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COUNTRY REPORT

Tea-growing countries of the world: Bangladesh

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Overview of Bangladesh Tea Sector

Bangladesh is a very small player in the global tea scenario but plays an important role in the national economy. Its contribution in terms of employment and welfare to rural backward areas is highly considerable. It employs 117,728 people of ethnic minority directly, ~51% of whom are women. Besides, ~800,000 people are indirectly dependent on its marketing, distribution, supporting industries, transportation and packaging industries, *etc.* It contributes ~3.3% to the national employment 0.81% to GDP and ~1.0% to export earning. Tea is grown on such land of a country where no other agricultural crop could be produced on commercial basis. It pays about Tk. 800 million (M) to the Government as VAT, LD Tax, tea cess, Income and other taxes every year.

Physiography of Bangladesh

Bangladesh is situated between 20°34'10" and 26°37' North latitude and 88°40'50" East longitude covering an area or 143,998.26 km^2, of which 9379.51 km^2 is traversed by rivers, and 22.289 km^2 by forests. Main striking physiographic feature of the country is the vast plain, with numerous streams, marshes, back swamps and bheels having less than 30 m above the sea level. The hilly regions are found in Sylhet-the-north-eastern region, and in Chittagong and Chittagong Hill Tract-the south-eastern part of the country where tea is cultivated. The snow and rains falling over the eastern Himalayas in Bhutan, Nepal and Assam to the north of Bangladesh provide the major water-supply of the Ganges–Brahmaputra–Meghna river system with over 3,000 mm of rainfall annually.

Tea Ecosystem

The Tropic of Cancer passes almost through the middle of Bangladesh, making country's southern part fall into the tropical and the northern parts into sub-tropical and even temperate zone. But, the physiographic of condition of the land which is generally low and level, the nearness to the sea, high rainfall and being a riverine in nature, have made the climate tropical with sub-tropical touch in some places in the north and Hilly regions of east and north-east. Bangladesh is a scene of a perpetual battle between three air-streams of different thermodynamic characteristics which determine the general climate.

The West monsoon which originates over the Indian Ocean carries a warm, moist and convectively unstable air stream. The easterly trades are warm and relatively dry. The North-East monsoon coming from the Siberian anticyclones is also dry and cold. This is in sharp contrast with other periods when the warm, moist South-West and less moist but warm trade winds give the country a warm and wet environment. The extreme north-west region, Dinajpur has less rainfall as the continentally opposes the effect of orographic lifting, during November-May when the dry north-east winds (November-February) and the less moist trade (March-May) domillates the circulation. On the contrary, the hills of Sylhet and Chittagong influence climate; Moisture-ladden wind blowing against hillside is forced upward (orographic lifting) produces vigorous condensation and causes rain in the regions facing the wind. Another Onshore-circulation which takes moisture inland over the Chittagong Hill Tract during daylight moves against the general easternly circulation. A convergence line is produced. Nocturnal thunderstorms arise and ride with the general easterly circulation and are reinforced by orographic lifting over the north-south hills of Chittagong and Chittagong Hill Tract.

Tea Climate

Individual plants or crops do not have unique transpiration co-efficient. As regards tea, there is a consensus of opinion that the distribution of rainfall plays a vital role on the growth of the tea plant while the temperature, photoperiod and latitude determine the cropping season of tea. It is found that 1270 mm annual rainfall is marginal for tea cultivation unless there are other mitigating conditions. Without exception the rainfall in the dry season is critical, and the crop production suffers severely if monthly averages fall below 50 mm of rain over a period of several months. In general, the minimum temperatures below 13°C are likely to bring about damage to the

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foliage and a cessation of growth, while mean maximum temperatures above 30°C are, likely to be accompanied by humidity, so low that a similar cessation of active development is inevitable.

Temperature is one of the most important factors for the growth and development of crops. Photosynthesis and Respiration of plants are influenced by temperature and light intensity. Generally the optimum temperature for photosynthesis is about 17.5°C and maximum carbon dioxide in atmosphere is found at temperature, 32.5°C while the assimilation is known to be inhibited at 0°C. Tea, being a perennial plant is grown under a wide range of temperature regimes in the tea world. It is cultivated best in temperatures ranging 12.7–28°C and the growth of tea plant is found retarded at the upper or lower limit of this temperature regime.

The seasonal variation of climatic elements in tea zone of Bangladesh is one of the prime factors for the establishment of tea gardens in Sylhet and Chittagong districts. In Tea districts, the water-deficit occurs during November-April, but the water-surplus is found in rainy season May–October, and about 80 per cent of the annual rainfall in obtained in June. The mean temperature in Sylhet and Chittagong tea zone during 1998–2007 are found respectively 18.3°C to 28.30°C, and 19.98°C to 28.85°C, while the mean relative humidity ranges from 56 to 86 per cent in Sylhet, and from 68% to 86% in Chittagong. The seasonal variation of rainfall varies in range 2.79–907.29 mm in Sylhet, while 3.56–792.48 mm. in Chittagong. There is no difference between the intensity of sunshine and cloud-cover in these two zones. In general, the rate of evaporation is found more in Chittagong than Sylhet. Under Bangladesh conditions, it is observed that about 1400 mm. of annual rainfall is a critical limit and the monthly mean temperature less than 18.33°C, and more than 29.44°C seem unfavourable for tea.

Biosphere of Bangladesh Tea Zone

Bangladesh climate is considered to be tropical monsoon with three distinct seasons: Warm season (mid February to mid May), Monsoon season (mid May to mid October) and Cold season (mid October to mid February). The year begins and ends with a dry period. The land lies parched and brown under a blistering sun; whirlwinds and dust devils prance unchallenged; man and his surrounding flora and fauna are in a critical suspense. By March rain begins and the south-west monsoon initiates in southern region, progressing northwards until the whole country is covered by the unstable south-west air mass during monsoon period. The climatic requirement for tea cultivation can not be precisely determined. Because tea is cultivated in variable climatic zone from the latitude 43° N (Georgia, USSR) to 27°S (Corrientes, Argentina). Under this perspective, the climate of Bangladesh is discussed under three important parameters like Rainfall regime, Temperature regime and Humidity-Evaporation cum Sunshine regime which are responsible for a successful tea culture

Rainfall Regime

The qualitative and quantitative rainfall pattern in Bangladesh is zonal. The annual rainfall ranges from 1,400 mm in the north-western dry area, Rajshani to over 5,000 mm in wettest area, Sylhet. The districts of Chittagong and Chittagong Hill Tract receive rainfall, not exceeding 3,000 mm While the extreme north-west region, Panchagar district where new tea planting started receives an annual rainfall from 2000 mm to 2400 mm.

The wet month, according to the climatic group's standard, is defined as one having 200 mm or more of rain while a dry month receives 100 mm of rain or less. To this standard, the wet areas of Bangladesh comprise of Sylhet. The eastern part of Sylhet where tea is grown receives over 200 mm. of rain for 7 months during April/May–September/October. Whereas in Chittagong and Chittagong Hill Tract has 5 months with less than 100 mm.

Tea zones of Bangladesh experience dry season from November to April while the rainy season continues from May to October and above 80% of annual rainfall is obtained during June–September. During 1998–2007, the average annual rainfall in different Tea Zones are seen about 2931 mm and 2797 mm, respectively. The amount of annual rainfall is higher in North Sylhet and is reduced in the lower western part (see Fig. 1).

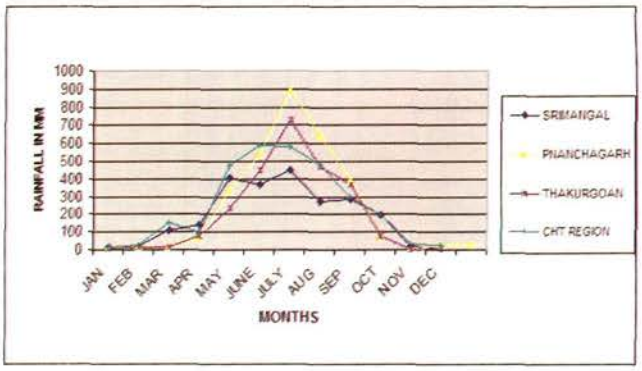

Fig. 1. Average monthly rainfall of the tea areas (1998–2007).

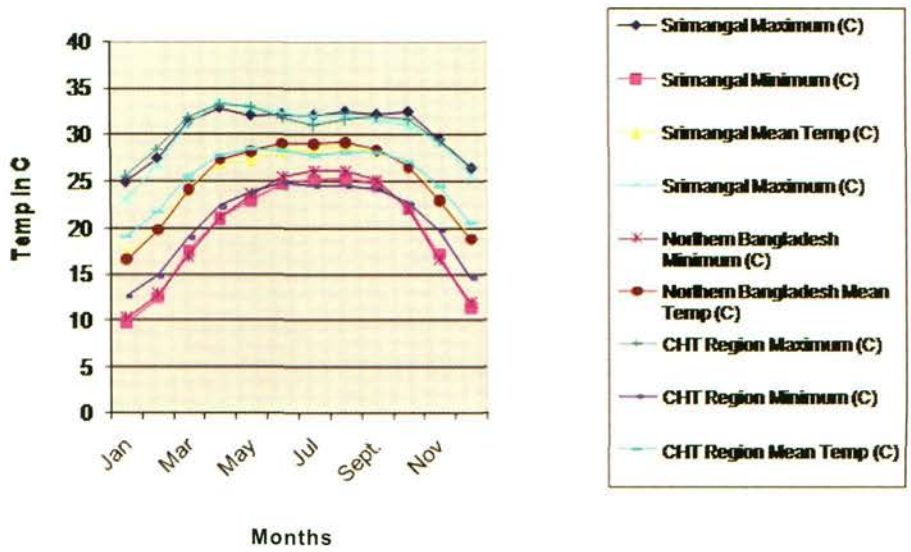

Fig. 2. Average comparatively mean monthly maximum minimum temperature of the study area for last 10 years (1998–2007).

Temperature Regime

In Bangladesh, temperature becomes generally highest in April or May, dips slightly during monsoon period and diminishes after September or October. Prolonged drought occasionally occurs after November or December when rain is meagre.

The following graph will reveal the comparative monthly maximum/minimum temperature of the tea areas for last 10 years (see Fig. 2).

Humidity Evaporation cum Sunshine Regime

Relative humidity is generally highest during night and early morning and lowest during mid-day. Average monthly humidity approaches 90% during the monsoon months of June through October, falling to 65% for March. An overall relative humidity in Sylhet and Chittagong Tea zone varies from 56% to 80% and 68% to 86%, respectively. It is also known that the rainfall in tea zones exceeds evaporation during the greater part of the year. A deficit of water-balance occurs normally from the end of October until April. Water-stress usually develops after January and lasts to first week of March.

The intensity of sunshine has also an important influence on the growth-potential of tea. It appears that the winter dormancy in tea occurs only in those tea areas that are at higher latitude as the tea is very sensitive to the day length (Photoperiod). The hours of bright sun-shine are few in rainy season of Bangladesh due to overcast of clouds. Although an intensity of 1500–2500 foot candles is known to be sufficient for photosynthesis, the overall effect of Evapo-transpiration is of great importance for the growth of plants. The overall, picture of evaporation regime of Bangladesh shows a primary maximum between April and May when temperature conditions over the country are at the highest. A secondary maximum often appears at random, even during the period of high rainfall or after it has began to recede. In December and January when temperature is also lowest, evaporation is lowest. This effect is felt more in the inland areas where the influence of continentally becomes more apparent than elsewhere. The tea zones of Sylhet and Chittagong are however experiencing less evaporation than the tea zone of northern districts of Bangladesh.

Total Soil Status of Bangladesh

Tea is grown on soils of diverse origin. Most of the tea soils of northeast Assam are alluvial and formed *in situ*. Such deposits are found in Doars and Malawi. Soils of widely different origins and different morphological characteristics support tea in different countries. Volcanic rocks are the basis of tea soils in Japan, Indonesia, Kenya and part of Tanzania. North East Assam gardens have been established on the alluvial plains drained by the Brahamaputra river and its tributaries and bounded on the north by the Himalayan foot hills and on the south by the Naga, Mikir and Khasia hills. A second tea area in Assam which is drained by the Barak and Surma rivers flowing into the Meghna and lastly joining the Ganges. These tea areas comprise the districts of Cachar and Sylhet known as Surma valley-an alluvial plain and is surrounded by the hills on the north, east and south. The third area comprising of Doars, Terai and Darjeel-

ing. The gardens in these zones are put on a strip of land extending from foot hills, stretching from Nepal frontier to the western boundary of Assam. There is also a small area of tea in Chittagong, According to Mann (1909), Chittagong soil is a southern continuation of the Surma Valley. These soils are distinguished by being reddish in colour and contain a high proportion of iron and aluminium oxides in proportion to their silica content (Choudhury, 1989). Colour of the soil is considered to be the indication of the suitability of tea cultivation. Red colour indicates good drainage and aeration, yellow imperfect drainage and aeration, grey colour poor drainage, aeration and poor in organic matter and the black colour indicates rich in organic matter content.

Texturally, the tea soils in Bangladesh are predominantly loamy. Soils of South Sylhet are loamy to sandy loams from surface downwards, loamy to clay in East Sylhet while loamy sand to loam in North Sylhet and in Chittagong zone clayey to sandy loam.

Soil Reaction and Nutrient Status

In Bangladesh, different valley circles have different pH values, average of Sylhet district is 4.3 to 5.6 while the Chittagong has a pH range 4.3 to 5.2. Nitrogen requirement for tea is high. An overall nitrogen and organic matter content of Bangladesh Tea soil varies in range 0.07–0.09% and 1.0–1.2%. The critical limit of nutrient status of tea should be around 30 mg g^{-1} for phosphorus, 80 mg g^{-1} for potassium 15 mg g^{-1} for magnesium and 10 mg g^{-1} for calcium (Sana, 1989).

Tea Zones of Bangladesh

Sylhet

It is situated between 24° and 25° N latitude and 91° and 92°E East longitude and covers an area of 8930 km^2 (Sylhet, Moulvi Bazar and Habiganj). It is a valley lying between Khasia–Jaintia Hills on the north and the Tripura hills on the south, bounded by Cachar on the east and by Comilla and Mymensingh on the west.

On the basis of agro-ecological condition, Bangladesh soil has been classified into 30 zones and Sylhet falls under AEZ 20 which is known as Eastern Surma – Kusiyara Flood plain, AEZ 21, Sylhet Basin, AEZ 22 Grey flood plain soil and AEZ 29 Northern and eastern Hills.

Surma–Kusiyara flood plain is formed by the sediment of river, draining into Meghna catchment from the hills. Soil generally grey, heavy silty clay loam on the ridges and clays in the basin, grey flood plain, Organic matter content is moderate with pH acidic to neutral. This zone encompasses Sylhet, Moulvibazar and Habiganj districts. Sylhet basin which is occupied by Sunamganj and Habiganj have grey clays in wet basin. Organic matter content is moderate with acidic pH. Fertility level is medium high. Sunamgang and Habigang also fall under this ecological zone. Sunamgang, Sylhet, Moulvibazar and Habigang are also included in this zone apart from two other districts. Hilly soil of Sylhet falls under the AEZ-29. Major soil are yellow brown. Texture of the soil is friable loam and strongly acidic. Organic matter content and general fertility level is low (Year Book of Agricultural Statistics of Bangladesh, 1998).

Chittagong and Chiattagong Hill Tracts (CHTs)

Hilly soils of Chittagong region are yellowish brown and have low moisture holding capacity. Soil pattern is complex due to differences in sand, silt and clay content. Organic matter content and general fertility is low like Sylhet hill soils.

Most of the northern and Eastern Hills fall under the Agro-ecological zone AEZ-29. The hills of CHT, khagracherri, Bandarban, Cox's Bazar have a complex relief. The hills have been dissected to different degree over different rocks. In general the slopes are steep and the low hills have flat summit. The soil types are complex due to composition of relative proportion of various size groups of soil grains such as sand, silt and clay. Soil in general is friable loamy, strongly acidic with reasonable organic matter content. Soil is generally yellow-brown in colour. Fertility level is low at the top areas of most of the hill soil (Year Book of Agricultural Statistics of Bangladesh, 1998).

Northern Districts

Panchagarh and Thakurgaon districts are situated in the extreme north of Bangladesh. The land is mostly plain. It is high in the north and sloppy towards south. According to Agro-ecological Division, these two districts fall under agro ecological zones (AEZ) 1 and 3. Most of Panchagarh and Thakurgaon and north western part of Dinajpur fall under zone 1. This region is developed on Tista alluvial fan extending from the foothills of the Himalayas having a complex relief pattern comprising of broad and narrow flood plain ridges and depression. Soil generally is sandy loam to sandy clay loam, Organic matter content is high. Soil is acidic on the top and subsoil is moderately acidic. It is also rich in minerals. But the eastern part of Panchagarh is characterised by silt loam to silty clay loam. Soil is moderately acidic. Organic matter

Table 1: Comparative Soil Nutrient Status of Tea Areas

Nutrients	Average soil nutrient status of the study area				
	Critical Value	Sylhet	Chittagong	CHTs	Northern Districts
Texture	SL-L	SCL, CL, SL	SCL, CL, SL	SCL, SiCL, CL, SL	SCL, SL, LS, CL
pH	4.5–5.8	4.5–5.4	4.5–5.7	4.7–5.4	4.5–5.3
Organic carbon	1%	1.06–1.72	0.98–1.22	0.93–1.53	1.09–1.86
Total nitrogen	0.1%	0.11–0.13	0.89–0.12	0.10–0.12	0.09–0.15
Available phosphorus	10 (µ/g)	1.02–24.08	2.00–24	1.00–20.04	6.2–74.8
Available potassium	80 (µ/g)	38.4–202.40	21.4–123.40	40.6–216.00	12.00–96.00
Available calcium	90 (µ/g)	64.8–690.8	37.6–210	120.4–340.2	17.6–126.2
Available magnesium	25(µ/g)	16.2–67.0	8.5–60.5	24.2–54.0	6.8–26.20

Note: S = Sandy, C = Clay, L = Loam, Si = Silty.

content is better as compared to Srimangal tea growing area. It is generally rich in parent materials.

Geographical Distribution & Salient Feature

There are 163 tea estates in Bangladesh, of which 132 are in Greater Sylhet (Sylhet, Moulvibazar and Habiganj), 22 are in Chittagong. One each in Chittagong Hill Tract and Brahmanbaria district and newly developed 7 in the Northern Bangladesh. The land and production share of the respective geographical regions are shown in Table 2.

Structure of the Ownership Pattern and Relative Share of the Tea Estates

The tea estates in Bangladesh are managed by the British/Sterling companies registered in the UK, public limited companies *viz.* National Tea Co. Ltd (NTC), having Government and private shares, private limited companies, proprietary ownership and Government or Bangladesh Tea Board. Details of the management of the tea estates, land distribution and performance are given in Table 3.

It appears from Table 3 that the Sterling companies and the Tea Board managed estates perform better in respect of land utilization, production and yield per hectare. Sterling companies hold 34% of the total land while contribute 45% of the total production.

Bangladesh Tea Board in its three estates occupies 2.25% of the total land for tea and contributes 3.24% of the total production. National Tea Co. Ltd occupies 10% of the total grant area for tea and produces 9% of the total production. Private Ltd companies and the proprietary ownership estates of the industry do not perform well on average. They contribute 30% and 13% of the total production against 35% and 19% land owned by them, respectively.

There are multiple reasons for poor performance

Table 2: Land and Production Share of Geographical Regions

District	No. of Tea Estates	Grant Area (ha)	Tea Area (ha)	Land Use	Production (2006)	Yield (kg ha^{-1})
Moulvibazar	90	64,624.34 (56%)	30,995.93	48%	31,684,507 (60%)	1,022
Habiganj	23	22,034.00 (19%)	11,606.51	53%	13,178,834 (25%)	1,135
Sylhet	19	11,514.73 (10%)	4,968.33	43%	4,970,834 (9%)	1,000
Chittagong	22	15,152.38 (13%)	4,048.77	27%	3,265,651 (6%)	807
Rangamati	1	307.00 (–%)	146.00	48%	24,566 (–%)	168
Brahmanbaria	1	62.52 (–%)	29.95	48%	– (–%)	–
Panchagar (purchased)	7	1,838.44 (2%)	515.38	28%	220,732 (–%)	428
Total	163	115,553.41 (100%)	52,310.87	45%	53,345,124	1,020
Small holdings		96.35	96.35	100	62,615	650
Grand total	163	115,629.76 (100%)	52,407.22	45%	53,407,739 (100%)	1019

Note: The above figures are average figures A/C 2006; *Source:* BTB.

Table 3: Management-wise Distribution of Tea Estates and Their Performance

Category of Management	No. of Tea Estates	Grant Area (ha)	Tea Area (ha)	Land Use	Production (kg)	Yield (kg ha^{-1})
Sterling Co.	28	39,386.02 (34%)	20,219.16	51%	24,027,525(45%)	1,188
BTB	3	2,559.39 (2%)	1,445.55	57%	1,536,480 (3%)	1,063
NTC	13	11,279.95 (10%)	5,583.66	50%	4,760,300 (9%)	852
Private Ltd Co.	61	40,652.05 (35%)	15,716.65	39%	15,815,700 (30%)	1,006
Proprietary	58	21,656.00 (19%)	9,345.85	43%	7,205,119 (13%)	771
Total	163	115,553.41 (100%)	52,310.87	45%	53,345,124	1,020
Small holdings		96.35	96.35	100	62,615	650
Grand total	163	115,629.76 (100%)	52,407.22	45%	53,407,739 (100%)	1019

Note: The above figures are average figures A/C 2006; *Source:* BTB.

by the proprietary and private limited company estates. Among many problems, poor management and improper utilization of resources have been identified as the major reasons. In fact, poor management has given birth to multiple problems for which the estates could not keep pace of development with the industry's target of development.

Market Growth of Bangladesh Tea Sector

Bangladesh tea is a small player in the world tea scenario, but has a mentionable role in the national economy and employment sector. During the last ten years, there has been no significant growth in production, and there is a gradual fall in the export during the corresponding years. It has been recorded that there is only 4% growth in respect of production in 2007 over 1998. The annual increase in production as calculated has been to the tune of 1% while the export has declined by 8.67% during the corresponding years. This is primarily because of increase in the internal consumption due to population growth, urbanization and social upliftment as shwon in Table 4.

Table 4: Tea Production, Export and Consumption for Last 10 Years

Year	Supply/Production (M kg)	Export (M kg)	Absorption/Consumption (M kg)
1998	55.83	22.20	33.63
1999	46.19	15.20	30.99
2000	52.64	18.10	34.54
2001	56.82	12.90	43.92
2002	53.62	13.70	39.92
2003	58.30	12.20	46.10
2004	56.00	13.10	42.90
2005	60.14	9.02	51.12
2006	53.41	4.79	48.62
2007	57.96	10.60	47.38

Note: Annual Report 2007; *Source*: National Brokers Ltd.

Table 4 clearly shows a steady growth in over all volume of tea consumption in the domestic market thereby ensuring a guaranteed market for the tea producers now and in future also since number of tea consumers are increasing every year along with the increase in per capita consumption (used only as beverage or drink in Bangladesh) of tea.

It would be revealed from the table and the graph that, the supply side is almost stable, on the other hand the demand side is showing an increasing trend as such market growth is evident.

Further, the per capita consumption of tea is increasing every year, which will lead the demand side further. The per capita consumption for last 10 years has been shown in Table 5.

Table 5 and Figure 5 show a gradual increase in per capita consumption of tea in Bangladesh for past 10 years, and these figures also give an indication of a guaranteed market for Bangladesh tea locally in future.

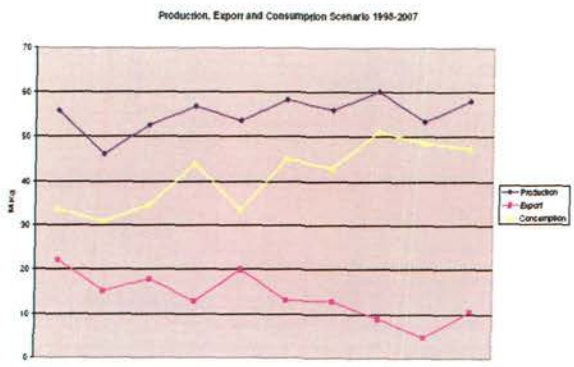

Fig. 4. Production, export and consumption during last 10 years.

Table 5: Per Capita Consumption for Past 10 Years

Year	1997–98	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07
Per capita consumption (Gm)	230	250	270	300	350	360	380	400	420	440

Note: The figures represent for 2006; *Source:* BTB.

On the other hand, profitability of the sector depends on the productivity per hectare and the price realised for tea in the auction. Table 6 will reflect the price scene in the auction for last 10 years as follows.

Tea price depends on the international market situation and the producer does not have any control over the auction. At the same time due to increased cost of inputs, the cost of production is also going high every year. However, since Bangladesh tea is mostly marketed for internal consumption with very less export, the auction price of tea for last 3 years were remunerative for the producers. The overall condition of the sector can be seen as profitable at present. These were further revealed from Key Informants Interviews (KIIs) of the industry leaders.

Though for the last 3 years, per kg auction price of tea appears profitable but it does not necessarily mean that the tea companies have accumulated huge amount. Tea auction price is quite variable and during few previous years most of the companies could not pay their instalments of long term loans which did not encourage the owners to make substantial investment except the extremely necessary ones. Therefore, a marked or tangible change in the estates is not visible since the routine development works do not draw attention of researchers.

Table 6: Average Sales Price during Past 10 Years

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Average sales price (in Tk. kg^{-1})	88.45	76.39	72.03	73.96	76.32	84.49	78.57	93.02	110.62	99.78

Note: Annual Repot 2007–2008; *Source:* National Brokers Ltd.

Labour wage and benefits are determined as per the agreement signed between BTA and BCSU. The wage and benefits as such are not linked with auction price. Labour account for only 30–40% of the COP while other factors of COP contribute about 60% and thus 60% cost is variable almost at every three months. If there is an increase in auction price then a major part of it certainly going to variable heads. But on expiry of the agreement, the BCSU bargain on the ground of increase in tea price and increase in cost of living and a rational adjustment is

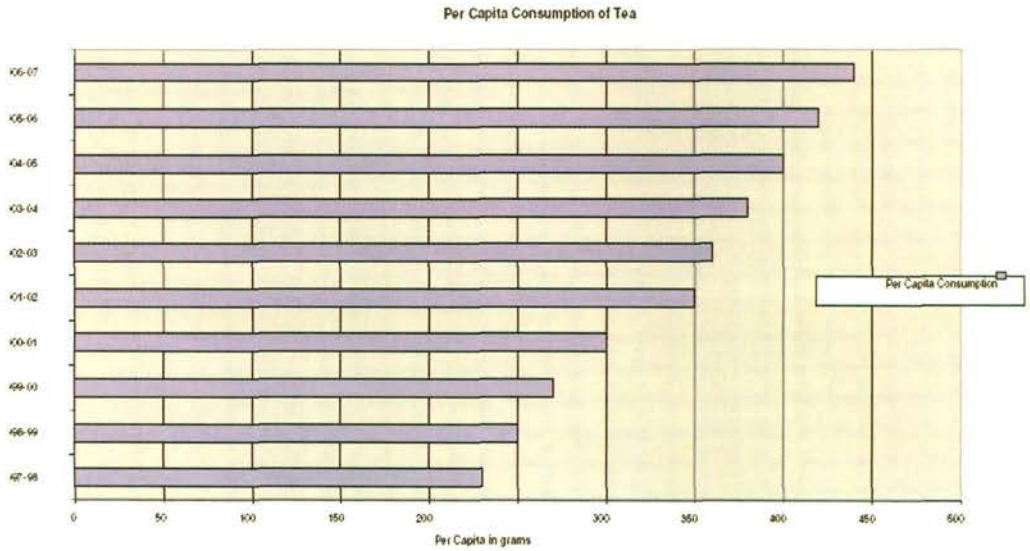

Fig. 5. Per capita consumption of tea for past 10 years.

made at the time signing the agreement.

Tea is no more an important export earner of the country. Due to rapid increase of internal consumption and on other hand production has failed to keep pace with the rapidly increasing internal demand as such there is little scope for export now and in the near future unless a massive development programme is implemented.

Tea Market Mechanism

The present tea marketing system dates back to 1695 when the first tea auction was held at Sir John Lyons House on the bank of the river Thames in London. Since then the auction process has under gone many changes/ stages of development and achieved today's transparency in the market mechanism of tea.

Like rest of the world in Bangladesh's 95 % tea is sold through the "Chittagong Tea Auction" held every Tuesday. There are Tea Broking Houses with skill professionals duly certified and licensed by Bangladesh Tea Board. For a better understanding the following self explanatory flowchart may be taken as the existing tea marketing mechanism in Bangladesh.

The value chain for tea from a labour to a consumer is not possible even to assume since the labour wage and benefits do not have any link with auction price. Tea price varies from grade to grade, estate to estate, auction to auction and lastly buyer to buyer. However a value chain in respect COP is furnished.

Value Chain of Cost of Production of Tea

The factory sends tea in bulk to the bonded warehouse in Chittagong from where the nominated Brokers draw samples from each lot of tea. The Brokers taste the quality of tea and fixes a price based on demand, supply and quality of tea, as a whole. The tasting report and their valuation are sent to the buyers and the producers as a part of sale process. After the tea is sold in auction on Tuesday the bidders viz buyers deposit/pay the price of tea to the Brokers within 7 days from the date purchase/ auction. The broker sends the sale proceeds to the tea estate owners on 15th day from the date of sale/auction after deducting 1% brokerage, 1% Tea cess for Tea Board and about 0.50% for warehousing and sample drawing.

The Broker also realises 15% VAT from the tea bought for local marketing while there is no VAT on exportable tea. The whole sellers then buy tea either in bulk from the bidders or in packets from the blenders and then they sell to the retailers (Fig. 6).[1-8]

The retailers sell tea either through their outlets or by home delivery or through both. In the whole process tea estate workers have the most important role only next to the management/owners. The national cost of production of tea is around TK75 kg^{-1} where the workers contribute 30–40% depending on the type of estate. Processing/ machinery depreciation, inputs and management together contribute 60–65% and about 2.76% is the financial cost on account of loan from the banks. In 2007 auction average was TK85 kg^{-1} from where 2.5% deducted by the brokers on account of their brokerage, Tea cess and warehousing as such the estate owner ended with an amount at 82.88 per kg. The estate worker as such ended with 27–28% share against one kg of tea based on the

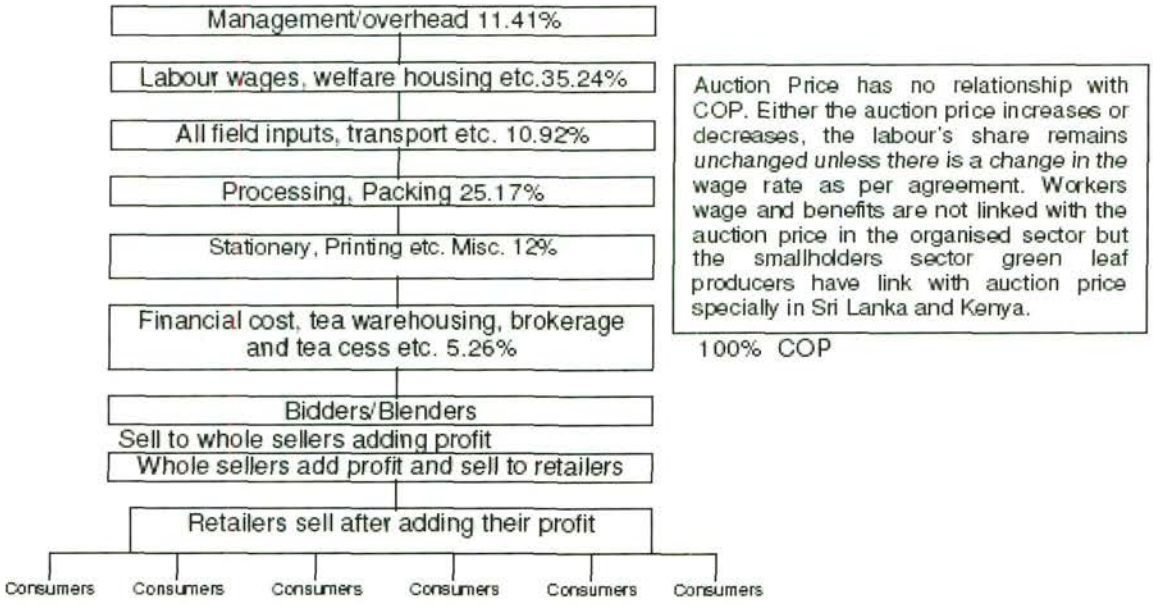

Fig. 6. Value chain of cost of production of Tea.

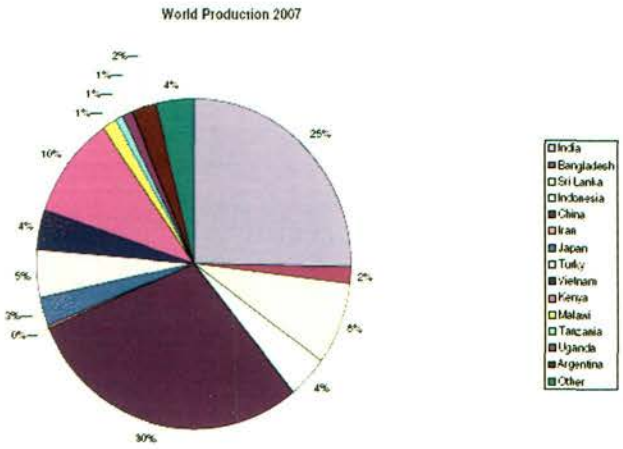

Fig. 7. World tea production share of major tea-producing countries in 2007.

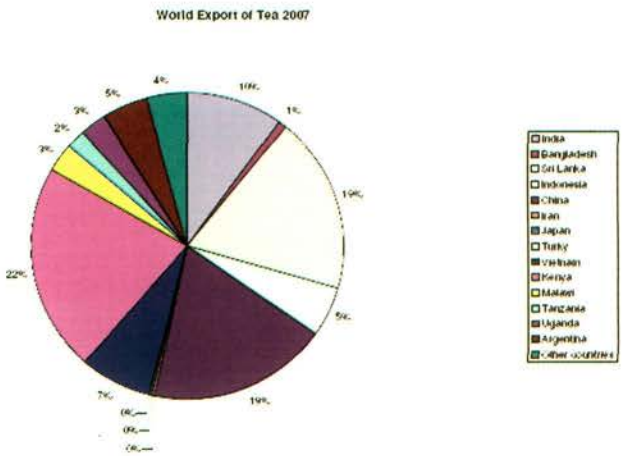

Fig. 8. World tea export share of major tea-exporting countries in 2007.

auction price. However, this percentage has no link with COP where they contribute 30–40%.

Position of Bangladesh Tea in the Global Scenario

Production

World production of tea in 2007 was 3,726.94 M kg. Bangladesh produced 57.96 which contributes only 1.56% of the crop. The major producers are China, India, Sri Lanka, Indonesia, Kenya, Vietnam, Turkey, Japan, and Argentina. Bangladesh position is 10th amongst the tea-producing countries with very negligible contribution to the world production (as per International Tea Committee, *Annual Bulletin of Statistics*, 2007) (Fig. 7).

Tea Consumption

World consumption of tea is estimated to be 3624.00 M kg in 2007. This estimate is based on the assumption that all teas retained in the producing countries and all teas imported for consumption in the importing countries have been consumed during the year. Among the countries India has the highest total consumption of tea of 787 M kg, followed by China consuming 651 M kg and Russian Federation consuming 170 M kg Bangladesh ranks 14th in terms of single country with a total consumption 47.41 M kg of tea in 2007.

Export

Total global export of tea in 2007 was 1585.80 M kg, of which Bangladesh exported only 10.55 M kg (0.67%). Major exporters are Kenya, Sri Lanka, China, India, Vietnam and Indonesia (Fig. 8).

Proposed Strategy to be Taken to Achieve the Required Growth

In the recent years competitiveness of the industry has been increasingly eroded thereby affecting the livelihoods of the people living on tea directly or indirectly. While consumption of tea is increasing at a faster rate, all other indicators for the industry are not favourable, such as:

- Production is fluctuating and that even with very little growth.
- Cost of production has increased by many folds.
- Price realization increasing but may not be able to keep pace with the increasing trend of the production cost.
- Export likely to decline to almost nil stage in the years to come.
- Low productivity in terms of per unit land and labour.

The challenge that Bangladesh tea industry has been facing has its roots in the archic and unagile upstream components of the value chain. The root causes appear to be lack of land revitalization resulting low land productivity, while lack of motivation appeared to be the reason for low worker productivity. These two factors coupled with unpredictable inputs cost, making Bangladesh tea industry globally uncompetitive and affecting the livelihoods of thousands of people engaged in tea sector as such Bangladesh tea industry needs revitalization to achieve a sustainable growth.

The revitalizing programme can be achieved by an integrated approach addressing through the cross cutting of two components; land value optimization and improving motivation level of the workers towards productivity model.

Land Value Optimization

Currently, on average, land allocation for tea is segmented in the following manner:

- Tea 45.72%;
- Infrastructure and other use 8%;
- Other economic crop including rubber 13%;
- Others including available for planting 33.28%.

It would be advisable to suggest the land under tea cultivation be re-aligned into the four components as follows.

(a) Intensive cultivation – continue intensive cultivation on the most productive sections focusing on teas less than 40 years of age.

(b) Old tea regeneration – rate of cyclical regeneration be increased significantly by uprooting and replanting old tea to bring down the average age of tea bushes to 40 years.

(c) Extension -Land for infrastructure to be rationalized and all available land suitable for tea should be brought under cultivation to get more than 50% of the grant area under tea.

(d) Non tea model – to compensate for the loss of revenue initially from increased land regeneration, allocate a portion of the less productive land for non tea models. We suggest that the regulatory framework for land use be optimized to include non tea models. Possible non tea models could include:

(i) Traditional – Farming: fruits, spices, fisheries, dairy, poultry, *etc*.

(ii) Innovative – medicinal plants, horticulture (value added), flowers (exportable), honey, etc.

(iii) Innovative non-agricultural – Eco-tourism, game Park, gulf clubs.

This may be mentioned that tea estate lands are government land leased to the companies or individuals for tea plantation only. In a tea estate, scientifically 100% land cannot be planted with tea since a large percentage of land is unsuitable for tea cultivation, certain percentage of land required for residential purposes, roads, water bodies, forests and other infrastructures.

Workers Productivity Model

Though very limited researches were conducted in this respect, but it was interesting to note that, the Socio-economic factors are directly related to worker productivity. These are as follows.

Management Sensitivity. While tea management readily recognize a direct linkage between plant nutrition and plant productivity, there is relative lack of appreciation of the input–output relationship in respect of the industry's major asset – Labour. There is a convergence between the workers' health and welfare and the interest of the management. It follows that in order to optimize labour productivity, the factors influencing it such as the workers' life at home, their life in the community and their relationship at the work place should be kept in good order.

Worker Motivation. In a situation where wages and incentives are uniformly applicable throughout the estate sector, there is little to motivate to create interest among the workers to put extra-effort. To that extent, it could only be motivation of special nature, not monetary factors that will help to augment productivity, particularly among women workers.

Optimising Welfare Investment. All management are incurring a wide range of welfare expenditure for labour. This expenditure appropriately to be better spent and made more cost effective, there will be both quantitative and qualitative improvement in the return on these investments. It would be ideal to integrate welfare into normal estate functioning.

Economic Status of Women Workers. The greater part of production activity in tea estates centers around women workers who not only share a separate labour identity but also form the key element in the family basis of estate employment. The independent economic status accorded to women tea workers, and the relatively equal terms on which they operate could serve as an effective vehicle for developing strategies that will bring the best out of them.

Although as per the agreement there is no difference in any respect between male and female workers, yet in most cases female workers earn more than male workers. Green leaf plucking is the only item of work in tea estate where there is a good provision of incentive. A plucker is expected to pluck at least 22–23 kg (varies from estate to estate) per day, for which the worker is paid full wages. But during the peak season (May–October), a plucker plucks at least 10 kg of green leaf in addition to the fixed task of 22–23 kg and the plucker earns Tk. 2 for every extra kg of leaf as such the pluckers earn at least Tk. 20 in addition to the fixed wage. Because 100% female workers are employed in plucking and male workers are more interested in others cultivation works, which do not have incentive provisions, thereby female workers earn more than male workers on average.

Controlling Common Illness. Two major categories of illness are prevailing in the estates, *e.g.* respiratory and water born, which are major contributors to absenteeism and sickness benefit and expenditure on drugs on a

estate. By improving safe water supply and providing primary heathcare education for better personal hygiene, these diseases can be controlled, which will have positive impact on labour productivity.

Reducing Birth Rate. Problem of anaemia among tea women workers are common due to high birth rate. By reducing birth rate and identifying and treating anaemia, productivity could be higher, as has been reported from a tea-growing region by giving 100 iron tablets to a cross section of pluckers found beneficial. De-worming of all workers annually can be another effective step. Experience shows that female workers having one to two children have better health, less sickness during the peak earning season. Reducing birth rate and supplemented by some medicare will certainly improve labour productivity since a healthy female worker plucks more green leaf than an ill-health female who has 7 to 8 children as seen from estate labour wage payment records.

Health. Productivity is directly related to workers health status as such data on health constitutes a necessary prerequisite for implementing a proper health programme on estates and evaluating the welfare status of workers.

Emerging Social Problem. Alcoholism, tobacco use and drug abuse have emerged as major problems in the estates. This type of addiction adversely affects labour productivity and reduces worker earnings; its impact on management is reflected through loss of man days, lower production resulting higher cost of production. Community involvement is the best way to prevent drug abuse, and heath education in this regard should be practiced in the labour lines.

Apart from the traditional age-old practices of tea development, it seeks to consolidate various factors that influence and enhance labour productivity not only for improving the country's competitiveness in the world market but also for assisting management to neutralize the impact of the escalating labour cost in the industry.

Presence of Research and Its Role

Bangladesh tea industry till 1947 was the beneficiary of the researches of Tocklai Experimental Station in Assam. The availability of research technology immediately after partition was not available. As such the-then Pakistan Tea Board in a resolution in 1952 decided to establish a tea research station of its own. But, it took a few more years when Pakistan Tea Research Station came into being and started its operation at Srimangal in 1957. After the liberation, the research station was upgraded and renamed as Bangladesh Tea Research Institute (BTRI).

BTRI apart from research is at present responsible for rendering technical and advisory services to 156 tea estates in greater Sylhet and Chittagong and 6 tea estates in Panchagar, along with newly emerged small growers.

The institute has five sub-stations in five different regions. One at Kaliti T.E at Moulvibazar district and one each in Sylhet town and in Fatikcharri of Chattigong district. One Regional Station of Bangladesh Tea Board has recently been established at Panchagarh, under which a research sub-station has been functioning at Panchagarh.

The Director is both the Technical and Administrative Head of the Institute. At present, BTRI has six research divisions in order to mainly conduct adaptive research on tea husbandry. The Department of Chemistry encompasses Soil Chemistry and Biochemistry divisions. The Department of Crop Production consists of Botany and Agronomy divisions while Department of Pest Management comprises Entomology, Plant Pathology, Statistics and Economic divisions. The Institute has its own research programmes which are executed by the respective divisions. It also has some collaborative research projects with other institutions and universities.

The mandate of BTRI is conducting research – both strategic and fundamental – in all aspects and conditions of tea for generating basic knowledge and evolving improved environmentally sound technologies, tea clones or varieties to achieve sustainable higher per unit production. Collecting, evaluating, conserving and exchanging gene resources of tea. Manpower development by assisting, guiding and supporting institutions devoted to academic pursuits of teaching, research and of extension of tea and allied disciplines. Promoting fishline extension service including adaptive trials, on farm research, extension research, training, demonstrations and communication of the latest technologies. Building strong scientific relation and linkage with national and international agencies for strengthening research and development efforts. Developing information and communication mechanisms including library and documentation, publications, internet network and MIS and GIS for national and international interactions, national policy-making.

Objectives of BTRI

- To increase yield and improve quality of Bangladesh tea through research;
- To render advisory services to tea industry;
- To transfer proven and adaptive newly innovated technologies to the tea industry.

Major Activities of BTRI

- Evolving high yielding and quality clones of tea for the industry
- Development of bi and poly- clonal seed stocks for seed orchards
- Conservation of gene resources of tea
- Raising vegetative cutting in the nursery using modern techniques and supply rooted and fresh cutting of improved clonal materials to tea estates
- Evaluation of the chemical composition of processed and/or unprocessed tea for quality assessment
- Standardization of quality and specification of Bangladesh tea in the international market
- Formulation of fertilizer policy for tea and ancillary crops
- Rehabilitation of soil, relationship analysis and understanding
- Adoption of appropriate methodology in improving the soil condition in existing, proposed and rehabilitated tea areas
- Standardization of cultural practices like: planting, spacing, pruning, plucking, mulching, planting shade trees and green crops, grafting etc.
- Management and control of various insects, mites and nematode pests, disease and weeds of tea and ancillary crops
- Pest surveillance and monitoring
- Investigation into manufacturing problems and improvement of factory machinery
- Possibility of multiplication of tea through micropropagation
- Introduction of suitable economic plants under crop diversification programme
- Regular advisory services to tea estates
- Economic study of tea cultivation.

Major Achievement of BTRI

Parietal Improvement

- Seventeen clones of high yield and quality evolved and released.
- Five hybrid tea seed of bi-clonal and poly-clonal stocks developed
- General seed stocks re-evaluated and 10 good seed orchards registered.
- A rich gene bank being established for germplasm conservation.

V.P Nursery Techniques

- Standardize vegetative propagation techniques for tea.
- Establishment and management of nucleus clone plots determined.

Tea Soil Management

- Fertilizer policy for mature and young tea updated on yield basis.
- Management of soil properties like texture, structure, organic matter, pH, nutrients etc. established.
- Critical values of nutrients in tea soil determined.
- Soil rehabilitation.

Methods Recommended

- Proper soil mapping initiated.

Agronomic Practice

- Pruning cycle for optimum crop production determined.
- Crop harvesting methods to optimize yield and quality determined.
- Ideal plant population, planting methods, pre- and post -planting practice determined.
- Grafting method for rapid mother bush establishment determined.

Pest Management

- Tea pest complex surveyed and major pests identified.
- Bio-ecology of major pests determined.
- Integrated pest management method optimized and decision analysis made.
- Standardized pesticides use in tea.
- Appropriate spraying technique and schedule determined.
- Few bio control agents identified.

Bio Chemical

- Correlation between the aflavin level and temperature during processing and fermentation established.
- A soft drink 'Cha-cola' from tea developed and patented.

Tea Processing

- Performance of different preconditioning methods of CTC processing determined.

Statistics and Economics

- Annual crop forecasting method determined.

Competitiveness of Bangladesh Tea in Global Perspective

Bangladesh is an insignificant player in the global tea sector. Bangladesh can hardly export ~1–1.5 M kg of tea to the international market in respect of price and quan-

tity. The COP of Bangladesh tea is comparatively lower than many other tea-producing countries even with lower productivity per unit area but due to increasing high auction price, it is difficult to find out buyers to buy this small volume of tea from Bangladesh. In fact, there are many companies in India, Sri Lanka and Kenya, which are as company bigger producers of tea than total Bangladesh tea production as such Bangladesh tea industry/production cannot play any role in the world tea market though Bangladesh has a comparatively lower cost of production due to various factors of production.

Bangladesh has lower cost of production as compared to India, Sri Lanka and Kenya, which are major players both in production and in global trade. Bangladesh currently can export hardly 1–1.5 M kg of tea since 80–85% tea marketed and consumed locally. The healthy local market has pushed the auction price higher as compared to the major exporters. Pakistan, Egypt and other Middle Eastern countries find it more convenient to buy tea from East African countries mainly due to little lower auction price and better shipping facilities as compared to buying tea from Bangladesh. Although Bangladesh has a lower cost of production, yet due to strong internal demand, export of Bangladesh tea is reducing in volume; if such strong internal demand continues, then Bangladesh will have to import tea by 2015.

Importance of Tea Industry in the National Economy

In the industrial sector, tea occupied the 3rd to 4th position in the national economy in the 1970s. But with opening of RMG, Leather, Fish, Handicrafts and Manpower sectors for Bangladeshi entrepreneurs, tea has lost its position of contribution to the national economy though about one million people are directly or indirectly dependent on it unlike a cash foreign exchange earner in the 1970s it has become an import substitute industry in the national economy. Bangladesh is certainly a low-income country which is changing fast along with life style, food and living habits resulting higher consumption of tea per capita. With the present trend of increase in domestic consumption, those days are not far away when Bangladesh might immerge as a tea-importing nation though tea was one of the major foreign exchange earners.

Tea industry currently does not have significant contribution or importance in the national economy but about 800,000 people are living on tea industry, which is established on lands not suitable for any other agriculture particularly food stuff. Tea industry, therefore, has its importance in utilizing the hilly land at its optimum level, employment generation to a large number of people. Further currently it is turning as an import substitute and with rising income level, it is expected that tea will play an important role as an import substitute industry in very near future.

Further Reading

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