

Sugar and cane pricing and regulation in India

A. Amarender Reddy

International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad
Patancheru 502324, Andhra Pradesh, India.

Tel: +91 40 3071 3071 Fax: +91 40 3071 3074

Email: a.amarenderreddy@cgiar.org

abstract

Sugar and cane prices in India are highly regulated, causing high fluctuations in supply and demand conditions. Present price policy and regulation in the sugar sector in India has resulted in low sugarcane productivity, and stifled profitability and modernization of sugar mills. To unleash the potential of small-scale farming and sugar mills in India, there is a need to eliminate the excessive controls on the sugar sector, which will reduce the costs of production of cane and sugar production. This study suggests a formula that reflects fair and remunerative price for cane that takes into account both costs of production and international price trends. Furthermore, for better price signals in domestic markets, the decontrol of sugar prices should be accompanied by measures to strengthen free trade such as a reduction in the duties for trade, measures to widen participation in futures markets and the elimination of the levy on sugar mills.

Keywords: cane, India, price policy, sugar

Supply and demand conditions

International sugar prices have recently followed a steady upward trend, moving from 12.1 US cents/pound in late 2008 to 29.7 US cents/pound, which is the highest price in 25 years, in January 2011 before dropping to 23.91 US cents/pound in April 2011. Domestic free market prices have fluctuated widely from Rs 17/kg in the first quarter of 2010 to Rs 50/kg in December 2010 before declining to Rs 30/kg in May 2011. However, the levy sugar price (the administered price at which each sugar mill has to sell 10% of its sugar production to the government) is half that of free market sugar. As a result of higher free market prices, the beginning of the 2009/10 sugar season (September/October) was marked by a number of *ad hoc* policy actions such as the imports of duty-free raw and refined sugar, stock

limits for traders, a ban on sugar futures trading, the declaration of a higher Fair and Remunerative Price (FRP) and a system for the fortnightly release of non-levy monthly sugar quota by mills. However, in April 2011 following a surplus production of sugar, the government of India decided to allow the export of 0.5 MT (million tonnes) of raw, white and refined sugar under Open General License (OGL) and reintroduced the futures market in sugar. These *ad hoc* policies affected the long-term competitiveness of the sugar industry in India.

India's sugarcane productivity has been stagnant at around 65 tonnes/hectare (t/ha) for the past two decades. Cane production has averaged around 290 MT over the past decade (2001-2010): 63% of this was used for sugar manufacturing, 22% for gur¹, 11% for seed and 3% for khandsari² (Table 1). The demand for cane to make gur and khandsari is stable year-on-year (low coefficient

Table 1. Basic production statistics of cane production and utilization

Year	Area (mln ha)	Yield (t/ha)	Production (MT)	Recovery (%)	Cane used for making (%)			
					Sugar	Khandsari	Gur	Seed
1985/86	2.90	60.0	174.0	10.0	39.7	6.0	41.1	13.1
1990/91	3.70	65.4	242.0	9.8	51.4	5.5	31.7	11.5
1995/96	4.20	68.0	285.6	9.8	62.2	3.5	23.6	10.7
2000/01	4.32	68.5	296.0	10.5	60.0	3.7	24.6	11.6
2001/02	4.41	67.4	297.2	10.3	60.8	3.5	23.8	11.8
2002/03	4.52	63.6	287.4	10.4	67.9	3.3	17.2	11.6
2003/04	3.94	59.4	233.9	10.2	59.1	4.3	26.5	10.1
2004/05	3.66	64.8	237.1	10.2	53.4	4.0	31.1	11.6
2005/06	4.20	67.0	281.2	10.2	66.5	3.0	17.9	12.6
2006/07	5.15	69.0	355.5	10.2	75.0	2.5	12.1	10.5
2007/08	5.06	68.8	348.2	10.6	72.6	2.0	16.2	9.2
2008/09	4.40	64.8	285.0	10.3	58.9	2.6	24.4	14.2
2009/10	4.30	63.9	274.7	10.3	59.9	2.6	24.1	13.4
Mean (2001-10)	4.40	65.7	289.6	10.3	63.4	3.2	21.8	11.7
CV %	10.2	5.1	13.9	1.4	25.7	18.8	17.6	12.9

Source: Indian Sugar Mills Association (2010)

Table 2. Cyclicity in supply and demand for sugar in India (MT)

Particulars	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Open stocks	5.6	7.9	6.6	5.6	6.9	9.3	10.7	11.3	11.6	8.4	6.3	3.9	11.3	8.1	2.0
Production	16.5	12.9	12.9	15.5	18.2	18.5	18.5	20.1	14.0	13.0	19.1	28.2	26.3	14.8	18.5
Imports	0.0	0.0	0.9	1.0	0.4	0.0	0.0	0.0	0.6	2.1	0.7	0.0	0.0	5.0	6.5
Availability	22.1	20.8	20.4	22.2	25.5	27.8	29.2	31.5	26.2	23.4	26.1	32.1	37.6	27.9	27.0
Consumption	13.1	13.8	14.7	15.2	16.1	16.2	16.8	18.4	17.5	17.1	18.5	19.5	22.5	23.0	24.0
For exports	1.0	0.4	0.1	0.0	0.1	1.0	1.1	1.5	0.3	0.1	1.4	1.3	5.0	2.8	0.0
Net exports	1.0	0.4	-0.9	-1.0	-0.3	1.0	1.1	1.5	-0.3	-2.0	0.7	1.3	5.0	-2.2	-6.5

Source: Indian Sugar Mills Association (2010); Note: 1996 indicates for sugar season 1995/6

of variation) compared with the demand for cane for centrifuged sugar. About 30% of sugar goes for domestic consumption and the remaining 70% is used by food processors such as bakeries, confectioners and soft drink manufacturers. Local sweet manufacturers consume most khandsari, while gur is mostly consumed in rural areas for household consumption. Khandsari and gur are mostly consumed within the same year of production, whereas sugar can be stored for a longer period.

The main source of fluctuation in sugarcane production is year-to-year changes in acreage rather than in yield. Table 2 indicates that the good crop years from 2001 to 2003 were a result of the higher world prices since the early 2000s and stockpiles of sugar in excess of the domestic requirement (the normative closing stock requirement of keeping three months stocks is 7.6 MT). The subsequent two years of low sugar production reduced stock levels to below normal by 2006. During 2005/06 and 2007/08, higher production of sugar resulted in stockpiles rising above 9.2 MT in 2007/08, before declining to 2.2 MT in 2009/10.

India was a frequent exporter of sugar to countries within Asia up until the 1980s. It became a net importer in the late 1990s

and once again emerged as an exporter in 2010/11. India has the capability to produce sugar to meet global demand, although its cost competitiveness is questionable under the current highly regulated and highly unstable price environment. To assess the potential and importance of price policy on productivity and competitiveness of Indian sugar sector, this study has the following objectives:

- (i) to examine price trends of cane and sugar;
- (ii) to evolve a formulae for fixing cane price that takes into account both domestic costs and international price trends;
- (iii) to examine the link between the cost of production of cane and competitiveness;
- (iv) to assess profitability and consolidation in mills;
- (v) to investigate decontrol and deregulation; and
- (vi) to review policy options. The balance sheet data were collected from the Indian Sugar Mills Association from 1996 to 2010, the cost of the production of sugarcane and price data were collected from the Ministry of Agriculture and the data on sugar mills were collected from the Parliament (2010) question and answer website

Cane and sugar price trends

The determination of Statutory Minimum Price (SMP) or FRP for cane is influenced by both economic and political factors. The SMP/FRP almost doubled during the past decade from Rs 621/t in 2001/02 to Rs 1391/t in 2010/11. For 2009/10, the government announced an FRP instead of an SMP and fixed it at Rs 1298.4/t, which was 32% higher than the average cost of production (Rs 873/t). In addition, most states announced that the State Advisory Prices (SAPs) at which mills had to procure the cane is above the SMP by a large margin. However, sugar mills procured the cane above the SAP to attract cane and increase production. For example, millers paid higher prices (between Rs 2100/t and 2500/t) compared with an FRP of Rs 1292.8/t in 2009/10. From 2003/04 to 2008/09, there was a nominal increase in the SMP every year. The low SMP regime reduced the burden on the government to pay millers for levy sugar at this lower price. The levy price index increased to just 121 in 2009/10 from 100 in the base year (2001/02). The intention to switch from the SMP to FRP was to provide remunerative pricing, which is substantially higher than the cost of production for cane, based on a cost-plus approach. However, the FRP ignores both domestic and international free market prices. For example, the SMP/FRP index (224) has been much lower than that of the free market price index (272) over the past decade. This is also one of the reasons for the higher volatility in domestic sugar demand and supply conditions as well as the increase in free market prices. One of the reasons for the rise in the price paid by millers to farmers for cane and the free market prices of sugar is rising domestic demand because of higher incomes, population growth and growing international sugar prices on the demand side. On the supply side, high growth in cane prices is because of stagnant productivity and rising input prices such as wages (the input price index increased to 150 over the past decade). The high volatility of free market price reflects the flux in demand and supply over the years compared with the

steady increase in levy sugar and cane prices. To reduce volatility in free market prices, administered prices need to be linked to both domestic and world market prices.

The index of the cane price paid by millers increased significantly (303) compared with the SMP/FRP index (224) and the input price index (150). This shows that in the past 10 years prices have moved in favour of farmers. In terms of the cost structure, the share of labour is higher (58%) than the cost of seed cane (19%), fertiliser (9%) and irrigation (7%). Most cane farmers have small farms (less than 2 ha) and are not extensively mechanised.

The mismatch between cane and sugar prices also hinders the progress of the sugar industry. There is little link between the SMP/FRP of cane and sugar prices, even though they affect the payment capacity of sugar mills, resulting in the accumulation of price arrears year-on-year. An examination of price arrears to be paid by mills to farmers revealed that whenever there is an increase in production, price arrears as a percentage of cane purchased from farmers increased and vice versa, resulting in the amplification of production cycles (Table 4). To smooth the production cycle, there should be a link between sugar and cane prices.

Linking the administered price (FRP) to market trends will not have an adverse impact on consumers, given the weight of sugar in the Wholesale Price Index (WPI) is only 3.6% and only about 30% of sugar is for household consumption. Further, reforming the public distribution system (PDS), so that sugar required for PDS to be procured from free market instead of levy on millers and distribute to the poor households at the subsidised price will eliminate any adverse effects of price rise on consumers. With this in mind, a modified FRP* formulae is presented in the equation below. The first term is the cost of production of cane (which also includes a risk premium and normal profit) and the second term is an adjustment factor for changes in the index of international sugar price, which ranges between -1 and +1 and is free from the problem of skewness. The FRP* should be linked to a basic recovery rate of 9.5%.

$$FRP^* = \text{Cost of Production} + \text{Cost of Production} * [(\text{International Price Index} - 1)/(\text{International Price Index} + 1)]$$

Table 3. Different prices trends in sugar complex

Years	Sugar availability (MT)	SMP/FRP for cane (Rs/t)	Price paid by mills for cane (Rs/t of cane)	Price levy sugar (Rs/kg)	Free market price (Rs/t) for sugar	Input price index
2001/02	29.2	621	925-1000	15.0	12850-16300	100
2002/03	31.5	695	695-1000	15.5	11470-15750	105
2003/04	26.2	730	730-1340	15.6	13200-15350	109
2004/05	23.4	745	745-1650	17.5	14100-18400	115
2005/06	26.1	795	795-1841	18.0	15500-19900	117
2006/07	32.1	803	1250-1300	18.0	11000-18300	118
2007/08	37.6	812	1300-1400	18.0	11400-14250	130
2008/09 (P)	27.9	812	1500-1550	18.0	17000-18000	134
2009/10 (P)	25.8	1298	2110-2500	18.0	30000-32000	142
2010/11 (E)	29.4	1391	2800-2900	20.0	35000-39000	150
Price index (2001/2=100)	100	224	303	121	272	150

Source: Indian Sugar Mills Association (2011); Note: p = provisional figures; E = estimates

Table 4. Price arrears (%) and sugar production trends

Year	Price arrears (% of purchases)	Cane production (MT)	Sugar production (MT)
2001/2	20.0	296.6	18.5
2002/3	27.0	286.2	20.1
2003/4	17.0	231.7	13.6
2004/5	4.0	239.4	12.7
2005/6	3.0	281.0	19.3
2006/7	16.0	358.8	28.2

Source: Parliament (2010)

This takes into account both the domestic cost of the production of cane and international price trends for sugar independent of efficiency in sugar factories. Hence, it will act as an incentive for sugar factories to improve efficiency and profitability and facilitate the consolidation of the industry based on efficiency and cost reduction. It will also reduce cyclicity, which helps in reducing price arrears. It will also eventually reduce the governmental cost of the management of the sugar economy. Bigger and more efficient sugar mills will enlarge their jurisdictions through mergers and acquisitions in the long run, and this will enable them to be internationally competitive. The larger and more efficient sugar mills bring stability to the sector and reduce the cyclicity in production with little government intervention. It is in line with price policies in other developing countries such as Brazil where cane prices are determined by a formula based on the end use, either sugar or ethanol. Formula-based cane pricing should be implemented simultaneously with the complete decontrol of sugar prices. The political pressure from both farmers and millers would then be curtailed towards market-oriented prices.

Cost of production, opportunity cost, support price and competitiveness

Cost of cane represents 65-75% of the overall production cost of sugar. A cost/benefit analysis for sugarcane and its competing cropping systems (opportunity cost) for 2009/10 for three major cane growing regions is given in Table 5. Generally, in all regions, net returns from sugarcane are higher than they are

from competing crops; however, sugarcane also requires higher investment. The margin is much higher in western India because sugarcane is irrigated, whereas competing crops are usually rainfed. In northern India, the cost of cultivation (Rs 40825/ha) and cost of production (Rs 740/ha) are lower and thereby the cost/benefit ratio is higher (1.77) because of the short duration of the crop. However, cane yields are higher in western India (86.6 t/ha) and southern India (83.6 t/ha) compared with northern India (55.5 t/ha). The higher cost/benefit ratio and abundant water in northern India suggests that it is a good candidate for expansion in cane production at the least cost.

Regulation, capacity utilization and profitability of mills

Although sugar production has increased significantly from 5 MT in 1980/81 to 26 MT in 2009/10, it is facing a crisis regarding its price policy. In the long run, on an average basis, even large sugar firms have struggled to generate a return on invested capital over and above their costs of capital (Rais, 1990). This is primarily because of high government regulation from raw material supply to final consumption. In the current scenario, industry has the potential to meet the large and growing domestic and international sugar demand.

The installed capacity of all sugar mills is about 23.9 MT, but actual production was about 26.3 MT in 2007/08, 15.0 MT in 2008/09 and 18.5 MT in 2009/10 (Parliament, 2010). Production was higher than installed capacity in 2007/8 because of the increase in crushing duration (days of operation of sugar mills/year). Average crushing duration varies from 150 days (2007/08) to 104 days (2008/09). The capacity counts only in the years of surplus production. Because of the increase in the average capacity of plants from 1394 Tonnes of Cane per Day (TCD) in 1971 to 3694 TCD in 2009 (Table 6), the Mahajan Committee (1998) and KPMG (2007) recommended that the government should consider increasing the radial distance between sugar mills for cane reception from farms to 25 km from the existing norm of 15 km to address the problem of underutilisation.

During 2006/07 and 2007/08, increase in sugar production resulted in low sugar price that was uneconomical for millers. This led to a large accumulation of price arrears to be paid by millers to farmers. In 2008/09, because of a reduction in cane output,

Table 5. Cost benefit analysis of cane and competing cropping system (2009/10)

	South India (Andhra Pradesh, Tamil Nadu)		Western India (Maharashtra)		North India (Uttar Pradesh)	
	Sugarcane	Paddy-Maize	Sugarcane	Cotton	Sugarcane	Paddy-Wheat
Total cost (Rs/ha)	79049	52120	79950	24732	40825	43841
Gross returns (Rs/ha)	108473	79713	112456	24450	72066	65832
Net returns (Rs/ha)	29424	27593	32506	-282	31241	21991
Benefit cost ratio	1.37	1.53	1.41	0.99	1.77	1.50
Cost of production (RS/t)	960		920		740	
FRP (Rs/t)	1298		1298		1298	
Yield (t/ha)	83.6		86.6		55.5	

Source: Ministry of Agriculture (2010)

Table 6. Sugar mill capacity utilization in India

Year	No. of factories working	Crushing duration (days)	Actual capacity (TCD)
1970/1	215	139	1394
1980/1	315	104	1718
1990/1	385	166	2088
2000/1	436	139	3080
2006/7	504	174	3474
2007/8	516	149	3546
2008/9	500	104	3694

Source: Parliament (2010)

the industry also suffered from the underutilisation of capacity and increased costs of production. Out of 485 operational sugar mills, only a fifth have capacities of at least 2500 TCD, which is estimated to be the base economic viability in India. Sugar factories in other leading sugar-producing countries operate in a range of 10,000 to 30,000 TCD. Tax incentives and profit sharing among employees, management and farmers will help in reducing costs and increasing efficiency. Shortage in cane supply, obsolete technologies, underutilisation, poor financial performance and high government regulation are some of the chronic problems resulting in a high cost of production and persistent losses (KPMG, 2007). The number of non-functioning mills rose from 119 in triennium ending (TE) 2005 to 162 in TE 2009 (Table 7).

Studies have found that profitability, short-term market position and capacity utilisation can significantly discriminate between functioning and non-functioning sugar mills (Rais, 1990). Net profit/working capital and the interest coverage ratio are the best discriminators for functioning units, which are directly related to the cane price policies.

In India, out of 634 sugar mills, 318 are in the cooperative sector, 254 in the private sector and 62 in the public sector. Almost one-quarter (23.7%) are non-operating, of which 26.1% are in the cooperative sector, 66.1% are in the public sector and 10.2% are in the private sector (Table 8). The higher proportion of non-operating units in the public sector and cooperatives may be because of the highly regulated environment, uneconomical size and lack of profit motives.

Large scale millers (both public and private) are better placed to profit from new revenue streams such as bagasse-based power generation and biofuels production if the industry is

deregulated, facilitating access to cheaper funds through initial public offering, external commercial borrowing and rights issues. Combination of competition for cane, increasing overheads and capitalizing on revenue opportunities from biofuel and power production has increased the need for consolidation in the sugar industry. However, the necessary market infrastructure in terms of roads, transport facilities and institutional development for ethanol and power purchases does not exist in many states and needs to be improved.

Consolidation and efficiency

Many large private companies (e.g. Balrampur Chini, Bajaj Hindusthan and Sri Renuka Sugars) with large capacities and multiple plants have consolidated through mergers in recent years (Damodaran, 2009). The main driving force for consolidation is to secure greater bargaining power compared with farmers and state governments and to cogenerate power and produce ethanol rather than simply enhancing capacity. In the past, there have been frequent and destructive 'cane wars' as mills were established too close to each other. At present, a cane area is reserved for a sugar factory mainly based on its crushing capacity. No regard is paid to the recovery rate in the factory. However, the SMP for cane is linked to the recovery rate. The cane growers of high-recovery sugar factories receive higher prices and vice versa. Many sugar factories continue to have recovery rates below 8.5% mainly because of their obsolete machinery. Modernisation has not progressed despite the availability of assistance by the sugar development fund. Furthermore, most mills have undertaken little cane development work in their allotted areas. One of the ways in which sugar factories can be encouraged to improve their recovery rates is to establish cane reservation areas, *inter-alia*, based on the recovery rate of the factory. Thus, an efficient factory with a high recovery rate should preferentially have access to larger cane acreage than an inefficient factory whose recovery rate is less. Such a move would stimulate factory modernisation and cane development.

Given the projected growth in domestic and international markets, India would need to produce a total of 32 MT of sugar by 2017 to meet demand (KPMG, 2007). This can be achieved through both productivity improvements and higher recovery rates without even increasing cane acreage. By adopting the appropriate production technology and applying latest research products, cane farmers can easily increase yields by 20% and factories improve their recovery rates by 50 basis points by

Table 7. Capacity utilization in sugar industry

State	Installed capacity (MT)				Production (MT)				Capacity utilization (%)				Number of non-working sugar mills	
	2008	2009	2010	TE2010	2008	2009	2010	TE2010	2008	2009	2010	TE2010	TE 2005	TE 2009
UP	7.3	8.5	8.5	8.1	7.3	4.0	5.3	5.5	100	47	63	68	13	27
Maharashtra	7.2	7.2	7.2	7.2	9.1	4.4	5.1	6.2	126	61	71	86	50	37
South India	4.5	4.7	4.7	4.6	10.8	4.2	5.0	6.7	240	89	106	145	23	33
Other	6.8	7.0	7.0	6.9	8.8	2.4	3.1	4.8	129	34	45	69	33	65
India	22.5	23.9	23.9	23.4	26.3	15.0	18.5	19.9	117	63	77	85	119	162

Source: Parliament (2010)

Table 8. Number of mills and percentage of units not operating in sugar season 2008-09

State	Cooperative	Public	Private	All
North India	28 (10.7)	33 (57.6)	94 (3.2)	155 (16.1)
Western India	165 (27.9)		30 (6.7)	195 (24.6)
South India	55 (25.5)	7 (42.9)	88 (12.5)	150 (18.7)
Other	70 (28.6)	22 (86.4)	42 (23.8)	134 (36.6)
India	318 (26.1)	62 (66.1)	254 (10.2)	634 (23.7)

Note: Figures in parenthesis are percentage of non-operating mills to total mills in the zones.
Source: parliament (2010)

2017 (IISR, 2008). This would enable the sector to produce an additional 8.2 MT of sugar. Water management is another key focus area since sugarcane is a water-intensive crop. The adoption of drip irrigation would increase water productivity in cane cultivation. In order to crush the additional cane, crushing capacity would need to be increased by 0.46 million TCD by 2017 (KPMG, 2007), which could be met through an increase in the capacity utilisation of existing mills.

Deregulation of the sugar industry

The perishable nature of cane, the need for immediate processing, small-scale farming and the need to protect consumers' interests are some of the justifications for government regulation. Hence, some regulations such as land demarcation for mills need to be continued, although considerable scope for deregulation exists in line with the Mahajan Committee Report (1998) recommendations. The full decontrol of sugar prices should be coupled with the removal of the levy sugar quota and monthly release schedules with free international trade. The committee also recommended that the required quantity of sugar distributed under a PDS for poor households should be purchased from the open market through tenders. However, the government is implementing a deregulation program in a phased manner: first through the reintroduction of futures trade in January 2011 and the reduction of the quota on levy obligation on sugar factories to 10%. The Committee on the Revitalization of the Sugar Industry (Tuteja Committee Report, 2004) has suggested scrapping the release mechanism for the free sale of sugar but this recommendation has not yet been accepted. The futures market can also help in price discovery in open market and transmit world sugar price signals to Indian producers and consumers to help plan their production and consumption strategies. The Abhijit Sen Committee Report (2008) pointed out that the daily price volatility of the WPI has been reduced from the pre-futures (2002 to 2004) volatility of 10.8% to 8.2% in the post-futures period (2004 to 2007). Even though the data are for a short period, we can conclude that there is no evidence of an increase in price volatility after the introduction of futures trade in sugar, especially because it is a highly liquid commodity.

Policy options and conclusion

Even though liberalisation started in India in the 1990s, the sugar sector remains highly regulated today. It is imperative that it is decontrolled to unleash its hidden potential. Since cane is produced primarily in nine states but cane-based products

are consumed across the country, uniform policies should be adopted across states. Moreover, for a sustainable price band to be effective across the country it is necessary that cane and sugar prices reflect market conditions across states. Furthermore, being a highly traded commodity, domestic prices should also reflect international prices. The recent conflict following the announcement of the FRP is an example of the adverse effects of high political intervention in price fixing, which has little economic reasoning. Different types of subsidies/incentives are practiced in different states and such distortions interfere with free competitive forces. There is a need for the centre to evolve uniform price policy for the industry across the country. In the long run, cane prices should be remunerative for farmers and also within the capacity of sugar mills to pay for, and the long run sugar prices should give normal profits to mills and within the reach of consumers. Governments should allow sugar sector to evolve with limited controls and along with appropriate regulatory framework. Keeping this in mind, the paper developed a modified fair and remunerative price (FRP*) formula which reflects both domestic cost structure of cane and world prices of sugar.

Major regulatory reforms needed, include (i) the cane payment system that is fair to both millers and growers, (ii) millers able to purchase cane from farms up to 25 km away, (iii) discontinuation of levy sugar and the requirements of the PDS should be purchased from the free market.

Endnotes

¹ Gur: a crude non-centrifugal sugar in lump form produced using the open pan evaporation method.

² Khandasari sugar: a low recovery centrifugal sugar prepared using the open-pan evaporation method.

References

- Abhijit Sen Committee Report (2008) The Impact Of Futures Trading On Agricultural Commodity Prices. Ministry Of Consumer Affairs, Food & Public Distribution, Government Of India.
- Damodaran, H. (2009) Why Bajaj Hindusthan is interested in Balrampur Chini. *Business Line*. Sunday, 1 November 2009.
- IISR (2008) Annual Report. Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh, India.
- Indian Sugar Mills Association (2010) World Sugar Market Review. Retrieved 13 July 2010. <http://www.indiansugar.com/briefings/wsm.htm>.
- KPMG (2007) Indian Sugar Industry Sector Roadmap 2017.
- Mahajan Committee (1998) Report. Department of Food and Public Distribution, Government of India.
- Ministry of Agriculture (2010) Report on Price Policy for Sugarcane for the 2008-09 Sugar Season. Commission for Agricultural Costs and Prices. Retrieved 13 July 2010. www.dacnet.nic.in.
- Parliament (2010) Unstarred question no.6224 answered on 04.05.2010 in the *lok sabha* and subsequent questions. Government of India, New Delhi, India. <http://164.100.47.132/LssNew/Questions/Question.aspx>.
- Rais, M. (1990) Financial Ratios and Industrial Sickness: A Study of Sugar Industry In Uttar Pradesh. Ph.D. Thesis, Indian Institute of Technology, Kanpur, India.
- Tuteja Committee Report (2004) Revitalization of the Sugar Industry. Government of India.