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# MICROECONOMICS OF COMPETITIVENESS

# THE SUGAR CANE CLUSTER IN COLOMBIA

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## I. Introduction

This report focuses in analyzing the sugar cane cluster in Colombia. It starts by presenting a thorough historical and economical review of the country as base context to analyze the countries competitiveness. Then it presents how sugar fits within Colombia's exports before turning to provide an overview of the sugar world market and its dynamics and distortions and then shifts to analyzing the sugar cane cluster in Colombia. The report ends by making recommendations to improve the cluster's condition.

## II. Country Analysis

Located in the northernmost part of South America, Colombia has access to two major oceans (Atlantic and Pacific). Covering an area equal to that of Spain, Portugal, and France together, Colombia has one of the richest biodiversities in the world and has access to multiple climates. However, despite privileged resource conditions, the country still lags in economic growth and competitiveness to many of its peers in the region and in Asia.

With a population of almost 44 million inhabitants resulting from a blend of indigenous population, Spaniards, and African slaves during the colonial times, Colombia still suffers from the longest internal social conflict of any country on earth. Violence has marked the history of the country since its independence in 1810[1] and has proven to be the main constraint for growth and development for the country. The conflict started with disputes to define the best government system for the country that finally led to the formation of a centralist republic in 1886. Then, it evolved to a political turmoil fueled by differences between parties enabled by an elitist dominated state greatly absent from most of the rural areas of the country. This political

[1] Based on "Nuestra Historia" – Universidad de los Andes, http://www.uniandes.edu.co/Colombia/Historia/historia.html

environment served as growing crop for the emergence of guerrilla movements in Colombia as early as in 1946. A military coop between 1953 and 1958 reduced the level of political violence in the country and almost restored peace. However, it left unattended some small dissident groups that -upon the return to democracy controlled by a coalition of the traditional political parties- resulted in the formation, between 1964 and 1965, of what today are Colombia's largest guerrilla movements: The FARC[2] - Colombia's Revolutionary Army, a self-described Marxist-Leninist guerrilla, and the ELN – National Liberation Army, a guerrilla movement influenced by the Roman Catholicism and the Liberation Theology (Dube and Vargas, 2006).

Initially, these groups remained highly concentrated in specific regions of influence where they had some degree of support from the local population. Throughout the 1970s and early 1980s, the conflict effectively served as a cold war proxy with the Soviet block supporting the guerillas and the US supporting counter-insurgency efforts (Dube and Vargas 2006). Given the rise in their popularity, during the 1980's the government tried to negotiate a peace-treaty with these groups. The 1984 cease-fire opened the door for the guerrilla to have legitimate political representation; the FARC introduced a political party, the Patriotic Union - UP. The cease of fire, however, was also used by the guerrilla to deploy a new expansion strategy aimed to duplicating the number of effectives and diversifying the financing sources thereafter.

The peace talks failed and the efforts of political representation vanished given the overruling power of the traditional parties. The conflict prevailed and worsened as it started to see the emergence of two new players. On one hand, illicit drugs dealers and cartels arose as threatening forces with great violent power both in the urban and rural areas. On the other hand, paramilitary groups were formed as a privately funded mean of protection for landowners in

[2] FARC is the acronym for Fuerzas Armadas Revolucionarias de Colombia. ELN is the acronym for Ejército de Liberacion Nacional

areas of guerrilla influence and limited government presence. This situation moderated the intensity of the conflict with the guerrilla during the early 90s. The government efforts (under pressure from the US) were focused towards defeating the drug cartels of Medellín and Cali. This gave the opportunity for the FARC to capitalize on the cartels' weaknesses and get control of the coca production business in the rural areas. Simultaneously, both FARC and ELN had been aggressively implementing their expansion strategy. By 1997 guerrilla presence had managed to reach over 50% of Colombian municipalities from 10% in the early 1990s (Rubio, 2001). Expanded geographical presence led the guerrillas to also achieve their second objective of their strategy, obtaining funds from three new sources: kidnapping, extortion, and illicit drugs.

As a result of these changes, during the late 1990s the Colombian conflict detached from the economical, social, and political reality of the country (objective causes) and gained its own dynamics (Rubio 2001). The conflict in Colombia turned into an end by itself, detached from its original roots (political motives) (Waldman and Reinares, 1999) and became the way through which multiple actors and *warlords* make their living. Guerrillas and paramilitaries lost most of their political motives and turned into war as a business.

Consequently, the conflict intensified. The guerrilla increased their military power and managed to destabilize the army by simultaneously attacking in different areas of the country. They also started to weaken Colombia's infrastructure by blowing bridges and electricity towers.

Concerned with the situation, the government decided to initiate a new set of peace talks with the FARC in 1998. As a concession to start the dialogues, it ceded control over five municipalities in a demilitarized zone (DMZ) south of Bogotá. The DMZ was effectively controlled by the guerrillas for over four years of peace talks. From there, the FARC continued staging attacks during the negotiations and the conflict exacerbated. In 1999, the largest number of massacres of the decade in the country was reported, more than one per day. […] The number

of kidnapping claims per inhabitant, already one of the highest in the world, tripled in the country […] and the number of terrorist attacks increased by 86% in the 1985 to 1995 decade (Rubio, 2001). The peace talks eventually failed as an agreement could not be reached and hostilities prevailed. After several high-profile kidnappings in 2002, the talks were discarded completely and the government re-launched a military campaign to gain control over the DMZ. Despite the failure, the peace talks turned the eyes of the international community to Colombia's conflict. Particularly, the United States started to support heavily the war against drugs and terrorism in the country by providing additional funding and military aid.

The current president, Alvaro Uribe, was elected [in 2002] on the basis of taking a harder line against the guerilla, which he has done through stepped up military pressure (Rubio 2001). With increased and stronger military action through a modernized and more efficient army, Uribe's so called 'national democratic safety' policy proved effective to limit the geographical control that guerrilla had gained of the territory and served to bring a large portion of the latter to surrender their weapons. In addition, it served a mechanism to reinstate the confidence of local and foreign investors in the country and the economy regained traction. The country regained some stability as the capability of violent groups was significantly reduced. During Uribe's mandate, the government also managed to sign peace treaties with a majority of the paramilitaries groups and bring over 34,000 people out of the conflict and back to the society through a complex process of national reconciliation. The process also allowed starting conversations with the ELN that were advancing slowly. No such a process could be started with the FARC and hostilities with this group continued.

Uribe's government also implemented a strong set of reforms to improve the state's efficiency and reduce the fiscal deficit. First, over 300 state institutions were closed or merged, leading to savings of more than 4.5% of GDP. Second, Labor reforms were introduced to

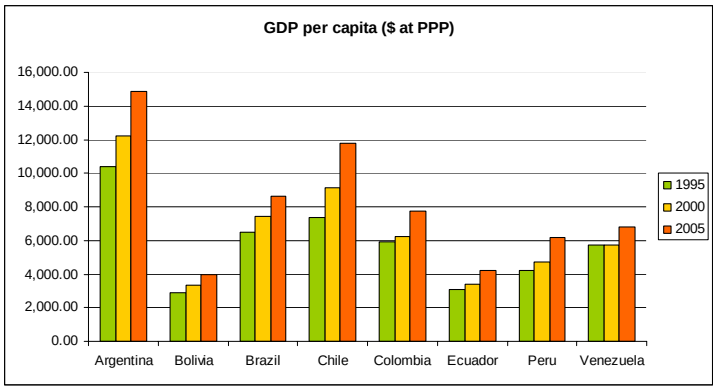
increase flexibility. Along with the reforms, came a pension reform representing 13% of GDP. Additional reforms were also to the judiciary system streamlining procedures and increasing the efficiency. Finally, a large set of SOE privatizations were in the process of being implemented. Leveraging the improved the relationships with the United States, Colombia also advanced in the negotiation of a Free Trade Agreement (FTA) that could mean a considerable trade opportunity for the country. In the case of sugar, for example, the FTA would imply increasing the country's tariff free quotas in the U.S. market from 25,000 thousand tons per year to 107.000.

As a result of the improved country conditions, Colombians gave impulse to a constitutional reform that led to the re-election of Uribe for a second term from 2006 to 2010.

## II.A. National Economic Performance

Colombia's economic performance reflects the continued history of violence and conflict. In continuous internal turmoil, the country has registered 70 years positive but limited economic growth (with the exception of 1999). However, the economy shows a GDP per capita improving at a compounded rate of 3.2% for the last 25 years (World Bank, 2007a), and an improving Human Development Index (HDI) since 1975. The conditions have played a role in placing Colombia at the forefront of the Andean region, although still lagging some of the developing economies of the Southern cone (namely Brazil and Argentina). *See Figure 1.*

***Figure 1. GDP per capita ($ at PPP)***



Several elements contribute to the lower growth rate (weak infrastructure, low enrollment in tertiary education, low innovation levels) but at the end, the largest drag on growth has been the continued prevalence of conflict and violence in Colombia. This situation doubtlessly destroys human, physical, social, and natural capital, making it difficult to create wealth and compromising the quality of life (Arnson, 2004). Nevertheless, the country has managed to maintain a positive economic trend given the strong entrepreneurial spirit of Colombian's which has concentrated in several major urban centers located through the country, contrasting to the 'main city' phenomena of most Latin American countries.

When analyzed over time, Colombia's economic performance clearly reveals the impact that the conflict has had on the economy. *Table 1* presents the average growth rate for the different periods of the conflict (since 1950) and complements it with the main events in the conflict for each period. This table allows building a parallel on how, when the intensity of the conflict increases (as well as drug-trafficking), the country's growth suffers considerably (Cardenas, 2001). It also suggests that the opposite assertion holds (or at least, that appears to be the trend since the instauration of the Uribe's Democratic Security Policy).

***Table 1. GDP growth in Colombia over time***

| | **1950-1980*** | **1981-1990** | **1991-2002** | **2003-2006** |
|---|---|---|---|---|
| Average Annual Growth | **5.0%** | **3.5%** | **2.6%** | **5.1%** |
| Key Events of Conflict | Period of relative calm. Guerrilla's focused on their areas of influence and financed mostly from moneys resulting from the Cold War. | Colombia emerges as the world's largest cocaine producer (70% of worlds harvest)**. Medellín and Cali drug cartels formed and develop amed power. Guerrilla groups start expansion and by 1997 reach 50% of municipalities. | Violence scalated in larger cities and municipalities. Government focused in dismantling the drug cartails. Guerrillas take over the coca business and continue increasing coverage. From 1998-2002 the government creates the DMZ. | President Uribe elected. Democratic Security Policy set in place. Military action against the guerrillas and paramilitaries increased and their presence gets reduced again to rural areas. Main paramilitary groups demovilized. |

* Cardenas, 2001

** United Nations Office on Drugs and Crime, 2003

Source: Economist Intelligence Unit: Country Data, 2007

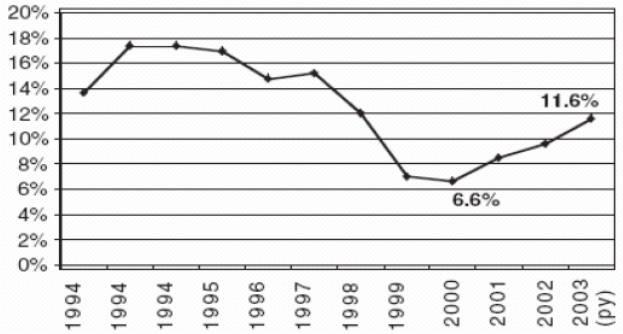
It is important then to understand how the inverse relationship between growth and violence works in Colombia. Recent studies by Cardenas (2001) and Guigale, et. al. (2003) have demonstrated that the prevalence of violence and drug-trafficking has limited the ability of the

country to accumulate human capital, reduced the investment level in the economy, destroyed infrastructure, and as a result of all the above, reduced productivity.

The conflict has impeded the accumulation of human capital in several ways. It has generated a huge migration from the rural areas to the cities (while in 1980 urban population represented 59% of the total, this figure had increased to 73% in 2006, WDI 2007) creating the largest internal community of war refugees in the world (HDI 2005). It has generated a significant migration (predictably of the most educated people) from the country to other places offering greater stability and security. Lowered human capital accumulation also manifests itself by reducing trust among social groups, increasing the level of unemployment (second largest unemployment rate of the region) and informality in the economy, and increasing the costs of social transactions, such as the costs of negotiation, enforcement, etc (Cardenas, 2001).

The conflict has also limited the confidence of investors in the country. Private Investment as % of GDP in Colombia has been lower than the average in Latin America (i.e. Colombia's 6.6% vs. 15.9% for the region in 2000 – See Figure 2), and the reduction was more severe when the conflict gets more intense (Cardenas, 2001).

***Figure 2. Private Investment as % of GDP in Colombia***




*Source: Arnson (2004)*

Foreign Direct Investment – FDI has also followed a similar pattern. Although Colombia opened itself to foreign direct investment since 1990, the inflows were still limited during that

decade since foreign investors and companies were skeptic about the Colombia's internal situation and focused their efforts in chasing internet start-ups in neighbor countries. Moreover, the poor performance of the Colombian economy as a result of the intensified conflict also deterred interest in Colombia from foreign investors. However, as the country's macroeconomic condition stabilized and the conflict's intensity was reduced at the turn of the century, foreign direct investment started to return to the country. In 1999, when the country faced a year of negative GDP growth (-4.4%), Colombia only received $1,508 Millions of FDI. In contrast, as the economy recovered traction in 2005 and 2006 growing over 5% in real terms in both years, the amount of FDI increased to $5452[3] Million and $6295 Million respectively for each year (BanRepública 2007a). The first semester of 2007 reaffirmed the trend (BanRepública 2007b). This increase was also due to a tax break approved by president Uribe's government towards FDI. Important to highlight too is that the flow of new FDI was starting to reach other segments of the economy like manufacture, commerce and tourism, and financial services, away from the traditional focus in oil and mining. It is expected that the approval of the Free Trade Agreement - FTA with the US would also help to maintain or even increase this flow.

The impact of the conflict on infrastructure results from the damage inflicted by the violent actors to the country's physical assets as well as on the increased military spending that could instead be directed towards social development (Colombia spends 3.71% vs. an average of 1.34% of GDP for Latin America in the period 00-05 – WDI, 2005). Moreover, these two elements have contributed to reduce Colombia's gross domestic savings to a low of 18.1% of GDP (World Bank, 2003) which is significantly lower than the regional average of 22.8% of

[3] This amount for 2005 excludes the sale of Bavaria, the largest Colombian brewing company to SAB Miller. If this one-time transaction is considered, the total foreign direct investment for 2005 was $10,255 Million

GDP for the region. This low savings rate has hindered the accumulation of capital and investment available to be plowed back into the economy.

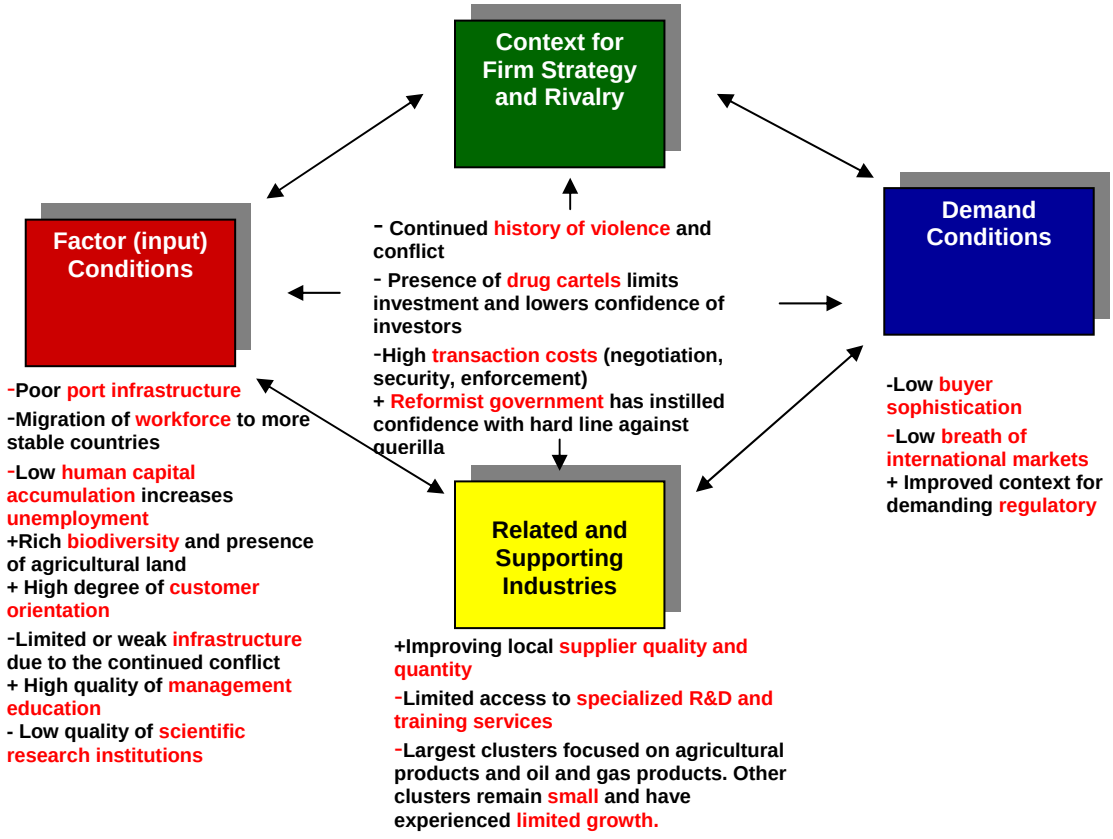
The net result is that Colombia's growth has been significantly held back for over 20 years. Considering that most of the conflict takes place in the rural areas, by taking a look at evolution of the Colombian GDP structure, it can be found that the conflict has also had an impact in the composition of the economy. While in 1990, services (mostly urban areas) represented 49,7% of the GDP and Agriculture (the rural sector) represented 17,2%, these figures had shifted to 56.3% and 13.6% by 2006. Industry and manufacture have also reduced their share from 33.2% and 19.1% respectively in 1990 to 30.2% and 16.1% in 2005.

When the composition of the Agricultural portion of the GDP is considered, one can quickly identify that another consequence of the conflict is that the rural sector has stagnated in producing raw materials. This situation can be seen more clearly by analyzing the country's international trade. In the 1995, agricultural products where the largest export of the country representing 25,1% of the total (mostly coffee and bananas) and the processed agricultural products represented 10.7% of total (mostly flowers and sugar). By 2005 these segments had been displaced as leading exports by oil, coal, and their derivatives which turned to represent 38.5% of the total exports (from 27,2% in 1995) not only for the increase in prices while other commodities plummeted (i.e. coffee) but also because the conflict didn't allow Colombia's agricultural sector to properly invest in infrastructure and modernize its production processes and therefore caused a lag in productivity. As a result, by 2005, agricultural products represented only 11.9% and processed agricultural products 9.7% (Ministry of Foreign Commerce and Tourism, 2007). In contrast, for the same year, imports were dominated by more elaborated products like machinery (34.5%) and chemicals (20.4%).

## II.B. National Competitiveness

Colombia's National Diamond reveals some of the key issues that the country faces to improve its competitiveness. While some factor conditions have helped the country develop its most important clusters (a rich biodiversity has certainly fostered Colombia's initial agricultural orientation), there are several deficiencies that continue to hold back national competitiveness.

***Figure 3. National Diamond for Colombia***




Again, Colombia's competitiveness has suffered from the continued conflict and violence and by the limited allocation of resources to research and development of high-value added sectors. Nevertheless, some variables have helped the country's sustained growth and outpacing of its Andean neighbors throughout the last decade: the high quality of management education, as well as recent improvements in local supplier quality and quantity, have played a critical role in Colombia's performance.

In terms of the country's overall competitiveness rating, the Business Competitiveness Index ranks Colombia 59th of the 129 countries included. This places Colombia well ahead of its Andean neighbors[4], although it still lags other Latin American countries like Chile and Brazil. Looking at the progression from previous' years, Colombia has made very slow progress in terms of both BCI and NBE, while COS has experienced a slight setback (see Table 2). A more detailed look at the microvariables reveals that while in general, Factor Conditions have shown significant improvement since 2001 (13 out of the 19 microvariables improved by at least 5 places from 2001 to 2006, and of those, 6 variables improved by more than 10 places), Demand Conditions have been relatively stagnant (only 1 out of the 5 microvariables showed an improvement of 5 places or more for the same period).

***Table 2. Global Competitiveness Report Rankings for Colombia***

| | 2006 | 2005 | 2004 | 2003 |
|---|---|---|---|---|
| **Business Competitive Index Ranking (BCI)** | **50** | **52** | **53** | **52** |
| **National Business Environment (NBE)** | **50** | **51** | **54** | **52** |
| **Company Operations and Strategy (COS)** | **51** | **45** | **50** | **49** |

*Source: Business Competitiveness Index (2006)*

The improvement shown by Factor Conditions variables has certainly contributed to the sustained growth that Colombia has experienced in the last decade. In particular, progress has been most visible in terms of "Judicial Independence", "Efficiency of the Legal Framework", and in the "Reliability of Police Services". These three variables compose some of Colombia's greater strengths relative to its overall position, as they ranked 43, 42 and 41 respectively. Colombia's most important relative strength lies in the quality of its management education (ranked an impressive 32nd). Significant progress was also made in the "Availability of Scientists

[4] *The closest Andean country in terms of competitiveness is Venezuela, which was ranked 71.*

and Engineers", although the overall ranking for this particular variable is 60, still below the aggregate country ranking of 59.

These improvements are reflected in Colombia's business environment, as evidenced in The World Bank's Doing Business survey, where Colombia was ranked 79 among 175 countries, ahead of countries like China, Costa Rica and Italy. The results of the survey place Colombia considerably above the South American region's average rankings in terms of ease of starting a business (which takes an average of 44 days and costs 19% of GNI per capita, against regional averages of 73 days and 48% of GNI) as well as in terms of registering property (which takes an average of 23 days and costs 3.5% of property value in Colombia as compared to a regional average of 77 days and 6% of cost). However, progress still remains to be seen in the areas of Paying Taxes (Total Tax Rate in Colombia came in at 82.9% of profits as compared to a regional average of 49%) as well as in Enforcement of Contracts (which take an average of 1,346 days in Colombia against a regional average of 642 days). Moreover, it is worrisome that Colombia lags the region in terms of ease of trading across borders (it takes on average 34 days to export at a cost of US$1,745 per container in Colombia as compared to 22 days and US$1,069 in the rest of the region). Given the nature of the armed conflict in Colombia, it's not surprising that trading costs and enforcement of contracts have suffered as a consequence. This, however, should improve with the approval of the FTA with the United States and other trade agreements.

But if Factor Conditions are a relative competitive advantage for Colombia[5], the question remains, why then is overall competitiveness lagging? The question becomes even more perplexing when we observe that the general Context for Firm Strategy and Rivalry has not only shown significant improvement in the past five years (5 of the 10 microvariables showed an improvement of more than 5 spots from 2001 to 2006), but is also a relative competitive

[5] Average factor conditions ranking is 49 compared to Colombia's overall competitiveness ranking of 59

advantage for Colombia (Average microvariable ranking is 48 compared to an overall 59 rank for the country). Worth noting in particular are the improvements the country has made in terms of “Favoritism in Decisions of Government Officials”, “Intellectual Property Protection”, “Intensity of Local Competition” and “Cooperation in Labor Employer Relations”, which ranked 48, 45,46 and 30 respectively while showing an overall improvement of more than 5 ranks for the period studied. This data seems to show that the efforts undertaken by President Uribe have significantly improved the environment in which companies operate and the prevalence of the rule of law despite the continued turmoil.

Although Factor Conditions and Context for Firm Strategy and Rivalry have shown progress, it is the Demand Conditions and Related and Supporting Industries that seem to be holding competitiveness down. For the most part, Demand Conditions have been stagnant during the past five years, with the exception of “Government Procurement of Advanced Technology Products” which improved by 10 spots. Meanwhile, “Buyer Sophistication” remains a competitive disadvantage for Colombia with a rank of 65 and shows no sign of recent improvement. For Related and Supporting Industries, most of the microvariales have shown some sign of improvement, in particular “Local Supplier Quantity” and “Reliance on Professional Management”, which remain a competitive advantage for Colombia at a rank of 42 and 37 respectively. However, “Company Spending on R&D” continues to lag with a rank of 60. With low R&D spending, Colombia continues to rely on a model of exporting agricultural raw materials without much value-added, and a general inclination to import machinery and technology. As mentioned in the country analysis, we link several of these conditions to the prevalence of internal conflict and violence, given the impact they have in the accumulation of human capital which, in turn, holds back the demand conditions.

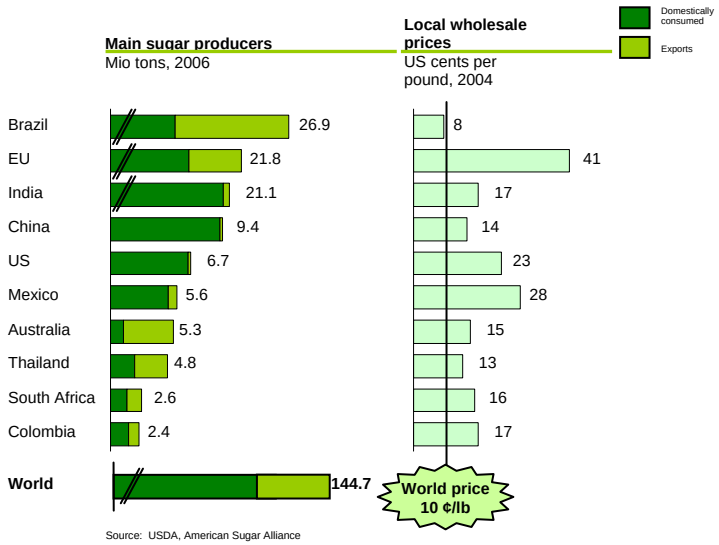
## III. Sugar World Market

Because sugar cane needs to be processed immediately after harvesting (otherwise it dries and becomes useless) there is no international market for sugar cane. Instead, the market is driven by sugar cane in its processed form, mainly sugar. Brazil's experience with ethanol as a bio-fuel also shows that increased ethanol consumption is an important driver in the production of sugar cane.

### *The Sugar World Market*

Currently, over one hundred countries produce sugar. Because sugar is considered a basic need, many countries choose to have a local sugar industry irrespective of natural local conditions for sugar production. As a result, most countries have highly protected local industries, local wholesale prices generally exceed world prices and most of production (~70% worldwide) is consumed internally. Figure 4 shows the main sugar producers, the share of local production consumed domestically and the different local wholesale prices. It is worthy to note that among the main sugar producers only Brazil has local wholesale prices lower than world market prices, indicating the existence of a dump market in the world trade of sugar.

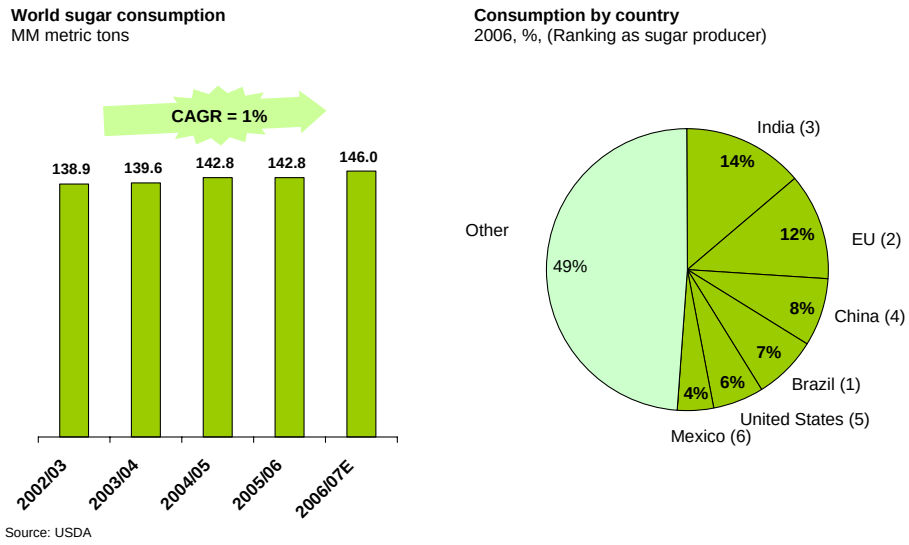
***Figure 4. Main sugar producers and local wholesale prices***



The world's largest sugar producers are Brazil, the European Union (EU), India, China, the United States and Mexico.

Worldwide sugar demand is stable and has grown at an average rate of only 1% annually in the last 5 years. It is driven by direct consumption and processed foods and beverages. However, growth in sugar demand has been slower than growth in processed foods and beverages mainly because of the increased use of sweeteners.

***Figure 5. Worldwide sugar demand***




As depicted in Figure 5, the same six regions that account for the bulk of sugar production are the largest consumers and account for 49% of world demand. This is not the result of particular advantages or efficiencies in sugar production, but rather of highly protected markets. Although many other countries protect local sugar industries, in this section we will briefly discuss these market distortions for the five main sugar players.

***United States of America***

The US supports its sugar industry by two main mechanisms: the price support loan program and the tariff-rate quota (TRQ) import system. The price support loan program guarantees minimum prices to sugar processors and producers by providing loans to processors

(18 cents per pound for domestically grown sugar cane processors and 22.9 cents per pound for domestically grown sugar beet processors) and accepting repayment in kind or in cash at the processors discretion. The TRQ system establishes a two-tiered tariff based on the volume of imports by country; imports from a specific country within its quota are taxed at a determined rate, whereas imports exceeding the quota are taxed at a higher level.

***European Union***

The highly protected European market shows a wide range of market distortions, namely minimum price requirements, production quotas, import quotas and direct subsidies, such as 'refining aid' for processors and 'production refunds' for sugar used in the pharmaceutical and chemical industries. The EU import quotas, as the US's TRQs, are broken down by country, with preferential treatment given to ACP countries[6].

***India***

Although the Indian government does not provide direct economic incentives to either producers or processors, it protects the market by allocating production quotas and setting minimum prices for processors and their customers.

***China***

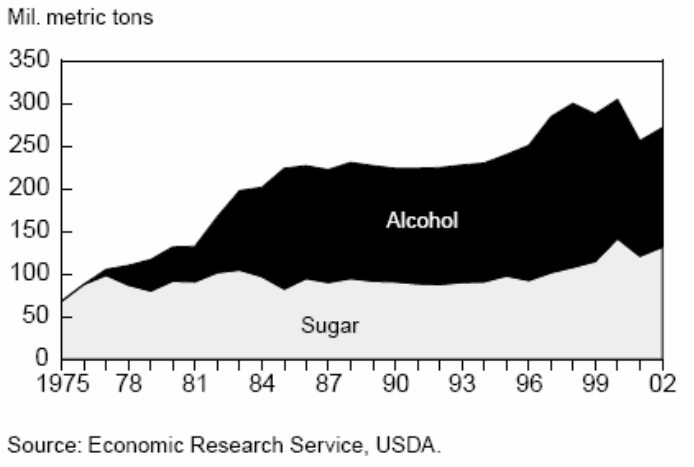
The Chinese government protects the local sugar industry through its control of domestic sales and imports, allowing it to determine prices. In terms of imports, it has set a 1.95 million MT quota for imports. Out of those, 70% are reserved for state owned companies.

***Brazil***

Unlike most other countries, Brazil's main output from sugar cane is not sugar, but rather fuel alcohol or ethanol, as depicted in Figure 6.

[6] Barbados, Belize, Congo, Côte d'Ivoire, Fiji, Guyana, Jamaica, Kenya, Madagascar, Malawi, Mauritius, Mozambique, St. Kitts and Nevis, Swaziland, Tanzania, Trinidad and Tobago, Zambia and Zimbabwe

***Figure 6. Sugar cane production for sugar and alcohol***




The origins of this can be traced back to the oil crises in the 1970s and the Brazilian government's launch of the Proalcool program in 1975. The program was launched to reduce Brazil's dependency on imported oil by restoring to alternative sources of fuel. Initially, ethanol was deemed to replace oil and cars were transformed to be powered 100% by ethanol. The program created of a huge demand for sugar cane, reducing the problems created by frequent excess sugar production and large fluctuations in its price. To launch and maintain the program the government invested heavily in direct subsidies to ethanol producers and gave control of the market to two institutions: the Institute of Sugar and Alcohol (IAA), with the mandate to control sugar and ethanol production and exports through production quota and fixed purchasing price of ethanol, and Petrobas, the state oil company, that controlled domestic ethanol sales and distribution. Sugar cane prices to independent growers were also set by the government and ethanol production quickly expanded to over 16 billion litres per year.

Nowadays, the program has evolved towards ethanol blended in gasoline and the market is being liberalized. Between 1997 and 1999 the government liberalized all ethanol prices, abolished Petrobras' monopoly over distribution, reduced subsidies to ethanol blend fuel producers and lifted restrictions on ethanol production. The government still influences ethanol

demand by requiring regular gasoline to be blended with ethanol and shifting the actual percentage of the blend ratio (19 to 26% ethanol, with 26% being the legal maximum).

In terms of sugar production, higher cost producers in the Northeast in Brazil, albeit producing less than their counterparts in South and Central Brazil, receive a small subsidy from the government due to the economic importance of sugar to the region. Additionally, the government allocates its entire export quota to the US (and therefore the higher US prices) to this region. Still, thanks to beneficial local conditions and several efforts to improve efficiency, Brazil is among the lowest cost producers in the world.

Table 3 summarizes the history of the Brazilian ethanol and sugar programs.

***Table 3. The Brazilian Ethanol and Sugar Programmes***

| Period | Ethanol | Sugar |
|---|---|---|
| 1975-1997 | Creation of the Brazilian National Alcohol Program (PROALCOOL)<br>IAA: responsible for sugar and ethanol production and exports through production quotas and fixed purchasing price of ethanol<br>Monopoly on domestic ethanol sales and distribution given to Petrobras<br>Subsidies to ethanol blend gasoline producers<br>Tax incentives to ethanol blend gasoline car owners | Credit and subsidies for distillers' production facilities investments<br>Set sugarcane price to independent growers |
| 1997-99 | Abolition of Petrobras' monopoly on distribution<br>Liberalization of ethanol prices<br>Reduction in subsidies to ethanol producers | Removal of government set sugarcane producer price |
| 1999-Present | Blend ratio of anhydrous ethanol-gasoline set between 19 and 26 percent | Direct subsidies and allocation of US export quota to higher cost producers in Northeast Brazil |

*Source: "The Brazilian Ethanol Programme: Impacts on World Ethanol and Sugar Markets"*

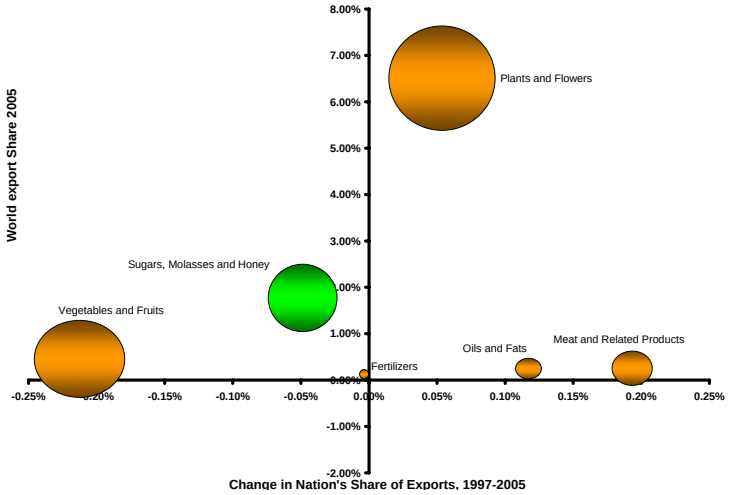
## IV. Cluster Analysis

### IV.A. Sugar Cane Cluster in the Context of Colombia's Economy

Colombia has 1.7% of the world sugar production. The Colombian sugar cane cluster, which represents 1.4% of the Colombian GDP and 10% of Vallle del Cauca's GDP, provides

direct employment to 36,000 workers and indirect employment to 216,000 workers (Asocaña, 2000) . Sugar cane fields occupy 200,000ha of land, of which 25% is owned by the sugar mills.

***Figure 7. Colombian Agricultural Product Exports as a share of World Exports***




*Source:* International Cluster Competitiveness Project

The cluster supplies all internal consumption, with an increasing amount geared towards exports. The industry has the capacity to produce 70,000 tons per day and generates 2.4 million tons per year (ECLAC, 2002). From this production, 43% goes to exports and the remaining 57% goes for internal use. According to Asocaña, from all the internal consumption, 59% is for human consumption, 6% for alcohol, 22% for beverages and 13% for food processing.

**History of the cluster**

The evolution of the Colombian sugar cluster can be divided into four stages: (i) initiation, (ii) expansion, (iii) consolidation, and (iv) internationalization. During the initiation stage, sugarcane was brought to the Cauca Valley in 1541 (Cenicaña, 2007). The production of sugar, sugar bread and other by-products was artisanal until the early twentieth century, when the first steam mill was imported in 1901 (ECLAC, 2002). The opening of the Panama Canal in 1914 led to important infrastructure developments that made the incipient sugar industry take off.

Between 1920 and 1930, twelve sugar mills started operations (Cenicaña, 2007), as well as the first research and experimentation center for sugarcane and other crops (ECLAC, 2002).

During the expansion stage, existent sugarcane varieties were improved with varieties brought from the Java islands, Barbados and Cuba. Several public policies helped expand the cluster: (i) the import substitution policy (which set the tariff for sugar at 20% and increased the number of mills to twenty-two), (ii) the creation of the Autonomous Regional Corporation of the Cauca Valley in 1954 to foster development of the region, (iii) the creation of several public banks to provide access to financial resources, and (iv) the creation of the Superior School of Tropical Agriculture and the Del Valle University to provide skilled labor (ECLAC, 2002).

The consolidation stage is characterized by a reduction of sugar mills from twenty-two in 1960 to thirteen in1980. Three public policies were important for the consolidation of the cluster: (i) the adjustment from an import substitution model towards one with export promotion (during this period the US established sugar quotas), (ii) the land policy, which induced proprietors of unproductive land to cultivate sugar cane for fear of having it expropriated, and (iii) the creation of the first private financial institution (Corporación Financiera del Valle), which helped promote the development of the region (Cenicaña, 2007) and fostered technological improvement.

During the internationalization stage, exports, which initially concentrated towards the Andean market, were expanded to Russia, Haiti, USA, South Korea, and other markets. Because of global market price distortions, price adjustment mechanisms were designed in the Andean Community framework. Among the important public policies at this stage are (i) capacitating programs for workers, (ii) environmental protection programs, (iii) the Competitiveness Agreement of the Sugar Cane – Sugar – Candy – Chocolate chain with the purpose of implementing joint projects favorable to the sector, and (iv) abolition of internal price controls

(in place since the 70s), and creation of a Price Stabilization Fund to set the reference price band system for the market (ECLAC, 2002).

## IV.B. Structure of the Cluster and Diamond Analysis

### Players

The Colombian Sugar Cane cluster is composed of 13 mills, more than 1,500 agricultural farmers, forty food and beverage companies, eleven alcohol and liquor producers, two energy plants, one paper producer, one sucrochemical industry, fifty suppliers, three soda companies, three associations of cane growers, one research center, one association of sugar technicians, two distributors and hundreds of small and medium companies that provide services to the cluster (Agrocadenas, 2005). Industry players are grouped into four groups within the value chain:

### Value Chain

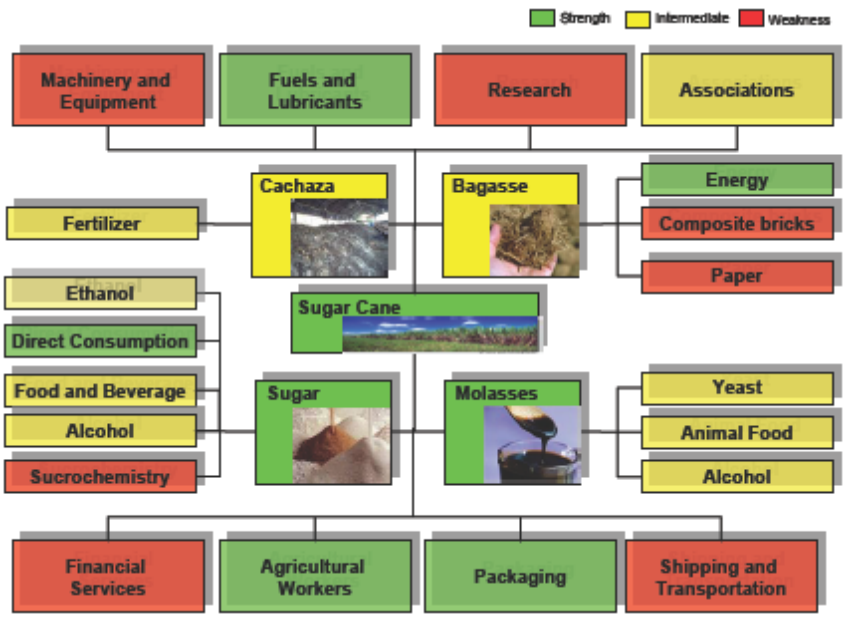
*Field.*- This stage groups the suppliers of agricultural products such as seeds and fertilizers, fuel and energy providers , research centers, and agricultural technicians. It also includes the farmers, machinery, equipment and professional services needed to provide the inputs needed in the field.

*Harvesting.*- This stage groups the labor and machinery necessary for harvesting activities such as cutting, gathering and transporting sugar cane.

*Fabrication.*- This includes the production of sugar and generation of byproducts such as cachaza, bagasse and molasses. Industries such as food, beverage and sucroquemistry are an important part of this stage.

*Distribution.*- This stage includes national and international distribution channels as well as wholesalers and retailers.

***Figure 8. Structure of the Cluster***



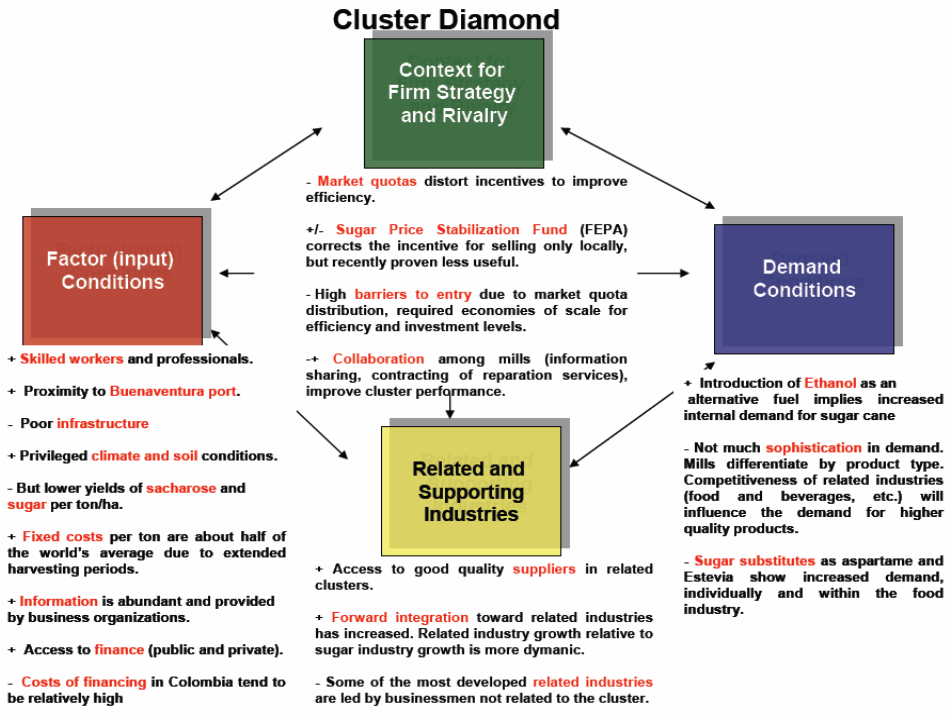

**Process**

The process begins by crushing the sugar cane stems to extract their juice. The crushed stems, called bagasse, serve as industrial fuel for the mills and as an input to produce paper, composite bricks, and furniture. The extracted juice is heated and mixed with lime to separate it from the cachaza, which is used as fertilizer. The filtered juice then goes through an additional process to separate the molasses from the crystallized sugar. Molasses are used in the production of alcohol, yeast and animal food. The sugar crystals are refined to produce the end product that is used for direct consumption and as input for sucrochemistry, food, beverages and ethanol.

The core business of the cluster has been migrating from sugar to sugar sub-products Every sub-product in the cluster (sugar, bagasse, molasses and cachaza) occupies the same economic relevance and helps diversify the economic structure of the cluster. Nevertheless, the development of each supporting industry is not evenly distributed. For example, direct consumption, and more recently ethanol, has been the main driver of sugar demand in the country, whereas industries such as the sucrochemical have not experienced the same degree of

sophistication, due to a lack of resources and low investment inflows into the sector. We believe this trend is likely to continue.

***Figure 9. Cluster Diamond***




## *IV.B.1. Factor Conditions*

Valle del Cauca's geography gives the cluster a unique comparative advantage. In most countries sugar cane is a product that can be harvested on average four to six months. However, the combination of humidity, sunlight, temperature and altitude in Valle del Cauca provides the optimum conditions for full year harvests. This means double the sugar cane yield per unit of land and lower fixed costs per unit of output. Fixed costs are estimated to be half, and sometimes even a third, of those found in the market. Nevertheless, the sacharose yield extracted form the sugar cane in Colombia is still below the world average.

The proximity to the port of Buenaventura also contributes to the competitiveness of the sector by lowering the transportation costs for exporting; however, poor infrastructure especially

in roads still has a negative impact. The supply of skilled workers and professionals in the region is also a positive factor. The wage of workers in the industry is double the minimum wage (ECLAC, 2002). Contracts for workers have good working conditions and are capable to attract a skilled labor force. Access to finance has not been able to be a positive engine for growth. Since 1961 the government, together with the Inter American Development Bank and regional private players, has promoted the creation of institutions such as the Financial Corporation of the Valley to attract funds into the sector; however, the high financing costs have not allowed these efforts to generate the expected results. As mentioned, FDI has limited due to the conflict's prevalence.

**Key Challenges**

- **Poor Infrastructure impacts the efficiency of the cluster**
- **Local and foreign financing is limited and still expensive**
- **Sacharose yield of sugar cane is low compared to the world average**

*IV.B.2. Context for Firm Strategy and Rivalry*

The Colombian sugar cane industry represents a market with high barriers to entry. Some of these barriers are: (i) the great influence that sugar mills have in defining industrial policy resulting from the market power that mills have over prices and suppliers. (ii) The economies of scale created by high fixed costs. (iii) The established quotas to distribute the market proportional to the production capacity of each mill. (iv) The oversupply of sugar in the internal and international markets.

The distortions generated by subsidies and protections in industrialized nations create a mismatch between international and local prices. For this reason, the Andean Community of Nations (CAN) established a 20% tariff above the international sugar price since 1931. The Colombian government has also created a Price Stabilization Fund with the purpose of reducing

sugar price volatility so producers, distributors and exporters are indifferent to sell in the national or the international market (Ministerio de Agricultura, 2005a). The fund works by redistributing resources between market players so that their revenues reflect a market with a unique price.

The cluster is characterized by a high degree of cooperation between participants. Formal and informal relationships exist so that sugar mills can unite forces to deal with suppliers, train their employees, use the same distribution channels, and share information. There is also a high degree of forward and backward cooperation between sugar mills, consumers and suppliers. Cooperation is generally seen through established contracts, for example in labor outsourcing, equipment repairs or consulting services.

Regarding information sharing, the cluster has developed a good infrastructure. There are several associations such as Asocana and Cenicana that intend to leverage and coordinate information within the cluster. Cenicana was created in 1977 as a research center aimed at improving the productivity of the sector. Asocana was established in 1959 to serve as a negotiating forum for all interest groups in the cluster. There are other associations such as Tecnicana and Procana whose goal is also to enhance efficiency. Ciamsa was established in 1961 with the goal of serving as the international commercial agent for the sugar industry. This entity is responsible for combining the exports' production of each mill and then selling the aggregate it in the international market.

**Key Challenges**

- Sugar mill have too much influence in public policy
- Industry is too regulated: quotas
- Horizontal and Vertical cooperation needs to be fostered

*IV.B.3. Related and Supporting Industries*

Sugar cane and sugar producers are supplied by similar products and services in a market of approximately five hundred million dollars per year (Ministerio de Agricultura, 2005a). This has led to the development of an important, well functioning local network of product and service providers that concentrate on three basic activities. (i) products and services such as tires, spare parts and lubricants required to maintain the vehicle fleets of mills and producers, (ii) products and services for the maintenance of the machinery used in sugar production and (iii) packaging and shipping supplies.

The low increase of sugar consumption during the 90s (2.21%), together with the significant growth in sugar production (47.9%) (ECLAC, 2002), led the economic groups that own the mills to increase exports and to integrate the production of sugar with that of food products. This has increased forward integration of the sugar industry. Such is the case of Ardilla Lulle Group, which owns Incauca mill and also produces powder refreshments, juices and inputs for the food industry (Ministerio de Agricultura, 2005a). Although there are several of these cases, in general there are still weak links between the mills and related industries such as food and beverage, alcohol, and sucrochemistry.

The chocolate confectionery industry is a supporting industry that lately has had an important impact in the cluster as a result of its remarkable increase in exports and competitiveness. Sugar represents around 25% of the inputs for chocolate products, and up to 80% for candy products (Ministerio de Agricultura, 2005b). Candy exports averaged $114.8 millions dollars in 2001-2003, which represents 50% of its production (Echeverri and Hernandez, 2005). Currently, this industry consumes 26% of the sugar produced in Colombia (Ministerio de Agricultura, 2005a) and has been increasing steadily. Nevertheless, the most important companies of this industry are located in Medellin and Bogota, far from the Cauca

Valley. The poor road infrastructure between these cities and Valle del Cauca increase the logistical costs and affect the efficiency of the cluster.

Finally, ethanol is a new related industry that has recently emerged. Information about this new industry is presented in the demand conditions' section below.

**Key challenges:**

- Forward integration of the sugar industry with food and beverage, alcohol, and sucrochemical industries remains low.
- Infrastructure quality (primarily roads) is low and related industries are physically far from the Cauca Valley region.

*IV.B.4. Demand Conditions*

There are two important factors that can affect sugar demand in the long run: (i) ethanol and (ii) substitute products. The Colombian Law 693 of 2001 dictated that by September 2005 ethanol should represent 10% of the fuel sold in major cities. The Government has expressed interest to raise this level to 25% by 2010. This changes will certainly have an impact in the consumption of ethanol and therefore in sugar consumption. Colombia has forecasted an increase from its current level of ethanol production of 900,000 liters per day to 3.8 million liters per day by 2020 (Proexport, 2004). Six of the most important sugar mills have already announced investments of 70 million dollars (Proexport, 2004) to build ethanol processing facilities.

Substitute products of sugar could also produce an important shift of demand in the long run. The demand of natural (corn syrup, honey and estevia), and artificial sweeteners (aspartame, and saccharine) has shown a positive trend in markets such as direct consumption and food production. The increasing demand in substitute products can be attributed to benefits such as less caloric content, more nutritional properties and cheaper prices. The particular case of "corn

syrup" could have an important impact in demand for sugar. This product has been heavily subsidized and exported by the US; however, the Colombia–US FTA aims to reduce tariffs of this product, which could potential affect the sugar market in Colombia (Proexport, 2004).

Demand sophistication in Colombia is low. While most developed nations have fifteen types of sugar quality, Colombia produces only four types: raw, white, white special and refined. This is a result of the quality specifications demanded by sugar-based industries such as food and beverages. As competition in these markets intensifies, the specifications will increase and therefore the demand for sugar will be affected.

**Key challenges:**

- Increasing demand for sugar substitutes is affecting the internal demand for sugar. Sustainability of the cluster is in question.
- Protected export markets prevent the industry on focusing on export growth.
- Unsophisticated demand deters innovation and differentiation between mills.

## V. Cluster Recommendations

### *V.A. Factor conditions*

The government should:

- Continue the implementation of policies favoring the utilization of alternative fuels. By increasing the requirement of ethanol in gasoline the government can increase sugar demand substantially and permanently. This will attract new competitors and increase competition. In addition, mills will specialize ethanol enabling them to export it in the future.
- Work on improving infrastructure (in particular road conditions) to facilitate the links between the mills and related industries. The infrastructure around Valle del Cauca is poor

and needs improvement. Special emphasize should be made to roads that connect the valley with major cities. The Buenaventura port should also be upgraded.

- Increase FDI attractiveness for sugar and related industries. Together with infrastructure improvements, limiting conflict's impact in the business environment would encourage FDI.
- Use technology to improve the sacharose yield of sugar cane. R&D should be destined to research on high sacharose yielding sugar cane.

*V.B. Context for firm strategy and rivalry*

The government should:

- Remove the excessive regulation (price stabilization mechanisms and quotas) to eliminate internal price distortions and favor more transparent competition. With the recent sugar world price reductions, the FEPA has proved to be ineffective. Although the elimination of the FEPA and quotas might cause further consolidation of the cluster (i.e. reduction in the number of mills), it will enhance competition, investment, efficiency and quality.
- Reinforce the efforts in controlling political unrest to enable an efficient utilization of the country's labor and resources. Economic and political stability, as well as security, have an important impact in investment and technology improvement decisions. It also destroys human capital. As a result, effective efforts in reducing the conflict will improve the country's business environment and the efficient allocation of resources.
- Reduce the influence of sugar mills in public policy in order to make the market work effectively. Economic and not political rules should govern the market.
- Promote horizontal and vertical cooperation to enhance cluster efficiency. The increased competition from deregulation of the market should be complemented with higher degree of cooperation to maintain a healthy cluster's balance between competition and cooperation.

*V.C. Related and Supporting industries*

The government should:

- Partner with universities to encourage entrepreneurship in higher value-added industries derived from sugar. For example, in high potential industries such as ethanol, chocolate and confectionery industries. Foster initiatives that increase R&D (i.e. through contestable funds).
- Provide investment incentives such as tax brakes and access to lower cost financing for new players willing to invest in related industries where currently there is only one player. This will help provide the incentives to thicken the cluster and generate competition. Particular interest should be given to high value-added activities that identify new and profitable uses for sugar, such as sucrochemistry. The same should be done in the case of related clusters that are still weak such as bagasse (used in composite bricks and paper production).
- Infrastructure quality (primarily roads) should be improved to minimize the negative effect of distance between sugar and related industries.

The firms should:

- Invest in infrastructure to take advantage of demand for Ethanol derived from new legislation. Infrastructure should be improved to competitively produce and transport ethanol within Colombia and to neighboring countries such as Brazil.
- Take advantage of available management talent and skilled labor to tap into higher-value added sectors. Upgraded management can help to sophisticate and improve overall quality of industries such as chocolates, confectionery, and beverage, making them more competitive at the international level and therefore favoring the sophistication of local demand for sugar.
- Foster the participation of players from related industries in Cenicaña (or a new institution for collaboration) to ensure a more efficient understanding of the market conditions for derivative products. Communication, coordination and cooperation are essential for

understanding the market conditions and trends. Companies could mutually benefit by identifying and strengthening their collaboration on these areas.

- Increase forward integration of the sugar industry with food and beverage, alcohol, and sucrochemical industries to adequately respond to the challenges in sugar demand. Given the characteristics of local and export markets, a reasonable strategy should be to increase connection with related industries and develop them further.

*V.D. Demand conditions*

The firms should:

- Partner with new incumbents in ethanol and other related products to increase the potential for the sugar cluster. Stronger connections with these industries and the development of still weak related industries would increase profitable opportunities. At the same time, further development and greater competition among new related industries would sophisticate demand and hence drive innovation and differentiation in the sugar cluster.
- Collectively invest in R&D to develop new cane varieties and improve the sacharose yield. This is especially important to increase forward integration and be able to compete with sugar substitutes in the food industry, as well as to be more efficient in the ethanol industry.

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