

**CHAIN COORDINATION MECHANISMS AND CONCERNS IN SUGAR
INDUSTRY IN PUNJAB, INDIA**

Veena Goel,
Sr. Economist (Marketing)
Department of Economics
Punjab Agricultural University, Ludhiana
India
Telephone: 91-40196080
Email: veengl@yahoo.com

Presentation Type – Symposium Paper
Track: Food Chain Approach-Food Chain Management

CHAIN COORDINATION MECHANISMS AND CONCERNS IN SUGAR INDUSTRY IN PUNJAB, INDIA

Abstract

This study examines the chain coordination mechanisms and concerns of market agents in sugar industry for the Punjab state of India. It is based upon primary data obtained on pre-structured schedules for the cane marketing *kharif* (winter) season 2005-06 from 180 cane growers selected from the command areas of sample five sugar mills. Study indicated that mutual interdependences of the chain partners coupled with regulatory provisions such as announcement of SMP/SAP for cane have facilitated chain coordination for sugar mills with the upstream and downstream chain partners. This ensures timely cane supplies to sugar mills while timely cane disposal and payments to farmers. However, cane production has not kept pace with capacity expansion in the industry. Instead, the industry has received increased cane supplies from a continuous upward revision in the state advised prices that diverted its supplies from the gur making units. Further, cyclical nature of the industry adversely affects its supplies particularly during the downward phase. As a result, cooperative segment of the industry is beset with several concerns. However, private sugar mills because of comparatively greater market orientation and a paddock-to-plate mentality in its operations have steamed ahead of co-operative mills.

Key Words: Sugar industry, chain coordination, private and cooperative sugar mills, regulatory framework.

Introduction

Supply Chain Management (SCM) includes the movement and exchange of products and knowledge from farms to final customers. It captures a holistic farm-to-fork perspective of food production and marketing that links markets, distributors, manufacturers/processors and producers. Efficiencies in SCM cause value chain transformation (better customer service, product quality, reduced cycle time, greater asset utilization, operational flexibility and better business performance), systems efficiencies in the value chain i.e. creating efficient and customized transactional and decision support tools and facilitate integration of different actors and activities leading to greater capacity utilization and operating efficiencies. Food supply chain efficiencies, as determined by costs and timing of deliveries, entail efficient coordination of the movement of products across different actors in the producer to consumer chain. A well-integrated supply chain can generate economies of scale and scope and therefore increase the operating efficiency and profitability of all actors in the supply chain (World Bank 2005). These ideas are not

new in the realm of social and business theories. For example, for more than 50 years, resource dependence theories have espoused the competitive advantage of inter-firm alliances. Firms enter into alliances because on their own these firms cannot access appropriate resources to efficiently access product market opportunities. Inter-firm alliances create market opportunities that were not available to these firms. However, such alliances call for the sharing of risks, costs and benefits between the actors.

In the supply chain perspective there is further complexity in that there can be many more actors as most supply chains entail a farm-to-fork integrated approach. Such relationships are often governed by contractual arrangements between actors in the chain. For example, in developed country settings, farmers and processors establish interlinked contract and this enables farmers to access credit, inputs and guaranteed purchases. Such agreements benefit the processing companies through guaranteeing higher quality and timely supplies of raw materials. Contract manufacturing agreements between processing companies and distributors and retailers ensure that processing firms have sufficient throughput and retailers are guaranteed timely and competitive supplies. Such an arrangement potentially increases greater market certainty and productivity and consequently benefits all actors in the supply chain (Swinnen 2005). However, all these activities call for efficient co-ordination within the supply chain. Often, binding contractual agreements are a centre-piece of initiatives to co-ordinate forward and backward integration between actors in the supply chain. Contractual relationships (formal or informal agreements) between actors that are costly to break either in terms of monetary penalty or lost future business often means that alliance partners conform to their contractual agreements and work seamlessly with one another even if they are dissatisfied with the relationship (Dimitri 1999). Successful alliance between supply chain partners is the outcome of cohesive relationships between partners. Personal and business relationships influence the form, evolution and ultimate success of an alliance (Gulati 1998).

Chain coordination mechanisms in the agriculture sector are product specific that vary across regions (Goel and Bhaskaran 2007a, c). However, supply chains in the developing countries are fragmented due to small scales of operations and the market actors tend to concentrate upon their own businesses. Chain coordination mechanisms

across the chain segments may be formal or informal or a combination of both. Hence product specific and country/regional level studies are required to understand the chain coordination mechanisms and concerns of the chain partners at a greater depth. So, this study has been carried out to delineate the chain coordination mechanisms and concerns of market agents for sugar industry in the Punjab State of India. Its objectives are to understand the macro level industry's environment. How do sugar mills coordinate supply chains with the upstream chain partners for a timely and adequate cane supplies and downstream chain partners for sugar distribution. What are the concerns of sugar mills and farmers in the chain?

Literature Review

Firm may develop a competitive edge either through product or process innovations that reduce the cost of producing existing products or enable the production of new products (Davies 1988; Johne 1985; Tirole 1988). Process innovations may refer to technological innovations i.e. those based on R&D or market-orientation skills and competencies (Dhar and Ray 2002). There is an increasing recognition that competitive capabilities of the organizations are not entirely dependent on the strengths and capabilities of individual organizations. These are also the outcome of the effectiveness with which organizations use their unique resource capabilities and work with other organizations that have other unique but complementary capabilities (Hunt 1995, 2000; Hunt and Morgan 1995). As inter-organizational collaborations increase there is need to examine the efficiencies of the supply chain that link individual organizations and the host of intermediaries that are engaged in the joint-enterprise. Because each organization in a supply chain is just one link in the producer-to-consumer pathway, upstream and downstream SCM practices significantly influence the competitive position of all actors in the producer-to-consumer chain (CDPIE 1998). Supply chain efficiencies have a significant impact on the capacity of individual organizations to match customer demands. A supply chain perspective takes a more holistic approach to competition in evaluating competition as being between competing supply chains as opposed to competition between organizations. And competition in the new age will increasingly be between supply chains rather than between individual organizations (Ibid.).

Firms can also develop supply chain strategies to obtain a competitive advantage. However, goals of an organization's supply chain components and those it deals with must be similar. A variety of regulatory, structural, cultural, historic, logistic, resource and organizational characteristics influence the performance and capabilities of different intermediaries in the supply chain. And, some of the supply chain partners may not have the resources to commit to realize these goals. Because of the interdependence of organizations, actions of any one intermediary can influence the operations of other linked organizations and consequently it is important for all organizations in the supply chain to share a common vision (Brito 2001; Reason 1999). Good communication can keep the extended supply chain in synchronize (Happek 2007).

In the marketing of agricultural products farmers can be pictured as being at the base of the supply chain pyramid. Farmers need access to specialized information, technology, knowledge, assets, institutions, infrastructure and credit to respond efficiently to customer demand and to be able to compete in global markets (Hulse 1999; IFPRI 2001). Farmers are constrained by poor information about markets, inexperience in negotiating deals and their inert inability to collaborate with other organizations so as to increase their capacity to efficiently access markets (IFAD 2001). Vertical co-operation enables downstream channel members to share their market knowledge with upstream channel members and also use this knowledge to develop strategies and tactics that successfully match offerings to the needs and demands of target markets (Etgar 1976). A few case studies have also looked at vertical co-operation in the food industry (Goel and Bhaskaran 2007a, c; Grunert et al 1995; Kristensen and Holmen 1994). In the sugar markets governments of sugar-producing nations intervene to protect its domestic industry from fluctuations in the world market prices. However, objectives and instruments of regulation, levels of internal supports and export subsidies differ among countries due to differences in their economic structures. For example, Australia has minimal regulations; India, China and Thailand are highly regulated markets while Brazil has since 1999-2000 deregulated the industry but regulations still exist to direct the product mix of ethanol and sugar (KPMG 2007).

This study adds to the extant literature by examining what is the business strategy of the Punjab State sugar industry in a developing country environment wherein cane

supplies come from thousands of producers while the consumers' markets are price sensitive. As government exercises control on the supply chain both for backward and forward linkages how does it develop its supply chain strategies to stay competitive in the changing environment.

Procedures

The study has been based upon both primary and secondary data. Data pertaining to various characteristics of cane production and sugar industry at the state level have been obtained from the Statistical Abstract of Punjab while primary data have been obtained from farmers and sugar mills.

All districts in the Punjab state on the basis of average cane production (in terms of jaggary) levels for three years i.e. 2002-03, 2003-04 and 2004-05 have been clubbed into three groups – low (below 25 thousand metric tones), medium (25 to 50 thousand metric tones) and high (above 50 thousand metric tones). Two sugar mills - one each co-operative and private (a competitor mill of the former) from each of the high and medium cane production areas while only a co-operative sugar mill from the low cane production area has been selected. This is because a private mill in its command area has not been set up because of poor soil fertility and poor quality of underground water. Thirty six farmers from the command areas of each of the sample five mills have been selected. Total sample size comprises of 180 cane producers and sample farmers from each mill area belong to several villages. Data have been collected from respondents on the pre-structured and pre-tested schedules by a personal interview method for the cane marketing *khariif* (winter) season 2005-06. When a respondent was unwilling to furnish the relevant information he was replaced with another who willingly cooperated for the conducting of this study. Data have been collected from respondents at the sample mill gates at the time of cane disposal. It eased their access and also did not interrupt in their routine work on farms because farmers have to wait at a mill gate till their cane is disposed off.

Information from mills has been gathered through intensive personal interviews held with each individual mill's Manager/Director, Cane Development Officer, Accounts Officer (also handles sugar sales) at mills' premises. Information has been gathered from mills relating to various aspects of chain coordination mechanisms with the upstream and

downstream chain partners and their concerns. This included the conducting of annual farm surveys, cane collection from farmers, cane payments to farmers, sugar distribution, etc.

Product Characteristics

Sugar is produced from two plant sources - cane and beet. Sugarcane is a perennial grass and its cultivation has a history of about 3000 years while sugar beets have been used for sugar production since the 19th century. Sugarcane is grown primarily in the tropical and sub-tropical regions of the southern hemisphere in the developing countries of Latin America, the Caribbean and Asia. Sugar beet is grown in the temperate regions of the northern hemisphere, mainly in Europe and North America while very little is produced in the developing countries (Haan 1988). Cane processing yields white sugar and several by-products - bagasse, molasses and press mud. Bagasse is a fibrous remainder of cane after extracting juice. It can be used as fuel for in house juice boiling, cogeneration of exportable power, paper and pulp industry, chemical industry, animal feed, etc. As an experiment white button mushroom (*Agaricums Bisporus*) has also been produced from bagasse (usually it is produced from paddy and wheat straw) and its yield stood at 79.6% compared to 78.1% from wheat straw and 74.54% from bagasse plus wheat straw (DFPD Report 2006-07). Molasses are distilled into power and industrial and potable alcohol. Fuel ethanol can be used as a substitute for gasoline and also it has the potential to generate revenues through carbon credits (KPMG 2007). This enables sugar mills to generate additional revenue from the sale of by products.

Study Context

With the introduction of green revolution technology for the major cereals i.e. wheat and rice, central government procures these crops from the surplus states through the Food Corporation of India (FCI) in connivance with the state agencies. These are purchased from the primary wholesale markets at the minimum support prices (MSPs) during the post harvest period. Milled rice and wheat are distributed through the public distribution system (PDS) at the subsidized rates to the ration card holders in the deficit areas. Punjab state in the north-west region of the country is surplus in both these crops. As the existence of public procurement system has provided assured markets to farmers for these crops. Despite this, during the *kharif* season farmers along with paddy also grow

several region specific alternative crops such as sugarcane, maize, bajra, oilseeds and cotton.

Results and Discussions

Sugar Industry Scenario - Country Level

Sugar industry is the second largest agro-based industry (next to textile) in the country. The industry comprises of two sub sectors - organized and unorganized; former includes sugar factories while the latter includes traditional sweeteners i.e. *gur* and *khandsari*¹. Sugar is manufactured under plants having various plant sizes and the ownership patterns - cooperative, private and public that account for about 54%, 40% and 6% of the total mills (533) in operation. Owing to the adoption of a socialistic pattern of development, government encouraged the setting up of cooperative mills started at states' initiatives during the Post Independence Period. Entry of private sector was encouraged with the initiation of market reforms during the early 1990s. Presently, sugar mills (total production capacity is 18.0 million tonnes) have an average cane crushing capacity of 3,500 TCD that has increased from about 2,500 TCD during 1995. This is because till the 1980s mills were licensed with a capacity of 1250 TCD while thereafter minimum economic size was imposed at 2500 TCD for new mills. Further, with the de-licensing of sugar sector entrepreneurs have been allowed to set up sugar factories or expand the existing capacities. Thereupon mills having capacities up to 10,000 TCD have also been set up. Each mill procures cane from about 18,000 farmers that increase the complexity of managing cane procurement, quality control and cane development (KPMG 2007). A sugar mill crushes sugarcane for about six months - starting from October till March/April because thereafter due to rise in temperature sucrose content of cane diminishes rapidly. The country mainly produces refined white sugar of 100-159 ICUMSA² (International Commission for Uniform Method of Sugar Analysis), also known as plantation white sugar and industry uses only sugarcane as an input. Traditionally, sugar mills in the country have concentrated only upon mass production of specified grades. With the liberalization of economy this sector has witnessed several developments on the industry front such as manufacturing of sulphurless sugar, branded sugar, packaged sugar in sizes of one, two and five kgs, value added products like sugar syrups, sugar cubes, etc.

Besides this, sugar companies have also begun to diversify businesses for strengthening their bottom lines by concentrating on the effective utilization of by-products

Being a vast country, sugarcane is cultivated under diverse agro-climatic conditions both in the tropical and subtropical regions, primarily in nine states. Of these five states, namely, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka and Gujarat lie in the tropical region while four states, namely, Uttar Pradesh, Bihar, Punjab and Haryana lie in the sub-tropical region. Sub tropical region is aheading in cane production but is lagging far behind in cane productivity while the tropical region is aheading in sugar production because of higher cane utilization and sugar recovery (Goel 2009). After meeting the requirements for seed, feed and chewing (about 11% -12%) remaining cane is used as a primary raw material for all the sweeteners. Being a bulky product, sugarcane must be processed within days of harvesting or it loses its sucrose content. Therefore, mills must be located closer to the cane fields to minimize transport costs and sucrose losses (Koo and Taylor 2004).

Regulatory Framework

The industry is regulated across the entire value chain from cane growers to millers/manufacturers, traders and final consumer. Various controls on the industry cover the aspects such as licensing, capacity, cane area, location of mills³, specific taxes and levies, cane cess, etc. The policy of partial decontrol has been adopted for sugar sale since October, 1967 and practiced since then after a brief respite during the 70s. Accordingly, mills deliver a fixed proportion of sugar as levy quota to the state governments or its nominees at the predetermined controlled prices. Proportion of levy sale sugar was initially fixed at 60% during 1967-68, increased to 70% during 1968-69, decreased back to 60% but increased to 70% during 1972-73, since then it has been consistently brought down⁴ to 10%. Levy sugar is supplied through the Public Distribution System (PDS) to the 'Below Poverty Line' families in all States (in the North Eastern Hill States and the Island Territories all ration card holders are eligible to buy sugar from the PDS) at the uniform retail issue prices throughout the country. Price of levy sugar is linked to the statutory minimum price (SMP) of cane (plus conversion cost as recommended by the Bureau of Industrial Cost and Prices (BICP) (Echevarría 1995). Central government on all India basis has since 1962-63 been fixing the SMP for

cane for each sugar season. This has been linked to the basic sugar recovery of 9% since 2005-06 (earlier it was 8.5%) with a premium for an every increase of 0.1%. Later, State governments brought into practice the system of State Advised Prices (SAPs) that are fixed over and above the SMP.

Mills are allowed to sell remaining 90% sugar as non-levy (free sale) in the open markets at the market prices. However, it is allowed to be sold through the system of 'regulated release mechanism'. Its objective is to stabilize open market sugar prices thereby protect the interests of sugarcane growers, sugar mills and consumers. Accordingly, keeping in view market availability, its requirement and the current sugar prices, government announces sugar release quotas on a quarterly basis. It is uniform and regulated between zones and so scheduled that about 25% of annual production remains in mills' stocks. State wise allocations are fixed based upon historical data plus state specific festival demand for a month. Mill wise allocations are made based upon its production/stock position on a pro-rata basis. Monthly release orders are issued to sugar mills specifying mill-wise quantity to be sold or dispatched during a month. And mills are bound to sell the sugar quotas evenly during each fortnight of a month. To avoid the piling up of stocks at the month end and seeking extensions (when carried forward to the next month disturb planned releases) sugar mills are advised to sell at least one-third of the monthly quotas in the first fortnight of a month. A failure to comply to this is that unsold sugar can be converted into levy sugar. Besides, state governments also impose sugarcane purchase tax on sugar mills (varies across states) and cess on sugar produced since June 1982 under Sugar Cess Act, 1982. It is imposed @ Rs. 14/qtl and funds are utilized to finance for the development of industry (DFPD Report 1990-91, 1995-96). Industry's annual contribution to the Central Exchequer as excise duty and other taxes is about Rs.16500 million while to the State governments through purchase tax and cess on sugar is about Rs.6000 million (DFPD Report 2006-07).

With the liberalization of economy a beginning for the restructuring of industry had been made by the lifting up of price and distribution controls on molasses in June, 1993. Government de-licensed the sugar sub sector in August 1998, withdrew stockholding limits on wholesale dealers from July 2000 and abolished turnover limits from August 2001. Mahajan Committee in 1998 recommended modifications in the cane

pricing system and a phased reduction of levy sugar to zero while Tuteja Committee in 2004 recommended a removal of monthly release mechanism for the industry. Government decided to create a buffer stock of 0.5 million tonnes from January 1996 for one year (extended for one year) and an additional buffer stock of 0.5 million tonnes from December 1996 to help the sugar industry to tide over its financial difficulties

Industry Status in Punjab

Number of total sugar mills in the state during 2006-07 stood at twenty three⁴. Of these, fifteen mills (six mills have till 2006-07 come under liquidation) are in the cooperative while seven mills are in the private sector. Cooperative mills are under the control of Sugarfed and private mills are under the control of Cane Commissioner. Industry's all decisions pertaining to government such as fixation of SAP are taken through the Cane Commissioner.

An examination of various characteristics of sugar industry under the two segments (table 1) reveals that the growth of industry was pulled by its cooperative segment during the Pre-liberalization Period but shifted to the private segment during the Post-liberalization Period. Some private mills have also installed automatic processing plants. A couple of sugar mills in both the segments have recently set up alcohol processing units and cogeneration plants (sell power to the State Electricity Board during the season). Share of cooperative mills in the industry's daily cane crushing capacity increased from 67.90% during 1971-72 to 76.89% during 1992-93 but declined to 45.94% during 2006-07. Correspondingly, share of private mills jumped from 23.11% during 1992-93 to 54.06% during 2006-07. Number of working days during 1971-72 stood higher i.e. 128.50 for the private mills (cooperatives mills 106.25) that declined to 115.33 during 1992-93 but rose again to 141 during 2006-07. This has been accompanied by similar movements both in the shares of cane crushed and sugar production for the two segments. Share of cooperative segment in the two jumped from about 2/3rd during 1971-72 to about 4/5th during 1992-93 but declined sharply to about 1/3rd during 2006-07. This had been accompanied by a drastic jump in the share of private segment to about 2/3rd. Cooperative mills focus primarily on sugar production and these mills do not have separate marketing/sales departments. None of the sugar mills in the state yet

manufactures branded sugar because of a small market size for it. This is because consumers are highly price conscious.

Table 1: Status of Cooperative and Private Sugar Mills in Punjab

Sugar Mills	1971-72	1992-93	2006-07
Cooperative Mills			
Number	4	15	15
Daily Cane Crushing Capacity (tpd)	4125	25850	25850
Cane Crushed (lakh tonnes)	3.66	33.12	16.40
Sugar Production (lakh tonnes)	0.32	3.08	1.57
Sugar Recovery (%)	8.77	9.28	9.58
Number of Working Days	106.25	141.06	100.77
Private Mills			
Number	2	3	8
Daily Cane Crushing Capacity (tpd)	1950	8416	35666
Cane Crushed (lakh tonnes)	1.95	8.60	34.51
Sugar Production (lakh tonnes)	0.16	0.89	3.29
Sugar Recovery (%)	8.45	10.30	9.54
Number of Working Days	128.50	115.33	141.00
Shares (%)			
Cooperative Mills			
Daily Cane Crushing Capacity	67.90	76.89	40.86
Cane Crushed	65.30	79.38	32.21
Sugar Production	66.13	77.62	32.30
Private Mills			
Daily Cane Crushing Capacity	32.10	23.11	56.37
Cane Crushed	34.70	20.61	67.79
Sugar Production	33.87	22.38	67.70

Chain Coordination Mechanisms

Mill Level

All sugar mills once start cane crushing during a season it is a continuous process unless interrupted by temporary plant breakdowns. Actual cane crushing period for each individual mill depends upon cane availability. Cane being a key input, its adequate availability plays a crucial role in extending the number of working days and improving mill's operational efficiency.

Sugarcane Purchase Pattern

Each sugar mill both in the private and cooperative segments of the industry in its command area enters into a formal written contract with farmers for cane delivery to a

mill. Mills conduct a comprehensive annual farm survey during the month of May/June to assess each cane grower's area under the early, mid and late cane varieties and the major cultivable practices i.e. plant and ratoon. Mills estimate cane production based upon the previous average cane yields. Thereupon, mills work out per visit cane delivery coupons for the entire season after taking into consideration its crushing capacity, working days and farmers' trolley sizes. These coupons along with entry numbers at mill gates are distributed to farmers at their doorsteps as the crushing season advances. Cane delivery coupons are generally distributed three to four days in advance for cane preparations i.e., cane harvesting, preparing lot sizes and its delivery at the mill gate.

To encourage cane production thereby availability of adequate cane supplies, cooperative sugar mills advance loans (up to Rs.5000/acre) to farmers i.e. either to new growers or those who want to shift to the new varieties (about 25%-30% of a mills client farmers avail this facility). Mills advance credit to growers through a third party largely for the purchase of essential inputs, supply insecticides/pesticides at subsidized rates, extend facilities for soil testing and seed treatment (only in the affected areas), extension services (for the introduction of new seed varieties) and also develop on farm new cane seed varieties. These practices, however, vary widely across mills (Goel and Bhaskaran 2007a). Private Mills also give thrust upon the development of mills' adjoining cane growing areas for the broadening and strengthening of its supply bases. To do so, mills occasionally supply essential inputs such as seeds, fertilizers, pesticides/insecticides to farmers; extend them free extension services, provide agricultural implements, occasional free refreshments at the time of cane disposal; pay a higher cane price i.e. Rs.5–10/qtl above the SAP⁶, make on the spot cash payments, etc. Some private mills such as Wahid Sandhar Sugars also distributed a free bag of fertilizer to farmers on the pre-condition that farmers will deliver cane to the mill. Private sugar mills have also developed upward supply chain linkages direct with manufacturers or agents for the purchase of various material inputs used for sugar processing and gunnysacks for packaging sugar. Such features are, however, lacking in the cooperative mills (Ibid.).

Sugar Distribution

All mills regularly submit data pertaining to sugar stock position to the Department of Food and Public Distribution. The Department directly allocates sugar

sales quotas to each private mill while to the cooperative mills it is allocated through the State Sugarfed. Mills are entitled to sell sugar only to the government approved licensed agents and actual users. Supply agents are attached to each cooperative sugar mill from both within the state and the adjoining states. Each agent is required to deposit a security amount of Rs 50,000 with a mill. These agents collect sugar purchase orders from wholesalers, place these along with delivery instructions before mills, arrange for sugar deliveries from mills and collect payments from wholesalers for the client mills. Mills pay them commission @ 0.5% - 0.75% for the rendering of these services. Sugarfed releases sugar to these agents at the prices fixed on a monthly basis (daily basis during a festive season) that are determined by the open market forces of demand and supply. However, sales agents quote sugar prices on a mill basis after taking into account the shipment costs depending upon a mill's distance from the market and also based upon their accumulated learning experiences they know about the various sugar grades manufactured by each mill. Previous years' sugar stocks because of change in its colour during storage fetch a lower market price. Fierce competition ensures that agents quote fair sugar rates. Financial and physical handling of sugar is carried out at an individual mill's level. Sales agents are required to sell sugar within two weeks of its receipt (earlier it was one week) to retailers/wholesalers (only once). Secondary sale deeds are transacted through brokers who bring together wholesalers and retailers for an ultimate sale and they charge a brokerage up to 0.25%. Sugar moves from mills as a mass product to the wholesale/retail markets. Retailers break down whole lots and pack sugar into consumer packs of sizes one or two kgs in the ordinary polythene bags.

In the open markets at the wholesale level inter and intra monthly variations exist in price movements. This is because demand pressure for sugar builds up particularly during the last quarter of a month and results in higher market prices. Private sugar millers from their accumulated experiences have learnt about these market trends. This strengthens mill's bargaining position to negotiate for prices and enhance sugar sales during this period while keep it low during a month start when the prices prevail low. This enables these mills also to avoid the lapses of sugar quotas from free sale to levy.

Cane Growers' Level

Farm Assets' Position

Sample respondents' total cultivated farm land stood at 2399.74 ha - owned land (1646 ha) and net leased in land (753.74 ha,) each having a share of 68.60% and 31.40%. Average size of operational holdings has been 13.33 ha - owned land (9.15 ha) and net leased in land (4.18 ha). 49.45% of the sample farmers cultivated only on their own land while the remaining 50.55% farmers leased in all the land. Average size of the operational holdings for the former group of farmers stood at 11.86 ha while for the latter group at 14.77 ha – owned land (6.49 ha) and net leased in land (8.28 ha). Respondents' cane cultivated area stood at 681.67 ha that constituted 31.83% of the total cultivated land⁷. Overall average cane yield stood at 681.67qtl/ha. Cane yield ranged from 247.10qtl/ha to 864.85qtl/ha - 494.20 to 741.30 qtl/ha (for about 80% farmers), 741.30 to 864.85 qtl/ha (for 12.77% farmers) while it remained below 494.20qtl/ha (for 7.22% farmers). Farmers chief source of irrigation is tube wells that are managed with electric motors (96.11%, of whom 16.18% farmers also had diesel engines), diesel engines (1.66%), jet pumps sets and electric motors on leased in land (0.55% each). 99.44% farmers owned tractors – one (77.65%), two (18.99%) and more than two (3.36%).

Farm Inputs - Purchase Sources

Farmers used several operational material inputs such as seeds, fertilizers, farm manure, insecticides/pesticides for raising sugarcane crop. They purchased each input from several sources. The largest majority (94.44%) of the sample farmers self retained cane seeds from their previous crops, 7.27% farmers purchased seeds from fellow farmers, 1.66% farmers from the open market, 1.11% from sugar mills and 0.55% farmers from the university⁸. Farmers prefer to buy seeds from their fellow farmers because they feel that these are of a superior quality to those purchased from the open market. For plant growth sample farmers used urea (100%), DAP (97.77%) and farm manure (about 3/4th). They purchased urea from the cooperative societies (77.22%), open market (13.33%) and sugar mills (9.47%); DAP from the open market (84.44%) and the cooperative societies (13.33%); farmers themselves prepared farm manure (about 1/4th), prepared it themselves as well as purchased from fellow farmers (47.22%) and purchased it from farmers (2.22%). Percentages of farmers using the various insecticides/pesticides

are as such - indosulfan (62.21%), gamma (75.54%), furadan/furadax (48.88%), amison (14.44%), zinc sulphate (1.66%), thinat (1.11%) and contidal (0.55%). Farmers purchased these insecticides/pesticides both from the open market and mills⁹, however, major purchase source remained the open market. This indicates that the largest majority of farmers for the purchase of various farm inputs relies upon several sources other than sugar mills.

For conducting of agricultural practices such as cane sowing, hoeing, cane tying and cane harvesting there existed wide variations across the sample farmers. However, for the conducting of these operations farmers relied upon migrant labour that comes from the poverty stricken regions of the adjoining states during the season. It is hired either on a contractual or daily wages but wages are paid in cash. For cane sowing farmers used hired labour (95.55%), hired and family labour (2.78%), only family labour (1.11%) and family labour as well as neighbourer (0.56%). 63.34% farmers (cultivating 71.30% cane area) went for hoeing - single (32.22%), two (25%) and three (6.11%) times and the cane area they cultivated stood at 33.16%, 27.35% and 9.77% respectively. 71.11% farmers (cultivating 83.82% cane area) got cane tied - once (40.55%), twice (35%) and thrice (5.55%) and the cane area farmers cultivated stood at 43.67%, 33% and 7.12% respectively.

Cane Disposal¹⁰

Sample farmers delivered cane at the mill gates either themselves or sent it through the hired labour (working on farms) while they reached later. They shipped it in their own tractor trolleys. They disposed off entire cane (table 2) i.e. 37355.50 tonnes to sugar mills during the post harvest period. On an average each farmer disposed off 207.53 tonnes of cane. Overall average numbers of mill visits for cane disposal stood at 5.22. Farmers delivered cane to mills mainly in four months i.e. November to February. It quantity stood the highest during the month of December (43.22%), followed by the month of January (26.12%), November (17.46%) and February (13.05%) that trickled down to nearly negligible during the month of March (0.12%). Both the average number of visits and the average cane quantities delivered at a mill gate stood the highest during the month of December being 8.40 and 1214.05 tonnes, followed by the months of November, January and February respectively. During the latter three months average

number of visits stood at 6.21, 5.06 and 3.78 while the cane disposal quantities at 815.56 tonnes, 733.83 tonnes and 518.99 tonnes respectively.

Table 2: Cane Disposal (tonnes) Patterns of Sample Respondents

Month	Farmers		Average Mill Visits		Cane Quantity	
	No	(%)	No	Quantity	Total	(%)
November.	80	44.44	6.21	815.56	6524.50	17.46
December	133	73.88	8.40	1214.05	16147.50	43.22
January	133	73.88	5.06	733.83	9760.00	26.12
February	94	52.22	3.78	518.99	4878.50	13.05
March	1	0.55	3.00	450.00	45.00	0.12
Overall	180	100.00	5.99	845.78	37355.50	100.00

Farmers' waiting time spent at a mill gate during the various visits varied from four to forty eight hours. They delivered cane to mills within 4 to 10 hours (56.67% farmers), 10 to 20 hours (49.44% farmers), 20 to 30 hours (46.11% farmers), 30 to 40 hours (8.88%) and above 40 hours (1.11% farmers).

Chain Management Concerns

Sugar Mills

Major concern of all sugar mills is that of inadequate availability of cane supplies. An examination of table3 indicates that at the state level cane production, a basic raw material, has not kept pace with capacity expansion in the industry. Cane area has kept fluctuating during the period 1970-71 to 2006-07. In comparison, cane productivity has consistently increased from 417.10 qtls/ha during 1970-71 to 642.50 qtls/ha during 2000-01 but declined to 608.30 qtls/ha during 2006-07. As a result, cane production has increased primarily because of an increase in cane productivity. However, cane production has remained subject to fluctuations because of cane area.

Table 3: Area, Production and Yield of Sugarcane in Punjab

Year	Area (Lakh ha)		Production (Lakh Metric tones)		Yield (qtls/ha)	
	Absolute	Change (%)	Absolute	Change (%)	Absolute	Change (%)
1970-71	1.28	---	52.70	---	417.10	---
1980-81	0.71	-44.53	39.20	-25.62	552.60	32.49
1990-91	1.01	42.25	60.10	53.32	594.10	7.51
2000-01	1.21	19.80	77.70	29.28	642.50	8.15
2006-07	0.99	-18.18	60.20	-22.52	608.30	-5.32

This is due to cyclical nature of the industry. Farmers' shift to paddy/cotton cultivation as mills find unable to make timely payments to cane growers particularly during its downward phase (Goel 2009a). As the industry has received increased cane supplies because of an increase in SAPs this raises its cost of production. As a result, the industry faces stiff competition when sugar supplies come from the low cost producing state of Uttar Pradesh.

Further, with the liberalization of economy cooperative sugar mills have come to fierce stiff competition from private mills. This is because cooperative sugar mills are not free to take independent decisions. And, these mills particularly during the downward phase of industry face a situation of cash crunch that delays payments to farmers. Thereupon farmers in the command areas of these mills divert cane supplies to private mills because of monetary gains and on the spot prompt cash payments. Even though cooperative sugar mills can impose penalties on farmers according to the contracts but these are seldom enforced. This is because penalties remain lower than the gains realized from selling cane to private mills and also the number of defaulters is large. Lack of autonomy to these mills also discourages quick and market friendly decisions to maximize returns from sugar sales. An examination of the revenues of two best performing mills (one each from the private and cooperative segment) indicated that the share of sugar sales realizations increased for both during 2005 compared to 2004. For the Nawanshahr Cooperative Sugar Mill it increased from 41.07% to 65.05% while for the Rana Sugars Pvt. Ltd it increased from 49.59% to 67.12%. However, latter's realizations accrued more from a larger sales volume of sugar. In addition, it also generated additional revenue from its cogeneration plant by selling electricity (6.70%) and from molasses (3.60%). Both these components contributed only nominally to the cooperative mill's revenue. Quite often cooperative sugar mills are not able to pace sales out of the allocated monthly non-levy sugar quota optimally over a month. So these have to approach the Directorate of Sugar for the extension of the validity period. Besides this, cooperative mills are also beset with a number of problems such as obsolete technologies, low level of mechanization, poor financial performance, staff's negligence in monitoring processes particularly at night (Goel and Bhaskarkan 2007a). As a result, all the

cooperative sugar mills have been confronted with losses during the Post –liberalization Period (Goel 2009b)

Mills' concerns at the intra mill levels accrue due to up gradation of the internal processes that give rise to variations in the cost of production. On the other hand, better sugar quality increases market demand. This gives rise to higher returns thereby net profitability.

Cane Growers

Cane cultivation provides its growers a regular income flow for about four months. Also its cultivation requires less supervision as the crop can easily withstand to the vagaries of weather conditions. However, farmers are fully dependent upon the industry for their cane disposal and a timely realization of its payments. In comparison, of its two alternative crops, paddy is comparatively less labour intensive while the existence of public procurement system eases crop disposal during a short duration. On the other hand, cotton can easily be shipped either to a market in the adjoining state of Rajasthan or sold to the Cotton Corporation of India when the local market conditions are pervasive. The existence of commission agents in the wholesale markets for both these crops and the establishment of long term business relationships with them ensures timely payments to farmers. Since farmers' dependence upon sugar mills for the securing of essential farm inputs is minimal, this facilitates the shifting of cropping patterns favouring these crops.

Cane growers' concerns on the input side at times arise due to timely non-availability of labour, farm inputs and electricity (increased use of diesel hikes costs). Other concerns relate to cane shipments to mills, quite often, farmers have to use bypasses because of prohibited entries through cities that adds to costs.

. Cane growers are vulnerable to opportunistic price renegotiations in several forms when they bring cane for its disposal at the factory gate. . These include cane weighing in poorly lighted rooms particularly at night, use of manipulated scales, undervaluation of cane juice, etc. Farmers' other concerns at mill premises include availability of inadequate basic infrastructure such as mettled cane shed areas that create problems particularly during a rainy season; proper security arrangements, bathrooms, see through guest houses for a clearer view of the trolleys for fears of thefts. Besides this, farmers' concerns at mill gates also accrue from their fellow farmers. Some

farmers bribe the mill employees (in cash or kind) who in turn oblige them by overweighing cane. Quite often, farmers ahead in the queues also disappear for food/tea, etc. that gives rise to quarrels. Large farmers also develop personal networks with the mill owners/employees to get cane supply coupons issued to them early and more frequently. Or, sometimes sugar mills issue coupons to uncontracted farmers. This result in delays in issuing coupons to the farmers with whom contracts had already been signed. Farmers' waiting time at a mill gates goes up either because of a slower speed of the crusher or delays in repairing plants during breakdowns. Both these problems emerge particularly at the cooperative sugar mills.

Conclusions

The study has indicated that under a regulatory framework mutual interdependences of the chain partners have facilitated chain coordination of sugar mills with the upstream /downstream chain partners in the Punjab state of India. This ensures timely cane supplies to mills while easy cane disposal and timely payments to cane growers despite the small holding sizes. All farmers ship entire sugarcane during the post harvest period as a bulk product individually either themselves or through the hired labour. The industry has expanded its capacity over time but cane production has not kept pace with it because of the existence of public procurement system for the alternative *kharif* crops. Rather, industry has secured increased cane supplies because of a continuous hike in the SAPs of cane. As a result, cooperative segment of the industry has come to face a fierce competition from its private segment and is running into losses since the liberalization of economy. This is because client farmers from the command areas of cooperative mills divert cane supplies to the private mills that pay slightly higher prices and make prompt cane payments. In comparison, private sugar mills because of comparatively greater market orientation in its various operations have steamed ahead of co-operative mills.

This indicates that in the agricultural sector in the midst of a variety of market dualisms that exist and vary widely across region and crops, sector's heavy dependence upon nature, diversity in firms' scales of operations and ownership patterns, processing firms are not always able to achieve the supply chain efficiencies in its operations. This is particularly so in the developing countries wherein agricultural sector is predominant and

farming is a vital source of livelihood for the large chunks of the population. This weakens the individual firm's position (economically as well as politically) for an effective implementation of even formal contracts particularly with its upstream chain partners to obtain requisite supplies of the basic raw materials.

Notes

1. *Gur* is clarified cane juice that contains molasses; it is hard and crystallized, colour ranges from golden to brownish yellow and has a recovery rate of about 10%. *Gur* is also produced in powder and semi liquid form. Consumers prefer *gur* for cooking certain dishes, eating it as a candy or as a digestive. *Khandsari* is a finely granulated, crystallized sugar. Under the traditional process its recovery rate varies from 4.5% to 5.5% while of the modernized process is from 6.5% to 7.5% (Haan 1988). Country produces about nine million tonnes of *gur* and one million tonne of *khandsari*. Three sweeteners - sugar, *gur* and *khandsari* are not complete substitutes for each other.
2. ICUMSA is an international unit for expressing sugar purity. Its lower number represents better sugar quality.
3. Radial distance between two sugar mills was first fixed during the 6th Five Year Plan Period at 30 kms but increased to 40 kms during the 7th Five Year Plan. It was brought down to 25 kms during 1991 and further to 15 kms during 1997.
4. It was brought down to 65% (1974-75), 45% (1985-86), 50% (1987-88), 45% (1988-89), 40% (1992-93), 30% (January, 2000), 15% (February, 2001).
5. Of these, one mill is under the control of Markfed (Punjab State Marketing Federation).
6. SAP of cane remained at Rs100/qtl since 1998-99 but private mills paid up to Rs 120-125/qtl. SAP of cane was had been raised to Rs 115/qtl during the cane marketing season 2005-06, Rs 132/qtl during 2006-07 and further to Rs.165/qtl during 2008-09.
7. Other *Kharif* crops in their cropping patterns included paddy cotton, fodder, maize, basmati rice and others that occupied 52.08%, 5.43%, 4.99%, 1.44%, 1.27% and 2.94% of the total cultivated area.
8. Farmers in the Gurdaspur and Amritsar districts also purchased seeds from the cooperative societies but its availability is neither in time nor adequate.
9. Mills extend subsidy @25% only on medicines used for seed treatment. Other insecticides/pesticides were sold at the market prices (about Rs. 10 -15 less than the maximum retail price). Farmers in the adjoining areas of mills purchased these from mills while the other farmers purchased from the open market.

10. Farmers' use cane crop residues i.e. green tops as fodder for domestic animals and tying cane. Farmers in command area of the Doaba Cooperative Sugar Mill also sell its small quantities in the open market.

References

Brito, C.M. 2001 Towards an Institutional Theory of the Dynamics of Industrial Networks, *Journal of Business & Industrial Marketing* 16 (3): 150-166.

Commonwealth Department of Primary Industries and Energy (CDPIE). 1998. *Chains of Success: Case Studies on International and Australian Food Businesses Cooperating to Compete in the Global Market*, Australian Government Publishing Service. Canberra.

Davies, S.1988. Technical Change, Productivity and Market Structure in *Economics of Industrial Organisation* edited by S. Davies and B. Lyons, :192-246, London: Longman.

Dhar T. P. and S.Ray. 2002. Understanding Dynamic Retail Competition through the Analysis of Strategic Price Response Using Time Series Techniques, www.aae.wisc

Dimitri C. 1999. Integration, Coordination, and Concentration in the Fresh Fruit and Vegetable industry, Special Article Fruit and Tree Nuts/FTS-285/March, www.ers.usda.gov

Echevarría O. A. 1995. Cuba and International Sugar Market Cuba in Transition, • *ASCE, lanic.utexas.edu*

Etgar, M. 1976. Effects of Administrative Control on Efficiency of Vertical Marketing Systems, *Journal of Marketing Research*, 13 (1): 12-24.

Goel, V. 2009b. Shifting Pattern of Cane Production and its Impact upon the Cooperative Segment of Sugar Industry in Punjab, paper presented at the *Seminar on Punjab Economy – Achievements and Challenges*, March 17th -18th, Patiala

Goel, V. 2009a. Problems and Prospects of Sugar Industry in Punjab, Report submitted to the Department of Economics and Sociology.

Goel, V. and S.Bhaskaran 2007c. Structure-Performance-Conduct Paradigm In Wheat Supply Chains in a Transitional Economy, *5th International Conference on Supply Chain Management and Information Systems*, 9th –12th Dec, Australia

Goel, V. and S.Bhaskaran, 2007b. Marketing Practices and Distribution System of Rice in Punjab, India, *International Journal of Food and Agribusiness Marketing*, 19(1):103-135.

Goel, V. and S. Bhaskaran. 2007a. Supply Chain Management: Is a Developed Economy Model Applicable in an Emerging Economy Context? *Monash Business Review*, 3(3):1-8.

- Goel, V. 2006. Supply Chain Management and Role of Relationships in Vegetable Industry in Mumbai City of Maharashtra in India”, *International Journal of Tropical Agriculture*, 24 (3-4): 589-609.
- Grunert, K. G. et al. 1995. A Framework for Analyzing Innovation in the Food Sector, MAPP Working Paper No. 38.
- Gulati, R.1998. Alliances and Networks, *Strategic Management Journal*, 19: 293-317
- Haan, H.H.de 1988. *Alternatives in Industrial Development: Sugarcane Processing in India*. New Delhi: Sage Publications.
- Happek, S. 1997. Supply Chain Strategy: The Importance of Aligning your Strategies, A UPS Supply Chain Solutions, [www.. ups-scs.com](http://www.ups-scs.com)
- Hunt, S. D. 2000. *A General Theory of Competition*. Sage Publications
- Hunt, S.D. 1995 The Resource-Advantage Theory of Competition: Toward Explaining Productivity and Economic Growth, *Journal of Management Enquiry*, 4 (4): 317-332.
- Hunt, S.D. and R. M. Morgan. 1995. The Comparative Advantage Theory of Competition, *Journal of Marketing*, 59 (2): 1-15.
- Hulse J.H. 1999. Food Security for Urban Families in Livelihood Strategies Across the Rural-Urban Divide, in *Policy Matters: Sustainable livelihoods* edited by C. Tacoli, Newsletter, IUCN Commission on EESP, 5.
- International Food Policy Research Institute, 2001. Sustainable Food Security for All By 2020, Draft. August 23.
- International Fund for Agricultural Development. 2001. Markets for the Rural Poor in *Rural Poverty Report*, www.ifad.org
- Johne, F. A. 1985. *Industrial Product Innovation*. London. Croom Helm
- Koo W. W. and R.D.Taylor. 2004. *Outlook of the U.S. and World Sugar Markets, 2003-2013*, Agribusiness & Applied Economics Report No. 536, Department of Agribusiness and Applied Economics, Center for Agricultural Policy and Trade Studies, North Dakota State University, Fargo, North Dakota 58105-5636
- Kristensen, P. S. and E. Holmen. 1994. Identification of a Supplier Network through Quality Function Deployment, Paper presented at the 10th IMP Conference, Groningen, Sept.30th – Oct.1st . .
- KPMG Advisory Services Pvt. Ltd. 2007. *The Indian Sugar Industry - Sector Roadmap 2017*, www.kpmg.ie,

Swinnen J.F.M. and M. Miet. 2006. Globalization, Privatization, and Vertical Coordination in Food Value Chains in Developing and Transition Countries, Leuven Interdisciplinary Research Group on International Agreements and Development, Working Paper 12, June.

Reason, P. 1999. Integrating Action and Reflection through Co-Operative Inquiry, *Management Learning*. 30 (2): 207-226.

Tirole, J. 1988. *The Theory of Industrial Organization*. Cambridge: MIT Press

World Bank. 2005. Rural Finance Innovations: Topics and Case Studies, Report No 32726-GLB, Agriculture and Rural Development Department, www.worldbank.org.

Websites

Economic Survey, www.indiabudget.nic.in
Department of Food and Public Distribution, www.finmin.nic.in