CHAPTER 7

ANALYSIS OF DATA
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7.1 Comparison of the performance of co-operative and private sugar factories in Belgaum district during the pre-implementation period and post-implementation period of WTO

7.2 PESTLE analysis of Indian, Brazilian, Australian, European Union and Thailand sugar industry.

7.3 SWOT analysis of the sugar industry of India, Brazil, Australia, EU and Thailand.

7.4 Assessing the competitiveness of the Indian sugar industry by applying Porter's Diamond model

7.5 Testing of Hypotheses
CHAPTER 7

ANALYSIS OF DATA

Analysis of Data

The data collected from the primary and secondary sources has been classified, tabulated and analysed. Since the research study involved the complete enumeration method, also called as census survey method, which involved survey of all the sugar mills in Belgaum district, the aggregate values of the responses have been calculated to analyse the data and arrive at meaningful conclusions.

The data analysis involves two parts viz.:

i. Quantitative data analysis and

ii. Qualitative data analysis

The quantitative assessment involves:

i. Comparing the performance of the co-operative and private sugar factories of Belgaum district, during the pre-implementation period and post-implementation period, in order to assess their competitiveness.
ii. Comparative analysis of the Indian, Brazilian, EU-25, Thailand, and Australian sugar industry on factors of competitiveness which is presented in Table 6.8 of Chapter 6.

The outcome of the quantitative data analysis has been presented in the form of tables.

Further, qualitative data analysis is also carried out to assess the competitiveness of the Indian sugar industry. The qualitative data analysis involved:

1. Conducting the PESTLE analysis of Indian, Brazilian, Australian, European Union and Thailand sugar industry.
2. Conducting the SWOT analysis of the sugar industry of India, Brazil, Australia, EU and Thailand
3. Developing strategies for the Indian sugar industry (which are also applicable to the Belgaum district sugar industry) based on the comparative SWOT analysis of India, Brazil, Australia, EU and Thailand, incorporating the impact of WTO regulations

The analyzed data has been interpreted with reference to the key issues, objectives, hypothesis and any other concerned relevant developments in regard to impact of WTO on the Indian agricultural sector and more specifically to the sugar industry.

Appropriate conclusions have been drawn from the interpretations of the analysed data. All the relevant information with respect to the research problem has been presented in a lucid manner for easier understanding.
QUANTITATIVE ANALYSIS

7.1 Comparison of the performance of co-operative and private sugar factories in Belgaum district during the pre-implementation period and post-implementation period of WTO

The data presented in the table 7.1 below has been obtained from the analysis of the primary data, collected through the survey of all sugar mills in Belgaum district, by administering the questionnaire.

Table 7.1: Comparison of the performance of co-operative and private sugar factories in Belgaum district during the pre-implementation period and post-implementation period of WTO

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Co-operative sugar mills</td>
<td>Private sugar mills</td>
</tr>
<tr>
<td>Capacity (TCD)</td>
<td>Average</td>
<td>2683</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>16100</td>
</tr>
<tr>
<td>Sugar production (Quintals)</td>
<td>Average</td>
<td>562056</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3372338</td>
</tr>
<tr>
<td>Average cane crushed (Metric tonnes)</td>
<td>488411</td>
<td>1259222</td>
</tr>
<tr>
<td>Average recovery rate (%)</td>
<td>11.02</td>
<td>11.32</td>
</tr>
<tr>
<td>Average number of crushing days in a year</td>
<td>184.11</td>
<td>222</td>
</tr>
<tr>
<td>Average cost of production of processed sugar (Rs./quintal)</td>
<td>1181.91</td>
<td>1170.26</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Average price per quintal of sugar (Rs.)</td>
<td>1196.53</td>
<td>1220.46</td>
</tr>
<tr>
<td>Command area (in acres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average (per sugar mill)</td>
<td>29659</td>
<td>56260</td>
</tr>
<tr>
<td>Total</td>
<td>177955</td>
<td>56260</td>
</tr>
<tr>
<td>Ethanol production (klpd)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spirit production (klpd)</td>
<td>48</td>
<td>60</td>
</tr>
<tr>
<td>Power co-generation (mw)</td>
<td>0</td>
<td>26.4</td>
</tr>
<tr>
<td>Bio-fertilizer (Tonnes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>13333</td>
<td>42058</td>
</tr>
<tr>
<td>Total</td>
<td>79999</td>
<td>42058</td>
</tr>
<tr>
<td>Sugar produced by refining imported raw sugar (Quintals)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Quantity of raw sugar imported for refining (Tonnes)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* There existed only one sugar factory in the private sector during the pre-implementation period.

The comparative analysis of the Indian, Brazilian, EU-25, Thailand, and Australian sugar industry on factors of competitiveness is as presented in Table 6.8 of Chapter 6.
QUALITATIVE ANALYSIS

7.2 PESTLE analysis of Indian, Brazilian, Australian, European Union and Thailand sugar industry

PESTLE analysis helps us to analyse the global sugar industry through its constituent environmental variables viz.:

P: Political factors influencing the environment
E: Economic factors
S: Sociological influences
T: Technological influences
L: Legal factors
E: Environmental and ethical issues

A need to carry out the PESTLE analysis was felt in order to understand the impact of the political, economic, sociological, technological, legal, environmental and ethical factors on the functioning and development of the sugar industry in India, Brazil, Australia, European Union and Thailand sugar industry. This comparative analysis would also help us to know the interaction of the sugar industry with the constituent variables of PESTLE and its effect upon the same in these countries. It would also give us an insight as to whether the constituent variables of PESTLE concerning the Indian sugar industry are aiding the Indian sugar industry to be competitive or not, especially in the context of the changing dynamics of the global sugar trade brought about by the WTO regulations.
The global sugar industry is undergoing changes due to certain factors like:

i. Changing dietary habits and health consciousness in western countries.

ii. Emergence of destination refineries across the world especially in sugar importing countries.

iii. Asian, Central American and African countries are driving world sugar consumption.

iv. Sugar industry is playing an important role in the generation of energy- ethanol for automobiles and cogeneration of electricity for industries.

v. WTO ruling on EU sugar subsidies has created vast opportunities for other efficient sugar producing nations to tap the global market as EU has to reduce its subsidised sugar exports by 4.5 million MT by 2010.

vi. Globally the industry is moving towards mechanisation on the farm side operation, which impacts the livelihood of farm labourers.

vii. Adherence to stricter global environmental standards as the sugar industry is regarded as a major polluting industry.

viii. Value addition through by-products is the driving force for growth of the sugar industry.

ix. Investments in sugar industry are taking place at a global level through acquisitions, tie-ups and greenfield expansions by multi-national companies especially by European MNC’s in Brazil.

The above discussion illustrates the need for a better understanding of the evolving global sugar industry through PESTLE analysis.
Table 7.2: PESTLE analysis of Indian, Brazilian, Australian, European Union and Thailand sugar industry

<table>
<thead>
<tr>
<th>Political factors</th>
<th>India</th>
<th>Brazil</th>
<th>Australia</th>
<th>European Union</th>
<th>Thailand</th>
</tr>
</thead>
</table>
| 1. High political involvement especially in the co-operative sector.              | 1. Government’s policy of focus on alcohol and ethanol indirectly affects the sugar production.  
Government influences ethanol pricing and sales by regulating the ethanol content in gasoline.  
2. Government no longer directly influences the production and exports of sugar.  
2. Liberalised regime with no policy intervention.  
2. The enlargement of EU to 27 members has led to further subsidizing high cost manufacturers of sugar, from eastern Europe.  
3. Policy changes being brought about                                               | 1. Government supported sugar prices for domestic market is high.  
2. Policy measures initiated to facilitate more payment to cane growers by raising domestic sugar prices. |
<table>
<thead>
<tr>
<th><strong>Economic factors</strong></th>
<th>cane</th>
<th>due to adverse WTO rulings on sugar subsidies.</th>
<th>High average due to adverse WTO rulings on sugar subsidies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Huge domestic market</td>
<td>1. Blessed with abundant natural resources.</td>
<td>1. Major dependence on exports, 72% of production is exported.</td>
<td>1. Domestic consumers pay about three times the world price to support subsidies and subsidised-exports.</td>
</tr>
<tr>
<td>2. Negligible exports, hence no risk of fluctuating global sugar prices.</td>
<td>2. European MNC’s acquiring stake in local sugar mills through joint venture or acquisition.</td>
<td>2. Affected by fluctuating and mostly depressed world prices.</td>
<td>2. Cost of sugar production from beet is about two times that of production from cane.</td>
</tr>
<tr>
<td>3. Low average crushing capacity of 3500 TCD.</td>
<td>3. Sugar production can be conveniently moderated by diverting cane to ethanol production. Hence, sugar industry not affected by global decline in</td>
<td>3. Affected by interventions in importing countries markets.</td>
<td>3. Production, exports and imports are regulated through domestic laws and agreements with</td>
</tr>
<tr>
<td>4. Second largest agro based industry after textiles.</td>
<td></td>
<td>4. Contractual obligation between miller and farmer on production of cane</td>
<td></td>
</tr>
<tr>
<td>Economic factors</td>
<td></td>
<td></td>
<td>1. High transportation costs.</td>
</tr>
<tr>
<td>cane Statutory Minimum Price and State Advised Price.</td>
<td>1. Affordable with abundant natural resources.</td>
<td>1. Major dependence on exports, 72% of production is exported.</td>
<td>1. Domestic consumers pay about three times the world price to support subsidies and subsidised-exports.</td>
</tr>
<tr>
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<td>2. Affected by fluctuating and mostly depressed world prices.</td>
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</tr>
<tr>
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<td>4. Contractual obligation between miller and farmer on production of cane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. High average</td>
</tr>
<tr>
<td>Sociological Influences</td>
<td>sugar prices. 1. Provides employment opportunity to more than million labourers, mostly in rural areas. 2. Labour oriented industry with high labour costs. 3. It has emerged as exporting countries like LOME convention, Everything But Arms etc 4. Exports sugar at marginal price, as domestic markets absorb fixed costs. 5. World’s largest and most efficient sugar producer.</td>
<td>crushing capacity of 10300 TCD.</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1. About 50 million sugarcane farmers and a large number of agricultural labourers are involved in sugarcane cultivation and ancillary activities. 2. The sugar industry</td>
<td>1. Vibrant agro-business model established by the PROALCOOL system has created significant number of jobs. 2. Emerged as one of the major industries influencing changing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. High employee cost 2. Low world prices affect sustainability of industry thereby affecting the employment scenario of sugar industry. 3. Certain areas</td>
<td>1. Industry provides employment to 300,000 people. 2. Dependence on labour in farms is minimal due to mechanisation. 3. Sugar mills have adopted concept of ‘Corporate Social</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Provides employment opportunity to more than million labourers, mostly in rural areas. 2. Labour oriented industry with high labour costs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technological influences</td>
<td>provides employment to about 2 million skilled and semi skilled workers and others mostly from the rural areas.</td>
<td>lifestyle due to income generation for the farmers and employees of industry.</td>
<td>depend mainly on sugarcane cultivation and have very few options of alternative agricultural crops. These areas are affected by a downturn in the global sugar demand.</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1. Most of the mills use double desulphitation method of production, which leaves traces of sulphur in sugar. 2. Farm yields of</td>
<td>1. Most of the sugar mills are fully integrated and diversified into manufacture of value added by-products, which is aided by the technological</td>
<td>1. Mechanisation adopted in harvesting since 1979 with the advent of the German mechanical harvesters. 2. Focus is on</td>
<td>1. Better farm yields of beet due to development and cultivation of higher yield varieties. 2. Increased use of mechanisation for harvesting.</td>
</tr>
<tr>
<td>Legal factors</td>
<td>1. Highly regulated industry which is subjected to many acts viz. Essential Commodities Act, 1955, Sugar (Control) Order, 1966, Sugarcane (Control) Order,</td>
<td>1. PROALCOOL programme has helped in the development of the sugar industry. 2. New environmental laws prohibit burning of fields after</td>
<td>1. Sugar Industry Act, 1979 provides regulatory framework for cane supply by farmers and raw sugar manufacture by mills. 2. Sugar industry</td>
</tr>
</tbody>
</table>
| Environmental/Ethical issues | 1. Air and water pollution due to emission from sugar industry.  
2. Excessive use of fertilizers and pesticides, which adversely affects the soil quality.  
3. Burning of fields during harvesting. | 1. Soil quality is being deteriorated, as cane is cultivated as a monoculture.  
2. Air and water pollution due to emission from sugar industry.  
3. Air pollution due to vehicles that run on roads near the sugar industry. | 1. Queens-land sugar industry is near to the eco-sensitive areas.  
2. Threat of polluting water and air.  
3. Use of chemical fertilizers harmful for farm workers. | 1. EU sugar policy encourages sugar beet cultivation even in unsuitable climatic conditions, leading to excessive use of fertilizers, thereby adversely affecting the soil quality.  
2. Burning of fields with cane stubs takes place, causing environmental damage.  
3. Excessive use of fertilizers and pesticides, which adversely affect the soil quality. | 2. Legislation to prevent illegal smuggling of sugar into domestic market. |
On the basis of the above PESTLE analysis, the conclusion can be drawn that Indian sugar industry lacks export-competitiveness, when compared with that of Brazil and Australia, but there exists a vast potential to tap the global market provided competitiveness is enhanced, in economic and technological factors, along with suitable legislative changes towards de-control of Indian sugar industry.

<table>
<thead>
<tr>
<th>Negative Impact</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Farmers use fertilizers and pesticides, which adversely affects the soil quality.</td>
<td></td>
</tr>
<tr>
<td>2. Farmers use excessive herbicides and pesticides to prevent the beet from being affected by disease, as it is highly susceptible to diseases. This further affects soil fertility.</td>
<td></td>
</tr>
</tbody>
</table>
| 3. Higher requirement for water for cane cultivation is leading to depletion of ground water table. | 219
On the basis of the above PESTLE analysis, the conclusion can be drawn that Indian sugar industry lacks export-competitiveness, when compared with that of Brazil and Australia, but there exists a vast potential to tap the global market provided competitiveness is enhanced, in economic and technological factors, along with suitable legislative changes towards de-control of Indian sugar industry.
7.3 SWOT analysis of the sugar industry of India, Brazil, Australia, European Union and Thailand

The SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the Indian, Brazilian, Australian, European Union and Thailand sugar industry is carried out to know the internal strengths and weaknesses of the sugar industry of these countries and the external opportunities available to them and threats that they have to face.

The SWOT analysis would help to develop strategies that would aid the sugar industry to leverage its internal strengths to tap the external opportunities and ward off the threats and also to reduce its weaknesses so that the loss of opportunities, on account of these internal weaknesses, can be minimized. These strategies are:

i. Aggressive strategies- obtained by matching the internal strengths with external opportunities

ii. Diversification strategies- obtained by matching the internal weaknesses with external opportunities

iii. Turn-around strategies- obtained by matching the internal strengths with the external threats

iv. Defensive strategies- obtained by matching the internal weaknesses with external threats
Table 7.3: SWOT analysis of the sugar industry of India, Brazil, Australia, European Union and Thailand

<table>
<thead>
<tr>
<th>Strengths</th>
<th>India</th>
<th>Brazil</th>
<th>Australia</th>
<th>European Union</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td>1. Second largest sugar producer after Brazil</td>
<td>Land resource</td>
<td>1. Factor endowment in form of vast natural resources-availability of tremendous amount of relatively cheap and productive land for sugarcane</td>
<td>Infrastructure</td>
<td>1. Good infrastructure with well-connected road and rail network for transportation of cane and sugar. Well-developed ports for export of sugar.</td>
</tr>
<tr>
<td><strong>Land resource</strong></td>
<td>2. Endowed with arable land for cultivation of sugarcane.</td>
<td></td>
<td>2. World’s largest and most efficient sugar producer.</td>
<td></td>
<td>2. Highly mechanized sugar industry in the world</td>
</tr>
<tr>
<td><strong>By-products</strong></td>
<td>3. Supports the downstream industries by supplying rectified spirit etc.</td>
<td>Cost leadership</td>
<td>2. Good quality sugar. Low ICUMSA value (= 45) of refined sugar for exports.</td>
<td>Cost leadership</td>
<td>3. Cost efficient- low cost of production</td>
</tr>
<tr>
<td><strong>Economies of scope</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cane yield &amp; sugar</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Export orientation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1. One of the major exporters of sugar.</td>
</tr>
<tr>
<td><strong>Government support</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Government supported sugar prices for domestic market is high.</td>
</tr>
<tr>
<td><strong>Freight advantage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Has a freight advantage for exports to South East Asia.</td>
</tr>
<tr>
<td><strong>Cost leadership</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Fluctuates between</td>
</tr>
<tr>
<td>Cost Leadership</td>
<td>Domestic Market</td>
<td>Export Orientation</td>
<td>3rd and 4th lowest cost producer of sugar in the world.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>--------------------</td>
<td>-----------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Bagasse from sugar cane provides scope for setting up of cogeneration plants.</td>
<td>6. Huge domestic sugar-market with an annual consumption of around 19 million tonnes.</td>
<td>6. One of the major</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>Production aspects</td>
<td>Financial problems</td>
<td>High dependence on the export market</td>
<td>European Union</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>--------------------------------------</td>
<td>----------------</td>
<td></td>
</tr>
</tbody>
</table>
| India     | 1. Average production capacity is low as compared to other leading sugar producing countries.  
2. Many sugar factories are more than 30 year old and still use old technology. | 1. Sugar industry is plagued by the high interest rates due to high inflation.  
2. Many mills have a heavy external debt burden and face financial problems.  
3. The significant requirement for start- | 1. High production cost due to manufacture of sugar using sugar-beet.  
2. Cannot diversify economically into cogeneration due to non-availability of by product like bagasse of cane. | Thailand |
| Brazil    | 1. High transportations costs due to middlemen and loss of recovery due to improper logistics.  
2. Total labour costs for cutting, loading                                                                 |                                                                                       |                                      |                |
| Australia | 1. Heavily dependent on the export market. It exports around 72% of its production at low world prices.  
2. Balance quantities are sold in the domestic market at world price.  
3. Exports to markets financially. |                                                                                       |                                      |                |
| European Union | 1. High production cost due to manufacture of sugar using sugar-beet.  
2. Cannot diversify economically into cogeneration due to non-availability of by product like bagasse of cane. |                                                                                       |                                      |                |

<table>
<thead>
<tr>
<th>Thailand</th>
<th>Production aspects</th>
<th>Financial problems</th>
<th>High dependence on the export market</th>
<th>Logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. High transportations costs due to middlemen and loss of recovery due to improper logistics.</td>
<td></td>
<td></td>
<td>High labour costs</td>
</tr>
<tr>
<td></td>
<td>1. Total labour costs for cutting, loading</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Currency value**  
7. Devaluation of Brazilian currency ‘Real’ increases its price competitiveness in export markets.
3. Many sugar mills are stand-alone in nature.
4. Lack of professional approach to exports.
5. Mills mainly produce plantation white sugar, which has less export demand.
6. Mills mainly follow the double desulphitation method of production which leaves traces of sulphur in the sugar, hence making it non competitive for

up capital is a serious barrier, in an unresponsive debt market.

Family-managed enterprises
4. Many mills are still family-managed enterprises and lack the professional expertise.

Production technique
5. Many mills still adopt old techniques of production.

Labour problems
6. Mechanisation in harvesting is creating like Russia and Arabian countries, where import volumes fluctuate significantly.

Wages
4. Industry wages are high

Legal framework
5. Cane growers and sugar mills are contractually bound and cannot expand or reduce production.

Low domestic competition
6. Lacks competition domestically as all sugar is marketed through state trading

Protected market
3. Protected EU market reduces the scope for increasing the intra-industry competitiveness.

Subsidies
4. Not competitive without the subsidies extended by the governments.

and transportation are in the range of 265-305 baht per ton. These costs represent 43-48 per cent of total costs and represent a significant proportion of the production costs.

Production aspects
3. Fluctuating production due to vagaries of nature.
4. High ICUMSA value of raw sugar.
High dependence on the export market
5. Heavily dependent
exports. Comparative cost disadvantage
7. High cost of production when compared to Brazil.
**Cane yield & sugar**
8. Low average sugar recovery rate from cane of 10.17%.
9. Lower cane yield/ha (62.8 Tonnes/ha) especially in Uttar Pradesh (53 tonnes/ha).
10. Higher cane price set by the central (statutory minimum

labour related problems.

enterprise

High currency exchange rate
7. High currency exchange rate of Australian dollar reduces its international competitiveness.

on the export market. It exports around 67% of its production at low world prices.
<table>
<thead>
<tr>
<th><strong>Opportunities</strong></th>
<th><strong>India</strong></th>
<th><strong>Brazil</strong></th>
<th><strong>Australia</strong></th>
<th><strong>European Union</strong></th>
<th><strong>Thailand</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic demand</td>
<td>1. Increasing domestic demand.</td>
<td>WTO induced sugar-policy changes 1. Sugar related policy changes in EU, Japan and the USA are required</td>
<td>WTO induced sugar-policy changes 1. Sugar related policy changes in EU, Japan and the USA are required</td>
<td>Increased world sugar prices 1. With the reduction in subsidies, the world sugar prices are likely to go up.</td>
<td>Domestic demand 1. Economic growths and the expansion of pharmaceutical, soft drinks and bakery industries have</td>
</tr>
<tr>
<td>Diversification</td>
<td>2. Bagasse based cogeneration plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
and paper plant
3. Diversification into ethanol production.

**WTO induced sugar-policy changes**
4. Sugar related policy changes in EU, Japan and the USA. Japan and USA are required to provide market access. EU has to reduce protection given to the EU sugar producers. EU sugar exports to reduce by 4.5 million MT.

**Value added products**
2. Potential in value added sugar-product differentiation.

**Diversification**
3. Diversification into ethanol, cogeneration and bio-fertilizers.

**Investment opportunities abroad**
4. Scope for investing

**Technology export**
2. Exporting of indigenous technology of producing fuel-alcohol from sugarcane.

**Cost efficient sugar manufacturers can sell at higher world prices.**

significantly contributed to the increase in sugar consumption.

**Diversification**
2. Diversification into ethanol production and cogeneration.

**Farm Management**
3. Huge potential to increase the productivity of cane and the sugar recovery rate.

**WTO induced sugar-policy changes**
4. Sugar related
| 5. Huge potential to increase the productivity of cane and the sugar recovery rate. **Investment opportunities abroad** | 3. Potential in value added sugar- product differentiation. | in sugar industry of Brazil and Thailand in order to gain cost and freight advantage. | policy changes in EU, Japan and the USA. Japan and USA are required to provide market access. EU has to reduce protection given to the EU sugar producers. EU sugar exports to reduce by 4.5 million MT. |

<p>| 6. Brazil and Thailand: Increased natural resource, opportunities for investment and management expertise |  |  |  |</p>
<table>
<thead>
<tr>
<th>Threats</th>
<th>India</th>
<th>Brazil</th>
<th>Australia</th>
<th>European Union</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Climatic conditions 1. Vagaries of nature-climatic variations affect the cane availability. Water scarcity 2. Water scarcity may affect the cultivation and hence availability of sugarcane. Ground water table is fast depleting due to indiscriminate use. Political interests 3. Sugar industry is vulnerable to political interests.</td>
<td>Climatic conditions 1. Vagaries of nature-climatic variations affect the cane availability. Foreign entrants 2. Foreign sugar companies are entering the Brazilian markets through joint ventures and green-field projects.</td>
<td>Less Government support 1. Very low Government assistance renders the sugar industry vulnerable to fluctuations in the world sugar prices. Competition from Brazil 2. Tough competition from low priced Brazilian sugar. Climatic conditions 3. Vagaries of nature threaten the supply of cane. Capacity expansion in other countries 2. Refining capacities being set up in importing countries.</td>
<td>WTO rulings 1. WTO rulings against the subsidies extended by EU to sugar manufacturers. Capacity expansion in other countries 2. Refining capacities being set up in importing countries.</td>
<td>Higher domestic price 1. Higher domestic price set by government is leading to Thailand sugar industries smuggling the exported sugar back into Thailand to reap higher profits, which is affecting the domestic sugar market. Exposure to international markets 2. High exposure to</td>
</tr>
<tr>
<td><strong>Import</strong></td>
<td><strong>other countries</strong></td>
<td><strong>sugar manufacturers</strong></td>
<td><strong>international markets as dependence on exports is more.</strong></td>
<td></td>
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</tbody>
</table>
| 4. Import of sugar is placed under open general licence (OGL) scheme. The Indian sugar industry may be affected due to the cheap import of sugar, especially raw sugar. **Quality of soil**
5. Deterioration in quality of soil due to over use of fertilizers and pesticides to increase the production. | 4. Increasing production capacities in other producing and importing countries. | sugar manufacturers can dislodge EU as one of the major sugar exporters. | Low raw sugar quality
3. High ICUMSA value of raw sugar. |

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7.4 Assessing the competitiveness of the Indian sugar industry by applying Porter’s Diamond Model

The competitiveness of the Indian sugar industry, to tap the global market, is assessed qualitatively by applying the competitive strategy model developed by Michael Porter, which is commonly known as the 'Porter’s Diamond Model'.

![Porter's Diamond Model Diagram]

**Figure 7.4.a: Porter’s Diamond Model**

India has a large population of over 1.1 billion of which about 66% is dependent on agriculture and rural economy for their livelihood. A crucial aspect of the Indian
agriculture is that it depends heavily on the economic opportunities of the domestic market. India has not been a major player in the international agricultural market, as she has a vast population to feed. The factors which make India's position vulnerable are lack of irrigation facilities, dependence on monsoon, fragmented small land holdings, declining soil fertility due to excessive use of chemical fertilizers and depleting ground water.

National level
Since 1991, the thrust of Indian government's economic policies has been towards economic reforms and deregulation with emphasis on ushering in a more competitive environment in the domestic market that promotes greater efficiencies. This has resulted in the structural adjustment of the various sectors of the economy while facing up to a number of internal and external pressures and challenges.

Industry level
About 60% of the sugar mills in India are in the co-operative sector, 25% in the private sector and 15% in the public sector. India is the world's largest consumer of sugar and the Indian sugar industry is the world's second largest producer. Hence, the Indian sugar industry is not dependent on the world market.

However, in the present context of changes taking place in the global sugar trade due to the WTO regulations, there is a need to reform the sugar industry and to steer it away from the rigidities and inefficiencies of the past. The government has initiated a few steps to liberalise the sugar industry, like doing away with the
license raj, reducing the quantum of levy sugar to 10% of production and lifting the cap on capacity limits. However, the sugar sector has not been fully deregulated as sugar is an essential commodity and hence the government maintains a monthly release mechanism for it. Given the fast changing global sugar scenario, there is an urgent need to make the sugar industry competitive to be able to compete globally and also be able to meet the growing domestic sugar requirements.

**Firm level**

At the individual firm level, the progressive sugar mills which are WTO sensitive are directing their efforts towards increasing capacity, diversification into cogeneration of electricity, manufacture of ethanol, bio-fertilizers, refined sugar of EC II grade and raw sugar for competing in the international market. They are increasing their efforts to align closely with the farmers by supporting the extension programmes in cane cultivation, harvesting and transportation.

However, the non-WTO sensitive sugar mills have largely remained stand-alone sugar mills and are not keen on tapping the export potential in the global market.

**Porter's Home-Country Diamond Model Analysis**

**Factor Conditions**

Indian sugar production enjoys the natural advantage of large areas of cultivable land, with suitable climatic conditions, which is one of the most important physical resources that can be considered as a basic and inherited factor of production.
However, the soil fertility is decreasing due to excessive use of water, where the land is irrigated, and chemical fertilizers. The climatic conditions are generally favourable but a major proportion of cane cultivation is dependent on rainfall, the reliability of which is a constraint owing to seasonal drought or even floods in some parts of the country.

Another basic factor of production is labour, which though abundant, sometimes becomes a constraint, in some parts of the country, especially during the harvesting season. Also in recent times a shift is being witnessed among the rural youth who wish to move to cities in search of livelihood, thus refraining from agriculture. However, both skilled and unskilled labour is available in abundance to work in sugar mills.

The sugar industry is highly capital intensive. In order to make the industry viable, profitable and efficient, the sugar mills will have to go in for forward integration and also focus on research and development.

**Demand Conditions**

The Indian sugar industry has primarily depended on the domestic market owing to the large population and consumption. Accordingly, the domestic market conditions have played a significant role in developing the capabilities and determining the strategies of the firms and industries. As the industry was subjected to greater governmental control as sugar is a product of mass consumption, the industry did not consider diversification as a needed strategy. Since 1997, the sugar
industry is being slowly liberalised and the industry is initiating steps to be more competitive. The orientation of the WTO sensitive sugar mills has led to the improvement in the quality of sugar and also the production of raw sugar for exports.

Related and Supporting industries

Research programs are being undertaken at institutes such as Vasantdada Sugar Institute, Pune (Maharashtra), Sugarcane breeding Institute, Coimbatore (Tamil Nadu), National Sugar Institute, Kanpur (Uttar Pradesh), Karnataka Sugar Institute, Belgaum (Karnataka) to develop better cane having higher yields and sucrose content.

There are many engineering firms that supply the required machinery and spare parts required for the functioning of the sugar mills. The alcohol industry is a major purchaser of the rectified spirit and molasses. The state owned oil companies are the main buyers of the ethanol manufactured by the WTO sensitive sugar mills. The state electricity boards purchase the electricity generated by the sugar mills, for distribution to the commercial and residential usage. Institutes such as Karnataka Sugar Institute and also some chemical and fertilizer companies conduct regular training programmes for farmers regarding the scientific management of farms and proper usage of the fertilizers.
Industry Structure, Firm Strategy and Rivalry

The Indian sugar industry consists of 581 installed sugar mills and 453 operating sugar mills located across 19 states of the country. The Indian sugar industry has been highly fragmented. Majority of the Indian farms are small in size with an average of about 2 hectares. Sugarcane is grown by about 50 million farmers and agricultural labourers, constituting 7.5% of the rural population. The sugar industry provides employment to about 2 million skilled and semi skilled workers, mostly from the rural areas.

The competition that arises between sugar mills is in the production or milling sector of the industry. This is because of the seasonal nature of the sugarcane supply. The interconnected factors of seasonality of sugarcane, its perishable nature, induced cyclicity and the need to maximise on capital invested, makes it imperative for the sugar mills to ensure simultaneously a sufficient supply of sugarcane and sufficient capacity to process all sugarcane at harvest time. The setting up of new sugar mills due to the reduction the radial distance between two sugar mills from 25 kilometers to 15 kilometers, along with an increase in the crushing capacity of the existing sugar mills, has led to an increase competition between the sugar-mills in sourcing sugarcane.

Role of Chance

The role of chance affecting the Indian sugar industry can be seen in the following cases:
i. Dispute Settlement Body's ruling on subsidised EU sugar exports.

ii. Setting up of destination refineries in the middle-east and other major sugar importing countries.

iii. Reduction in the trade barriers due to the WTO regulations.

iv. Increasing per capita consumption of sugar in India and Asia, due to an increase in the income levels, urbanization and economic growth.

Role of the Government

The central and state governments, through the various legislations, play a major role in the functioning of the sugar mills in India. However, in recent times, there has been an effort on behalf of the government to partially liberalise the sensitive sugar industry, in order to bring in competitiveness and an improvement in the efficiencies of the sugar mills, so that they can compete at a global level. This has been necessitated due to the coming into being of the WTO, whose regulations advocate a reduction in the trade barriers.

The outcome of the above discussion is presented in Table 7.4, which helps us to identify the factors that affect at the level of firm (F), industry (I) or nation (N).
Table 7.4: Porter’s Home-Country Diamond Model Analysis for India (Indian sugar industry)

<table>
<thead>
<tr>
<th>Factor conditions</th>
<th>Demand conditions</th>
<th>Related and supported industries</th>
<th>Industry structure, firm strategy and rivalry</th>
<th>Role of chance</th>
<th>Role of government</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Availability of natural resources and suitable climatic conditions.</td>
<td>1. Existence of a high domestic demand. (I)</td>
<td>1. Diversification into ethanol, cogeneration of electricity, alcohol and bio-fertilizers.</td>
<td>1. 581 installed sugar mills and 453 operating sugar mills classified in co-operative, private and public sectors. (F)</td>
<td>1. Dispute Settlement Body’s ruling on subsidised EU sugar exports provides an opportunity to tap export market. (F and I)</td>
<td>1. Government regulates the sale of sugar in the market through monthly release mechanism (I and N)</td>
</tr>
<tr>
<td>2. Research institutes developing improved varieties of sugarcane for better productivity. (*F and I)</td>
<td>2. Indian consumers are less demanding in terms of ICUMSA level and sulphur content than international consumers. (F and I)</td>
<td>2. Research institutes in terms of better cane variety, farm implements, varieties of sugar.</td>
<td>2. Sugar sales competition is limited by government release control mechanism.</td>
<td>2. Setting up of destination refineries in the middle-east and</td>
<td>2. Government is slowly liberalizing the sugar sector, though it may not be completely liberalised as sugar.</td>
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<td>3. Demand from</td>
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<td>3. Lack of trained human resources for international operations. (F and I)</td>
<td>institutional buyers is around 60% while remaining 40% is for household consumption. (I)</td>
<td>Scope exists for competition in institutional sales. (F and I)</td>
<td>is a product of mass consumption. (I)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Scope for improvement in infrastructure viz. transportation, storage and shipping. (I and N)</td>
<td>and production processes. (I)</td>
<td>3. Competition exists in procurement of cane, especially during low cane production season. (F)</td>
<td>other major sugar importing countries. (F and I)</td>
<td></td>
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<td></td>
<td>3. Suppliers of machinery and spare parts have a strong technical base. (F and I)</td>
<td></td>
<td>3. Reduction in the trade barriers due to the WTO regulations. (F and I)</td>
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<td></td>
<td></td>
<td>4. Increasing per capita consumption of sugar in India and Asia, due to an increase in the income levels and economic growth. (I)</td>
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* F: Firm, I: Industry and N: Nation
7.5 Testing of hypotheses

Methodology adopted for testing of hypotheses

Since the survey conducted, to collect the primary data, included all the operational sugar factories of Belgaum district (12 at the time of conducting the survey) i.e. the population survey, the hypotheses are tested by using the aggregate values or average values, of the parameters, that are applicable for the respective hypotheses. The data for the respective parameters are collected over a 11 year period from 1995-96 to 2005-06. The year 2000-01 was the year when the implementations of most of the WTO regulations were to be brought into force by the member countries. Hence the year 2000-01 is considered as the implementation year, the years 1995-96 to 1999-2000 have been called as the pre-implementation period and the years 2001-02 to 2005-06 have been called as the post implementation period.
The following null and alternate hypotheses pertaining to this research study have been tested, on the basis of the quantitative and qualitative analysis carried out.

**Null Hypotheses**

Ho) 1: Awareness level among the sugar industrialists of Belgaum district about the implications of the various provisions of WTO are very minimal.

Ho) 2: The sugar factories of Belgaum district are not competitive enough to tap the export market.

Ho) 3: The performance of the co-operative sugar mills of Belgaum district has deteriorated during post-implementation period of WTO regulations due to lack of competitiveness.

Ho) 4: The performance of the private sugar mills of Belgaum district has deteriorated during post-implementation period of WTO regulations due to lack of competitiveness.

Ho) 5: There has been no difference between the performance of the co-operative sugar mills and the private sugar mills of Belgaum district during the pre-implementation period of WTO regulations.

Ho) 6: The performance of private sugar mills, of Belgaum district, is better than that of co-operative sugar mills during the post-implementation period of WTO regulations.
Alternate Hypotheses

H1) 1: Awareness level among the sugar industrialists of Belgaum district about the implications of the various provisions of the WTO is high.

H1) 2: The sugar factories of Belgaum district are competitive enough to tap the export market.

H1) 3: The performance of the co-operative sugar mills of Belgaum district has not deteriorated during post-implementation period of WTO regulations.

H1) 4: The performance of the private sugar mills of Belgaum district has not deteriorated during post-implementation period of WTO regulations.

H1) 5: There has been a difference between the performance of the co-operative sugar mills and the private sugar mills of Belgaum district during the pre-implementation period of WTO regulations.

H1) 6: The performance of the private sugar mills, of Belgaum district, is worse than that of the co-operative sugar mills during the post-implementation period of WTO regulations.
Ho) 1: Awareness level among the sugar industrialists of Belgaum district about the implications of the various provisions of WTO are very minimal.

H1) 1: Awareness level among the sugar industrialists of Belgaum district about the implications of the various provisions of the WTO is high

From the survey it is found that 83 percent of the sugar mills in Belgaum district are not aware about the various agreements of WTO and their provisions, are not aware about the provisions of Agreement on Agriculture that are concerned with the conduct of the global agri-trade and are not aware about the different rulings given by the WTO’s dispute settlement body (DSB). Only 17 percent of the sugar mills in Belgaum district are aware about the various agreements of WTO, their provisions and also their implications. These 17 percent sugar mills fall under the private sector.

Hence, the **null hypothesis is accepted**.
Ho) 2: The sugar factories of Belgaum district are not competitive enough to tap the export market.

H1) 2: The sugar factories of Belgaum district are competitive enough to tap the export market.

On the basis of the comparative assessment of the competitive factors of the Indian, Belgaum, Brazilian, EU-25, Thailand and Australian sugar industry for the year 2005-06, as shown in Table 61 earlier, we draw the following conclusions.

The table 61 indicates that the recovery rate of the Belgaum district sugar industry is 11.02%, which is above the national average of 10.17% and is comparable with that of Thailand (11.3%) but very less when compared with that of Brazil (14.6%), EU-25 (13%) and Australia (13%)

The average crushing capacity of Belgaum district sugar industry is 3468 TCD, which is below the national average of 3500 TCD. However it is much below than that of Brazil (9200 TCD), EU-25 (above 10000 TCD), Thailand (10300 TCD) and Australia (above 10000 TCD)

The average number of crushing days of Belgaum district sugar industry is 161 days, which is above the national average of 97 days and comparable with that of Australia (165 days). It is above that of EU-25 (115 days) and Thailand (104 days) while it is below than that of Brazil (186 days).
The cost of production per tonne of plantation white sugar of Belgaum district is US$ 300.52, which is below the national average of US$ 310. It is also below that of EU-25 (US$ 400) and Thailand (US$ 360), while it is above that of Brazil (US$ 210) and Australia (US$ 290).

The quality of the refined sugar (Indian plantation white sugar) of Belgaum district varies between 70 to 90 ICUMSA (while one sugar mill manufactures refined sugar with an ICUMSA of 45), which is below the national average of 100 ICUMSA (ranges between 70 -200 ICUMSA). It is below that of Thailand and comparable with that of Brazil (average 100 and also manufactures 45 ICUMSA sugar), EU-25 (45 ICUMSA) and Australia (45- 100 ICUMSA). The lower the value of ICUMSA the better the whiteness and quality of sugar. Hence the quality of the sugar manufactured by the Belgaum district sugar mills is comparable with the major sugar exporting nations. However, the sugar manufactured by the Belgaum district sugar mills is plagued with the problem of sulphur content due to the double desulphitation method of production, which leaves traces of sulphur in the sugar.

Out of the twelve sugar mills in Belgaum district, only one sugar mill produces raw sugar and exports it, which indicates a low prevalence of raw sugar production among the Belgaum district sugar mills. Even the national scenario indicates a similar pattern with low production of raw sugar for exports. The production of raw sugar for exports among sugar mills in Belgaum district is
very low when compared with that of Brazil, Thailand and Australia where almost all sugar mills manufacture raw sugar for exports. Only the EU-25 does not manufacture raw sugar because they use beet for manufacture of sugar, which is directly converted to refined sugar. As the demand for raw sugar in the global sugar trade is increasing, due to the setting up of the destination refineries in the major sugar importing countries like Russia, Indonesia, Middle-East nations, Bangladesh etc, there is a greater need to focus on the production of raw sugar for tapping the global sugar trade.

The ICUMSA value of the raw sugar of Belgaum district sugar industry ranges from 800-1200, which matches with the national vale of raw sugar ICUMSA. It is higher than that of Brazil (500-800 ICUMSA) and Australia (600-700 ICUMSA, the standard ‘Brad One’ grade has an ICUMSA value of 200), which indicates that the whiteness and quality of Belgaum and Indian raw sugar is lower than that of Brazil and Australia. However its whiteness and quality is better than that of Thailand whose raw sugar ICUMSA value ranges from 1800-2200, with the average being above 2000.

The sugar factories of Belgaum district do not own any sugar factory abroad nor do they have any investments in a foreign sugar factory. This is in tune with the national sugar industry scenario in India. However some sugar factories of Brazil, EU-25, Thailand and Australia own or have investments in sugar factories located abroad. This gives them the competitive advantage of access to cheaper raw materials, low cost of labour, access to markets abroad and lower
freight costs associated with transportation of sugar. This makes them more competitive in the global market.

The Indian sugar industry and the sugar industry of Belgaum district face the challenge of induced cyclicity. Sugar production in India follows a typical cycle of 5 to 6 years, wherein 2 to 3 years of higher production are followed by 2 to 3 years of lower production. This is an induced cycle as higher cane availability of leads to over production of sugar, which results in a fall in the sugar prices, affecting the revenues of the sugar mills leading to cane payment arrears. This forces the farmers to shift cultivation to other crops, which lead to a reduction in the cane cultivation and hence cane availability to the sugar mills. This forces the sugar mills to pay a higher price to procure cane from farmers leading to a cane-war among the sugar mills. The higher price for cane encourages the farmers to cultivate more of sugar cane and the cycle thus continues. The competitiveness of the Indian and Belgaum district sugar mills is adversely affected by the induced cyclicity. The induced cyclicity is not prevalent in Brazil, Thailand and Australia, as Brazil has its booming ethanol industry to shift to, Thailand mainly depends on export markets and Australian sugar industry is a completely liberalised one.

The productivity of farms cultivating sugarcane in Belgaum district is 73.42 tonnes/ha, which is higher than the national average of 62.8 tonnes/ha. It is also higher than that of Brazil (72.3 tonnes/ha), EU (8.61 tonnes/ha of beet = 15 tonnes/ha of cane) and Thailand (59 tonnes/ha). However it is lower than that of Australia (98.9 tonnes/ha). This indicates that the Belgaum district sugar
industry is competitive with that of Brazil, EU-25 and Thailand with respect to the productivity of the sugarcane farms.

The average export price (FOB) of sugar exported from Belgaum district is US$ 312.52 per MT, which is lower than the national average of US$ 382.17 and the international white sugar price of US $ 325 per MT. It is however higher than that of Brazil (US $ 236- US$ 244 per MT, FOB), Thailand (US$ 259 per MT, FOB) and that of Australia (US$ 298- US$ 316 per MT, FOB)

The sugar exported from Belgaum district and India is mainly the plantation white sugar while that exported from Brazil, Thailand and Australia is both raw sugar and refined sugar with ICUMSA of 45. EU-25 exports refined sugar of ICUMSA 45. The demand for raw sugar in global sugar trade is increasing due to the setting up of destination refineries in major sugar importing countries, while the demand for plantation white sugar is limited to only Sri Lanka, Bangladesh, Pakistan and some middle-east countries. There exists a demand for refined grade sugar with ICUMSA of 45 in the global sugar trade. Hence the competitiveness of the Belgaum district sugar is reduced due to the type of sugar manufactured.

The percentage of Belgaum district share in world's sugar export is very negligible and also intermittent while that of our nation is negligible (around 2 percent and also intermittent). It is very less when compared with that of Brazil (30%), EU-25 (15.2%), Thailand (10%) and Australia (12%). The exports of sugar as a percentage of total production of India is 4% which is intermittent and is very less when compared with that of Brazil (56%), EU-25 (20%) Thailand
(67%) and Australia (72%). The corresponding value for the Belgaum district sugar industry is very negligible. Also most of the sugar mills of Belgaum district resort to exports mainly to earn revenues to pay off the cane arrears, debt servicing of banks and working capital requirements. The Belgaum district sugar industry and the Indian sugar industry is not a regular exporter and hence its reliability of being a credible and regular sugar exporter is less in the global sugar markets. India imports sugar to meet any increase in the domestic demand, if domestic production is low.

The sugar factories of Belgaum district are competitive in terms of the recovery rate, average number of crushing days in a year, cost of production per tonne of plantation white sugar and sugarcane yield per hectare. However they are not competitive in terms of the average crushing capacity, quality of the refined sugar (Indian plantation white sugar) and raw sugar, not owning any sugar factory abroad nor having any investments in a foreign sugar factory, face the challenge of induced cyclicity, sulphur content in sugar, no focus on manufacture of raw sugar for export, intermittent and very less quantity of exports and lack of acceptance as a credible exporter.

Hence, on the basis of the above analysis and discussion, we can conclude that the sugar factories of Belgaum district are competitive to tap the export market. Hence, the null hypothesis is accepted, on account of lack of competitiveness of Belgaum district sugar industry on the main factors namely lack of desired quality, no focus on manufacture of raw sugar for export, intermittent exports and inability to export in bulk quantity.
Ho) 3: The performance of the co-operative sugar mills of Belgaum district has deteriorated during post-implementation period of WTO regulations due to lack of competitiveness.

H1) 3: The performance of the co-operative sugar mills of Belgaum district has not deteriorated during post-implementation period of WTO regulations.

The data analysis reveals that even though the total crushing capacity of all the co-operative sugar mills put together has increased from 16180 TCD during the pre-implementation period to 20610 TCD during the post implementation period, we find that the average sugar production has decreased from 562056 quintals to 421532 quintals, the average cane crushed has decreased from 488411 tonnes to 372545 tonnes, the average recovery rate has decreased from 11.02 % to 10.63%, the average number of crushing days in a year has decreased from 184.11 days to 131.46 days, the total command area increased from 72046.6 hectares (177955 acres) to 83392.71 hectares (205980 acres) however the average command area per co-operative sugar mill has decreased from 12007.76 hectares (29659.17 acres) to 11913.24 hectares (29425.71 acres) thereby affecting the availability of cane to the co-operative sugar mills, whose cane requirement has increased due to the increase in the crushing capacity. Further the average cost of production of the plantation white sugar of co-operative factories has increased from Rs. 1181.91 to Rs. 1368.03 (an increase of 15.75%) and the corresponding average selling price obtained for the free
sugar sale is Rs. 1196.53 and Rs. 1286.87 respectively, which indicates that on an average during the pre-implementation period the co-operative sugar mills made a profit of Rs.14.62 per quintal of sugar sold while during the post-implementation period, on an average, the co-operative sugar mills incurred a loss of Rs.81.16 per quintal of sugar. Also there has been no production of ethanol, rectified spirit and co-generation of electricity by the co-operative sugar mills during the pre and post implementation period, rendering these sugar mills to be stand-alone sugar mills, which adversely affects their competitiveness.

On the basis of the above findings, the null hypothesis is accepted as the performance of the co-operative sugar mills has decreased on all performance related criteria.

Hence we can say that the competitiveness of the co-operative sugar mills of Belgaum district has been reduced during the post implementation period of WTO regulations.
Ho) 4: The performance of the private sugar mills of Belgaum district has deteriorated during post-implementation period of WTO regulations due to lack of competitiveness.

H1) 4: The performance of the private sugar mills of Belgaum district has not deteriorated during post-implementation period of WTO regulations.

The data analysis reveals that during the pre-implementation period there existed only one private sugar factory, which increased to five during the post implementation period. Even though the total crushing capacity of the private sugar mills has increased from 6500 TCD during the pre-implementation period to 19960 TCD during the post implementation period, we find that the average sugar production has decreased from 1444204 quintals to 786602 quintals, the average cane crushed has decreased from 1259222 tonnes to 608243.8 tonnes, the average recovery rate has decreased from 11.32 % to 10.84%, the average number of crushing days in a year has decreased from 222 days to 189.76 days, the total command area increased from 22777.33 hectares (56260 acres) to 58843.24 hectares (145342.8 acres) however the average command area per private sugar mill has decreased from 22777.33 hectares (56260 acres) to 11768.65 hectares (29068.56 acres) thereby affecting the availability of cane to the private sugar mills, whose cane requirement has increased due to the increase in the crushing capacity. Further the average cost of production of the plantation white sugar of private sugar factories has increased from Rs. 1170.26
to Rs. 1396.76 (an increase of 19.35%) and the corresponding average selling price obtained for the free sugar sale is Rs. 1220.46 and Rs. 1291.74 respectively, which indicates that on an average during the pre-implementation period the private sugar mills made a profit of Rs.50.2 per quintal of sugar sold while during the post-implementation period, on an average, the private sugar mills incurred a loss of 105.02 per quintal of sugar. Also the production of ethanol is has increased from 0 klpd to 30 klpd, the rectified spirit production capacity has remained same at 30 klpd and co-generation capacity of the private sugar mills has increased from the pre-implementation period value of 26.4 mw to the post implementation period value of 83.1 mw, rendering these sugar mills to be integrated sugar mills, which are better prepared to face the competition due to the advantage derived from the economies of scope.

On the basis of the above findings, the **null hypothesis is rejected** and the **alternate hypothesis is accepted**.

Hence, we can say that the competitiveness of the private sugar mills of Belgaum district has improved during the post implementation period of WTO regulations, as compared to the pre-implementation period.
Ho) 5: There has been no difference between the performance of the co-operative sugar mills and the private sugar mills of Belgaum district during the pre-implementation period of WTO regulations.

H1) 5: There has been a difference between the performance of the co-operative sugar mills and the private sugar mills of Belgaum district during the pre-implementation period of WTO regulations.

The data analysis reveals that during the pre-implementation period, the total crushing capacity of the co-operative sugar mills was 16100 TCD (with an average of 2683 TCD per sugar factory) while that of the private sugar mills was 6500 TCD.

The total sugar manufactured by co-operative sugar mills was 3372338 quintals (with an average of 562056 quintals per sugar factory) while that of the private sugar mills was 1444204 quintals (with an average of 1444204 quintals as there existed only one sugar factory in the private sector during the pre-implementation period).

The total cane crushed by co-operative sugar mills was 2930464 MT (with an average of 488411 MT per sugar factory) while that of the private sugar mills was 1259222 MT (with an average of 1259222 MT as there existed only one sugar factory in the private sector during the pre-implementation period).

The average recovery rate of the co-operative sugar factories during the pre-implementation period was 11.02 % while that of the private sugar factories was 11.32%.
The average cost of production, of the plantation white sugar, of the cooperative sugar factories was Rs. 1181.91 per quintal of sugar and that of the private sugar factories was Rs. 1170.26.

The average price realisation by the sugar cooperative factories during the pre-implementation period was Rs. 1196.53 per quintal of sugar indicating a profit margin of 1.24% while that of the private sugar factories was Rs. 1220.46 per quintal of sugar indicating a profit margin of 4.29%. Hence on the factors of cost and profit margin the private sugar factories were more competitive than the co-operative sugar factories during the pre-implementation period.

There was no production of ethanol by the co-operative and private sugar factories.

The production capacity of spirit by the co-operative sugar factories was 48 klpd while the lone private sugar factory had a capacity of 30 klpd.

There was no cogeneration of electricity by the co-operative sugar factories while the private sugar factory had a generating capacity of 26.4 mw during the pre-implementation period.

The total production of bio-fertilizer by the co-operative sugar factories was 79999 tonnes with an average of 13333.20 tonnes per sugar factory while that of the private sugar factory was 42058 tonnes, with the average value also being 42058 tonnes (due to the presence of only one private sugar factory).

From the above analysis, we find that the performance of the private sugar factories is better than that of the co-operative sugar factories in terms of the average sugar production, average cane crushed, average recovery rate, average
cost of production, average price realisation and profit margin per quintal of sugar, co-generation capacity of electricity and the average production of bio-fertilizer.

Hence, the null hypothesis is rejected and the alternate hypothesis is accepted, due to better performance of the private sugar factories than that of the co-operative sugar factories.
Ho) 6: The performance of private sugar mills, of Belgaum district, is better than that of co-operative sugar mills during the post-implementation period of WTO regulations.

H1) 6: The performance of the private sugar mills, of Belgaum district, is worse than that of the co-operative sugar mills during the post-implementation period of WTO regulations.

The data analysis reveals that during the post-implementation period, the total crushing capacity of the co-operative sugar mills was 18110 TCD, an increase of 12.48% when compared with the total capacity of pre-implementation period (with an average of 2944 TCD per sugar factory) while that of the private sugar mills was 19960 TCD an increase of 207% when compared with the total capacity of pre-implementation period (with an average of 6500 TCD).

The total sugar manufactured by co-operative sugar mills was 2950723 quintals (with an average of 421532 quintals per sugar factory) while that of the private sugar mills was 3933010 quintals (with an average of 786602 quintals)

The total cane crushed by co-operative sugar mills was 2607814 MT (with an average of 372545 MT per sugar factory) while that of the private sugar mills was 3041219MT (with an average of 608244 MT per sugar factory).

The average recovery rate of the co-operative sugar factories during the post-implementation period was 10.63 % while that of the private sugar factories was 10.84%.
The average cost of production, of the plantation white sugar, of the cooperative sugar factories was Rs. 1368.03 per quintal of sugar and that of the private sugar factories was Rs. 1396.76.

The average price realisation by the sugar cooperative factories during the post-implementation period was Rs. 1286.87 per quintal of sugar indicating a loss of 6.31% while that of the private sugar factories was Rs. 1291.74 per quintal of sugar indicating a loss of 8.13%. Hence on the factors of cost and profit margin the co-operative sugar factories were more competitive than the private sugar factories during the post-implementation period.

The production capacity of spirit by the co-operative sugar factories was 48 klpd while the private sugar factories had a capacity of 60 klpd.

There was no cogeneration of electricity by the co-operative sugar factories while the private sugar factories had a generating capacity of 83.1 mw during the post-implementation period.

The total production of bio-fertilizer by the co-operative sugar factories was 82949.6 tonnes with an average of 11849.94 tonnes per sugar factory while that of the private sugar factories was 106798.8 tonnes, with the average value being 21359.76 tonnes.

From the above analysis, we find that the performance of the private sugar factories is better than that of the co-operative sugar factories in terms of the average sugar production, average cane crushed, average recovery rate, cogeneration capacity of electricity and the average production of bio-fertilizer.
The performance of the co-operative sugar factories is better in terms of the average cost of production and loss margin per quintal of sugar. However, as the private sugar mills are an integrated sugar complex i.e. they manufacture ethanol and generate electricity, hence they are able to overcome the loss suffered due to sugar sales and are more competitive.

Hence, the **null hypothesis is accepted**, as the performance of the private sugar factories is better than that of the co-operative sugar factories.