CHAPTER NO. I
AN OVERVIEW OF SUGAR FACTORY AND RESEARCH DESIGN

1) BRIEF HISTORY OF SUGAR FACTORY

1.1.1 Introduction:

Sugar Industry is very important industry in India, because Sugar industry is related to Indian farming. In Indian agriculture cane crop is important crop for the farmers. Sugar Industry is the second largest organized and agro based industry in the country, next only to textiles. Sugar Industry has provided lot of employment, which has helped in the development of socio-economic factor in the rural area. After Brazil, India is the second country in Sugar production. It is useful to obtain valuable foreign currency.

1.1.2 Co-Operative Movement

In United Kingdom during the second half of the 18th and the first half of the 19th century Industrial Revolution tracked. At that time leader of the workers Robert Owen began to preach that workers could attain their emancipation through self-help and co-operation alone. Back to 1844 'Rochdale Pioneers of England established their store, they found in this 'store' a solution to their common problem eg. exploitation by the traders, this is the origin of modern cooperative movement. All countries have accepted the cooperative Philosophy to remove their economical and social problems.

The co-operative credit societies Act, 1904 was the first Act which established the legal framework for the co-operative movement in India. In 1945 the co-operative movement in India was diverted to various activities such as processing, marketing, distribution and housing etc. In the development of rural economy co-operation was an important instrument of development of rural economy throughout first five year plans in India. Co-operative movement play a significant role in both developed and developing countries which are affected by many socio-economic problems. In 1950-51 there were 138 sugar factories in India. In 2008-09 there were 488 sugar factories in operation. And in Maharashtra state there were 147 Sugar factories, out of that 20 are in Kolhapur District.

In year 2008-09, 145.39 lakh Metric tonne Sugar produced in India. The Maharashtra only produced 46 Lakh metric tonne.
In the development of the cooperative movement Maharashtra played an important role. In 1906 the first co-operative society was formed in Khandesh (Now Jalgaon) district at a village called Bodhwad. First Sugar factory in India established in the year 1784 at Sooksugar, Second in 1791 at Haregaon in Ahmednagar district under private sector.¹

"One for all and all for one" is the basic principle of co-operation. The success such a vast movement depends on Constructive leadership, effective management. Co-operative movement is not only an economic and political movement but also an educational movement. Now, our country has the largest co-operative movement in the world. Co-operation is a state subject and it is the state Governments responsibility to implement the provisions of the Directive principles of state policy.

The National Federation of cooperative Sugar Factories Limited (NFCSF) was established on December 2, 1960 as an apex organization of all cooperative. Sugar factories in India.³ At that time there were only 174 sugar factories producing 30.21 lakh tonnes of sugar annually. Out of these only 30 sugar factories were in the cooperative sector and accounted for only 14.9 % of the total sugar production. India at that time had no standing in the globe sugar map.³

The establishment of NFCSF however changed the scenario. There was a steady increase in sugar production and in the cooperatives share in the total production. By 1992-93, the cooperatives share in total sugar production had reached 61 %. But more important was the fact that the cooperatives share in total sugar production enabled India to established itself as the worlds largest producer of sugar in 1982. This feat was repeated in 1988 to 1993, 1995, 1996, 2000, 2006-07 and 2010-11.

The cooperative sugar factories have also proved as a 'nuclei' for bringing about an overall socio-economic development of the rural areas of the country. In many states they have converted barren areas into modern cities with all amenities. They have been mainly responsible for arresting migration of the rural population to cities in search of education, employment and medical facilities. With the establishment of schools, colleges, professional colleges, other educational institutes, social welfare centers like hospitals, libraries and economic organizations like banks by the members of the Sugar cooperatives in the factory area there was no need for them to move out. On the other hand some of the professional colleges established by the sugar cooperatives have been attracting students from the metropolitan cities.
1.1.3 The sugar Factories in India

Sugar Industry is playing an important role in Indian economy. The Sugar Industry is the largest Processing industries in the country, next only to textiles. Co-operative sugar factories are large, modern industrial units. Each factory (2200 TCD to 7500 TCD) has a membership of 4000 to 25000 cane growers with an area of operation of 40 to 200 villages and crashes 2.5 lakhs to 9.5 lakhs tonnes of cane annually during the season lasting about 7 to 8 months and employs about 1000 to 3000 persons directly and 3000 to 8000 persons indirectly. Each factory is managed by a board of directors elected by the sugarcane growers.1

1.1.4 Sugar Scenario : World

The sugar scenario is also on the threshold of a change - both globally and nationally. In Indian Sugar production in the second half of the current sugar season has changed the scenario completely, not only for India but globally also. After two years of deficit Sugar production, the global Sugar production during 2010-11 is forecast to be surplus. Ironically this is a worrying factor for the sugar factories because as per past experience surplus availability of sugar leads to fall in sugar prices.2

1.1.5 Sugar Scenario : India

India is the second largest sugar producer in the world after Brazil and contributes 40-44 % production Share of Asia. During 2009-10 season, the country produced 188.00 lakh tonnes of white sugar which was more by 38.00 lakh tonnes form its initial projection of 150.00 lakh tonnes at the start of season. The main reason for this change were the revision in the sugar output of two major sugar producing states, Maharashtra and Uttar Pradesh. The countries opening stock of sugar was only 33.50 lakh tonnes at the start of 2009-10 season. The sugar production of India as whole was increased by 29.30 % (42.60 lakh tonnes) as compared to the previous seasons production of 145.40 lakh tonnes.4

Tables No. : 1.1

India sugar balance (October-September)

<table>
<thead>
<tr>
<th>Sugar</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Stocks</td>
<td>115.30</td>
<td>109.30</td>
<td>33.50</td>
</tr>
<tr>
<td>Production</td>
<td>263.60</td>
<td>145.40</td>
<td>188.00</td>
</tr>
<tr>
<td>Imports</td>
<td>0.00</td>
<td>11.00</td>
<td>44.00</td>
</tr>
</tbody>
</table>


## Sugar Scenario Maharashtra:

Maharashtra is one of the major sugar producing states in the country, that contributes 30-35% of total nations sugar production. The sugar production of the state was initially projected as 47.00 lakh tonnes with slight increase of 2.62% as compared to the season 2008-09. However, there was sharp rise in sugar production of the state with production of 70.66 lakh tonnes which accounted for 54.37% increase as compared to the previous season 2008-09 (45.79 lakh tonnes)^4

### Table No. 1.2

**Technical performance of sugar factories in Maharashtra for last five seasons.**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No. of Installed of sugar factories</td>
<td>187</td>
<td>188</td>
<td>193</td>
<td>195</td>
<td>199</td>
</tr>
<tr>
<td>2</td>
<td>Installed capacity (lakh TCD)</td>
<td>4.48</td>
<td>4.55</td>
<td>4.71</td>
<td>4.77</td>
<td>4.99</td>
</tr>
<tr>
<td>3</td>
<td>No. of sugar factories not in operation</td>
<td>45</td>
<td>25</td>
<td>19</td>
<td>48</td>
<td>57</td>
</tr>
<tr>
<td>4</td>
<td>No. of sugar factories in operation</td>
<td>142</td>
<td>163</td>
<td>174</td>
<td>147</td>
<td>142</td>
</tr>
<tr>
<td>5</td>
<td>Gross days</td>
<td>121</td>
<td>189</td>
<td>182</td>
<td>107</td>
<td>170</td>
</tr>
<tr>
<td>6</td>
<td>Sugarcane crushed (lakh tonnes)</td>
<td>445.71</td>
<td>798.83</td>
<td>762.27</td>
<td>400.27</td>
<td>613.90</td>
</tr>
<tr>
<td>7</td>
<td>Sugar production (lakh tonnes)</td>
<td>51.97</td>
<td>91.00</td>
<td>90.74</td>
<td>45.79</td>
<td>70.66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Capacity Utilization %</td>
<td>98.85</td>
<td>94.98</td>
<td>92.12</td>
<td>97.41</td>
<td>95.03</td>
</tr>
<tr>
<td>9</td>
<td>Recovery % Cane</td>
<td>11.68</td>
<td>11.39</td>
<td>11.94</td>
<td>11.46</td>
<td>11.54</td>
</tr>
<tr>
<td>10</td>
<td>Lost hrs % to available hrs.</td>
<td>13.85</td>
<td>14.56</td>
<td>15.68</td>
<td>15.30</td>
<td>15.63</td>
</tr>
<tr>
<td>11</td>
<td>Po1 % cane</td>
<td>13.58</td>
<td>13.42</td>
<td>13.90</td>
<td>13.36</td>
<td>13.45</td>
</tr>
<tr>
<td>12</td>
<td>Share of state in countries sugar production (%)</td>
<td>26.98</td>
<td>32.16</td>
<td>34.41</td>
<td>31.50</td>
<td>37.61</td>
</tr>
</tbody>
</table>

Source: Technical performance of V.S.I. year 2009-10

It is observed from the table No. 1.2 that during last five years number of sugar factories were increased from 187 to 199. but number of sugar factories in operation remained in the range of 142 to 174. There was a large variation in states. Sugar production with minimum of 45.79 lakh tonnes (2008-09) and maximum of 91.00 lakh tonnes (2006-07). The main factor affecting the sugar production is availability of sugarcane for crushing. The fluctuations in sugarcane production mainly depend on pattern of rainfall, incidence of disease and pests on crop, availability of quality seed material, irrigation facilities, availability of fertilizers, Governments policy on sugarcane pricing, ratoon management practices etc. The Cane crushed by state varied from 400.27 lakh tonnes to 798.83 lakh tonnes. States average sugar recovery remained around 11.54 % except during 2007-08 season achieving average sugar recovery of 11.94 %.

1.1.7 Sugar Price:

Sugar prices have always been a bone of contention between the farmers, sugar factories and the consumers, with the Government as the referee. India's sugar cycle is well known. There years of surplus sugarcane and sugar production is normally followed by two years of deficit production. It is overlooked that the employees of the sugar factories and the sugarcane farmers are also consumers. The sugar factories are not get reasonable, return on their produce, they will neither be able to continue operation nor be able to pay remunerative cane price to farmers. In India cost of sugar production is higher and the sugar prices are lower. In other sugar producing countries such as Brazil and Thailand sugar prices are higher than India.
The sugar prices are not conducive to payment of remunerative, sugarcane price. This has also been recommended in the report of the Group of Experts on sugar headed by Dr. Y. S. Thorat.  

1.1.8 Sugar cane Price  

The Government introduced the 'Fair and Remunerative price' (FRP) for sugarcane from this season. As the FRP provides "reasonable margins for the growers of sugarcane on account of risks and profits". The sugarcane farmers will be assured reasonable returns and sugarcane growers interest in sugarcane cultivation is sustained. A new clause 3B has been incorporated in the sugarcane. Control order that if any authority or state Government fixes any price above the "fair and remunerative price" fixed by the central Government, Such authority or state Government shall pay the differential amount, which it fixes above the "fair and remunerative, price" as fixed by the central Government.  

1.1.9 Production of Sugarcane in India.  

The FRP fixed by the central Government. Against the FRP of Rs. 129.84 per quintal linked to a basic recovery of 9.5 % subject to a premium of Rs. 1.37 per quintal for every 0.1 percentage point in recovery above that level, fixed by the central Government for 2009-10, Maharashtra sugar factories have on average paid first advance of Rs. 200-220 per quintal. The other states excepting Tamil Nadu have also declared state Advised Prices (SAPs) ranging between Rs. 170-197 per per quintal of sugarcane. In addition haryana and Uttar Pradesh have also declared bonus of Rs. 25 to 50 per quintal of sugarcane. In Tamil Nadu, the state Government has declared an SAP of Rs. 143.74 per quintal linked to 9.5 % recovery.  

The results of this high cane price being paid are already evident in South and Central India where sugarcane plantation is taking place in large scale. The Government has also introduced many policies for increasing the production and productivity of sugarcane.  

1.1.10 State wise production of Sugar cane in India. (In' 000 tonnes)  

Table No. 1.3 : State wise production of sugarcane in India. (Enclosed)  

Table No. 1.3 indicates that sugarcane productivity is higher in Uttar Pradesh and Maharashtra. About the year 2006-07 sugarcane production has increased, but the year in 2008-09 and 2009-10 sugar production has decreased.
Table No. 1.4 : State wise number of sugar factories in operation in India. (Enclosed)

Table No. 1.4 indicates that during 1999-2000 - 2007-08 total No. of sugar factories increased. In the year 2007-08 total 516 sugar factories were installed in India out of which 249 factories are working in cooperative sector. In Maharashtra in the year 2007-08. 135 sugar factories were working in cooperative sector but the total number of co-operative sugar factories has decreased in the year 2008-09 up to 110.

1.1.11 Sugar industry of Maharashtra

There are four natural regions/ zones in the state of Maharashtra viz, South Maharashtra, Central Maharashtra, North-Maharashtra and west coast maharashtra (Konkan). Cropping pattern and cultivation practices are naturally different in each of these regions and sugarcane crop is no exception. Cane cultivation practices, sugarcane yield and pol % cane varies from zone to zone. Sugar factories have been established in three zones viz 1) South Maharashtra 2) Central Maharashtra and 3) North-East Maharashtra. The names of districts with number of installed sugar factories in three zones are depicted in Table No. 1.5.

Table No. : 1.5

District wise number of installed sugar factories, in Maharashtra year 2009-10.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Zones/Districts</th>
<th>Co-operative</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1) South Maharashtra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Kolhapur</td>
<td>18</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Sangli</td>
<td>15</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>3.</td>
<td>Satara</td>
<td>9</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>42</strong></td>
<td><strong>4</strong></td>
<td><strong>46</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Central Maharashtra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pune</td>
<td>12</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>Solapur</td>
<td>15</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>Ahmednagar</td>
<td>17</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>Nasik</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>11</strong></td>
<td><strong>61</strong></td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Zones/Districts</td>
<td>Number of factories</td>
<td>Co-operative</td>
<td>Private</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>---------------------</td>
<td>---------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III) North-East Maharashtra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A) Khandesh</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Dhule</td>
<td></td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Nandurbar</td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Jalgaon</td>
<td></td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total (A)</strong></td>
<td></td>
<td><strong>13</strong></td>
<td><strong>1</strong></td>
</tr>
<tr>
<td>(B) Marathwada</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Aurangabad</td>
<td></td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Jalna</td>
<td></td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>Beed</td>
<td></td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Parbhani</td>
<td></td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Hingoli</td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>Nanded</td>
<td></td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>17</td>
<td>Osmanabad</td>
<td></td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>Latur</td>
<td></td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total (B)</strong></td>
<td></td>
<td><strong>44</strong></td>
<td><strong>14</strong></td>
</tr>
<tr>
<td>(C) Vidarbha</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Buldhana</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Yeotmal</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>Akola</td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>22</td>
<td>Washim</td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>23</td>
<td>Amaravati</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>Wardha</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>25</td>
<td>Nagpur</td>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>Bhandara</td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Total C</strong></td>
<td></td>
<td><strong>15</strong></td>
<td><strong>5</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total (A) + (B) + (C)</strong></td>
<td></td>
<td><strong>72</strong></td>
<td><strong>20</strong></td>
</tr>
<tr>
<td></td>
<td><strong>State Total</strong></td>
<td></td>
<td><strong>164</strong></td>
<td><strong>35</strong></td>
</tr>
</tbody>
</table>

Table No. : 1.6
Sugar Industry in Maharashtra

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Running Factories No.</td>
<td>137</td>
<td>102</td>
<td>142</td>
<td>163</td>
<td>172</td>
<td>147</td>
</tr>
<tr>
<td>2</td>
<td>Sugar Produced (In 000 tonnes)</td>
<td>3175</td>
<td>2217</td>
<td>5197</td>
<td>9100</td>
<td>9075</td>
<td>4578</td>
</tr>
<tr>
<td>3</td>
<td>Cane Crushed (In 000 tonnes)</td>
<td>29077</td>
<td>19456</td>
<td>44578</td>
<td>79884</td>
<td>76144</td>
<td>40023</td>
</tr>
<tr>
<td>4</td>
<td>Sugar recovery percentage</td>
<td>10.92</td>
<td>11.39</td>
<td>11.68</td>
<td>11.39</td>
<td>11.92</td>
<td>11.44</td>
</tr>
<tr>
<td>5</td>
<td>Yield of Sugar cane (Tonnes per Hectare)</td>
<td>57.9</td>
<td>63.2</td>
<td>77.6</td>
<td>74.9</td>
<td>80.9</td>
<td>79.0</td>
</tr>
</tbody>
</table>

Source : Cooperative sugar September 2010, Sugar India 2010.

Table No. 1.6 Indicates that a number of running factories, sugar production cane crushed, average recovery and yield of sugarcane of sugar industry in Maharashtra. In comparison with 2003-04 to 2007-08 running factories are increased from 137 to 172 but in 2008-09 sugar factories are decreased from 172 to 147. Cane crushed are cyclical. In comparison with 2003-04 to 2007-08 Sugar production are increased from 31.75 lakh M. T. to 90.75 lakh M.T. but in the season 2008-09 sugar production are decreased from 90.75 to 45.78 lakh M.T. in the year. In 2003-04 to 2007-08 sugar recovery is increased from 10.92 to 11.92.

Table No. : 1.7
Seasonal Statistics of sugar factories in Maharashtra seasons : from 2003-04 to 2009-10

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No. of sugar factories in operation</td>
<td>136</td>
<td>102</td>
<td>142</td>
<td>163</td>
<td>174</td>
<td>147</td>
<td>142</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>2</td>
<td>Sugarcane crushed (LAKH MT)</td>
<td>290.39</td>
<td>194.58</td>
<td>445.71</td>
<td>798.83</td>
<td>762.27</td>
<td>400.27</td>
<td>613.90</td>
</tr>
<tr>
<td>3</td>
<td>Sugar Production LAKH MT</td>
<td>31.71</td>
<td>22.17</td>
<td>51.97</td>
<td>91.00</td>
<td>90.75</td>
<td>45.79</td>
<td>70.67</td>
</tr>
<tr>
<td>4</td>
<td>Recovery % Cane</td>
<td>10.95</td>
<td>11.42</td>
<td>11.68</td>
<td>11.39</td>
<td>11.94</td>
<td>11.46</td>
<td>11.54</td>
</tr>
<tr>
<td>5</td>
<td>Pol % Cane</td>
<td>12.88</td>
<td>13.30</td>
<td>13.58</td>
<td>13.42</td>
<td>13.90</td>
<td>13.36</td>
<td>13.45</td>
</tr>
<tr>
<td>6</td>
<td>Fibre % Cane</td>
<td>14.00</td>
<td>13.75</td>
<td>13.80</td>
<td>13.95</td>
<td>13.89</td>
<td>13.58</td>
<td>13.61</td>
</tr>
<tr>
<td>7</td>
<td>Bagasse % Cane</td>
<td>29.68</td>
<td>28.99</td>
<td>29.29</td>
<td>29.74</td>
<td>29.58</td>
<td>28.89</td>
<td>28.95</td>
</tr>
<tr>
<td>8</td>
<td>Molasses % Cane</td>
<td>3.97</td>
<td>3.87</td>
<td>3.97</td>
<td>4.17</td>
<td>4.05</td>
<td>3.96</td>
<td>3.96</td>
</tr>
<tr>
<td>9</td>
<td>Sugar Lost % Cane</td>
<td>1.95</td>
<td>1.90</td>
<td>1.93</td>
<td>2.05</td>
<td>1.99</td>
<td>1.92</td>
<td>1.93</td>
</tr>
</tbody>
</table>


Table No. 7 indicates that a number of running factories, sugar production, Cane Crushed, average recovery, pol percentage, fibre percentage, bagasse percentage, molasses percentage sugar lost percentage of sugar factories in Maharashtra.

In comparison with 2003-04 to 2007-08 sugar factories are increased from 134 to 174 but in 2008-09 and 2009-10 sugar factories are decreased from 174 to 142. Sugarcane crushed in the year 2003-04 to 2007-08 are increased but decreased in 2008-09. In comparison to 2003-04 to 2007-08, Sugar production are increased from 31.71 Lakh M. T. to 90.75 Lakh M.T. but in the season 2008-09 sugar production are decreased from 90.75 Lakh M.T. to 45.79 Lakh M.T. In 2003-04 to 2007-08 are increased but decreased in 2008-09. In comparison to 2003-04 to 2007-08. Sugar production are increased from 31.71 Lakh M.T. to 90.75 Lakh M.T. but in the season 2008-09 sugar production are decreased from 90.75 Lakh M.T. but in the season 2008-09 sugar production are decreased from 90.75 lakh M. T. to 45.79 lakh M. T. In 2003-04 to 2007-2008 sugar recovery is increased from 10.95 to 11.9 but in the season 2008-09 and 2009-10 sugar recovery is decreased. In 2008-09 sugar recovery is 11.46 and in 2009-10 sugar recovery is 11.54 average recovery for this period is 11.48.

Higher sugar recovery percentage is found in Maharashtra as compared to that in other states.
1.1.12 Sugar Co-Operatives In Kolhapur District

The Kolhapur district of Maharashtra lies between 15° 43' and 17° 10' north latitude and 73° 40 and 74° 42 East longitude in the krishna, Panchaganga basin. It is bound on the north by Satara and Sangli Districts, on west by Ratnagiri District and on the east and south by Belgaum District of Karanataka state. The main rivers of the district are Krishna, Warana, Panchaganaga, Doodhganga, Kumbhi-kasari, hiranyakeshi which are helpful for irrigation and sugar cane production. This area lies under the tropical belt and its hot climate and humid atmosphere are favourable for the growth of sugarcane.¹

Kolhapur is the birthplace of land highness Chhatrapati Rajashri Shahu Mharaja and many socio-economic reformers. Chhatrapati's dream of agro industrial commonwealth has been brought in to reality by the great cooperation like Tatyasaheb Mohite, Bhai Madhavrao Bagal, Padmbhushan Vasantdada Patil, Tatyasaheb Kore, Deshbhakt Padmashri Dr. Ratnappa Kumnhar, K. B. Awade, Sarre Patil, Sahakarratna. Shamraoji Yadravkar, D.C. Narke, V.T. Patil, Dadasaheb Patil - Kaulavkar (Bhogavati) etc.

The history of Kolhapur district is as years old. In the year 1900 Rajarshri Chhatrapati Shahu Maharaj thought to construct a dam, so that as sured water supply for the irrigation purpose. He constructed a dam across river Bhyogavati, the period from 1908-1918, Which is known as "Radhanagari Dam".⁷

Now the district has 18 co-operative and 2 private sugar factories with total 71,200 TCD. The economical Social and Educational development of the region has become possible because of the sugar co-operative movement. Sugar industry area is lot of employment in this region.⁶
2) RESEARCH DESIGN

1.2.1 Introduction:-

The researcher has selected to study the cost of conversion and technical efficiencies of sugar factories in Kolhapur district. Sugar Industry is very important industry in Kolhapur district. The researcher has selected six sample co-operative sugar factories out of eighteen co-operative sugar factories for analysis and it is 33.33 percent of the population. According to close study of the working of co-operative sugar factories, Specific objectives and Hypotheses has set by the researcher. For analysing the cost of conversion and Technical efficiencies of cooperative sugar factories in Kolhapur district 7 crushing seasons from 2003-04 to 2009-10 have been considered. Primary and secondary methods are used for data collection for this study.

1.2.2 Statement Of The Problem

Elements of the cost and Technical Parameter are the most important factors in reducing the production cost. The crushing capacity utilization is the most important factor in reducing the production cost. Optimum crushing capacity utilization results in reducing the use of oil, lubricants and process chemicals like lime, sulphur phosphoric acid etc. Further with uniform and continuous operation the higher capacity utilization can be achieved which ultimately results in reducing sugar losses, consumption of bagasse and steam. Under utilization of capacity results in wastage of capital and implies avoidable reduction in production. On the other hand production cost also increases and profitability reduces of the concerned industry because of underutilization at the capacity.

The efficient working of any sugar factory is related to the supply of cane. Sugarcane price is very important factor for cane farmers. The co-operative sugar industry having the objective of welfare of the cane farmers. Sugar cane is the key factor for sugar industry But the cultivation of sugarcane in India mainly depends on rainfall. The cane price is decided directly varies on sugar price. Some times the factory has to crush a larger quantity of sugar cane and some time sugar factory has faced the problem of "stoppage". The problem of under utilization and over utilization both effected on the cost of production and sugar price. Cooperative sugar factories are established by the cane farmers. The capital is collected from the farmers for their economical, educational, social development. The present study is particularly designed to find out the cost of conversion of cooperative sugar factories in Kolhapur District with special reference to WARANA, DUTTA JAWAHAR, KUMBHI, BAVADA AND SHARAD, by the way of using primary and secondary data.
1.2.3 Objectives Of The Study

The specific objectives of the present study are

1) To study the fixation of sugarcane prices.
2) To study the reasons of high conversion cost.
3) To study the technical efficiencies of the sugar factory.
4) To find out the reasons of "Stoppage"
5) To study the effects on cost of sugar production of under utilization of the capacity.
6) To suggest different measures for solving problems by the way of detail study of cost of conversion.

1.2.4 Hypotheses:

1) Salary and wages of workers are more as compare to other expenses.
2) Cost of conversion of sugar factories varies due to efficiency and size of sugar factories.
3) High TCD sugar factories are more consistent than Low TCD sugar factories.
4) Maximum capacity utilization reduces the cost of conversion.
5) Low TCD sugar factories are more efficient than high TCD sugar factories.
6) Maximum average of reduced overall extraction (R.O.E.) reduce the sugar lost percentage.

1.2.5 Conceptual Framework

The aim and objective of this study is to create awareness to reduce the cash conversion cost. Researcher has considered in two groups. The factories which have crushing capacity within 2000 to 4000 M.tonne and those who are having in between 5000 to 7500 M.tonne. This study is related to the cost of conversion and technical efficiencies of sugar factories in Kolhapur District. This study is related to the high recovery zone and higher cost of conversion. Cost of conversion and technical efficiencies affects on the cost of production of sugar.

Total cost is segregated into each conversion cost and fixed cost to arrive at total cost of production. The cash conversion cost includes the elements of cost like power, chemicals, & consumables, salary & wages, packing materials, repairs & maintenance and overheads. The fixed cost includes interest & depreciation. Sugar recovery duration of crushing, and capacity utilization of sugar factories are important parameters for determining conversion cost. The percentage of components of cost of production of Maharashtra for the year 2003-04 to 2009-10 is mentioned in graphical
form and the comparative figure of seven years are given in the table No.4.9. This table indicated the percentage of conversion cost to total cost of production. Sampling factories are taken into account and compared to the cost of production.

Another part of this study is Technical efficiencies. Features of technical performance are as follows.

1) *Duration of season*:

The duration of season largely depends on availability of cane. For economic working of any factory, the duration of the crushing season should be around 160 days.\(^5\)

2) *Crushing capacity and its utilization*:

Cane crushing capacity of sugar factories in Maharashtra varies from 500 TCD to 7500 TCD. The capacity utilization is the most important factor in reducing the production cost. It reduces the use of oil, lubricants and process chemicals like lime, sulphur, phosphoric acid etc. Further with uniform and continuous operation, the higher capacity utilization can be achieved which ultimately reduces sugar losses, consumption of bagasse and steam.

From 1986 for the calculation of capacity utilization the following formula has been used. This is modern method of calculation of capacity utilization.

\[
\text{Capacity Utilization} \% = \frac{\text{Cane crushed during the season (tonne)}}{\text{Available days} \times \text{Daily Installed (TCD)}} \times 100
\]

\[
= \frac{\text{Available hours}}{22}
\]

\[
= \frac{\text{Actual Crushing hours + lost hours}}{22}
\]

3) *Lost hours %*:

The continuous crushing of cane throughout crushing period is one of the important factors for any sugar factory to achieve optimum technical performance. In sugar factory, stoppages mainly occur due to the following reasons.

1. Cane shortage
2. Mechanical and electrical defects.
3. General cleaning.
4. Miscellaneous such as untimely rain, strikes etc.
With proper planning and timely action and adopting preventive maintenance, level of stoppages can be kept at minimum. The preventive maintenance of machinery and equipment during off season can reduce the mechanical and electrical stoppages. An efficient cane harvesting and its transportation with minimum time for crushing can minimize down time due to cane storage.

4) Cane quality:

The quality of Cane is of paramount importance in getting higher sugar recovery. It also affects the productivity and efficiency of a sugar factory. The quality of cane can be understood by the value of (1) pol % cane, (2) Fiber % cane (3) Brix % primary juice and (4) primary juice purity.

5) Sugar recovery:

Sugar recovery is the most vital indicator of any sugar factory. The sugar recovery mainly depends on the quality of cane that also includes types of cane variety its maturity at the time of harvest and total losses during processing.

6) Milling performance:

Extraction of maximum sugar from cane into the mixed juice with minimum loss in bagasse is the ultimate aim of milling section. The reduced Mill Extraction (R.M.E) indicates the performance of milling section of any factory. The characteristics like added water % fiber, pol % bagasse also highlights the milling performance. The performance of mill depends upon fiber content in cane. Higher fiber content increases difficulties in getting a good mill extraction. Therefore RME is more useful in comparing the performance of milling tandem at different intervals of different milling tandems. RME indicates the mill extraction of factory that would be obtained if fiber content were 12.5 % on cane.

7) Boiling house efficiency:

The Boiling house performance of any sugar factory can generally be judged from boiling house recovery and reduced boiling house recovery (RBHR). The boiling house recovery of sugar factory indicates % extraction of sugar that was available in mixed juice. Performance of boiling house is dependent on purity of mixed juice Hence, RBHR is more useful (Which is calculated for mixed juice purity equivalent to 85%) for comparing the performance of the boiling house of different sugar factories having different mixed juice purity.
8) **Final molasses purity and molasses % cane:**

The sugar loss on final molasses is the highest loss amongst all the losses. The extent of this loss depends on the purity and the quantity of final molasses produced. The purity of molasses depends largely on the efficiency of clarification of juice working of pan, crystalliser and centrifugation station. The purity of final molasses also depends on the exhaustibility of the molasses which ultimately depends on juice quality, the percentage of reducing sugar and ash content present in it. The final molasses purity should be as low as possible. Usually the final molasses purity below 30 is considered as satisfactory.

9) **Total sugar losses:**

The achievement of minimum total sugar losses (below 2%) by any sugar factory is one of the important norms for assessment of technical performance. Sugar loss is dependent on fiber % cane, milling, boiling house performance, efficiency of plant machinery and skilled manpower.

10) **Consumption of chemicals:**

In consumption of chemicals two major chemicals, viz lime and sulphar used in sugar factories. Under the category of store consumption, combined lubricant consumption is oil and grease. The lime is used in sugar factory for juice clarification.

Considering above all points researcher has measured cost of conversion and technical efficiencies of the sample factories for the period under study.

1.2.6 **Methodology**

**A. The Universe and sample:**

This is the study of cost of conversion and technical efficiencies of sugar factories in Kolhapur District. While selecting the factories for study researcher has considered crushing capacity in two groups. The factories which have crushing capacity within 2000 to 4000 M.Tonne and those who are having in between 5000 to 7500 M.Tonne.

After classifying the sample factories according to their average of total sugar losses researcher has considered the crushing capacity wise classification of the co-operative sugar factories. The researcher has considered total sugar losses from the basis of parameters of technical efficiencies and calculated the cost of conversion from the basis of elements of cost. So the sample consists of six factories each from high sugar losses, medium sugar losses and low sugar losses. About high conversion cost medium conversion cost and low conversion cost.
These six co-operative sugar factories are as under.

A) From small factories which have crushing capacity within 2000 to 4000 M. tonne.
   1) Shree Chhatrapati Rajaram S.S.K Ltd.
      Kasaba Bavada, Tal - Karvir
      Crushing capacity (M.T) - 2200
   2) Kumbhi-Kasari S.S.K Ltd. Kuditre
      Tal - Karvir
      Crushing capacity (M.T) - 3000
   3) Sharad sahakari sakhar karkhana Ltd.
      Narande, Tal - Hatkanangle
      Crushing Capacity (M.T) - 2500

B) From big sugar factories which have crushing capacity within 5000 to 7500 M. Tone.
   1) Shree Datta Shetkari SSK Ltd, Shirol
      Tal - Shirol
      Crushing capacity (M.T) - 7000
   2) Jawahar SSK Ltd., Hupari
      Tal - Hatkanangle
      Crushing capacity (M.T) - 7500
   3) Shri Tatyasaheb kore Warana SSK Ltd.,
      Warananagar Tal - Panhala
      Crushing capacity (M.T) - 7500

B. Period Covered:
For analyzing the cost of conversion:
   Technical efficiencies of co-operative sugar factories in Kolhapur district
   seven crushing seasons from 2003-04 to 2009-10 have been considered.

C. Data Sources:
This research study is mainly based on the secondary data collected
principally from the Annual Reports and R.T.(8) C charts, Accounting books of the
factories for the period under study. Additional information required was collected
from the official records of the factories and from the reports published by Vasantdada
sugar Institute, Pune, sakar Diary book from Anekantr prakashan, Jaysingpur A
monthly publication "co-operative sugar" published by National Federation of co-
operative sugar Factories Ltd. Delhi.

For this research study primary data is also used. Personal discussion were
held with the key persons like managing Directors, Chief Accountant, Chief Engineer,
Chief Chemist, Agricultural officer, Labor Officer, Chairman and Vice-Chairman and General manager mukadam of the cane cutter's of the factories. These discussions helped in understanding for various problems and cleared the doubtful points.

D. Tools Of Analysis:

The researcher has used following tools of analysis to examine the problem of cost of conversion and technical efficiencies of co-operative sugar factories in Kolhapur District.

1) For analysing trends in the cost conversion the statistical methods like average, co-relation, mean, standard Deviation, Coefficient of variances $x^2$ test and $z$ test etc. are used.

E. Scope And Limitation Of The Study:

This study is very important to the sugar factories for maintain the cost of conversion. The proposed study is covered to highlight overall problems of cost and productivity of selected co-operative sugar factories in Kolhapur district cane price, sugar price, elements of cost of conversion cost of production, technical efficiencies etc. are the areas which has studied by the researcher. The study uses the formula for determined the capacity utilization, lost hours %, sugar recovery etc. This study deals the problems of sugar factories and cane growers. Sugar prices have always been a bone of contention between the farmers sugar factories and the consumers with the Government as the Referee. It is also turned on the fact that unless the sugar factories get reasonable return on their produce, they will neither be able to continue operation nor be able to pay remunerative cane price to farmers, consequently the sugar prices are not conducive to payment of remunerative sugar cane price. This study deals all problems of sugar Industry.

1) It is not possible to study all 18 co-operative sugar factories. So six co-operative sugar factories have been selected for this research.

2) This study is related to Kolhapur District only.

3) The private sugar factory is not considered for this research.

4) The reports of the factories during the period 2003 to 2010 be considered only.

1.2.7 Chapter Scheme:

The present study has divided into seven chapters.

Chapter No I:

An Overview Of Sugar Factory And Research Design

A) Brief history of sugar factory

B) Research Design.
This chapter deals with two parts, 'A' and 'B'.
'A' parts relates to the study of factories in India, Maharashtra, and Kolhapur District. The second part 'B' relates with research methodology.

Chapter No - II:
Introductory Aspects Of Cost Of Conversion

This chapter is concerned with cane cost, cash conversion cost, elements of cash conversion cost, fixed cost, and conversion cost, maintenance of sugar factories, Techniques of Cost Control etc. Historical background of sample sugar factories in Kolhapur district and their position, location are also considered.

Chapter No III
Introductory Aspects Of Technical Efficiencies

This chapter is concerned with Technical parameter for eg. Duration of season, Crushing capacity and its utilization, Lost house %, cane quality pol % cane, Fiber % cane, Brix of primary juice, purity, sugar recovery, milling performance, Boiling house efficiency, RBHR, Molasses purity etc.

Chapter No IV
Cost Of Production Of Sugar Factory

This chapter considers an analysis of cost of sample sugar factory, for e.g. Crushing capacity, cane pricing policy, by product cost, cane cost, Depreciation, Interest etc.

Chapter No V
Conversion Cost And Cost Analysis Of Sugar Factories.

This chapter deals with the relationship between conversion cost and productivity of sugar factories.

Chapter No VI
Technical Efficiency And Productivity Analysis Of Sugar Factories.

This chapter deals with the relationship between Technical efficiency and productivity of sugar factories.

Chapter No VII
Conclusion And Suggestions

1.2.8 Review Of Literature

Review of Literature of some previous studies related to the cooperative sugar factories is as follows
1) **Dr. JUGALE V.B. –**

Studied about “Policy procedure and operations of sugar cane pricing.” He concludes that shortage of sugarcane is a grave problem to sugar factories, because it is only raw material required to manufacture sugar. The prices of sugar cane cannot be determined by supply and demand forces as it happens in manufacturing commodities. The conversion cost of sugar production varies due to number of reasons. He concludes that professionalization of sugarcane cultivation initiated by the sugar factories should spread among the farmers. Night harvesting gangs may be created to harvest sugarcane even at night so that there will be a regularity in the supply of fresh sugarcane.

2) **CHAVAN K.R.-**

Studied about sugarcane pricing in KARNTAKA. He concludes that the prices of sugarcane should be linked with cost of cultivation. Further the price of sugarcane should be paid on quality rather than weight basis. There are only 30 sugar factories in the state – Many of them have outdated technology. Therefore there is urgent necessity of establishment of new sugar factories or expansion of existing ones. This will help in avoiding the diversion of sugarcane to other state also for other use.

Further activities such as maximum utilization of by – products should be applied in the process. The duration of crushing should be raised. In Karnataka the prices paid by these factories are lower resulting to low remuneration for the cane growing farmers. There fore steps should be taken to adopt ex – field payment of cane price by all factories. Efforts should be made to improve production by the recovery and to minimize the cost of sugar production by the factories for payment of additional cane price.

3) **Dr. Kakade V.B. –**

Studied about “Capacity Utilisation of co-operative sugar factories in Maharashtra.” He concludes that the utilization of the installed capacity is higher in the co – operative sectors compared to the rest of the sectors. The high recovery zone has Witnessed better utilization of capacity followed by medium recovery zone and low recovery zone. The fluctuations in capacity utilization are minimum for high recovery zone followed by medium and low recovery zone.

The contributions to farmers are affected both by the total revenue and total cost of the factory. If the factory succeeds in generation internal surplus for its modernization, the burden of interest could be controlled. The austerity measures adopted at all level will help to strengthen the financial viability of the unit.
4) Mahajan Lalita D –

Studied about “Sugarcane pricing in India process and problems.”

She concludes that there is no definite relationship between cost of cane cultivation and price of sugarcane. Year after year the cost of cane cultivation has been increasing but the price of sugar cane has not increased correspondingly.

The price of sugarcane should be based on the quality of sugarcane. A common sugarcane price to all cane cultivators based on weight irrespective of the undivided cane recovery which in not a very sound policy.

5) Nanaware H.S. –

Studied about “A comparative Study of sugarcane pricing in private and co-operative sugar factories.” He concludes that the price of sugarcane should be based on the quality of sugarcane. A common sugarcane price to all sugar cane cultivators based on weight irrespective of the undivided cane recovery which is not a sound policy. There is farther need have an intensive research of quantifying various implicit inputs in terms of cost of cultivation. Which will be determined as an economic interests of the farmer community.

It Maharashtra the pricing policy of sugarcane in cooperative sector is nothing but distribution of surplus over and above all expenses to cane suppliers in proportion to sugar cane supplied by them. Whereas private sugar factory pay the near about the similar rate of neighboring co – operative sugar factory pays.

6) Dr. N. R. Patil –

Studied about “comparative study of co – operative sugar factories in Karanataka and Maharashtra.” He concludes that co – operatives are the best and suitable form of organization for the agricultural processing industry in India. The democratic Principles and decentralization of power introduced in these organisations may hope to lead the people of these areas to understand the benefits of co – operative venture.

7) Dr. A. M. Gurav

He studied about "Cost and Productivity of Co-operative sugar factories in Kolhapur District." He concludes that capacity utilization is most important factor. High capacity utilization reduces the cost of conversion. He studied the cost of conversion and all factors about cost of production. He compared relation between cost and productivity.
References:


3) Sugar India - (2011), P.P. 78, 64, 72, 80.

4) Technical performance of sugar factories in Maharashtra (2009-10) P.P. (M-2), M-3, (M-4)


6) Nivas Chougule - Expectation of sugar industry, Sat 1 May 2010, P.P. 7, Daily "Sakal"

7) Historical Background of Chh. Rajaram Sahakari Sakhar Karkhana Ltd. Kasaba Bawada. from Brief note.

Others:--


3) V. B. Kakade - "Technical Presentation of Industry in Maharashtra". "Shivarth" 19th yearly Adhivation.

4) Sakhar Diary - 2009.

5) Nivas Chougale - "In Maharashtra Kolhapur section is second about Crushing Capacity." Daily Sakal, 6 May 2010, Page No. 4.


7) Khasdar Raju Shetti - Expectation of 'FRP' Daily Sakal, 29 April 2010, Page No. 07