the consumers. While the influence of agricultural prices on allocation of resources between agricultural and non-agricultural sectors in an area like Kerala, characterised by a large proportion of perennial crops, may not be large, its impact on the allocation of resources within the agricultural sector and on the modernisation process cannot be underemphasized. The short term goal of price policy is stability in crop prices to create certainty. The medium term goal of price policy is stability in terms of trade for agriculture and the focus of the long term goal is an agricultural adjustment of all prices towards their equilibrium level. Thus the role of agricultural price policy is to moderate short run price fluctuations and to allow prices to perform their long run allocative function. In short it may be emphasised that the aim of the price policy should be to effect a proper structure of production and distribution (Pandit Som Nath, 1982).

Economists often find it useful to think of the market demand as consisting of demand for current use or consumption plus possible demand for addition to inventory; and the market supply , similarly, as consisting of supply from current production plus possible supply from inventory. Inventories may have either a stabilising or destabilising effect on the commodity's price depending on the conditions that permit or require the holding of inventories. However, traditionally, economists have assumed that the effect of inventories is to stabilise price, though the extent to which it will do so, of course, varies from one market to another. Agricultural price analysis is one of the most important and well developed parts of price analysis. The agricultural price analysis is not a mere exercise of academic curiosity but results of it are immediately put to work as bases for huge economic programmes. In this section we will examine the behaviour of natural rubber and synthetic rubber prices which are used as raw materials in the rubber-based industry. Attempts were made to analyse both the inter and intra year variations in natural rubber prices after the 1970's and the role played by rubber stocks in explaining it.

5.1 Price Movement of Natural Rubber

Market price of indigenous natural rubber had increased

considerably over the last two decades. Interestingly wide intra year fluctuations are also noticed in the market price of rubber. This may be due to fluctuations in production and stock of natural rubber in different months. In 1969-70, price of natural rubber was as high as Rs.584.10 per quintal in April (Table 5.1). Upto September the market price of natural rubber was above the average price level of Rs.501 per quintal. During 1970-71 price of natural rubber per quintal was lower than that in the previous year. In 1970-71 the price is worked out to be Rs.464 per quintal. Price was lower in the month of November. During 1971-72 also the average price of lot rubber showed a declining trend and stood at Rs.420.78 per quintal. During the year price of lot rubber was lower in the month of December and higher in the month of March. In the next year 1972-73, price of natural rubber increased marginally and it stood at Rs.459 per quintal. The percentage increase when compared to the preceding year is found to be 9.03. During the next two years also average market price of lot rubber showed an increasing trend. In 1974-75 the average market price of lot rubber per quintal is worked out to be Rs.849 per quintal. This is 64.85 per cent increase when compared to the previous year. However, during the period 1975-76 and 1976-77 the average market price of rubber showed a declining trend, mainly due to the fact that

Table - 5.1

Monthly Average Market Prices of Cut Rubber at Kottayam

(Rs. Per Quintal)

Months	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
April	471.60	453.02	482.04	468.21	689.40	831.72	654.70	608.80	700.10	1074.17	1023.33	1438.96	1560.68	1586.96	1666.74	1890.40	1706.00
May	466.20	444.76	489.29	473.60	836.40	793.70	591.73	622.60	858.27	1149.42	1026.48	1477.08	1524.00	1766.35	1632.95	1650.58	1706.30
June	454.21	435.84	468.03	478.29	899.40	807.12	585.19	612.30	960.50	1071.40	1048.00	1463.85	1526.15	1763.08	1708.40	1654.60	1620.40
July	437.78	435.09	464.90	482.96	986.67	795.77	628.89	630.10	1088.33	1068.85	1199.63	1350.93	1564.81	1721.80	1728.07	1691.67	1566.11
August	439.70	413.58	435.50	498.03	1003.80	764.78	599.71	656.00	970.00	1082.20	1248.91	1423.60	1544.00	1801.46	1690.40	1706.25	1551.80
September	460.60	384.47	429.18	495.40	957.50	763.02	565.50	638.75	1182.00	945.22	1296.73	1389.05	1360.22	1777.80	1579.00	1677.60	1500.95
October	470.00	400.64	436.93	490.20	777.30	701.39	536.30	649.50	938.20	969.58	1269.40	1372.73	1218.88	1639.38	1565.42	1671.92	1495.58
November	481.83	394.86	438.30	494.71	716.85	721.75	595.10	627.60	896.92	942.00	1178.20	1359.00	1272.30	1702.40	1493.75	1624.65	1505.00
December	473.35	377.45	442.34	495.41	718.35	715.00	572.50	610.98	974.00	907.08	1240.38	1414.81	1228.00	1749.07	1503.62	1615.83	1507.69
January	476.95	423.13	472.40	509.58	904.40	696.31	606.30	637.30	956.54	1006.80	1307.88	1463.04	1303.33	1707.80	1457.75	1669.04	1584.62
February	467.97	429.09	470.10	647.92	874.37	676.67	615.83	637.50	942.40	977.71	1338.48	1497.29	1404.58	1628.54	1500.25	1672.32	1648.54
March	462.63	457.50	475.56	650.39	826.40	656.20	599.73	653.94	973.89	1003.65	1369.03	1517.41	1399.23	1645.77	1521.15	1713.54	1709.00
Average	463.60	420.78	458.71	515.39	849.24	743.62	595.96	632.11	953.43	1016.51	1212.20	1430.65	1408.83	1707.53	1587.29	1660.70	1591.83

Source: Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Table - 5.1

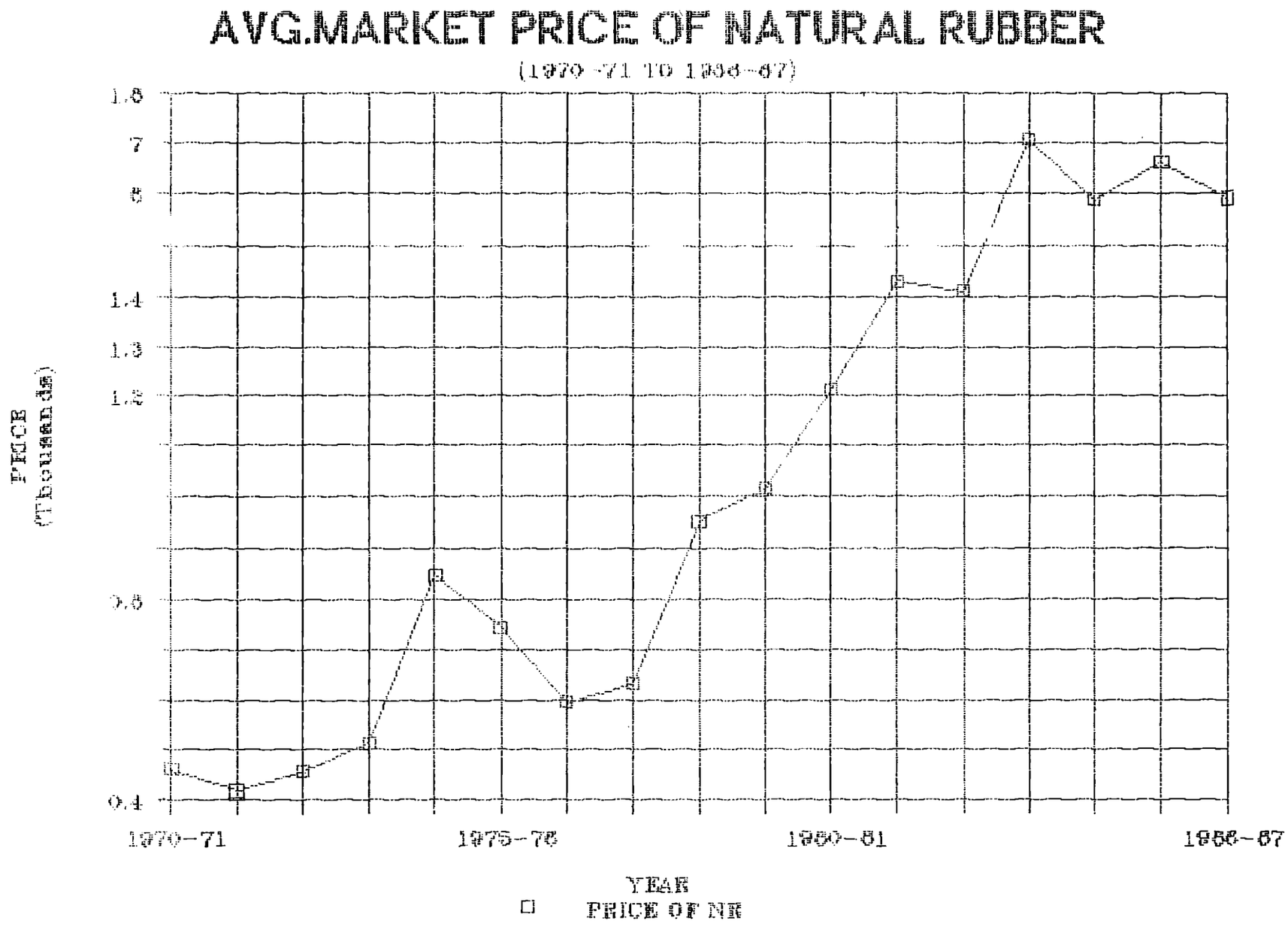
Monthly Average Market Prices of Lot Rubber at Kottayam

(Rs. Per Quintal)

Months	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
April	471.60	453.02	482.04	468.21	689.40	831.72	654.70	608.80	700.10	1074.17	1023.33	1438.96	1560.68	1586.96	1666.74	1590.40	1706.00
May	466.20	444.76	489.29	473.60	836.40	793.70	591.73	622.60	858.27	1149.42	1026.48	1477.08	1524.00	1766.35	1632.95	1650.50	1706.30
June	454.21	435.84	468.03	478.29	899.40	807.12	585.19	612.30	960.50	1071.40	1048.00	1463.85	1526.15	1763.08	1708.40	1654.60	1620.40
July	437.78	435.09	464.90	482.96	986.67	795.77	628.89	630.10	1088.33	1068.85	1199.63	1350.93	1564.81	1721.80	1728.07	1691.67	1566.11
August	439.70	413.58	435.50	498.03	1003.80	764.78	599.71	656.00	970.00	1082.20	1248.91	1423.60	1544.00	1801.46	1690.40	1706.25	1551.80
September	460.60	384.47	429.18	495.40	957.50	763.02	565.50	638.75	1182.00	945.22	1296.73	1389.05	1360.22	1777.80	1579.00	1677.60	1500.95
October	470.00	400.64	436.93	490.20	777.30	701.39	536.30	649.50	938.20	969.58	1269.40	1372.73	1218.98	1639.38	1565.42	1671.92	1495.58
November	481.83	394.86	438.30	494.71	716.85	721.75	595.10	627.60	896.92	942.00	1178.20	1359.00	1272.30	1702.40	1493.75	1624.65	1505.00
December	473.35	377.45	442.34	495.41	718.35	715.00	572.50	610.98	974.00	907.08	1240.38	1414.81	1228.00	1749.07	1503.62	1615.83	1507.69
January	476.95	423.13	472.40	509.58	904.40	696.31	606.30	637.30	956.54	1006.80	1307.88	1463.04	1303.33	1707.80	1457.75	1669.04	1584.62
February	467.97	429.09	470.10	647.92	874.37	676.67	615.83	637.50	942.40	977.71	1338.48	1497.29	1404.58	1628.54	1500.25	1672.32	1648.54
March	462.63	457.50	475.56	650.39	826.40	656.20	599.73	653.94	973.89	1003.65	1369.03	1517.41	1399.23	1645.77	1521.15	1713.54	1709.00
Average	463.60	420.78	458.71	515.39	849.24	743.62	595.96	632.11	953.43	1016.51	1212.20	1430.65	1408.83	1707.53	1587.29	1660.70	1591.83

Source: Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Diagram - 5.1


AVG.MARKET PRICE OF NATURAL RUBBER
(1970-71 TO 1986-87)
PRICE
(Thousands)
1.8
7
6
1.4
1.3
1.2
0.6
0.4
1970-71
1975-76
1980-81
1986-87
YEAR
PRICE OF NR

during these years the internal production was sufficient to meet the demand in the country. In 1976-77 average price of lot rubber is worked out to be Rs.596 per quintal. This was 29.80 per cent lower than that in 1974-75.

From 1976-77 to 1981-82 average market price of lot rubber showed a remarkable increasing trend. In 1981-82 the average market price of natural rubber stood at Rs.1431 per quintal. During this year the price of lot rubber was higher in March and lower in July. It is to be noted that production of natural rubber was lower during the month of March. The percentage increase in prices during the period 1976-77 to 1981-82 is estimated to be 140.10. Although there was some variations in the price level, it showed an increasing trend after the period 1981-82 also. In 1986-87 price of natural rubber stood at 1591.83. The compound annual growth rate in prices during the period 1970-71 to 1986-87 is worked out to be 9.98 per cent (Appendix 1). When we take three yearly moving averages we can see that market price of natural rubber was 462 in 1970-71 (Table 5.2). This has increased to 729.27 in 1975-76. Except for the years 1976-77 and 1977-78 moving average showed an increasing trend. These are the two years where the import of natural rubber did not take place. It is also to be noted that production of natural rubber tends to

Table - 5.2

Average Market Price of Lot Rubber at Kottayam

(Rs. per Quintal)

Year	Average Market Price	Three Yearly moving average
1969-70	500.86	--
1970-71	463.60	461.75
1971-72	420.78	447.70
1972-73	458.71	464.96
1973-74	515.39	607.78
1974-75	849.24	702.75
1975-76	743.62	729.61
1976-77	595.96	657.23
1977-78	632.11	727.17
1978-79	953.43	867.35
1979-80	1016.51	1060.71
1980-81	1212.20	1219.79
1981-82	1430.65	1350.56
1982-83	1408.83	1515.67
1983-84	1707.53	1567.88
1984-85	1587.29	1651.84
1985-86	1660.70	1613.27
1986-87	1591.83	--

Source: Computed from Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

be higher during the period September to January. Interestingly more than 50 per cent of the total production takes place during this period. Production of natural rubber is comparatively low during the months of February and March. Prices of natural rubber tend to be high during this lean period.

Now let us examine the factors which are influencing the price of natural rubber. We have developed two models for inter and intra year variations in prices. Our basic assumption regarding the determination of inter year price variations is that it is governed by several factors viz., production, consumption and total stock of natural rubber. In order to examine whether international prices have any bearing on the Indian natural rubber prices we have taken price of natural rubber in London as a proxy variable. As natural rubber is a primary commodity with a derived demand concentrated in the industrial countries, it is posited that the spot pricing process is dominated by stocks held in the consuming regions, the size of these stock holdings (nearly half of total stock holdings) and the operation of the spot market by consumer reinforce this argument. Thus it is the London spot price that exerts ultimate influence over natural rubber price formation in the producing areas in each period (Tan Suan, 1984). In the case of intra year price variations it is assumed that it

is influenced by the manufacturer's monthly purchase decisions in relation to net availability. The manufacture's purchase decisions are governed by purchase for current use or consumption and for addition to inventory or stocks. Monthly production of natural rubber also exerts some influence on intra year price variations. The estimated equations are given below:

$$P_t = -114.15904 + 0.27524\ PLD + \underset{(150.34482)}{} \underset{(0.35600)}{}$$

$$0.01547\ \overset{***}{CN}_t - 0.01255\ \overset{***}{QN}_t \quad \underset{(0.00860)}{} \quad \underset{(0.00670)}{}$$

$$+ 0.00583\ SN_t \quad \underset{(0.06628)}{} \quad R^2 = 0.9395$$

$$R^{-2} = 0.8986, \quad F = 36.448$$

$$MP_t = 798.5176^{*} - 0.00497\ \overset{***}{MQ}_t \quad \underset{(131.9520)}{} \quad \underset{(0.00271)}{}$$

$$+ 0.07848^{*}\ MC_t - 1628.9465^{*}\ \frac{SSTC}{MTS} \quad \underset{(0.00695)}{} \quad \underset{(227.4779)}{}$$

$$- 914.1303^{*}\ \frac{SGD}{MTS} \quad \underset{(323.9641)}{} \quad R^2 = 0.7090$$

$$R^{-2} = 0.6962, \quad F = 55.4289.$$

---

*: Significant at one per cent level.
***: Significant at twenty per cent level.

$$MP_t = -645.8532^{*} + 0.00055\ MQ_t$$
$$(135.8387) \quad (0.00306)$$

$$+ 0.08712\ MC_t + 1502.7219^{*}\ \frac{MS}{MTS}$$
$$(0.00623) \quad (228.6328)$$

$$R^2 = 0.6882$$

$$R^{-2} = 0.678, \quad F = 67.6870$$

where

MP_t = monthly price of natural rubber

MQ_t = monthly production of natural rubber

MC_t = monthly consumption of natural rubber

MTS = monthly stock of natural rubber

SSTC = stock of natural rubber with the State Trading Corporation of India

SGD = stock of natural rubber with the growers and dealers

SN_t = total stock of natural rubber in the year t

PLD = Price of natural rubber in London in the year

QN_t = production of natural rubber in the year t

CN_t = consumption of natural rubber in the year t

P_t = price of natural rubber in the year t

MS = monthly stock of natural rubber with the manufacturers.

The regression estimates show that consumption of natural rubber is influencing positive movements of prices. Production variable as expected showed a negative relationship. Although coefficient of stock variable and coefficient of PLD showed the right signs they are found to be statistically not significant. In the case of intra year variations consumption and the ratio of the manufacturers stocks to total stocks are found to be positive and statistically highly significant. Coefficient of the monthly production of natural rubber turned out to be significant only in the first model. Coefficient of the ratio of the growers and state trading corporation's stocks to total stocks are found to be negative and significant. The high value of the coefficient of the ratio of the manufacturer's stocks and state trading corporation's stocks to total stocks reveals the significance of buffer stocks for indirectly controlling prices rather than direct price control measures.

5.2 Movements of Prices of Synthetic Rubber

During the last decade prices of synthetic rubber has

increased considerably. Price of styrene butadiene 1502 has increased from Rs. 4.4 per kilogram in 1970-71 to Rs. 25.17 per kilogram in 1986-87 (Table 5.3). The percentage increase is worked out to be 472.05. In 1970-71 price of styrene butadiene 1712 was Rs.3.90 per kilogram. This has increased to Rs.8.58 per kilogram in 1978-79. In 1986-87 the price has increased to Rs.22.85 per kilogram. The percentage increase when compared to 1970-71 is worked out to be 485.90. Similarly an increasing trend was observed in the case of styrene butadiene 1958 also. Its price stood at just Rs.6.8 per kilogram in 1970-71. This increased to Rs.29.15 per kilogram in 1986-87. The percentage increase is estimated to be 328.68.

Price of latex SC - 2000 also showed an increasing trend during the last nine years. From just Rs.6 per kilogram in 1976-77 price increased to Rs.14.78 per kilogram in 1986-87. A similar pattern in increase was seen in the case of other synthetic rubbers also. From Rs.18.70 per kilogram in 1976-77 price of nitrile 3309 increased to Rs. 20.70 per kilogram in 1978-79. After 1982 its price has increased alarmingly. During the period 1982-85 it has almost doubled. In 1986-87 its price stood at Rs.36 per kilogram. Same is the case with nitrile 3809/11 rubbers also. From Rs.20.70 per kilogram in 1976-77 its price increased to Rs.39.50 per kilogram in 1986-87. The percentage increase is worked out to be 90.82.

Table - 5.3

Grade-wise Prices of Styrene Butadiene and Nitrile Rubber

(Ex-Bareilly - Rs/Kg.)

Year	1500/1502/ 1552x	1712/ 1752	1958/ 1941x	Latex SC - 2000	Nitrile 3309/11	Nitrile 3809/11
1970-71	4.40	3.90	6.80	--	--	--
1971-72	4.40	3.90	6.80	--	--	--
1972-73	4.40	3.90	6.80	--	--	--
1973-74	4.27	3.77	6.14	--	--	--
1974-75	9.02	7.32	12.26	--	--	--
1975-76	7.79	7.20	13.70	--	--	--
1976-77	8.13	7.63	13.78	6.00	18.70	20.70
1977-78	8.55	8.05	14.20	6.50	19.70	21.70
1978-79	9.09	8.58	14.40	7.80	20.70	21.70
1979-80	12.22	11.34	17.32	11.38	20.70	22.70
1980-81	15.07	13.17	20.19	11.75	20.70	22.70
1981-82	17.29	15.42	21.30	11.75	20.70	22.70
1982-83	18.33	16.34	22.10	11.75	24.00	24.35
1983-84	18.53	16.51	22.26	12.75	28.00	31.00
1984-85	20.86	18.08	23.82	13.15	31.50	38.00
1985-86	23.50	21.10	27.36	13.83	37.50	41.50
1986-87	25.17	22.85	29.15	14.78	36.00	39.50

Source: 1) Handbook of Rubber Statistics, AIRIA, Bombay, 1987.
2) Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

agram - 5.2

AVG. PRICE OF SYNTHETIC RUBBER

STYRENE BUTADIENE

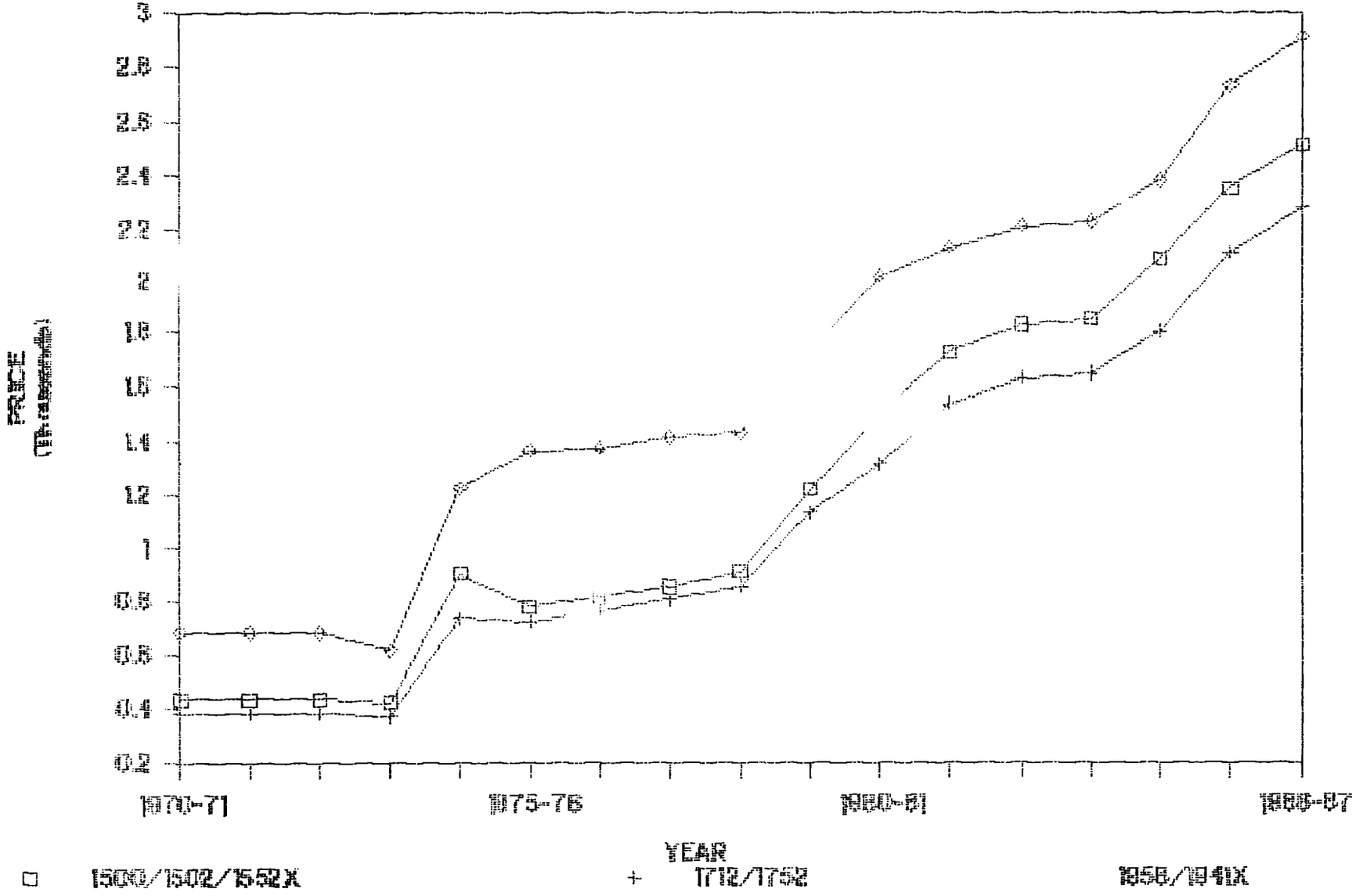


Table - 5.4

Average Price of Polybutadiene Rubber (Ex-Baroda Price Rs./Kg.)

Year	Polybutadiene	
	1203	1220
1978-79	8.53	8.53
1979-80	9.76	9.76
1980-81	12.24	12.24
1981-82	14.14	14.14
1982-83	14.77	14.77
1983-84	14.77	14.77
1984-85	16.98	16.76
1985-86	19.28	19.07
1986-87	20.72	20.72

Source: 1) M/s. Synthetics & Chemicals Ltd. and Indian petrochemical Corporation Ltd.

2) Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam, 1988.

Prices of polybutadiene rubber has also increased considerably over the years. From Rs.853 per kilogram in 1978-79 price of polybutadiene 1203 has increased to Rs.20.72 per kilogram (Table 5.4). The percentage increase is estimated to be 142.91. Polybutadiene 1220 price has increased from Rs.8.53 per kilogram in 1978-79 to Rs.20.72 per kilogram in 1986-87. The percentage increase is worked out to be 142.91.

Thus the analysis reveals that prices of styrene butadiene, nitrile rubber and polybutadiene have increased considerably during the last decade.

5.3 Analysis of Wholesale Prices

As already mentioned rubber manufacturing industry can be divided into tyre sector and the non-tyre sector. Besides natural rubber a large number of other raw materials are also used in the manufacture of various tyre and non-tyre goods. The other major raw materials used in the manufacture of rubber goods are synthetic rubber, carbon black and rubber chemicals. It is also to be noted that most of the above raw materials are manufactured by a small number of large firms while natural rubber is being produced by a

large number of small holders. Another factor which needs to be mentioned is that majority of the non-tyre rubber goods are manufactured by small scale units. Thus we can see that an escalation in the prices of raw materials is going to affect the unorganised non-tyre sector much more than that of the organised tyre sector.

Now let us compare the growth rate in wholesale price index of natural rubber, synthetic rubber and rubber-chemicals vis-a-vis the prices of rubber products. An analysis of wholesale prices of natural rubber shows that from 1970-71 to 1973-74 prices of natural rubber did not show any rising tendency (Table 5.5). But in 1974-75 wholesale price index of natural rubber shot upto 166.3. Again upto 1977-78 prices showed a declining trend. In the subsequent years wholesale price index of natural rubber showed an upward trend. From 199.4 in 1978-79 the wholesale price index climbed to 301.2 in 1981-82. This is clearly a remarkable increase indeed. Wholesale price index of natural rubber reached an all time high of 359.4 in 1983-84. Thereafter it showed a fluctuating tendency. In 1986-87 it stood at 336.5. The compound annual growth rate in prices during the period 1970 to1987 is worked out to be 9.62. The coefficient of variation of natural rubber prices during the period is estimated to be 44.44.

Table - 5.5

Index Number of Wholesale Prices of Selected Commodities

(1970-71 = 100)

Year	Natural Rubber	Synthetic Rubber	Carbon black	Rubber chemicals	Rubber products	Camel back	Tyres & tubes	Rubber & plastic shoes	Belting	Hoses	Sponge Rubber
1970-71	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1971-72	104.70	100.00	99.60	105.90	101.70	103.90	101.30	100.60	104.80	102.30	113.10
1972-73	104.70	100.00	99.60	113.30	103.70	107.30	103.20	100.70	109.30	106.00	116.40
1973-74	104.70	99.00	99.60	117.30	105.30	112.60	103.60	101.30	122.00	114.20	133.20
1974-75	166.30	205.00	242.80	213.10	140.00	159.70	136.80	126.20	168.40	175.90	190.50
1975-76	153.20	177.00	246.60	243.70	156.90	188.00	155.10	128.60	184.00	197.40	217.60
1976-77	125.20	185.00	246.60	243.70	157.20	180.70	155.10	127.40	184.20	197.80	226.20
1977-78	135.30	194.00	248.00	251.70	156.90	174.70	153.70	128.20	192.10	202.40	231.20
1978-79	199.40	207.00	268.20	278.70	181.90	190.30	181.50	135.20	208.20	247.00	196.50
1979-80	214.80	278.00	347.40	316.60	214.90	213.10	215.90	147.60	236.50	300.20	221.10
1980-81	255.00	174.40	532.70	380.80	248.80	236.30	252.10	158.40	266.10	354.80	226.20
1981-82	301.20	190.10	664.00	418.30	284.10	265.80	291.01	158.40	291.80	399.50	259.30
1982-83	296.60	199.60	685.70	462.80	306.10	284.40	315.50	161.50	301.40	426.20	282.40
1983-84	359.40	201.50	678.60	486.30	316.60	291.60	325.20	162.60	323.80	461.60	282.40
1984-85	333.60	224.10	689.30	498.00	335.30	294.40	344.70	164.10	363.00	473.70	282.40
1985-86	349.20	252.60	826.40	587.20	360.60	294.80	372.30	164.10	396.10	502.80	282.40
1986-87	336.50	275.50	826.40	651.50	381.60	308.90	387.20	201.70	435.30	562.90	282.40
Coefficient of variation	44.44	30.19	64.59	52.33	44.49	35.03	46.05	20.24	43.24	52.52	29.12
Compound growth rate	9.62	5.89	16.39	12.71	9.83	7.95	10.16	4.13	9.71	12.53	6.54

Note: Coefficient of Variation and Compound growth rate are computed from the data.

Source: 1) Chandak, H.L., wholesale price statistics, India, 1947-78, Vol.1 & revised index of wholesale prices.

2) Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Diagram. 5.3

WHOLE SALE PRIC.. INDEX OF RAW MATERIALS
(1970-71 TO 1986-87)

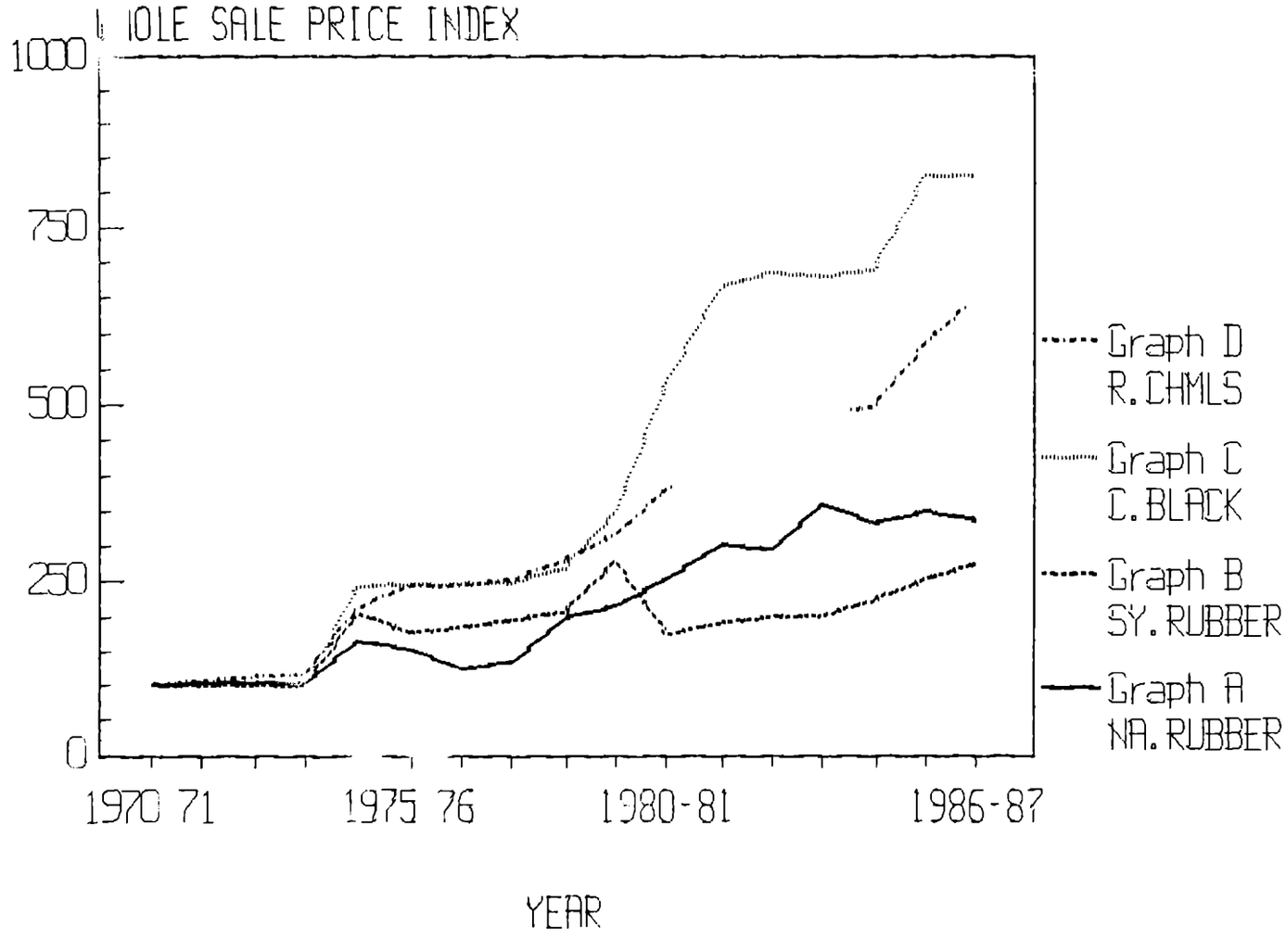
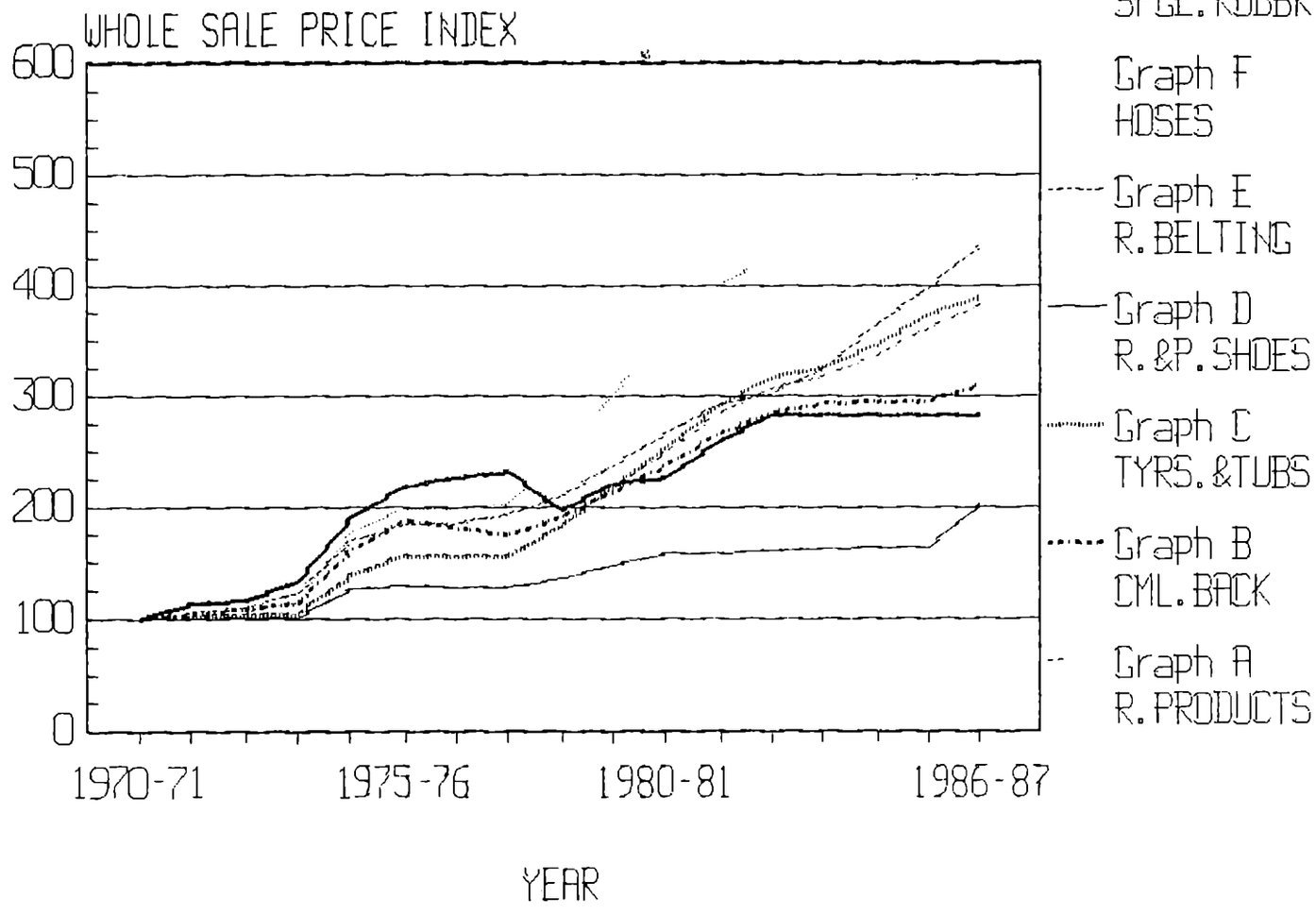


Diagram 5.4

WHOLE SALE PRICE INDEX OF FINISHED RUBBER PRODUCTS (1970-71 TO 1986-87)



During the period 1970-73 the wholesale price index of synthetic rubber remained stagnant. In 1973-74 it declined marginally to 99. Interestingly wholesale price index of synthetic rubber almost doubled in the year 1974-75 when compared to the previous year. During the period 1975-80 prices showed wide variations. After 1980-81 wholesale price index of synthetic rubber showed a steady increase in trend. In 1986-87 wholesale price index of synthetic rubber remained at 275.5. The compound annual growth rate in prices during the period is found to be 5.89 and the coefficient of variation is worked out to be 30.19.

The wholesale price index of carbon black and rubber chemicals increased much more than that of natural rubber and synthetic rubber. From 99.6 in 1971-72 the wholesale price index of carbon black increased to 826.4 in 1986-87. This is an alarming increase by all means. Wholesale price index of rubber chemicals increased from 105.9 in 1971-72 to 651.5 in 1986-87. The compound annual growth rate in the wholesale price index is found to be 16.31 and 12.71 respectively in the case of carbon black and rubber chemicals. Wholesale price index of carbon black showed wide variability when compared to rubber chemicals. This can be understood from the coefficient of variation. Coefficient of variation of wholesale price index of carbon black is 16.39, whereas that of rubber chemicals is only 12.71.

Now let us analyse the changes in the wholesale price index of finished rubber products. Wholesale price index of tyres and tubes was found to be 101.3 in 1971-72. This has increased to 155.1 in 1975-76. Although wholesale price index of tyres and tubes marginally declined in 1977-78 it showed a steady increase in trend after 1977-78. In 1986-87 it stood at 389.2. The compound annual growth rate is estimated to be 10.16 and coefficient of variation in prices is found to be 46.05. Wholesale price index of camel back also increased substantially over the years. From 100 in 1970-71, wholesale price index has gone upto 188 in 1975-76. During the period 1976-79 wholesale price index of carbon black showed a fluctuating tendency. However from 1978-79 onwards wholesale price index of camel back showed an increasing trend. In 1986-87 wholesale price index of camel back stood at 308.9. The compound annual growth rate during the period 1970-87 is worked out to be 7.95 and the coefficient of variation is found to be 35.03. Among the finished rubber products rubber and plastic shoes showed the least increase in prices. From 100 in 1970-71, wholesale price index of rubber and plastic shoes rose to 201.7 in 1986-87. The compound annual growth rate and coefficient of variation is estimated to be 4.13 and 20.24 respectively. The comparatively smaller growth rate in prices is mainly due to the lower increase in prices of plastics. The wholesale price

index of other rubber products has also increased considerably over the years. In 1986-87 wholesale price index of other rubber products stood at 381.6. The coefficient of variation in prices is estimated to be 44.49 and the compound annual growth is found to be 9.83 during the period under study. As in the case of rubber and plastic shoes wholesale price index of sponge rubber also showed a comparatively smaller growth rate. The compound annual growth rate in wholesale prices of sponge rubber is 6.54 and its coefficient of variation is worked out to be 29.52. Wholesale price index of rubber belting and hoses also showed considerable increase during the last decade. The compound annual growth rate is estimated to be 9.71 and 12.53 respectively in the case of rubber belting and hoses. Prices of hoses showed wider variations than that of rubber belting. Coefficient of variation of rubber belting and hoses are worked out to be 43.24 and 52.52 respectively during the period.

Thus the foregoing discussion shows that wholesale price index of raw materials and finished products has increased considerably in the rubber manufacturing industry. From the analysis emerges that among the raw materials carbon black showed the highest variability followed by rubber chemicals and natural rubber. Synthetic rubber prices showed the least variability among the raw material prices. Among the finished

rubber products, hoses has shown the highest variability and rubber and plastic shoes showed the least. Tyres and tubes showed a higher variability in prices than natural rubber prices. The study reveals that synthetic rubber has shown the lowest growth rate followed by natural rubber among the raw materials. In the case of finished rubber products hoses has shown the highest growth rate followed by tyres and tubes and other rubber products sector. The lowest growth rate in prices was shown by rubber and plastic shoes. Thus it emerges that growth rate in prices of raw materials is almost similar to the growth rate in prices of finished rubber goods. Therefore we can infer that increase in prices of inputs are mainly responsible for the increase in prices of finished rubber products.

CHAPTER VI

PRODUCTIVITY IN THE RUBBER-BASED INDUSTRY IN KERALA

The analysis in this chapter focusses on the sources of industrial growth from the supply side, with particular emphasis on the trends in efficiency in the use of factor inputs. The latter are studied within an aggregative analysis of total productivity growth analysis.

In precise terms, productivity measures the output per unit of input. Theoretically there are a number of indices available to measure productivity. In this case, however the measurement of productivity will be confined to three indices of productivity namely i) Labour productivity ii) Capital productivity and iii) Total factor productivity.

Since both labour and capital contribute to output, their productivities are only indices of partial productivity. The total factor productivity index takes account of both labour and capital as inputs. Productivity may be defined as the ratio between the production of a given commodity measured by volume and one or more of the corresponding input factors also measured by volume (Beri, 1962). Productivity refers to a comparison between the quantity of goods and services produced

and the quantity of resources employed in turning out these goods and services. The term productivity is used with reference to efficiency in production of land, labour and capital separately or together, unit quantities of mixes of various commodity or financial expenditures and investments. Productivity, as a source or cause of comparatively high levels of output and improvements in productivity as the major contributor to growth, have been important themes of analytical enquiry in economics all along (Brahmananda, 1982). Alongwith increases in quantities of factors and inputs, productivity improvements will also be contributing an additional source of output increase. For any given increase in output a higher rate of productivity improvement, if obtained connotes a saving or economy in the requirement of additional supplies of factors and inputs.

The importance of the study of productivity can hardly be overemphasised especially in a developing country where the task of planned growth and development of the national economy has been undertaken. It shows to what extent the real resources of a country, the natural resources, the existing capital equipment and the labour resources are effectively utilised in the national economy (Chatterjee, 1973). Productivity is determined by several factors or several factors affect productivity. The

quality of labour, technological progress, capital intensity, availability of raw materials, natural conditions, socio-economic organisation and efficiency of firms affect productivity. We can say that technological innovations lead to greater improvements in output per worker. Thus it is clear that the growth of technological development serves to augument productivity. The quality of the labour force, ie. the skilled labour force has been a major contributing factor in the transformation of the static past into the dynamic present, with its ramifications for the future that holds promise and prosperity for human well-being. The existing socio-climatic conditions also influence to a large extent the productivity levels in an economy. It is, therefore, necessary to find out exactly the extent by which productivity improvements are occuring in the rubber manufacturing industry in the State of Kerala.

6.1 Partial Productivity Indices

6.1.1 Labour Productivity

Labour productivity is obtained by dividing the net value added by the total labour input. Measurement of labour productivity is a complicated exercise because of the difficulties of segregating the contribution of labour to a given

rise in output from that of other equally important factors. Labour productivity estimated comprises the whole result of labour within a unit of time determined jointly by factors dependent on and independent of the worker. Symbolically labour productivity can be written as

$$\text{Labour productivity} = \frac{\text{Output}}{\text{Labour input}}$$

Labour is measured in terms of total number of persons employed. Labour productivity does not as such reveal changes in the intrinsic efficiency of labour only but show the changing effectiveness with which labour is utilised in conjunction with other factors. Thus labour productivity is influenced by the capital investment, organization of work and the natural resources used in production. Besides the above mentioned factors labour productivity is influenced by the skill of the worker, intensity of work and the innate ability of the worker.

6.1.2 Capital Productivity

Capital productivity is obtained by dividing the net value added by the fixed capital input. Capital input relates to the services of fixed and working capital. Fixed capital comprises factory land, building, plant and equipment. The latter includes inventory and cash. In the present analysis for the purpose of measuring only fixed capital input has been considered.

Capital input is measured in terms of net fixed assets arrived at through a perpetual inventory accumulation method. In the calculation of capital productivity, working capital is not considered. But it is to be noted that inventory and cash holdings particularly under inflationary conditions are more often determined by supply and market expectations than by purely technological pipeline requirements. Further the stock of fixed capital has a more direct bearing on productivity than working capital.

Algebraically capital productivity can be written as

$$\text{Capital productivity} = \frac{V}{K} = \frac{\text{Output}}{\text{Capital input}}$$

which is the average product of capital or capital productivity.

6.1.3 Capital Intensity

The above partial productivity indices will not give a fully clear picture of the productivity in the manufacturing sector. As already mentioned productivity is subject to the influence of so many factors. Hence despite their association it is difficult to isolate the scale effect from the rise in

productivity due to technical change. Productivity is primarily a function of three factors, namely capital intensity, labour productivity and wages. Labour productivity is general linked to capital intensity since the productivity of labour i assumed to increase with an increase in the amount of capital invested per person. Excessive capital necessarily implies un utilised capacity and wastage of capital. Therefore a study of capital intensity is also of prime importance in an economy Symbolically capital intensity can be written as

$$\text{Capital per person} = \frac{K}{L} = \frac{\text{Capital}}{\text{Labour}}$$

Thus $\frac{K}{L}$ is the average capital per person. Increase in any of the above partial productivity ratios means that over a period of time more output is possible with decreasing amounts of inputs and there is saving in the use of a particular input overtime.

6.1.4 Empirical Results

As already mentioned rubber-based industry in the stat is classified into two categories, namely tyres and tube indus and other rubber products sector. In the present study these two groups are analysed separately besides considering the pro ductivity of the rubber-based industry as a whole.

In the case of tyres and tube industry labour productivity has declined from 31.48 in 1973-74 to 9.26 in 1984-85 (Table 6.1). However, labour productivity showed considerable variations during the period under study. Labour productivity reached an all time high of 65.87 in 1983-84 and an all time low of 4.50 in 1981-82. The compound annual growth rate in labour productivity in the tyres and tube industry is estimated to be - 2.78. Capital productivity has also shown a decreasing trend during the period under study. From 269.79 in 1973-74 capital productivity has declined to 37.16 in 1984-85. It is to be noted that from 1978-79 onwards capital productivity showed considerable decrease, except for the period 1982-83. The decline in annual growth rate during the period is worked out to be 17.68. However, capital intensity in the tyres and tube industry increased from 11.67 in 1973-74 to 24.92 in 1984-85. The compound annual growth rate is found to be 12.52. Thus we can see that an increase in capital intensity has not improved either labour productivity or capital productivity. Underutilisation of capacity may be one of the important reasons for this state of affairs.

Labour productivity in the other rubber products sector has increased from 7.81 in 1973-74 to 16.84 in 1984-85. It is to be noted that labour productivity showed considerable

Table - 6.1

Labour Productivity, Capital Productivity and Capital Intensity in the Rubber-Based Industry During the Period 1973-74 to 1984-85

Year	Tyres and Tube Industry			Other Rubber Products sector			Rubber-based Industry		
	V/L	V/K	K/L	V/L	V/K	K/L	V/L	V/K	K/L
1973-74	31.48	269.79	11.67	7.81	102.30	7.63	14.09	161.89	8.70
1974-75	19.60	254.07	7.72	10.10	117.93	8.57	13.36	161.39	8.28
1975-76	20.76	176.75	11.74	10.98	134.59	8.16	14.12	151.68	9.31
1976-77	27.71	129.63	21.38	7.00	128.38	5.45	11.75	129.06	9.10
1977-78	18.58	103.92	17.88	11.17	176.27	6.34	13.20	139.00	9.50
1978-79	9.83	68.91	14.26	7.86	159.26	4.94	8.30	118.17	7.03
1979-80	70.34	30.25	56.32	18.43	280.14	6.58	17.96	77.40	23.20
1980-81	7.76	16.15	48.03	9.73	194.17	5.01	9.15	52.01	17.60
1981-82	4.50	10.66	42.25	9.73	176.70	5.50	8.29	53.14	15.60
1982-83	37.95	121.52	31.22	10.86	212.03	5.12	19.58	144.75	13.53
1983-84	65.87	64.76	25.61	9.53	138.54	6.87	11.83	91.07	12.99
1984-85	9.26	37.16	24.92	16.84	204.80	8.22	14.45	107.20	13.48
Compound annual growth rate	- 2.78	-17.68	12.52	3.54	8.88	-1.67	-0.2096	-6.04	6.21

Note: V/L = Value added - labour ratio, K/L = Capital - labour ratio, V/K = Value added - Capital ratio.

Source: Computed from Annual Survey of Industries (factory sector), Directorate of Economics and Statistics, Trivandrum.

variations during the period under study. It reached an all time high of 18.43 in 1979-80 and an all time low of 7.00 in 1976-77. The compound annual growth rate during the period is estimated to be 3.54. Capital productivity also showed an increasing trend in the other rubber products sector. From 102.30 in 1973-74 capital productivity increased to 204.80 in 1984-85. It is to be noted that capital productivity has shown an increasing trend particularly after 1977-78. The compound annual growth in capital productivity is worked out to be 8.88. However, capital intensity in the other rubber products sector showed a decreasing tendency during the period. From 7.63 in 1973-74, capital intensity declined to 5.12 in 1982-83. Then it increased to 8.22 in 1984-85. The decline in annual compound growth rate is found to be 1.67 during the period.

When we take the rubber-based industry as a whole we can see that labour productivity showed considerable variations over the years. From 14.09 in 1973-74, labour-productivity declined to 8.30 in 1978-79. However, it increased to 19.58 in 1982-83. In 1984-85 value added - labour ratio stood at 14.43. Thus we can find that there is a slight decline in labour productivity during the period under study. The decline in annual growth rate is found to be 0.2096. Capital productivity also showed a declining tendency in the rubber manufacturing industry. From 161.89 in 1973-74 capital productivity declined

to 107.20 in 1984-85. The decline in growth rate during the period is estimated to be 6.04. Capital intensity in the industry showed an increasing trend over the years. From 8.70 in 1973-74 capital intensity increased to 13.40 in 1984-85. The compound annual growth rate is estimated to be 6.21.

Thus the foregoing analysis reveals that only in the other rubber products sector labour productivity and capital productivity showed an increasing trend during the period under study. In the tyres and tube industry and the rubber-based industry as a whole both labour productivity and capital productivity showed a declining trend.

6.2 Total Factor Productivity

Both labour and capital productivities are however only partial indices of productivity. Since both labour and capital jointly contribute to output, it is necessary to derive a total productivity index that will include both labour and capital as inputs. The total factor productivity indices aim at relating the output to the combined use of all the resources. Interestingly among the usual indicators of the growth performance of industries in developing countries the behaviour of total factor productivity growth (TFPG) has received the least

attention (Alai, 1986). Studies on total factor productivity acquires great significance in the context of growth in developing economies. These economies are characterised by acute scarcity of resources (particularly capital) and must use the available resources as best as they can. Also, generation of surplus which plays a pivotal role in their growth depends crucially on the efficiency with which resources are used (Goldar, 1986).

Total factor productivity may be defined as the ratio of output to a weighted combination of inputs. Several TFP indices suggested differ from one another with regard to the weighting scheme involved. Stigler developed the concept independently in 1947 and suggested that a measure of real factor input could be obtained by weighing inputs by their marginal products to components of labour input. In majority of the empirical studies either the Kendrick index or the solow index has been used. The translog index which is an approximation of the Divisia index was introduced by Christensen and Jorgenson (1970) and has been used in a number of recent productivity studies including Gallop and Jorgenson (1980) and Christensen, Cummings and Jorgenson (1980). However, in the present study only Kendrick and Solow indices are used.

6.2.1 Kendrick Index

According to this method the total factor productivity index is a measure of the ratio between output and the sum of combined inputs of labour and capital, the inputs being weighted by their base year remuneration, and all inputs and outputs being measured in real terms. Algebraically this may be expressed as follows:

$$KI_t = \frac{V_t}{W_o L_t + r_o K_t}$$

where KI_t is Kendrick index, V_t is value added in year t, W_o is the base year wage rate and r_o is the base year return on capital. The Kendrick index of total factor productivity corresponds to the linear production function of the form $V = a_o L + b_o K$ where V,L,K are value added, labour and capital inputs respectively and a_o and b_o are co-efficients of labour and capital, which are constants. In the Kendrick index 'W_o' is obtained by dividing total salaries, wages and benefits by the average number of persons employed. 'r_o' is obtained by substracting salaries, wages and benefits from the value added and dividing the result by the value of fixed capital. It is to be noted here that the whole amount of non-wage and salary part of the value added does not accrue

to capital alone. There are items such as managing agents, remuneration and depreciation on capital which have to be deducted. Those items however constitute only a small part of the value added. Thus the non-wage and salary part of the value added divided by the net fixed assets (both at constant prices) is taken as a broad measure of the rate of return on capital.

Kendrick index is based on the assumptions of competitive equilibrium, constant returns to scale and Hicks neutral technical change. A serious drawback of the Kendrick index is that it includes a linear production function and thus fails to allow for the possible diminishing marginal productivity factors.

6 2.2 Solow Index

Solow has devised to measure technical change by specifying a simultaneous equation system. He has used production function approach by taking the assumptions that (i) the production function is of Cobb Douglas type (ii) the factors are paid to their marginal products (iii) the technical change is of neutral type and (iv) there is constant returns to scale. Accordingly, the function takes the special form $V_t = A_t (K_t, L_t)$ - (1). The multicative factor A_t measures the cumulative effects of shifts over time. V, L

and K are value added, labour and capital respectively. If equation (1) is differentiated totally with respect to time and divided by output V, we would have

$$\frac{\dot{V}}{V} = \frac{\dot{A}}{A} + \frac{A \partial F \dot{K}}{\partial K V} + \frac{A \partial F \dot{L}}{\partial L V} \qquad \text{——————(2)}$$

where dots indicate time derivatives. The marginal productivity conditions for capital and labour imply

$$\left(\frac{\partial V}{\partial K}\right) \frac{K}{V} = W_k \quad \text{and}$$

$$\left(\frac{\partial V}{\partial L}\right) \frac{L}{V} = W_L \quad \text{where } W_L \text{ and } W_K \text{ are}$$

shares of labour and capital. Substituting these in equation (2) we would obtain

$$\frac{\dot{V}}{V} = \frac{\dot{A}}{A} + W_k \frac{\dot{K}}{K} + W_L \frac{\dot{L}}{L} \qquad \text{——————(3)}$$

Solow simplified his equation further by taking

$$\frac{V}{L} = q, \quad \frac{K}{L} = k \qquad \text{and}$$

$$W_k = 1 - W_L$$

$$\text{ie.} \quad \frac{\dot{q}}{q} = \frac{\dot{A}}{A} + W_k \frac{\dot{K}}{K} \qquad \text{——————(4)}$$

Once $\frac{\dot{A}}{A}$ is computed using the equation (4) total factor productivity growth is obtained by the following identity (taking A_o as unity).

$$\text{ie.,} \quad A_t + 1 = A_t \left(1 + \frac{\dot{A}}{A}\right)$$

Being based on the Cobb-Douglas production function, the Solow index of total factor productivity involves the assumption of unitary elasticity of substitution. Although this appears quite restrictive, Nelson (1965) has shown that the fact of non-unitary elasticity of substitution is unlikely to make significant difference to the estimate of total factor productivity.

6.2.3 Empirical Results

Two alternative measures of total factor productivity associated with the names of Kendrick and Solow have been used. According to the Kendrick index only total factor productivity in the other rubber products sector showed an increasing trend (Table 6.2). In the other rubber products sector Kendrick total factor productivity index reached an all time high of 260.97 in 1979-80. In 1984-85 total factor productivity index in the other rubber products sector stood at 204.72. The compound annual growth rate in total factor productivity in

for the Years 1973-74 to 1984-85

Year	Kendrick Index			Solow's A_t Series		
	Tyres and Tube Industry	Other Rubber products sector	Rubber-Based Industry	Tyres and Tube Industry	Other Rubber products sector	Rubber-Based Industry
1973-74	100.00	100.00	100.00	1.00	1.00	1.00
1974-75	89.54	119.30	98.77	0.78348	1.20926	0.980214
1975-76	65.55	134.23	94.80	0.5649	1.37044	0.960820
1976-77	50.14	111.73	80.35	0.48982	1.16916	0.927889
1977-78	39.79	162.12	87.17	0.31775	1.82002	0.798966
1978-79	25.98	133.29	69.99	0.175331	1.44438	0.892750
1979-80	12.09	260.97	53.87	0.00431	2.422206	0.634767
1980-81	6.43	163.47	35.34	0.00215	1.54103	0.382764
1981-82	4.23	154.37	35.66	0.00121	1.43272	0.232689
1982-83	4.78	180.08	95.54	0.01239	1.65806	0.224733
1983-84	25.27	130.99	59.80	0.00643	1.05433	0.562342
1984-85	14.48	204.72	70.73	0.00411	1.62800	0.342297
Compound annual growth rate	-21.59	4.68	-5.21	-46.54	2.30	-11.96

Source: Computed from Annual Survey of Industries, Directorate of Economics and Statistics, Trivandrum.

the other rubber products sector is worked out to be 4.68. In the tyres and tube industry Kendrick index of factor productivity showed a declining trend. It reached as low as 4.23 in 1981-82. In 1984-85 total factor productivity index in the tyres and tube industry stood at 14.48. It is to be mentioned that during the period under study considerable variations in total factor productivity is noticed in the tyres and tube industry. The decline in growth rate in the tyres and tube industry during the period is worked out to be 21.59. Kendrick index of total factor productivity in the rubber-based industry as a whole also declined during the period under study. Total factor productivity index in the rubber manufacturing industry declined to 70.73 in 1984-85. The decline in growth rate during the period is found to be 5.65.

The Solow index of technical change showed an increase only in the case of other rubber products sector. It reached an all time high of 2.481 in 1979-80. The increase in growth rate can be more vividly depicted by the compound growth rate. The annual compound growth rate during the period is worked out to be 2.30. However Solow's index showed a declining trend in the case of tyres and tube industry. The decline in growth rate is estimated to be 46.54. When we take the rubber-based industry as a whole also we can find that Solow's index

showed a decreasing trend. This is mainly due to the considerable decrease in productivity in the tyres and tube industry. The decline in growth rate in the rubber-based industry during the period 1973-74 to 1984-85 is found to be 11.96. Thus we can infer that productivity showed a declining trend in the rubber manufacturing sector in Kerala. Only in the case of other rubber products sector total factor productivity index showed an increasing trend over the years.

6.3 Production Function Estimates

In economic theory the production function is generally a concept which states quantitatively the technological relationship between the output and the various factors of production. A production isoquant tells us how many units of capital and labour are necessary to produce a given amount of output. Measuring the elasticity of substitution, ie., to what extent the various factors of production can be substituted for each others in the production process, has been a very important issue in economic literature. Prior to 1961 applied production function studies dealt almost exclusively with functional forms which assumed specific numerical values for the elasticity of substitution parameter (Chakraborthy, 1982).

In the past, many growth models have been developed and analysed with the help of a production function subject

to certain restrictive features. For quite some time the Cobb-Douglas production function provided a simple maintained hypothesis with its input exponents adding upto unity and a unitary elasticity of substitution. But the discovery of theoretically and empirically better and more representative production functions embracing a wide variety of hypotheses has resulted in the greater accumulation of information concerning the various established indices of technology in production theory. The most widely known and popular production function in recent times has been the constant elasticity of substitution production function which includes Cobb-Douglas as well as Leontief production functions as special cases. Nevertheless the elasticity of substitution parameter in this production function is not variable along an isoquant, though it can take different values for different industries. This constraint on the index of technology is inappropriate in that the available data must have wide choice, so that the formulation of a structural hypothesis is plausible, relevant and free from specification bias. The variable elasticity of substitution production function overcomes this defect of constant elasticity of substitution production function as it explicitly permits the capital labour ratio to be an explanatory variable of productivity which does not enter into the theoretical and empirical specification of the CES production function.

Thus we can see that the constant elasticity of substitution and variable elasticity of substitution production functions do not assume any specific value for the elasticity of substitution, but, as their names imply, the former takes this elasticity as a constant while the latter allows it to vary. Thus the form of the production function is determined by the elasticity of factor substitution. In the present study estimates of Cobb-Douglas production function, C.E.S. production function and V.E.S. production function are attempted.

6.3.1 Concepts and Measurements

The data relating to net value added by manufacture, fixed capital, physical production, total employment and wages have been obtained from the annual survey of industries. As between gross value of output and net value added, the latter is to be preferred in most of the cases as it is a more reliable indicator of the contribution of labour to output. All the above-mentioned data have been obtained at current prices. All the major economic variables which are available in current prices were converted into constant prices (1970-71 prices). Gross output and value added have been deflated by the wholesale price index of concerned commodity or the nearest commodity price available. The wages and salaries have been deflated by

consumer price index of industrial workers. The fixed capital has been deflated by the wholesale price index of machinery and transport equipment.

Total persons employed have been taken for analysis and labour productivity has been measured by calculating net value added by number of persons employed. Similarly capital-labour ratio has been calculated as fixed capital per person employed. This is also an indicator of capital intensity.

6.3.2 The Cobb-Douglas Production Function

The objective of applying Cobb-Douglas production function in this study is to estimate the coefficients of inputs, shares in total output and degree of returns to scale. The relationship between input and output variables in the Cobb-Douglas form is usually expressed in either of the two forms.

$$V = A_1 K^{a_o} W^{a_1} e^{u} \qquad \text{———————} \quad (1)$$

$$Q = A_2 K^{a_2} W^{a_3} R^{a_4} e^{u} \qquad \text{———————} \quad (2)$$

where V = value added at constant prices

L = total number of persons employed

K = total fixed capital at constant prices

Q = total output at constant prices

W = total wages, salaries and benefits at constant prices

R = materials consumed at constant prices

U = error term.

A_1 and A_2 are efficiency parameters. a_o, a_1, a_2, a_3 and a_4 are empirical constants determined by the method of least squares. Function (2) differs from function (1) in the sense that while former includes raw materials as a factor of production and takes value of output as a measure of output the latter disregards raw material as a factor of production and measures output in net terms (value added). Although raw materials and other intermediate goods cancel as inputs and outputs for the economy as a whole, they do not cancel within an industry. This points out the use of value of output instead of value added and for the use of raw materials etc. as a factor of production. However, it is to be noted that such a use renders other factors of production, viz., capital and labour, as insignificant determinants of output in empirical studies. Functional form (1) is reasonable either when raw material cancels out as an intermediate good produced and consumed in the industry or when the coefficient of raw material in the equation form (2) is unity (Murty and Sastry, 1957).

Hence the following single variable regression model has been fitted and the statistical significance of the exponent has been tested by 't' test.

$$Q = C_o R^{C_1} \qquad \text{---------- (3)}$$

where Q = value of output at constant prices

R = value of raw materials at constant prices.

C_o and C_1 are parameters. Results of the function (3) shows that C_1 values are statistically different from unity and hence the linearity of output with raw material relationship does not hold good. The estimates of function (1) and (2) are presented in table 6.3. Table 6.3 gives estimates of labour and capital elasticity duly tested for their significance alongwith values of R^2 and F. In the tyres and tube industry the unrestricted Cobb-Douglas function yielded a positive estimate of the labour coefficient but a negative and statistically insignificant estimate of the capital coefficient. The negative capital coefficient may be because of the under-utilisation of capacity of the industrial units and the presence of uneconomic units which are carrying out production with worn-out machineries. The coefficient of determination in function (1) in the case of tyres and tube industry is quite

Table - 6.3

Regression Coefficients of the Cobb-Douglas Production Function

Model	Coefficients	Tyres and Tube Industry	Other Rubber Products Sector	Rubber-Based Industry
$Q = C_0 R^{C_1}$	Constant	0.82889*	0.9068*	1.10409*
		(0.05037)	(0.02247)	(0.03707)
	C_1	0.79257*	0.77389*	0.73175*
		(0.09872)	(0.03893)	(0.07623)
	R^2	0.8657	0.9753	0.9021
		64.46	394.85	92.145
$V = A_i K^{a_0} W^{a_1}$	Constant	2.3380*	0.26829*	1.606687*
		(0.26627)	(0.08728)	(0.108076)
	a_0	- 0.28109	0.468118***	0.044748
		(0.30257)	(0.216390)	(0.259206)
	a_1	0.428002**	0.840989*	0.493058*
		(0.17465)	(0.23343)	(0.100386)
	R^2	0.1927	0.7265	0.442661
	R^{-2}	0.0133	0.6657	0.320
	F	2.15	11.95	3.58
$Q = A_i K^{a_2} W^{a_3} R^{a_4}$	Constant	0.628239*	0.761475*	1.151710*
		(0.47383)	(0.022579)	(0.037887)
	a_2	-0.11220	0.081157	0.060048
		(0.0647)	(0.1081637)	(0.096756)
	a_3	0.035221*	0.126272*	0.125169*
		(0.002388)	(0.023127)	(0.0016933)
	a_4	0.933424*	0.67428*	0.580067*
		(0.122818)	(0.090578)	(0.144291)
	R^2	0.9049	0.9801	0.9182
	R^{-2}	0.8692	0.9726	0.8875
	F	25.374	131.34	29.93

Note: * Significant at one per cent level.
** Significant at five per cent level.
*** Significant at ten per cent level.

Source: Computed from Annual Survey of Industries (factory sector), Directorate of Economics and Statistics, Trivandrum.

low. Production function estimates reveal that decreasing returns to scale exists in the tyres and tube industry. When the raw materials etc. was introduced as an input, coefficient of determination turned out to be fairly high. But this results in the low values of capital and labour. Here the raw material co-efficient was found to be as high as 0.93. In function(2) also estimates of capital coefficient yields negative values.

In the other rubber products sector coefficient of labour is found to be as high as 0.84. Coefficient of capital is also comparatively high. Coefficient of determination is also fairly high. Regression estimates reveal the presence of increasing returns to scale in the other rubber products manufacturing sector. When raw material was introduced as an input (function (2)) coefficient of determination increased to 0.98. However, as in the case of tyres and tube industry raw materials coefficient turned out to be quite high, resulting in the low values of capital and labour in the function (2).

When we take the industry as a whole we can find that only the labour coefficient turned out to be significant (function (1)). Although capital coefficient is having the right sign it is not statistically significant. Coefficient of determination is found to be 0.44. Production function estimates show that there exists decreasing returns to scale

in rubber-based industry in Kerala. When raw materials was introduced as an input R^2 increased to 0.92. But this results in the low values of capital and labour coefficients.

Thus Cobb-Douglas production function estimates show that raw materials and labour are the major inputs that determine the output in the tyres and tube industry, other rubber products sector and the industry as a whole. There exists increasing returns to scale only in other rubber products sector. In the rubber-based industry as a whole there exists decreasing returns to scale, mainly because of the low productivity in the tyres and tube industry.

6.3 Constant Elasticity of Substitution Production Function

The elasticity of substitution is the most crucial parameter in terms of its implications about growth, output, employment and patterns of resource use. It is also an important parameter for determining resource allocation and economic growth, international trade and relative distribution of income (Solow, 1964). The elasticity of substitution can be defined as the proportional change in relative factor inputs to a proportional change in the relative factor price ratio.

The derivation of the C.E.S. functional form had been based on the empirical observation by Arrow et.al. (1961) that

a log linear relationship existed between output per unit of labour and real wage rate. The most widely used production function for determining this parameter is the constant elasticity of production function. The C.E.S. production function for two inputs can be written as

$$V = a_o \left[b_o K^{-r} + (1 - b_o) L^{-r} \right]^{-1/r} \qquad \text{——————(1)}$$

where V is value added, K is fixed capital, L is total number of employees and a_o, b_o and r are efficiency, distribution and substitution parameters respectively. The statistical model viz. C.E.S. production function presented by equation (2) can be derived from equation (1).

$$\log V/L = a + b \log w + u \qquad \text{——————} (2)$$

where 'a' is a constant, 'b' is the elasticity of substitution and u is the error term. The main advantage of the above form lies in their simplicity and that enters as a first order parameter which increases the possibility of its being estimated more precisely. Further in the above model the elasticity of substitution can be obtained easily.

The estimates of the C.E.S. production function are presented in Table 6.4. In the case of other rubber products

Table - 6.4

Regression Coefficients of the C.E.S. Production Function

(log V/L = a + b log W)

Industry	Constant	b	R^2	F
Tyres and Tube Industry	1.147263* (0.284886)	0.061130 (0.068479)	0.0797	0.779
Other Rubber products sector	0.468913* (0.087171)	1.187209* (0.336575)	0.5554	12.492
Rubber-Based Industry	0.743908* (0.114951)	0.600474** (0.24119)	0.355808	5.523

Note: *: Significant at one per cent level.

**: Significant at five per cent level.

Source: Computed from Annual Survey of Industries, Directorate of Economics and Statistics, Trivandrum.

sector R^2 is found to be 0.56. The fit of the C.E.S. function in this industry is fairly good with the model explaining 56 per cent of the variance in V/L. The value of the regression coefficient of wage rate (b), which gives the elasticity of substitution, is greater than unity with respect to the other rubber products sector and statistically significant. In the case of tyres and tube industry coefficient of determination and elasticity of substitution are found to be quite low. Further 'b' is not statistically significant. In the rubber-based industry as a whole also coefficient of wage rate turned out to be less than unity. Coefficient of determination is comparatively low in the rubber manufacturing industry as a whole.

6.3.4 Variable Elasticity of Substitution Production Function

The C.E.S. production function is based on the assumption of the existence of relationship between the value added per labour and wage rate independent of capital stock. But when the above relationship is not independent of capital-labour ratio, the usual C.E.S. function ceases to be valid. When the capital-labour ratio varies due to changes in the factor price ratio it is possible that the elasticity of substitution will vary as capital-labour ratio varies. So LU and Fletcher (1968) derived the variable elasticity of substitution production

function model from the following relationship:

$$\text{Log}\frac{V}{L} = \log c_o + c_1 \log W + c_2 \log\frac{K}{L} + U \quad \text{——(1)}$$

where V = value added at constant prices

W = real wage rate

L = total number of persons employed

and c_o, c_1 and c_2 are constants and u is the error term. Equation (1) can be estimated by the method of least squares. More generally V.E.S. function can be specified as

$$\frac{V}{L} = a_o \left[b_o K^{-r} + (1 - b_o)\, d_o \left(\frac{K}{L}\right)^{-c_2(1+r)} L^{-r} \right]^{-1/r} \quad \text{——(2)}$$

where a_o and b_o are efficiency and distribution parameters respectively. This production function has the same form as C.E.S. except that L^{-r} is multiplied by $\left(\frac{K}{L}\right)^{-c_2(1+r)}$ and $d_o = \frac{1 - c_1}{1 - c_1 - c_2}$ is introduced. Obviously if c_2 equals zero the multiplier becomes unity and the new function reduces to C.E.S. production function. The elasticity of substitution by this model is given by

$$e = \frac{c_1}{1 - c_2\left(1 + \frac{WL}{rK}\right)}$$ where c_1 and

C_2 are constants determined by equation (1). 'W' is wage rate and 'r' is returns to capital

Table 6.5 fives the estimates of the regression coefficients for V.E.S. production function . The values of C_1 and C_2 of V.E.S. production function as well as its R^2 and F values have been computed. In the case of other rubber products sector both C_1 and C_2 are found to be statistically significant. Further 64 per cent of the variations are explained by the estimated equation. It is to be noted that coefficient C_1 in the other rubber products sector is as high as 1.1413. Coefficient C_2 also is fairly high in the estimated equation. This shows that capital intensity has got an influence on the productivity in the other rubber products manufacturing sector. In the case of tyres and tube industry coefficient C_1 is found to be 0.30159. Coefficient C_2 is found to be negative and statistically not significant. This is in conformity with the results obtained by the earlier production function models. Coefficient of determination is found to be quite low in the case of tyres and tube industry. V.E.S. production function estimates for the rubber-based industry as a whole show that coefficient C_1 is less than unity. Coefficient of determination is comparatively low. Coefficient of capital intensity is negative and statistically not significant.

Table - 6.5

Regression Coefficients of the V.E.S. Production Function

$(\log V/L = C_0 + C_1 \log W + C_2 \log(K/L)$

Industry	Constant	C_1	C_2	R^2	R^{-2}	F
Tyres and Tube Industry	1.557027*	0.301588	-0.44769	0.2843	0.130	1.79
	(0.27133)	(0.67376)	(0.314694)			
Other Rubber products sector	0.162144***	1.14130**	0.406526**	0.640	0.56	8.00
	(0.082673)	(0.32076)	(0.179349)			
Rubber-Based Industry	0.756458*	0.6345**	-0.03068	0.3569	0.220	2.50
	(0.121092)	(0.26297)	(0.285342)			

Note: *: Significant at one per cent level.

**: Significant at five per cent level.

***: Significant at ten per cent level.

Source: Computed from Annual Survey of Industries (factory sector), Directorate of Economics and Statistics, Trivandrum.

Table - 6.6

Estimation of Elasticity of Substitution for VES Production Function Model

Year	Tyres and tube industry	Other Rubber products sector	Rubber-Based Industry
1973-74	0.201998	2.76577	0.611622
1974-75	0.181963	2.55672	0.608131
1975-76	0.179529	2.393153	0.608608
1976-77	0.179599	2.95277	0.606347
1977-78	0.166814	2.611483	0.606211
1978-79	0.144748	2.616495	0.605451
1979-80	0.168231	2.26301	0.609216
1980-81	0.0697046	2.77735	0.602183
1981-82	0.067403	2.83297	0.599970
1982-83	0.195029	2.814741	0.610140
1983-84	0.176769	3.01945	0.605675
1984-85	0.140470	2.42863	0.607523

Source: Computed from Annual Survey of Industries, Directorate of Economics and Statistics, Trivandrum.

Table 6.6 gives the estimates for the elasticity of substitution for the fitted V.E.S. production function model. It may be worthwhile to note that this elasticity is found to be varying throughout the span period from 1973-74 to 1984-85. However, it is observed that this elasticity is more than one only in the case of other rubber products industry. In the tyres and tube industry and the rubber-based industry as a whole elasticity of substitution is less than unity.

From the above discussion it emerges that productivity showed a declining trend in the rubber manufacturing industry. Only in the case of other rubber products sector productivity showed an increasing trend. Production function estimates show that there exists decreasing returns to scale in the rubber-based industry as a whole. Among the different sectors of the industry only in the other rubber products sector there exists increasing returns to scale. Elasticity of substitution estimates obtained by the C.E.S. and V.E.S. production functions show that elasticity of substitution is less than unity in the rubber manufacturing industry. However in the other rubber products sector elasticity of substitution is more than unity.

CHAPTER VII

CAPACITY UTILISATION AND GENERAL FUNCTIONAL PROBLEMS OF THE SURVEYED UNITS

Production can be considered as the joint resultant of many forces which facilitates production such as setting up men, machines, tools, customer orders, inprocess inventory, spare parts, raw materials and machine operator (Solomon Morris, 1965). If any of the factors above are not functioning properly it will lead to the underutilisation of capacity. Better capacity utilisation provides an opportunity for a quick increase in output and productivity in the short-run, thus improving the prospects for controlling inflation and creating conditions for accelerated growth in output as well as investment in the years to come. Capacity utilisation influences cost of production, profitability and generation of internal resources. It is therefore necessary that the problems of underutilisation of capacity should be identified and estimated in early stages itself to tackle the problem effectively.

Underutilisation of capacity has been one of the important factors affecting the efficiency of a productive enterprise. Underutilisation of capacity is a manifestation of a number of causes of stagnation. It is a symptom of

certain imbalances in the growth, drawbacks in the government policies and controls, in the quantity and quality of management and inappropriate choice of techniques of production.

Capacity utilisation has important implications for employment generation in developing countries (Samuel Paul,1974). Capacity utilisation rates can tell us what scope there is for stepping up output in the short run. Further, such evidence is important in taking decisions in the long run expansion required in the industrial sector. An improvement in the rate of utilisation of capacity will result in more than one-shot increase in output (Winston, 1974).

Several factors might affect capacity utilisation, some are supply factors and others are demand factors. On the supply side, raw material availability is the single most important factor affecting utilisation. Raw material availability would depend on domestic production, net imports and stocks. Factors like power shortage and transport bottlenecks would affect utilisation rates (Sastry, 1984). On the demand side, the most important factor affecting the capacity utilisation is lack of adequate demand for finished products. The fall in demand can occur either due to fall in purchasing power in the economy or emergence of some substitute in the market or a rise in the cost of production of the product.

From an economist's viewpoint capacity is a cost concept. It is usually defined as that output which can be produced at minimum average total cost, given the existing physical plant and organization of production and the prevailing factor prices (Hickman, 1964). Capacity utilisation means that proportion of the total capacity which has been gainfully utilised for production of required goods and services. Thus it is a ratio usually expressed as a percentage of actual production to the capacity. Although a plethora of prefixes are available to qualify capacity, ratio of actual production to installed capacity is used in the present study as a measure of capacity utilisation.

Since excess capacity is a pervasive and serious deterrent to growth in developing countries, a study of utilisation of industrial capital has got high significance. As already mentioned excess capacity would be attributed to fallacies, rigidities and errors in industrial policies and development planning. Thus we can see that better capacity utilisation is an important parameter to determine the efficiency of an industrial enterprise. Therefore, an attempt is made to analyse the capacity utilisation of the surveyed units in the present study.

7.1 Capacity Utilisation of the Sample Units

The estimates of rates of utilisation of capacity of the 54 rubber-based industrial units surveyed are presented in Table 7.1. The percentage of current output to the installed capacity output is taken as the degree of capacity utilisation.

An analysis of the capacity utilisation of the individual units revealed that majority of the units suffers from the highest rates of underutilisation (Table 7.1). Among the surveyed units capacity utilisation is the lowest in a tread rubber unit. In the industrial unit number 48, only 6.67 per of the installed capacity is utilised for production. It is significant to note that only one unit is having a capacity utilisation of more than 100 per cent, ie., in industrial unit number 46, capacity utilisation is found to be as high as 105.90 per cent. This unit is manufacturing rubberised coir products. When we take the average capacity utilisation of the surveyed units we can see that utilisation of capacity is to the level of 42.06 per cent in the rubber manufacturing industry. It is quite evident from Table 7.1 that the tyres and tube industry suffers from the highest rates of under-utilisation of capacity. Capacity utilisation in the surveyed tyres and tube industrial units revealed that the average capacity utilisation is as low as 39.895 per cent. Among the

Table - 7.1

Capacity Utilisation of the Sample Units During the Period 1986-87

(Value in Rs. '000)

Industrial unit			Installed Capacity		Actual Production		Percentage of capacity utilisation
			Q	V	Q	V	
1	2	3	4	5	6	7	8
1.	Contraceptives/Condoms	M.Pcs	288.00		281.9535		97.90
	Rubber band		30.00		18.00		60.00
3.	Rubber Compound		375.00		188.00		
							75.00
	Tread Rubber						48.00
	Tread Rubber						58.29
	Hawai Chappals M.C. sheet Hawai sheet V straps	I I I I				4050.00	
	Foam mattress						
	Bus seat						
		Dozen					
	Bushes, oil seal, oil rings, water seal	I I I I					
	Tread Rubber						
	Latex foam goods						
	Tread Rubber						
	Cushion gum						
	Bus seat						
	Cushions						
				172.987			
				3640.000		1092.000	
				447.917		350.500	
				282.250		200.400	
	strap			400.600		300.600	
	Kattai sheets			104.375		66.800	
	Tread Rubber		72.46	1449.275		1000.000	
	Hawai chappals		111351.00	1360.241		788.940	
			2083.00	1046.875		502.500	
			3438.00	343.800		165.000	
			17188.00	687.500		330.000	
				305.128		238.000	
	Hawai strap			29.470		22.250	
20.	Industrial gloves			182.432	15000.00	135.000	
	Tread Rubber			8148.000	220.00		
	Mastication			1538.500			
	Tread Rubber		265.15	5303.000			
	Rubber band		55.56	1555.556			
	Rubber chappals		29428.00	294.280			
	Rubber band		20.83	583.000			
	Rubber band		25.00	875.000			
	Tread Rubber						
				255.000			
	Tread Rubber			6667.000	59.70		
				2285.000	40.00		
			35.42	1068.000	17.00		

(contd...)

1	2	3	4	5	6	7	8
34.	Rubber band	Tonnes	12.00	350.000	7.20	210.000	60.00
	Finger tip	Kilogram	235.00	4.706	120.00	2.400	51.00
	Industrial gloves	Pair	2105.00	23.155	1200.00	13.20	57.00
35.	Automotive tyres		600000.00		110075.00		18.35
	Automotive tubes		600000.00		81950.00		13.66
36.	Automobile tyres	Nos.	534000.00		423560.00		79.31
	Automobile tubes	Nos.	420000.00		288817.00		68.77
	Retreading materials	Tonnes	3000.00		16.58		0.56
37.	Cycle tyres		1500000.00				0.00
	Cycle tubes		1500000.00				0.00
	Cycle rim	Nos.	300000.00				0.00
	Tread rubber	Tonnes	1200.00		418.00		34.83
	Tyre flap		24000.00		8354.00		34.81
	Latex foam goods	Tonnes	30.00		13.00		43.33
	Bus body fabrication		72.00		4.00		5.55
	Tyre retreading		14400.00		455.00		3.15
	Journal lubricating pad		250000.00		2110.00		0.84
38.	Rubber band	Tonnes	45.63	1596.875	6.20	217.000	13.59
39.	Rubber band	Tonnes	15.00	441.450	3.44	101.090	22.93
40.	Rubber band		10.00	339.300	1.025	34.780	10.25
41.	Rubber band		60.00	1920.000	28.000	896.000	46.67
42.	Rubber bands	Tonnes	60.00	2400.000	33.00	1320.000	55.00
43.	Tyres and tubes	Nos.(lakhs)	11.68	19760.000	6.50	11000.000	55.67
44.	Tread Rubber		180.00	5400.000	15.50	464.973	8.61
45.	Rubber bands	Tonnes	12.00	360.000	8.00	240.000	66.67
46.	Rubberised coir	Tonnes	730.00	21900.000	773.056	23191.680	105.90
47.	Tread Rubber	Tonnes	300.00	6750.000	41.61	936.225	13.87
48.	Tread Rubber		150.00	3750.000	10.00	250.000	6.67
49.	Hawai chappals			520.000		118.000	22.69
50.	Rubber band	Tonnes	18.00	594.000	8.00	264.000	
51.	Hawai sheet			327.000		208.100	63.64
	strap			120.000		78.000	65.00
52.	Latex cement adhesives	Litres	300000.00	4500.000	202800.00	2849.255	67.60
53.	Hawai chappals			5800.000		3700.000	63.79
54.	Latex thread			2875.000		1205.000	41.91

Note: Q: Quantity, Value.

Source: Computed from the data obtained from sample survey and the annual reports of the companies surveyed.

surveyed units tread rubber units are having the next lowest utilisation of capacity. Its capacity utilisation is found to be only 41.78 per cent. Average capacity utilisation in the rubber band units is also found to be low. Average capacity utilisation in the rubber band units is estimated to be 44.76 per cent. Rubber footwear, Rubber foam products and other rubber products industries are having comparatively better capacity utilisation. Their capacity utilisation is found to be 68.10 per cent, 60.36 per cent and 94.65 per cent respectively. However, when compared to the national level we can see that the capacity utilisation is far below the expected level. Shortage of power supply, demand constraints and worn-out machinery may be the major reasons for the under-utilisation of capacity in the rubber-based industrial units.

Thus the analysis revealed that capacity utilisation in the rubber manufacturing industry is comparatively low. Almost 57.94 per cent of the capacity still remains unutilised in the surveyed units. Among the surveyed units, tyres and tube industrial units, rubber band units and tread rubber units are utilising below 50 per cent of their installed capacity.

7.2 General Functional Problems of the Sample Units

An industrial enterprise is confronted with a number of problems in its functioning. The functional problems arise

in the course of the day-to-day functioning of an enterprise. These problems differ from industry to industry and from unit to unit. The major among them relate to both supply and demand factors. The important problems faced by an industry relate to the problem of finance, supply of raw materials, power, technical and managerial shortcomings, marketing and state policy. All the above-mentioned factors in one way or other affect the smooth and efficient working of an enterprise. Although Kerala is having the largest number of rubber-based industrial units in the country, they are facing a lot of problems. To analyse the major problems encountered by the rubber manufacturing industry, 54 units were selected on a stratified random basis for an indepth study. These industrial units were asked to specify the problems by major heads. A detailed analysis of the above-mentioned problems are given below:

7.2.1 Finance

Finance is an important catalyst for the smooth functioning of an enterprise. Capital is required not only for the establishment of an industry, but also for the day-to-day working of an enterprise.

Out of the 54 units surveyed only 19 industrial units are facing the problem of finance (Table 7.2). This constitutes

Table - 7.2

Problems of Finance Faced by the Sample Units

Sl. No.	Industry	Shortage of capital	Delays in official procedures in Govt. agencies	High rate of interest	Meagre assistance from Govt. and other financial institutions	Other difficulties	Total units facing the problem	No difficulty units	Total Units
1.	Tread Rubber	2	1	2	--	--	5	9	14
2.	Rubber band	3	-	1	1	1	6	9	15
3.	Rubber footwear	1	1	2	--	--	4	7	11
4.	Tyres and tube	1	-	-	--	--	1	3	4
5.	Foam products	-	-	1	--	--	1	3	4
6.	Other Rubber products	1	-	1	--	--	2	4	6
	Total	8	2	7	1	1	19	35	54

Source: Survey Data.

35.19 per cent of the surveyed units. Among the 19 units facing financial problems eight units complained shortage of capital as the major financial problem facing them. This accounts for 42.11 per cent of the total units facing the problem of finance. Seven units are of the opinion that high rate of interest is their major financial problem. This constitutes 36.84 per cent of the total units facing financial problems. Timely financial assistance is a crucial factor for the sustained development of an industry. Therefore delays in official procedures in government agencies and other financial institutions create problems for the industries. Two rubber-based units complained about delays in official procedures in government agencies for getting financial assistance. One rubber-based unit complained about the meagre assistance from government and other financial institutions. Only one unit is facing other difficulties related to finance. It include difficulties in connection with credit sales and delay in the settlement of accounts.

Out of the total units facing the problem of finance five are tread rubber units. This is 35.71 per cent of the total tread rubber units surveyed. Six rubber band units and four footwear units are also facing the problem of finance. This constitutes 40 per cent of the rubber foot-

wear units surveyed. One unit each from tyres and tube and foam products industry faces financial problems. Two other rubber products units are also facing the problem of finance. Out of the eight units facing the shortage of capital two units are tread rubber units. Three rubber band units are also facing shortage of capital. One unit each from rubber footwear, tyres and tube and other rubber products sector also faces shortage of capital. None of the surveyed foam products units faces any shortage of capital. Out of the two units complained of delays in official procedures in government agencies one each is from tread rubber and rubber footwear sector. Two footwear and tread rubber units complained about the high rate of interest. Out of the seven units who are facing the problem of high rate of interest one unit each is from rubber band, foam products and other rubber products sector. One rubber band unit complained about the meagre assistance from government and other financial institutions. They are of the opinion that commercial banks and other financial institutions are reluctant to give adequate finance to the industry. Another rubber band unit is facing other difficulties like delay in the settlement of accounts and credit sales.

Thus the analysis shows that 35.19 per cent of the total surveyed units are facing financial problems in one way or other. Out of the nineteen units facing the problem of finance as much as 78.95 per cent face shortage of capital and difficulties related to high rate of interest.

7.2.2 Raw Materials

Raw materials form an important element in the cost structure of rubber-based industrial units. Shortage of raw materials can lead to the underutilisation of the plant. An increase in the prices of raw materials may result in the low profitability of the product. The major raw materials required for the rubber manufacturing industry are natural rubber, synthetic rubber, carbon black and rubber chemicals.

Out of the total 54 units surveyed only 15 are facing the problem of raw materials (Table 7.3). This is 27.78 per cent of the total units surveyed. Among the 15 units facing the problem of raw materials eight units complained high prices of raw materials as their major problem. This constitutes 53.33 per cent of the units encountering the problem of raw materials. Only two units are facing the problem of getting low quality raw materials. Three units complained about the scarcity of raw materials. It is significant to note that none of the units complained about the shortage of natural rubber. This is due to the abundance of natural rubber in the state. However, these units complained about the shortage of synthetic rubber and rubber chemicals. Shortage of synthetic rubber is mainly due to the low production of synthetic rubber in the country. As consumption is comparatively smaller many

Sl.No.	Industry	High prices	Inferior quality	Scarcity	Other problems	Total units facing the problem	No. difficulty units	Total units
1.	Tread Rubber	1	1	2	1	5	9	14
2.	Rubber band	2	1	-	1	4	11	15
3.	Rubber footwear	2	-	1	-	3	8	11
4.	Tyres and tube	1	-	-	-	1	3	4
5.	Foam products	1	-	-	-	1	3	4
6.	Other rubber products	1	-	-	-	1	5	6
	Total	8	2	3	2	15	39	54

Source: Survey Data.

of the synthetic rubbers and compounding ingredients are not produced in our country. They have to be imported and such imports lead to time delays and other problems. In fact Nitrile rubbers, Polyacrylate rubbers, V.P. latex, Polybutadiene etc. have been brought into the restricted category. This creates a lot of problems to the non-tyre sector in particular as many of the automobile rubber components are made out of speciality synthetic rubbers like Nitrile and Poly-acrylate. Only two units complained that they are facing other problems like transportation and irregular supply of raw materials.

Out of the eight units facing the problem of high prices of raw materials two each are from rubber band and rubber footwear units. One unit each from tread rubber, tyres and tube, foam products and other rubber products sector complained about the high prices of raw materials. Only one tread rubber unit and rubber band unit is facing shortage of getting high quality of raw materials. Out of the three units facing the problem of scarcity of raw materials two are tread rubber units and one is a rubber footwear unit. One tread rubber unit and rubber band unit face other difficulties like transportation, high tax rates etc.

Thus the above discussion shows that majority of the surveyed rubber manufacturing units are not facing the problem of raw materials. Among the 15 units facing the problem of

raw materials 53.33 per cent of the units complained high prices of raw materials as their major problem.

7.2.3 Labour

Labour occupies an important position in the cost structure of a product. Therefore labour problems undoubtedly affect the cost of production of products. Labour is considered important not only because it is productive, but also because it activitates other factors and makes them useful for production purposes.

Interestingly majority of the surveyed units are of the opinion that labour is not a major problem facing their industrial unit (Table 7.4). Out of the 54 units surveyed, only 21 units complained that they are facing problems connected with labour. This is 38.89 per cent of the total units surveyed. One of the major reasons for the above-mentioned factor is the comparatively smaller number of labourers in the majority of the rubber-based industrial units. Among the 21 units facing the problem of labour 10 attributed unionisation as their major labour problem. This constitutes 47.62 per cent of the total units facing labour problems. Three units complained want of skilled labour as the major problem faced by them. Another three units complained abstenteeism of labourers from work as

Table - 7.4

Problems of Labour Encountered by the Sample Units

Sl.No.	Name of the Industry	Want of skilled Labour	Unionisation	Absenteeism	Other problems	Total units facing the problem	No Difficulty units	Total units
1.	Tread Rubber	1	3	1	1	6	8	14
2.	Rubber band	-	1	1	1	3	12	15
3.	Rubber footwear	1	2	1	1	5	6	11
4.	Tyres and tube	-	2	-	1	3	1	4
5.	Foam products	-	1	-	1	2	2	4
6.	Other Rubber products	1	1	-	-	2	4	6
	Total	3	10	3	5	21	33	54

Source: Survey Data.

another major difficulty facing them. Five other units are facing other difficulties like high wage rate and low labour productivity.

Out of the 21 units facing the problem of labour, six are tread rubber units, three are rubber band units, five are rubber footwear units, three are tyres and tube units and two each from foam products and other rubber products sector. Of the 10 units facing the problem of unionisation three are tread rubber units, two are tyres and tube units,one each from rubber band, foam products and other rubber products sector. Industry-wise analysis of the problem of absenteeism shows that one unit each from rubber band, tread rubber and rubber footwear is worried about absenteeism of their labourers. One unit each from tread rubber, rubber footwear and other rubber products industry faces the problem of shortage of skilled labour. Among the five units facing other difficulties related to labour one unit each is from tread rubber, rubber band, rubber footwear, tyres and tube and other rubber products sector.

Thus the above analysis shows that majority of the rubber-based industrial units do not face the problem of labour. Among the 21 units facing labour problems 47.62 per cent complained unionisation as their major problem.

7.2.4 Power

Power is the backbone of the industries and plays a vital role in fostering industrial activity. The most important source of power in the state is electricity. Easy availability of power was one of the important factors for the development of industries in the state. Electricity is no longer an abundant factor and the power shortage owing to lack of rainfall has caused substantial losses to the different productive enterprises.

Out of the 54 units surveyed as many as 35 units complained that power is a major problem affecting them(Table 7.5). This is 64.81 per cent of the total units surveyed. Among the 35 units facing the problem of power 16 units are of the opinion that scarcity of power is the major problem affecting them. This accounted for 45.72 per cent of the units facing power problems. Another eleven units complained irregular supply of electricity as the major problem affecting them. This is particularly important as some of the rubber-based units have to work continuously and any breakdown in between affects the quality of their products. Out of the 35 units facing power problems six complained of high cost of electricity. Another two units are facing other problems related to power.

Among the thirtyfive units facing the problem of power,

Table - 7.5

Problems of Power Supply Faced by the Sample Units

Sl.No.	Name of the Industry	High cost	Irregular supply	Scarcity	Other problems	Total units facing the problem	No Difficulty units	Total units
1.	Tread Rubber	2	3	3	-	8	6	14
2.	Rubber band	2	2	4	1	9	6	15
3.	Rubber footwear	1	2	4	-	7	4	11
4.	Tyres and tube	1	2	1	-	4	-	4
5.	Foam products	-	1	2	-	3	1	4
6.	Other Rubber products	-	1	2	1	4	2	6
	Total	6	11	16	2	35	19	54

Source: Survey Data.

nine are rubber band units, eight are tread rubber units, seven are rubber footwear units, four each are from tyres and tube and other rubber products sector and three are foams products industrial units. Out of the sixteen units reported scarcity of power as a major drawback, there are four units each from rubber band and rubber footwear, three units from tread rubber, two each from foam products and other rubber products sector and one unit from tyres and tube industry. Three tread rubber units, two units each from rubber band, rubber footwear and tyres and tube complained that they have problems related to irregular supply of power. Among the six units complained about high cost of power, two units each are from tread rubber and rubber band and one unit each from rubber footwear and tyres and tube industry. One rubber band unit and other rubber products sector unit face other difficulties related to power.

Thus the above discussion shows that majority of the rubber manufacturing units are facing problems related to power. Scarcity and irregular supply of power are the major problems faced by the surveyed units.

7.2.5 Marketing

Successful marketing of products is an important factor for the efficient running of an enterprise. one of

the major reasons for the underutilisation of capital and industrial sickness is poor marketing management. In most of the rubber-based industrial units which face underutilisation of capacity there exist problems in marketing their products.

Among the 54 units surveyed as much as 39 units are facing problems in marketing their products (Table 7.6). This is 72.22 per cent of the total units surveyed. Out of the 39 units facing problems in marketing, eighteen units considered low demand as their major constraint. This constitutes 46.15 per cent of the total units facing problems in marketing. Another ten units considered competition as their major marketing problem. Another seven units complained transportation as their major bottleneck in marketing their products. Two units each complained inferior quality and other problems related to marketing as their major marketing constraints.

Industry-wise analysis of marketing problems shows that eleven tread rubber units, twelve rubber band units, eight rubber footwear units, two units each from tyres and tube and foam products industry and four other rubber products units are facing problem in marketing. Out of the eighteen industrial units which face slackness in demand, eight are tread rubber units, six are rubber band units, four are rubber footwear units, two are other rubber products units and the remaining one is a foam rubber products unit. Thus we can see that of the total units facing problems in marketing 46.15 per cent are suffering from

Table - 7.6

Problems in Marketing Faced by the Sample Units

Sl.No.	Name of the Industry	Low Demand	Competition	Inferior quality	Transportation	Other problems	Total No.of units facing the problem	No difficulty units	Total units
1.	Tread Rubber	5	4	1	1	-	11	3	14
2.	Rubber band	6	3	-	2	1	12	3	15
3.	Rubber footwear	4	2	1	1	-	8	3	11
4.	Tyres and tube	-	1	-	1	-	2	2	4
5.	Foam products	1	-	-	1	-	2	2	4
6.	Other rubber products	2	-	-	1	1	4	2	6
	Total	18	10	2	7	2	39	15	54

Source: Survey Data.

low demand for their products. Out of the ten units facing competition from other units in marketing their products, four are tread rubber units, three are rubber band units, two are rubber footwear units and one is a tyre and tube manufacturing unit. Tread rubber units are of the opinion that the domination and competition from large units creates a lot of problems in marketing their goods. One tread rubber unit and footwear unit considered low quality of their products as a major bottleneck in marketing their products. Among the seven units which face the problem of transportation two are rubber band units and one unit each is from tread rubber, rubber footwear, tyres and tube, foam products and other rubber products sector. An important characteristic of the rubber band unit is that rubber band is mainly sold outside the state either through selling agents, or through middlemen or directly. The units which have established their marketing are only a few and as a result majority of the units are dependent on the intermediaries. The extent of control exerted by the intermediaries is evident from the fact that many of the smaller units have to resort to price cuts to sell the products and consequently the sale price in monetary terms is stagnating (George Tharian, 1986). Analysis shows that one rubber band unit and other rubber products sector unit face other problems related to marketing.

From the above analysis it is clear that majority of the surveyed rubber manufacturing units are facing problems in marketing their products. This may be one of the major reasons for the underutilisation of capacity in the surveyed units.

7.2.6 Managerial and Technical Problems

Out of the 54 units surveyed only fourteen units complained managerial and technical shortcomings as their major problem. This is 25.93 per cent of the total units surveyed. Four unit each from tread rubber and rubber band, three rubber footwear units and one unit each from tyres and tube, foam products and other rubber products sector complained managerial and technical constraints as their major problem. They considered difficulty in getting technical expertise as a major hurdle affecting the rubber manufacturing industry, especially the small scale sector. There is no single organisation capable of giving technical guidance in various aspects of the industry as a whole. Therefore many entrepreneurs are afraid of putting up rubber-based industrial units. Majority of the manufacturers are of the opinion that the testing facilities which the Rubber Research Institute of India provides is insufficient. Some of the entrepreneurs complained about the inadequacy of satisfactory management development programmes and consultancy services provided by various institutions.

7.2.7 State Policy

Among the 54 units surveyed, 17 units considered the need for state intervention for the development of rubber-based industry in the state. Five units each from tread rubber and rubber band, three rubber footwear units, one unit each from tyres and tube and foam products and two other rubber products sector units felt the need for more favourable state policy towards the rubber manufacturing industry in the state. They are of the opinion that the existing tax structure is not in tune with the changing conditions. High tax rates on various types of rubber-based units adversely affect the growth of many units. The high incidence of excise duty on tread rubber, carbon black etc., which are used in retreading and repairing of tyres, is detrimental to the growth of the tread rubber industry (Laxminarayan, 1986). If the duty is exempted in such items many sick and limping units can be revived and new entrepreneurs will come forward to set up more such units.

The industry suffers enormously under the heavy customs duty on various synthetic rubbers and compounding ingredients imported into the country. The total duty structure varies between 114 per cent and 319 per cent in most of the cases. All these increase the cost of the finished products at the end putting a burden upon the average consumer. Another important

consequence of the present tax policy is that many of the units are forced to resort to unaccounted sales. The net result is that both central and state governments are deprived of their due tax revenues (Laxminarayan, 1986).

7.2.8 Other Problems

Out of the 54 units surveyed, 10 units complained that they are facing other problems like difficulty in transporting their products to distant places, lack of feasibility reports about the demand for various rubber products etc. This is 18.52 per cent of the total units surveyed. Three rubber band units, two units each from rubber footwear and tread rubber, one unit each from tyres and tube, foam products and other rubber products sector face other difficulties in running their enterprises. These manufacturers pointed out the lack of marke feasibility studies as a reason for the non-diversification of rubber products manufacturing in the state.

Thus the above discussion reveals that capacity utilisation in the rubber-based industry is low. Rubber-based industrial units in the state are facing a plethora of problems in financing, marketing, raw material availability etc. The major problems faced by the surveyed units are problems in mark ing their products and shortage of power. This may be one of t reasons for the presence of large excess capacity in the survey units.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

In this chapter an attempt is made to highlight the major findings with a view to providing a basis for the policies that should be adopted, so as to accelerate the development of rubber-based industry in Kerala.

8.1 Growth of Rubber Production

Kerala accounted for 87.94 per cent of the total area and 92.1 per cent of the total natural rubber production in the country in 1986-87. The study shows that area, yield and production of rubber has increased substantially during the last three decades. An analysis of the supply response reveals that short-term response is mainly affected by current price rather than lagged price. In the case of long term planting decisions cultivators are influenced by the past eight year prices and that they positively respond to price. Yield response of natural rubber is mainly affected by lagged price. Thus the analysis conclusively established that favourable price was one of the major reasons for the increase in rubber production in the state.

8.2 Rubber-Based Industry in Kerala

Although rubber cultivation was started on a commercia scale in the latter half of the 19th century, rubber-based industry in the state was established only in the first half of the twentieth century. However, the number of licensed manufacturers in the state has increased substantially over the years, particularly after the post-independence period. From just 54 rubber manufacturing units in 1965-66, the number of licensed rubber-based industrial units has increased to 630 in 1986-87. In 1986-87 Kerala occupied the primary position in the number of manufacturers in the country. In fact, in 1986-87 15.72 per cent of the total rubber manufacturing unit in the country were in Kerala.

As a direct consequence of the increase in the number of licensed manufacturers, rubber production and industrial output, consumption of rubber has increased considerably. Kerala consumes 12.22 per cent of the total consumption of natural rubber in the country and 14.93 per cent of the total production of natural rubber in the state. Consumption of synthetic and reclaimed rubber has also increased considerably over the years. In 1988-89 tyre sector accounted for 33.78 per cent of the total licensed quantity of consumption of natural rubber in the state. Tread rubber sector accounted

for 21.43 per cent of the total consumption of natural rubber. The rest is accounted by other different categories of rubber-based industrial units.

Although fixed capital, working capital, materials consumed, total inputs, total output and net value added in the rubber-based industry have increased over the years, the increase has been considerably low in real terms. In 1984-85 the share of the rubber-based industry in the total fixed capital investment in the state manufacturing sector is worked out to be 2.32 per cent. Value added in the tyres and tube industry showed wide fluctuations during the period under study. In 1984-85 the share of the rubber manufacturing industry in the total net value added in the manufacturing sector in Kerala is worked out to be 5.17 per cent. It is to be noted that during the period under study only the share of the other rubber products sector showed an increasing trend both in the state and in the national levels.

8.3 Movements of Input and Output Prices

An analysis of the trends in input and output prices reveals that the wholesale price index of raw materials and finished rubber products has increased considerably over the years. From the analysis it emerges that synthetic rubber

prices showed the least variability among the raw material prices followed by natural rubber. Among the input prices carbon black has shown the highest variability in prices. Among the finished rubber products, rubber hoses has shown the highest variability in prices, whereas rubber and plastic shoes showed the least. Synthetic rubber prices have shown the lowest growth rate among the raw materials followed by natural rubber. Among the finished products rubber hoses has shown the highest growth rate followed by rubber and plastic shoes. The study shows that the growth in input prices are mainly responsible for the increase in prices of finished rubber products.

High value of the coefficient of the ratio of the manufacturer's stock and State Trading Corporation's stock to total stock in the regression estimates reveals the significance of buffer stocks for indirectly controlling natural rubber prices rather than direct price control measures.

8.4 Productivity Trends

An analysis of the partial productivity trends shows that only in the other rubber products sector labour productivity and capital productivity showed an increasing trend. In the rubber-based industry as a whole the aforesaid ratios showed a declining trend. An increase in capital intensity

has not resulted in any increase in capital productivity and labour productivity in the tyres and tube industry and rubber-based industry as a whole. However, in the case of other rubber products sector both labour productivity and capital productivity showed an increasing trend. Both Solow and Kendrick indices reveal a declining trend in total productivity in the tyres and tube industry and rubber manufacturing industry as a whole.

Cobb-Douglas production function estimates show that there exists decreasing returns to scale in the tyres and tube industry and the rubber-based industry as a whole. However, it is to be noted that increasing returns to scale prevails in the other rubber products sector. Elasticity of substitution estimates obtained by constant elasticity of substitution and variable elasticity of substitution production functions show that it is less than unity in the tyres and tube and rubber-based industry as a whole, though it is greater than unity in the other rubber products sector. Variable elasticity of substitution production function estimates show that capital intensity does not influence value added-labour ratio in the rubber manufacturing industry as a whole and tyres and tube industry. However it has got marginal influence on labour

productivity in the other rubber products sector.

8.5 Capacity Utilisation and Functional Problems

Average capacity utilisation of the surveyed units shows that 57.80 per cent of the capacity still remains unutilised in the surveyed units. Among the surveyed units tyres and tube industrial units, rubber band units and tread rubber units utilised below 50 per cent of their installed capacity.

Although majority of the surveyed units are facing a wide range of functional problems the major problems faced by the surveyed units are problems in marketing their products and shortage of power. The study shows that 35.19 per cent of the total surveyed units are facing financial problems in one way or other. It is to be noted that only 27.78 per cent of the total units surveyed are facing the problem of raw materials. Out of the 54 units surveyed 38.89 per cent of units are facing labour problems. The analysis reveals that 64.81 per cent of the surveyed units are facing problems related to power and 72.22 per cent of the surveyed units face problems in marketing their products.

In short we can say that although number of units and consumption of rubber has increased considerably productivity

in the rubber-based industry showed a declining trend over the years. Capital productivity showed a dismal picture in the rubber-based industry in Kerala. Rubber-based industrial units are facing a lot of problems viz., underutilisation of capacity, power shortage, problems in marketing etc. These anomalies can be removed only with the assistance and co-operation of the government, Rubber Board, financial institutions and trade union leadership.

8.6 Recommendations

Following recommendations are made in the context of the present study:

1. In order that the domestic rubber goods industry is able to produce goods at competitive prices, prices of basic inputs should be stabilised with the help of a buffer stock system.

2. Steps should be taken to increase the productivity in the rubber manufacturing industry in Kerala.

3. Capacity utilisation in the rubber-based industry should be increased.

4. It is important to undertake a review of the existing tax structure to examine the possibilities of reducing the tax burden.

5. Testing laboratories should be set up in every district to assist the units in testing the quality of their products.

6. Financial institutions should provide timely and adequate finance for the setting up and expansion of rubber-based industry in the state.

7. Export potentialities of rubber products should be examined to solve the marketing problems of rubber-based industrial units.

8. The Kerala Government and Rubber Board should jointly come forward to set up a consultancy organisation to provide feasibility reports of rubber products, updated technology, marketing acumen and to impart training to the entrepreneurs.

To sum up, in this study an attempt has been made to study the development, productivity and problems of the rubber-based industry in Kerala. Since the present study relates to the above-mentioned aspects it does not seek to answer some of the issues which future researchers should concern such as

i) How far rubber-based industry is effective in creating linkage effects between different sectors in the industry?

ii) What measures can be taken to utilise more effectively the underutilised capacity?

iii) What should be the optimum size of the buffer stock system to control the prices of inputs?

iv) What kind of technology and investment criteria should be adopted for the development of rubber-based industry in the state?

v) How far were the government and other promotional agencies successful in promoting the rubber-based industry in the state?

Feasibility studies of various rubber products, impact of the growth of rubber manufacturing industry on other sectors etc. are some of the other areas which can be taken up for further research.

Appendix - I

Estimates of the Semi-Log Trend Equation

(Period, 1970-71 to 1986-87)

Sl.No.	Item	Estimated Equation	R^2	F
1.	Consumption of natural rubber in India	Log $CNRI_t$ = 4.9513* + 0.02674* t (0.02278)(0.001127)	0.974	561.923
2.	Consumption of synthetic rubber in India	Log $CSRI_t$ = 4.3910* + 0.02643* t (0.06909)(0.00343)	0.799	59.63
3.	Consumption of reclaimed rubber in India	Log $CRRI_t$ = 4.12678* + 0.02736* t (0.0199) (0.000986)	0.9809	770.34
4.	Natural rubber production in Kerala	Log Q_t = 4.9661* + 0.01818* t (0.03005) (0.001497)	0.91	151.67
5.	Yield per hectare of natural rubber in Kerala	Log Y_t = 2.8227* + 0.007615* t (0.02068) (0.001023)	0.7867	55.32
6.	Area under natural rubber in Kerala	Log A_t = 5.2273* + 0.01659* t (0.01979) (0.000979)	0.951	291.12
7.	Consumption of natural rubber in Kerala	Log $CNRK_t$ = 3.7737* + 0.04435* t (0.05235) (0.00259)	0.951	291.12
8.	Consumption of synthetic rubber in Kerala	Log $CSRK_t$ = 3.02484* + 0.049385* t (0.154436)(0.007645)	0.736	41.82
9.	Consumption of reclaimed rubber in Kerala	Log $CRRK_t$ = 2.6599* + 0.059184* t (0.11401) (0.005644)	0.88	110.00
10.	Average Market Price of Natural Rubber	Log P_t 2.5854* + 0.04130* t (0.06933) (0.00343)	0.906	144.57

Note: 1) $CNRI_t$ = Consumption of natural rubber in India, $CSRI_t$ = Consumption of synthetic rubber in India, $CRRI_t$ = Consumption of reclaimed rubber in India, Q_t = Production of natural rubber in Kerala, Y_t = Average yield per hectare of rubber in Kerala, A_t = Area under natural rubber in Kerala, $CNRK_t$ = Consumption of natural rubber in Kerala, $CSRK_t$ Consumption of synthetic rubber in Kerala, $CRRK_t$ = Consumption of reclaimed rubber in Kerala, t = trend in years, P_t = Price of Natural Rubber.

2) * Significant at one per cent level.

Computed from Indian Rubber Statistics, Vol.18, Rubber Board, Kottayam.

Appendix - 2

Production of Natural, Synthetic and Reclaimed Rubber in India

(Metric Tonnes)

Year	Natural Rubber	Synthetic Rubber	Reclaimed Rubber
1970-71	92171	29791	15507
1971-72	101210	32911	16710
1972-73	112364	21832	17186
1973-74	125153	23542	18644
1974-75	130143	17712	19360
1975-76	137750	25119	19581
1976-77	149632	23212	20256
1977-78	146987	27288	21817
1978-79	135297	28054	27618
1979-80	148470	29524	26786
1980-81	153100	25293	29336
1981-82	152870	28499	28787
1982-83	165850	30290	28242
1983-84	175280	32270	32964
1984-85	186450	37669	34155
1985-86	200465	34758	39195
1986-87	219520	38816	38995

Source: Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

Appendix - 3

Area and Average Yield Per Hectare of Natural Rubber in India

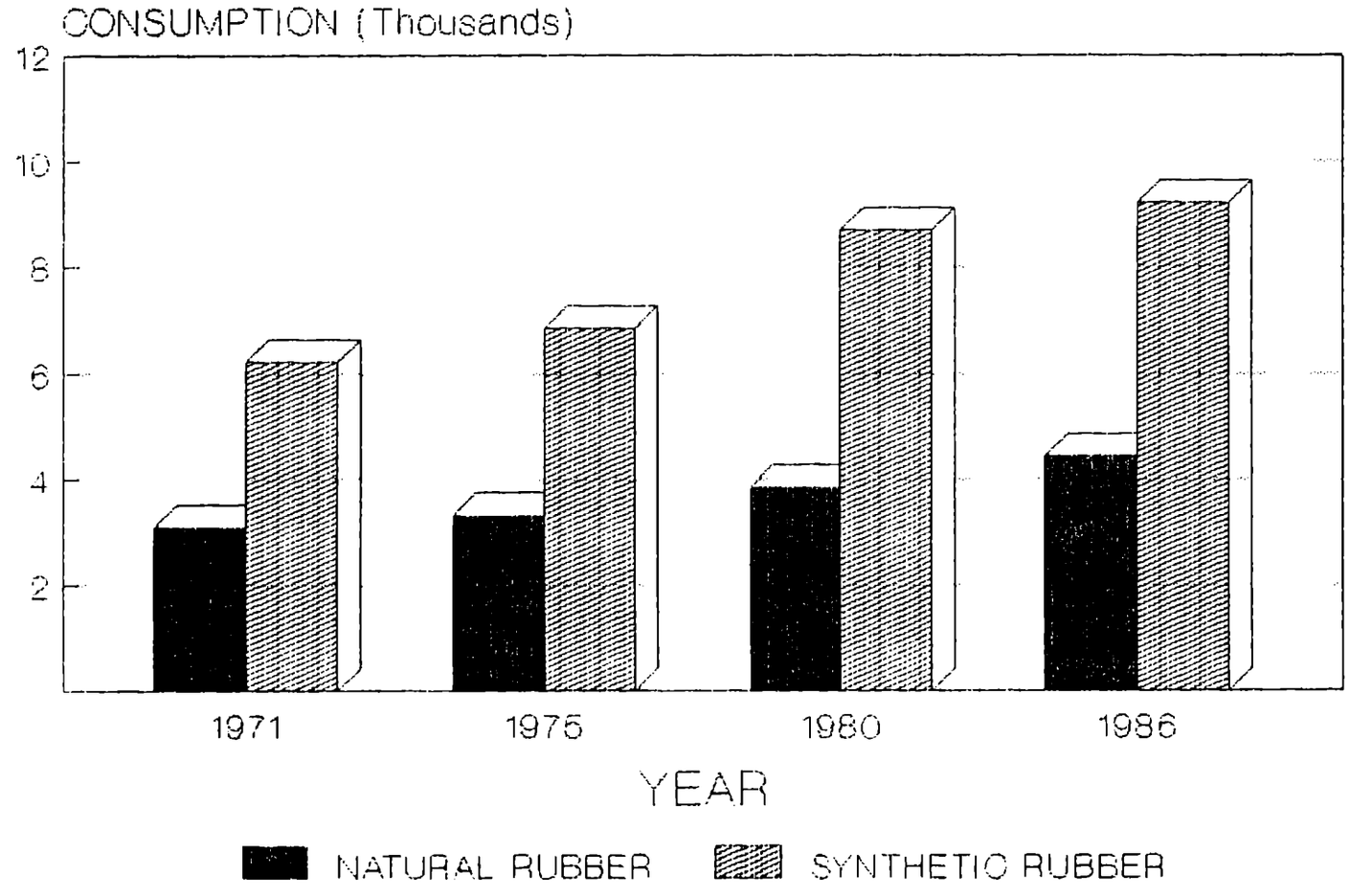
(Area in hectares, yield per hectare in kgs.)

Year	Area	Yield
1955-56	83867	353
1960-61	129905	365
1970-71	203098	653
1971-72	208781	678
1972-73	213112	725
1973-74	217540	756
1974-75	221265	762
1975-76	224428	772
1976-77	230563	806
1977-78	245200	770
1978-79	249250	711
1979-80	261495	771
1980-81	278057	788
1981-82	295543	779
1982-83	313223	830
1983-84	331767	857
1984-85	351850	886
1985-86	369348	898
1986-87	384000	926

Source: Indian Rubber Statistics, Vol. 18, Rubber Board, Kottayam, 1988.

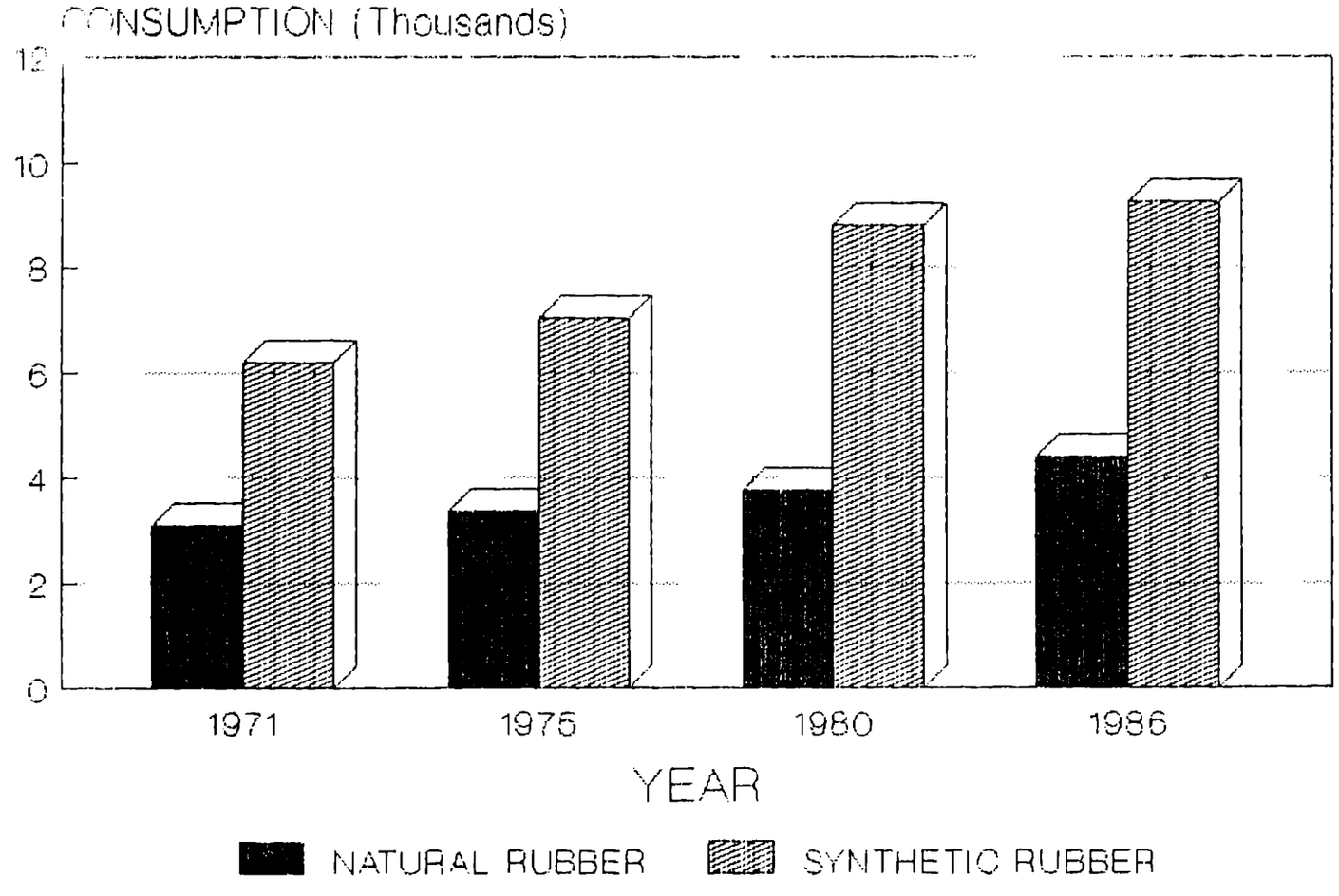
Appendix- 4

WORLD PDN.OF NR&SR
(IN THOUSAND M.TONNES)

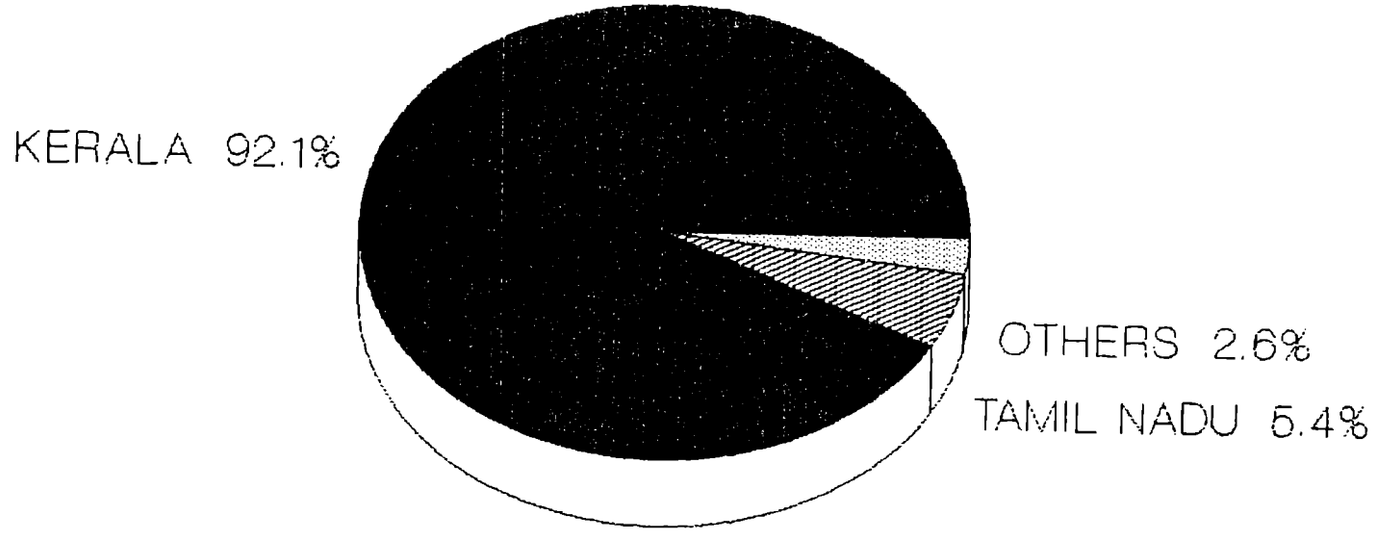


Appendix 3

WORLD CONS. OF NR&SR
(IN THOUSAND M.TONNES)

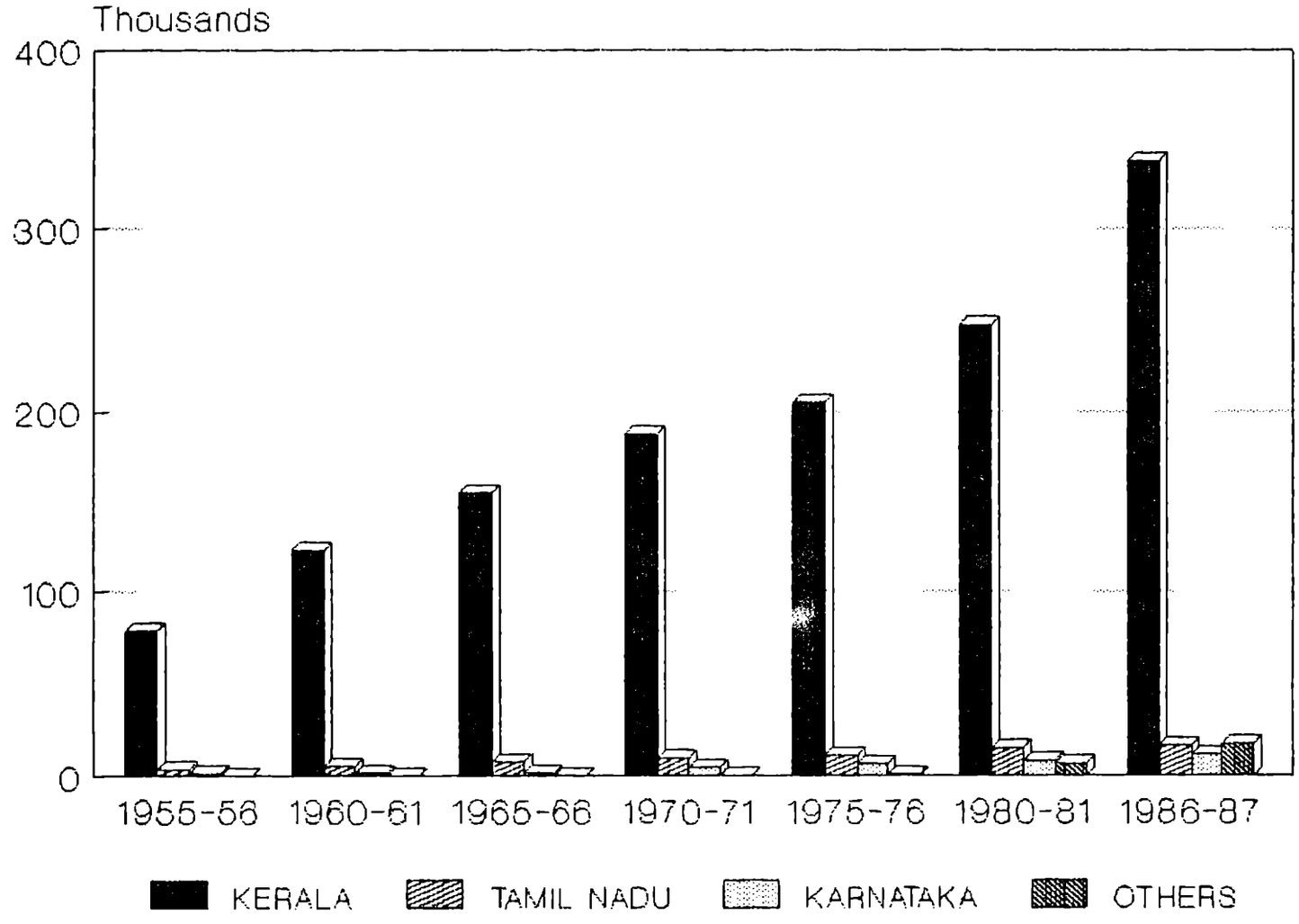


PRDN.OF NR IN DIFFNT.STATES
(1986-87)



APPENDIX - 7

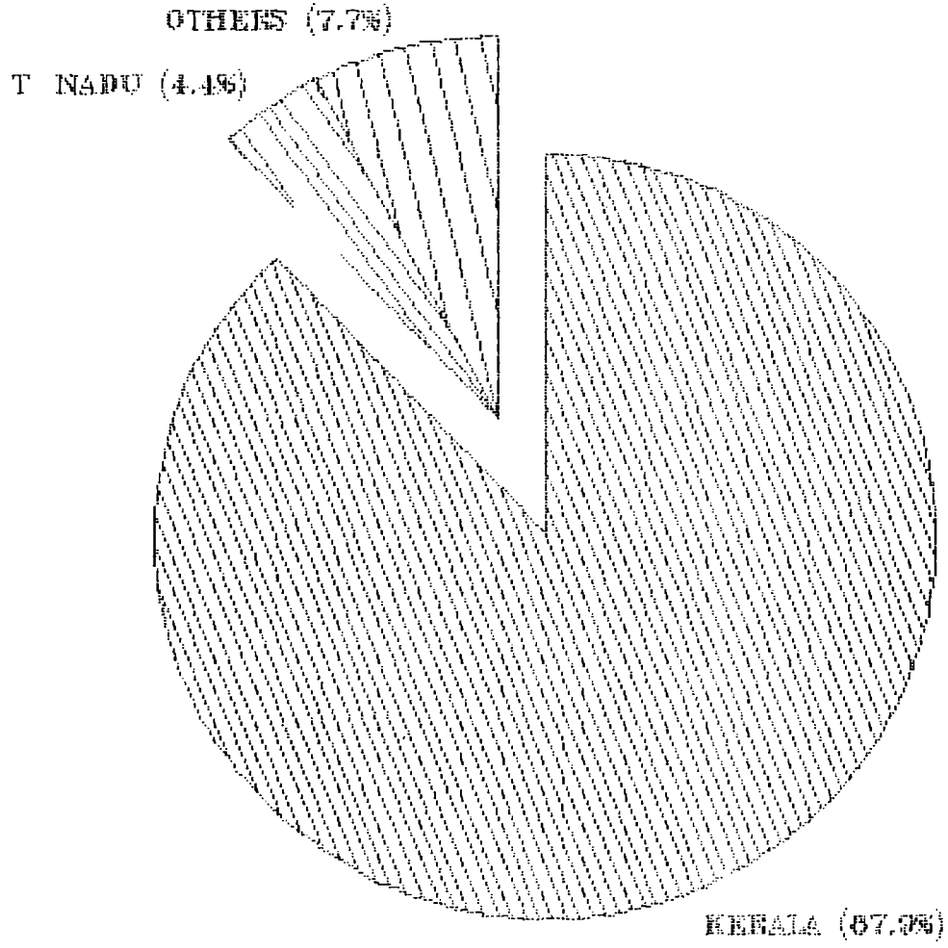
STATEWISE AREA UDR.NR.



APPENDIX - 8

AREA UNDER N.RUBBER IN DIFF.STATES.

(1986-87)



ANNEXURE

THE ECONOMICS OF RUBBER-BASED INDUSTRY IN KERALA

A Survey on Rubber-Based Industries in Kerala

Section - I

1. Name and address of the unit:
2. Tye pf ownership
3. Year of establishment
4. Year of initial production
5. Average working hours/day

Section - 2

Details of Fixed Assets

Sl.No.	Item	Value on the date of survey	Asset not owned(value)
1.	Land		
2.	Building		
3.	Pland and Machinery		
4.	Transport equipment		
5.	Tools & other fixed assets		
6.	Total		

Section - 3

Details of Working Capital

Sl.No.	Item	Value
1.	Raw Materials	
2.	Stores and fuels	
3.	Finished products & by-products	
4.	Total physical working capital (1+2+3)	
5.	Cash in hand and bank	
6.	Amount receivable	
7.	Semifinished goods	
8.	Amount payable	
9.	Net balance (6-7)	
10.	Total working capital (4+5+8)	

Section - 4

Details of loan taken

Sl.No.	Institutions	Outstanding amount at present	Percentage of interest	Amount paid as interest during the year
1.	K F C			

2. KSIDC

3. Other financial Corporations (Specify)

4. Banks

5. Government

6. Money lenders

7. Friends & relatives

8. Others (specify)

9. Total

Section - 5

Employment Details

Sl.No.	Item	Average number of workers per working day				Salaries, wages & allowances	Bonus & other benefi-ciaries	Total
		Men		Women				
		C	P	C	P			
1.	Hired workers							
2.	Paid family workers							
3.	Supervisory staff							
4.	Other employees							
5.	Working propreitors							
	Total							

C = Casual, P = Permanent.

Section - 6

Cost of Stationery, Services, Power and Taxes

Sl.No.	Item	Value
1.	Electricity	
2.	Repair of fixed assets	
3.	Inward transport charges	
4.	Postage and stationery	
5.	Insurance charges	
6.	Audit and account charges	
7.	Other services	
8.	Taxes and License	
9.	Interest paid	

Section - 7

Materials Consumed

I. Basic Materials

S.No.	Name	Unit	Quantity	Value
1.	Natural Rubber			
2.	Synthetic Rubber			
3.	(Specify)			
4.				
5.	Total			

II. Chemicals

S.No.	Name	Unit	Quantity	Value
1.	Carbon black			
2.	(Specify)			
3.				
4.				
5.	Total			

III. Packing Materials

Total

Section - 8

Cost Structure of the Product

S.No.	Product	Cost of raw materials	Packing materials and related cost	Manufacturing overhead	Profit
1.					
2.					
3.					

b) High rate of interest

c) Delays in official procedures in Government agencies.

d) Meagre Assistance from the Government and other financial institutions

e) Any other problem (Specify)

ii) Raw Materials

a) High prices

b) Scarcity

c) Inferior quality

d) Other problems (specify)

iii) Power

a) High cost

b) Irregular supply

c) Scarcity

d) Other problems (Specify)

iv) Labour

a) Want of skilled Labour

b) Unionisation

c) Absenteeism

d) Other problems (Specify)

v) Marketing

a) Low Demand

Section - 9

Products and By-Products

Sl.No.	Item	Unit	Quantity	Value (exfactory)

Section - 10

Details of Capacity Utilisation

Sl.No.	Name of the product	Installed Capacity		Actual production		Percentage of capacity utilisation
		Q	V	Q	V	
1.						
2.						
3.						

Q = Quantity, V = Value.

Section - 11

Major Problems Encountered

What are the major problems faced by your unit? Specify the following reasons in the order of importance under each head (Rank):

i) Finance

a) Shortage of capital

b) Competition

c) Inferior quality

d) Transportation

e) Other problems (Specify)

vi) Technical and Managerial Assistance

a) Expensive and ineffective Consultancy Service

b) Non-availability of proficient Managers

c) Other problems (Specify)

vii) Policies of the Government

Describe the policies of the Government which are detrimental to the interest of your industrial unit.

viii) Other Problems: (Specify)

Section - 12

Other Details

a) What is your opinion about the help extended by Rubber Board in promoting the Rubber-Based Industry in Kerala?

b) Do you think that a separate agency is necessary for the development of rubber-based industry in Kerala? If yes give reasons.

c) What are your suggestions for the development of rubber-based industry in Kerala?

d) Do you have any other relevant information which you want to share with us?

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