CHAPTER II

REVIEW OF LITERATURE,

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2.1 Introduction

Review of literature is concerned to the study of previous research work in the field of chosen research problem. This is one of the most important components in the research process, which introduce the researcher to research gaps as well as to the research process. In order to get familiarity with the research process and to understand the research gaps in the chosen research problems about 100 research articles, 12 Ph. D thesis and 5 M. Phil dissertations were reviewed and the reviewed literature is presented under the following heads, viz., sugar industry in India and abroad, co-operative sugar sector in India, cost and operational analysis of sugar factories, financial analysis of sugar factories, human resources in sugar factories and in sugarcane fields, sugarcane and sugarcane cultivation.

2.1.1 Sugar Industry in India and Abroad

S. Pruthi¹ (1995) studied the history of sugar industry in India. The study focused on history of sugar, sugar making in ancient and medieval India, during British period and after independence till 1992. The consolidated chronological write up backed by secondary data, which was collected from the Government records and books. The study concluded with remarkable findings that the English trader brought sugarcane at Agra and Luknow to meet the growing sugar needs of the British Empire; the manufacturing of sugar was intensified by the
East India Company; dominance of small size units in the initial phase of the growth of the sugar industry and the existence of major regional difference in the size of sugar mills in India; and after the independence the growth of sugar industry was adversely affected by a variety of factors such as control, cane price, quota, duty and sugar politics.

D.K Grover and S.S Grewal (1991) examined the problems of sugar industry in India with special reference to four selected sugar mills and 72 sugarcane growers during the period 1960-61 to 1989-90. The main objectives were to study cane suppliers, the related changes in production and price, and to identify the various price and non-price factors responsible for fluctuations. The techniques used for analysis were Growth Rate Analysis with help of simple statistical tools such as ratios and averages, the compound growth rates for the important parameters were estimated by fitting the following equation $Y_t = Y_0 t^b$ where $Y_t$ is the value of the dependent variable in current year, $T$ is trend variables, $Y_0$ and $b$ are constants, ‘t’ statistics was used to estimate significance of the growth and Regression Analysis to identify the various price and non-price factors responsible for fluctuations in the area under sugarcane. The Nerolovian adjustment lag model was used to obtain the response function as $A_t = x_0$. The findings of the study were the major sugar growing states showed the similarities in their growth; the compound growth rates showed increasing trend; and the coefficient of variable showed that all the variables were subject to a wide fluctuations.
Ram Vichar Sinha\textsuperscript{3} (1998) studied the agricultural economics of sugarcane, problems of cane marketing and transport, technical performance, utilization of By-products, labour relations and policies on sugar economy. Simple tabulation method is used to analyse the data for the period from 1979-80 to 1983-84. The study revealed that the sugarcane development activities were not efficient, effective plant modernization and effective infrastructure developments were not under taken, utilization of By-products yet to introduce in the sugar mills and the work force yet to get proper wage.

D.K. Pant\textsuperscript{4} et al (2005) examined various process and economics of refined sugar production followed by the Indian sugar industry and also made an attempt to explain the efficient manner By-products utilization. The concluding remark was if the By-products of the industry were utilized properly the sugar production cost could be reduced.

C. Ramaswamy\textsuperscript{5} et al (2006), the researchers used secondary data to analyse the effective utilization of By-products. Indian sugar industry produces By-products in the forms of Bagasse (45 Million MT), Press mud (5 Million MT) and Molasses (7.5 Million MT) per year. There were 285 distilleries produced 2.7 billion litters of ethanol by utilizing 7.5 million MT of molasses during 2005-06. The authors gave a concluding remark that the large quantity production and higher amount of sugar export on regular basis may provide incidental added value to the sugar sector and enable setting up of large sugar complexes that can produce clean energy in the form of ethanol and power besides sugar.
M. Sivaraman⁶ (2005), the author made an attempt to describe the various sections in the Act and Amendments of Intellectual Property right effecting Indian agriculture. The Agriculture related issues in WTO Treaty; Indian Patent Law and Agriculture; Biological Diversity Act and Agriculture; Plant Varieties Protection Act and the provisions of these Acts affecting traditional knowledge of Indian farmers have been discussed. The analyses concluded with some suggestions to modify the said Acts.

P.J. Monohar Rao⁷ (2005) has compared the performance of seven countries viz., Brazil, India, Thailand, Mexico, Australia, South Africa and Argentina during the year 2002-04. The study revealed that India was the world’s largest producer of all the sweetening agents (sugar, Gur, Khandsari) and has the largest number of sugar mills.

Dietmar Achilles⁸ (2005) critically evaluated the German position on EU reform proposal for sugar market regime. The German government generally supports the EU reform proposal for the EU sugar market regime but warns that the proposed quota reduction might not be sufficient to meet the reduction requirement resulting from the on going WTO negotiations and the WTO panel decisions on EU sugar exports. Farmers and the industry requested full compensation for income losses resulting from price and quota reductions. The author studied the cause and effect of EU reform proposal on sugar producing countries.
2.1.2 Co-operative Sugar Sector in India

S.S. Sirohi\(^9\) (2005) studied the status of co-operative sugar industry in India - past, present and future. This research article describes the status of co-operative sugar industry in India during 1936 to 1950, 1951 to 1985 and 1986 to 2005. In these periods sugar co-operatives underwent major changes. The author has given sixteen recommendations for improving the health of sugar industry.

V.M. Hilage\(^{10}\) (1989) studied the growth of sugar industries in India in general and co-operative sugar sector in Maharashtra in particular. The main objective of the study was to take review of methods of performance analysis and determents of performance to evaluate the performance of two selected units situated in southern Maharashtra and to study the top management style and climate of the organization for the period 1976 to 1986. The study revealed that the Co-operative Act 1904 played a significant role till 1947 in sugar sector. But the co-operative sugar sector suffered from financial weaknesses, lack of professionalism, underdeveloped marketing system and the low production of sugar. It is a case study of two units; the stratified random sampling was used for selection of farmers and members from 50 villages from the study area. The opinions of the middle level management were obtained by personnel interview.

S.S. Chandrasekhar\(^{11}\) (2005) has compared the two phrases of corporate concept - 'Co-operative Society' and 'Corporate Society' phonetically proximate but genetically too far. An in-depth understanding of the two concepts
was discussed with the opinions of co-operative and corporate scholars. The author compared the concept with business ethics, traditions and present situation and concluded that the executives of both the societies had to think in the same direction for overall development of the society.

Ghanshyambhai H. Amin\textsuperscript{12} (2005) explored the progress and development of co-operative movement in Gujarat. It is a consolidated report of co-operative movement in Gujarat state right from 1889 to 2005. More stress was given on milk co-operatives with a special reference to ‘Amul’ followed by Bordoli sugar co-operative. There were 27 sugar co-operative mills in the state out of which 15 factories were in operation. The study revealed that co-operative movement in the state contributed tremendously under the able leadership and guidance of co-operative scholars.

Biradar Patil\textsuperscript{13} (1995) has examined the growth, problems of the co-operative sugar factories in Belgaum district of Karnataka State during 1985-88. The objectives of the study were to study the growth, problems, structure, working and socio-economic impact of co-operative sugar factories; role of sugar co-operatives in uplifting of small and marginal sugarcane growers; to compute the cost of sugarcane cultivation and net income of sugarcane growers. Both primary and secondary data were compiled; the primary data was gathered through structured questionnaire. The sugarcane growers were stratified into marginal (up to 5 acres of land), small (5 to 10 acres) and big (above 10 acres) farmers for the study. The study revealed that there was low yield of sugarcane in the region; instability in the sugarcane supply and price; high cost of production; delay in
payment of farmers’ bills; and observed under utilization of By-products (bagasses, molasses and press mud) within the region.

Paramjit Sharma (2005) investigated ‘why co-operatives are often coaxed for poor performance?’ The writer of the research article made an attempt to evaluate the fundamental misconceptions in the minds of the people throughout the world regarding co-operative sector. The author observed that in the era of corporate scandals, most co-operatives are practicing a high degree of ethics and exhibited less greed.

P. Sivaprakasham (2005) examined the need of professionalisation of management in co-operatives to meet the challenges and proposed the strategies. The author made an attempt to convince the co-operative managers about the present need of Human Resources Development (HRD) in co-operatives referring to the area of planning, executing, educating, training, motivating and ensuring adequate skilled manpower in development programmes both for the societies and for the co-operatives and concluded with a remark ‘professionalisation in co-operatives is the need of the hour’.

2.1.3 Cost and Operational Analysis of Sugar Factories

Vinay Kumar (2005), Managing Director of N.F.C.S.F. examined the sugar technology - prospects and challenges with reference to the technical area of the sugar industry and the efficiency norms applicable to the industry and concluded with a remark that the productivity can be improved by developing sugar complexes with the help of professional management.
Pitam Singh\textsuperscript{17} et al (2005) studied tuning of mill for optimum primary extraction. The optimum value of primary extraction can only be achieved by matching the values of the parameters, which can be matched by knowing their quantitative or qualitative effect on juice extraction. Preparatory Indexes (PI) and Fibre Loading (FL) are the governing factors. The Factorial Design Analysis (FDA) states that 16 sets of observations required to decide the quantitative effect of these parameters. The study revealed that one could tune the mill for its optimum primary extraction at site by adopting the procedure started in the FDA method.

Ramchari S. Nikam\textsuperscript{18} (1995) analysed the composition of various cost elements and their magnitude in total cost of sugar production, and also cost and productivity trend in co-operative sugar factories in Solhapur district of Maharashtra State for the period of 1987 to 1993. The study revealed that the rapid growth was observed in co-operative sugar industry. Post-independent period was dominated by co-operative sugar sector. The sector's total sugar production and average crushing capacity increased from 800 TCD to 5000 TCD; capacity utilization gone up from 94\% to 131\%; and average sugar recovery increased from 9\% to 12\% during the study period. The booms in the said industry fetch an attractive return to the cane growers. A notable suggestion is, over dependence on loan and deposits may hamper the sugar sector in future and cost consciousness is yet to be popularised among these mills. With the help of structured questionnaire primary data was computed. The secondary data was obtained form seven sugar mills in co-operative sector from Solhapur area comes under 'drought area', out of seven, only three expanded their capacity.
The duration of crushing ranges from 100 to 128 days and the average recovery rate was 10.68 percent.

A.K. Nanda\textsuperscript{19} (2005) made an attempt to analyse the energy consumption and water management at various stages of sugar processing and suggested certain techniques, which would reduce the energy consumption and promote better water management.

A. Krishna\textsuperscript{20} (2005) proposed the future sugarcane complex with an example of 2500 TCD mill. The study concluded with a notable remark that the distillery attached to a sugar mill will fetch five times more income than that of a sugar mill without distillery.

V.B. Kakade\textsuperscript{21} (1995) studied the capacity utilization of co-operative sugar factories in Maharashtra State. The research was based on published data during the period from 1981 to 1990. The main objectives were to find out the degree of capacity utilization, BEP and variation and the cause for change in capacity utilization. The study revealed that the capacity utilization depends upon the supply of sugarcane.

M.G. Jadhav\textsuperscript{22} (2005) made an attempt to analyse the sugar loss at various stages with the help of a parameter developed for this study known as 'Reduced Total Loss Ratio Concept'. The loss of sugar contents at all stages from harvesting to final sugar in bag is a serious economic problem in sugar industry.
The study revealed that the reduced total loss ratio gives clear picture of losses at various stages, which could be studied and could be controlled.

**A.S. Mahadik**\(^{23}\) (1991) analysed the economics of molasses based By-products of co-operative sugar factories in Kolhapur, Satara, Sangli and Solapur districts of Maharashtra State, during the period from 1975 to 1989. It was a micro level analysis. The main objectives were to analyse the cost, income and utilization of By-product and to examine employment generated by the selected units. The required data were gathered from the records of the factory, Excise Department and Government machinery. The study revealed that the bagasses and molasses constitute the main By-products of sugar industry and the utilization of the By-products affects the processing cost of the sugar. The study concluded with a suggestion that every sugar factory must utilize their By-products effectively to reduce the total cost of the sugar.

**Klaus Niepoth**\(^{24}\) (2005) examined the developments in falling film plate evaporator technology right from 1992 to 2004 in Germany. The said technology could be further improved to reduce the primary energy consumption, high process stability and high thermal efficiency.

**Sanjay Mohan Bhatnagar**\(^{25}\) (2005) summarised many research works done by various institutions on co-generation of electricity from the huge quantity of bagasses. The studies conducted by Tata Energy Research Institute (TERI), indicated that 5200 MW of power could be generated through the use of co-
generation in sugar factories in India. Hence, there was a need of modernization of Indian sugar industry.

Jahar Singh et al (2005) collected sugar samples from ten different sugar factories in India, which followed Double Sulphitation Process (DSP) and found the presence and formation of colour in cane sugar crystals influenced by both macro and micro environmental factors and the sugar colours were acidic in nature.

B.L. Mittal (2005) studied the evaporating crystalliser in sugar mills. The crystallization of sugar in a sugar mill was carried in three or four stages. The last stage is most important as the sugar lost in final molasses depends upon the efficiency of crystallization. The crystallization by cooling in air or in water has got its own limitations. To recover 100% sugar from final molasses was the main objective of the experiment. The researcher has designed an apparatus called the 'Continuous Evaporating Crystallisers' and says that the objective can be achieved if the process procedures are followed.

G.M. Jenekar and R.V. Gabadi (2005) studied on kinetics of crystallization of sugar, effect of manganese and cobalt salts. The study deals with the role of manganese and cobalt salts on the rate of crystallization of sugar, which plays an important role in the economics of sugar industry. Many methods and procedures have been developed to get enhanced the rate of crystallization, of these manganese and cobalt salt were found to have beneficial role for pan boiling in sugar factories.
S. Thangavely\textsuperscript{29} (2005) explained twenty methods of estimating the presence of iron in sugarcane juice, \textit{jaggery} and sugar. The analytical methods were collected from various sources right from 1970 to 2005. At the end, the author advised that the said methods might be tested and compared for their relative efficiency.

S. Thangvely\textsuperscript{30} (2005) has examined the various types of materials available for packing and wrapping of \textit{jaggery} right from jute bags to galvanized iron drums. This analytical research work revealed that the alkthene lined Hessian bags are recommended by most of the researchers for the storage of \textit{jaggery}.

Jasbir Singh\textsuperscript{31} (2005) examined the benefits of adopting co-generation system in sugar mills, trends of steam generation per MT cane and power consumption pattern in sugar factories. The study revealed that the appropriate standards to be adopted by the sugar mills as per their capacity so as to gain the highest benefits of energy consumption.

Raghavendra Kumar\textsuperscript{32} (2005) examined the role of Energy Service Companies (ESCOS) in saving energy and how it could be beneficial to the sugar Industry. The ESCOS at global levels and National levels have been discussed and concluded with a remark that the development of energy efficiency business in general and ESCOS business in particular has not yet taken place up to a desired level in our country for which collective action needs to be taken immediately.
2.1.4 Financial Analysis of Sugar Factories

G. Gaur\textsuperscript{33} (2005), ex-financial advisor of National Federation of Co-operative Sugar Factories made an attempt to explain the financial norms and classification of fixed and variable costs applicable to the co-operative sugar mills. In his concluding remark said that any improvement in productivity both in the field and factory would provide level playing ground to the Indian Sugar Industry to face the competition in future.

Basavraj S. Benni\textsuperscript{34} (2005) studied the physical and financial performance of twelve co-operative sugar factories during 2001-02 with the help of Ratio Analysis and Multivariate Econometric Technique Method. The study revealed that the physical and financial performance indicators influenced the total performance of sugar co-operative factories and concluded with a remark that in the total sugar production cost, cane conversion cost was greater than the cane cost.

Chandrakant Janardhana Joshi\textsuperscript{35} (1991) analysed the finances of sugar factories (From 1960 to 1987) in Kolhapur District of Maharashtra. The objectives were to measure the liquidity, solvency, efficiency, working capacity, profitability and socio-economic developments. The study revealed that the financial performance depends on internal and external factors; internal factors are factory maintenance, employee behaviour, liquidity, solvency and profitability. The external factors were social, economic and political. The study concluded with remarks that the units should enhance their equity capital; introduce cane development programme, man power planning and plant modernization.
Mahadev G. Powar\textsuperscript{36} (1997) analysed the raising and utilization of finance by co-operative sugar factories (From 1961 to 1993) of five co-operative sugar factories at the micro and the macro level. The objective was to interpret the data with the help of ratios - liquidity, solvency, efficiency and profitability. The findings of the research were, the use of chemical fertilizer made much harm to the soil; there was a need of innovation of modern technology and plant modernization; and there was a need of man power policy, accounting producers and inventory control.

Hanchinmani S.N.\textsuperscript{37} (1996) has done the financial analysis of co-operative sugar factories in Belgaum district of Karnataka with a sample size of one unit. The annual reports and manufacturing reports from 1990-1994 were used as secondary data. The main objectives were to assess the financial position of co-operative sugar factory under study and to evaluate the financial operations and performances with the help of financial ratios. The parameters used in the study were, Financial Structure = Capital Structure + Current Liabilities; Capital Structure = Total Owned Fund + Term Loan; and Assets Structure = Fixed Assets + Current Assets. The study revealed that there were disproportionate relationship between different financial variables and standards; the co-operative sugar factory had a week financial base, more dependent on bank loan; and the professional management yet to step in co-operative sugar factory.

Daxa Gohil\textsuperscript{38} (2005) examined the transaction cost vis-à-vis financial performance of sugar industry in India. The study was based on secondary data of the private sugar mills working in India during the period form 2000-01 to 2002-03 with a sample size of 44 private sector sugar mills. The main objectives
behind the study were to examine the role of transformation vis-à-vis transaction cost in economic and financial performance (was tested based on regression model) of the Indian private sugar industry; and to bring out the policy implication of transaction cost approach for future development of sugar industry. In order to examine the relationship across the financial variables the parameters used were: (i) Return on Total Assets (RTA-Y1) and Return on Total Sales (RTS-Y2). The author's concluding remark was that the financial variables related to transformation costs and transaction costs (in advertising, marketing and bad debts) and transaction costs based on sugar production were statistically highly significant. Hence, the transaction costs influencing the financial performance at greater extent.

Shivajirao N. Borhade\textsuperscript{39} (1991) studied the management of productivity in a co-operative sugar factory during the period 1981 to 1989 with the help of published data. The objectives were to measure productivity and to evaluate best approach of productivity. Time lost in percentage; labour lost in terms of revenues; machine efficiency in terms of per hour crushing; and the total productivity value of output, were the productivity parameters used in the study. The concluding remark was performance of the mill was moderate.

2.1.5 Human Resources in Sugar Factories and in Cane Fields

A.H. Dagde\textsuperscript{40} (2001) has proposed a new concept of right sizing of manpower in sugar industry and advocated that without restructuring, right sizing, down sizing or optimising Indian sugar industry may be private or co-operative sector would not survive. Right sizing of manpower does not mean reduction in manpower but
does mean right person at right place at right time; avoiding duplication of work force; and reduction in salary and wage bills. The study proposed a model based on the manpower requirement stated by the various authorities/institutions based on the crushing capacity of sugar factories.

Maduri L. Bandasoda\(^{41}\) (1998) examined the employee services in Rajarampur Patil Sahakari Sakhar Karkhana Ltd. Rajarampur, Sangli District of Maharashtra for the year 1997. The objectives of the study were to study personnel services, legal aid, vocational guidance, send-off ceremony, employee convenience, canteen and restaurant facilities, existence of co-operative stores, housing facilities, transport, drinking water facility, uniform, etc. The study revealed that less than fifty percent of the employees were observed to have availed basic facilities.

V.A. Patil\(^{42}\) (2002) analysed the problem of seasonal workers working in selected sugar factories during the period 1997 to 2001. The main objectives of the study were to assess the degree of job satisfaction of the seasonal workers; to analyse the demographical statues of the seasonal workers. The study revealed that the majority (66%) of the seasonal workers were young and were in between 20 years to 30 years; 32 percent were working in manufacturing section; 27 percent in engineering department; 17 percent in agriculture; 57 percent of them had more than 10 years experience; the degree of job satisfaction was 79 percent; and 81 percent told job was not boring.
Waman Nimbagi\textsuperscript{43} (1990) analysed the socio-economic status of seasonal migrants in the co-operative sugar factories during the study period 1983 to 1989. The main objectives of the study were to analyse the demographic status of the seasonal migrants to list out problems of seasonal workers and socio-economic conditions of the seasonal migrants. Both primary and secondary data were used to arrive conclusions. The study revealed that the social and economical conditions of the seasonal migrants were not satisfactory.

K.D. Jadav\textsuperscript{44} (1991) examined the socio-economic impact of the six sugar co-operatives factories in Satara District of Maharashtra during 1982 to 1989. The objectives of the study were to study the growth of sugar industry during the period in Satara district; to examine the total fund raised as share capital; to estimate the employment generation; to examine the cost of production and price; and to examine the contribution to rural development. The research report revealed that the number of co-operative sugar factories increased in the region: the socio-economic growth has been taking place in Sahyadri; the sugar industry generated employment; and the contributed considerably to the rural development.

Vandana S. Dandekar\textsuperscript{45} (2000) made an economic analysis to find out rate of return to education due to inception of sugar co-operative factories in Sangli District of Maharashtra State during the period of 1987 to 1997. The required primary data was gathered with the help of structured questionnaire. A random sample survey method was used. The main objectives were to measure the return to educational expenditure for the employees in sugar co-operatives; to
measure the social, private and marginal rate of return. The published reports of
the sugar co-operatives and published Govt. records were used as secondary
data. The study revealed that 99 percent of the employees had invested in Life
Insurance Corporation and purchased gold; and primary education cost was
Rs.5811, High school Rs.8644, and ITI Rs.13,240.

N.S. Patil\textsuperscript{46} (2005) studied the unique and successful rehabilitation of Satpuda
Tapi Parisar SSK Ltd. Purushottam Nagar, Maharashtra. The research paper
based on case study and the true story of Tapi Parisar SSK Ltd. pioneered by
Mr.P.K. Annu Patil in 1969. The step-by-step achievements of the mill explained
till the season 2005-06. The study concluded with an advise to the low
performing mills to follow the action plan so as to achieve the success.

2.1.6 Sugarcane

S. Thangavelu and D. Subhadra\textsuperscript{47} (2005) explored the footsteps of sugarcane
right from 1923 to 2003. The data was compiled from various sources and
presented to give conclusion. The researcher says that sugarcane cultivation
cannot be increased beyond a certain limit but the left out way before us was

Balwant Kumar\textsuperscript{48} et al (2006) examined the fifteen sugarcane clones of different
maturity groups, which were grown under eight different environments, such as
autumn and spring crops for two consecutive years during 1999-2000 to 2002-
2003 at Pusa Farm, Bihar. It was found that the BO128 clone suitable for autumn
crop whereas, BO110 and BO109 were suitable for spring crop.
B.R.Bhite et al (2006) experimented different sugarcane varieties for post-harvest effect. Advancement in agro genetic management technique significantly increased yield of sugarcane. However, the sugar recovery rates till today have not shown any significant improvements. This study focused on post harvest inversion of sucrose in different ten varieties of sugarcane was conducted at Padegaion and Satara. Uniformly matured canes of ten varieties of sugarcane were harvested from the experimental plot during 2003-04. It was found that the two varieties viz. COM 7125 and CO92020 showed variable response to post harvest storage.

S.Tanguvelu and K.Chiranjivi Rao (2006) conducted field experiments to asses reasons for reduction in sugar contents in top and bottom portions of sugarcane genetic stocks and its associations with other quality characters. In a replicated field trial 30 clones were planted to study the sugar content in juice at 9,10,11 and 12 month in top and bottom portions of the early maturing and late maturing clones. The study revealed that the variations of reducing sugar between clones, sugar and portions were noted; significant positive associations of reducing sugar in juice were found with fructose and glucose and the importance of reducing sugar in maturity trend of sugarcane clones and its clear associations with other quality parameters.

S. Thangavelu (2005) analysed the role of sugarcane varieties on jaggery research. Sugarcane varieties play a major role in jaggery quality and yield hence, the factors influencing quality of jaggery taken as parameter such as agro-climate, fertilization, soil, irrigation, boiling, storage. Ninety years research work performance sugarcane varieties were taken into consideration to conclude the
The researcher says that the clones with high jaggery quality and quantity were suitable for jaggery making and the chemical compositions of cane juice are important in jaggery making.

G.Manickam\textsuperscript{52} et al (2005) conducted field experiments to evaluate the performance of three early season sugarcane clones viz., C960696, Si96129 and G96736 along with five standards (Coc98061, Co86249, Co86032, Co8021 and Cosi95071) for their cane yield, juice, quality and sugar productivity during 2002 to 2004. The result revealed that the new clone C96696 significantly registered the highest mean cane yield of 160.49 MT and 154.67 MT that respectively in plant and ratoon crop. The same clone registered the highest commercial cane sugar percent of 12.62 in plant and 12.68 in ratoon crop.

Niranjan Murthy\textsuperscript{53} et al (2005) conducted field experiments on a promising early maturing sugarcane variety for Bhadra command area of Karnataka. The clone co-94005 early maturity group was evaluated in comparison with coc.671 and co.7704 groups during 2003-04. The study revealed that the performance of co.94005 for sugar and cane yield was better (16\% to 21\%) as compared to others.

Radha Jain\textsuperscript{54} et al (2006) examined the sugarcane germination. Germination in sugar cane refers to sprouting of buds and early growth of young shoots from it. The productivity of sugar cane is higher in tropics than subtropics. Termination of sets / buds is usually less than 40 percent in subtropical India as against that of 60 percent to 80 percent in tropical zone. The germination can take place from seed or from cane cuttings. The research consists of germination study made by
the different scholars from 1947 to 1998 and concluded with a few details of factors that influencing with germination in sugar cane.

**Shree Ram Singh**\(^{55}\) et al (2005) examined the role of frontline demonstration in transfer of sugarcane production technology in U.P. The study was undertaken to ascertain the role of demonstrations in sugarcane production technology in increasing the yield. The researchers conducted frontline demonstrations on farmers' fields during the period from 1996-97 to 2002-03. In all 34 areas (crop management, seed, weed, insect, pest, etc.) were selected for demonstration. The study revealed that after the demonstration the productivity was better and low yield due to poor knowledge.

**P.K. Singh**\(^{56}\) et al (2005) conducted a field experiment at Indian Institute of Sugarcane Research, Lucknow during 1999 and 2000 crop seasons to assess the impact of sub-optimal conditions on eleven elite sugarcane genotypes along with two standard varieties as compared to the normal conditions. The genotypes CoLk9704 recorded the highest yield followed by CoLk9705 and CoLk9702. The highest sucrose percentage (19%) was recorded in LoLk9804 followed by CoLk9703.

**Chhaya P. Shinde**\(^{57}\) (2005) analysed the influence of sulphur application on sugarcane yield and quality. Field experiments were conducted during 2001 to 2004 to study the response of *suru* sugarcane to the graded levels and sources of sulphur. The present study indicated that, the application of 60 kg. Sulphur per hectar was effective in increasing the cane yield and for better quality.
Pagire B.V.\textsuperscript{58} and S.T. Sarje (2005) analysed the input use and output in \textit{suru} and ratoon sugarcane. The study was undertaken in \textit{Solhapur} district of western Maharashtra. The farmers' data for the year 2001-02 were collected by survey method. The study revealed that the yield obtained by ratoon cane was 47 percent less than the expected yield. The production function analysis for \textit{suru} and ratoon cane showed 34 percent and 57 percent respectively of the total variation in the output.

2.1.7 Sugarcane Cultivation

Pawar P.P.\textsuperscript{59} et al (2005) examined the benefits in adopting improved production technology in sugarcane farms in Western Maharashtra. The investigators approached 270 sugarcane growers during 2002-03 to assess the degree of knowledge about improved production technology of sugarcane farms. The survey revealed that 25 percent of the farmers were not aware of the techniques.

B. Sundara\textsuperscript{60} (2005) has analysed his experiments and experience in drip irrigation for sugarcane at sugarcane Breeding Institute, Coimbatore, during 1990 to 1996. The surface and sub-surface drip systems were compared with the conventional furrow irrigation and also the water saving skip-furrow and alternate furrow irrigation techniques. The study concluded with a remark that around 40 percent of the water was observed to be saved by adopting drip system with an increase of cane yield in the range of 10 to 20 percent.

Tej Pratap\textsuperscript{61} et al (2006) studied the effect of row-spacing seed rate and fertilizer requirement levels on growth and yield of sugarcane for maximization of the
productivity of sugarcane. The experiment was arrived out during the spring season of 1995-96 and 1996-97. The study concluded that the row spacing had significant effect on germination percentage because the crop planted at 90cm row spacing exhibited significantly lower germination than spaced at 60cm.

C.S. Poswal\textsuperscript{62} et al (2005) examined the constraints in adopting of transfer technology on sugarcane production and also to know the influence of farmers' knowledge level in adoption of improved sugarcane technology. The farmers were selected on the basis of size of holding. The area selected for the study was Muzafarnagar, U.P during 2003-04. The main practices adopted by the farmers were evaluated. They were cane varieties, planting operations, fertilizers application, irrigation management, weed control, plant protection, binding and harvesting. The study revealed that the average knowledge level of the farmer was 49 percent, 60 percent and 58 percent in marginal, small and other farmer respectively.

S.S. Wadkar\textsuperscript{63} (1990) examined the changing pattern and trends in agriculture in Radhanagari Taluka of Kolhapur District in Maharashtra during 1961 to 1987. The main objectives were to assess the agricultural change in the taluka such as land used pattern, cropping pattern, technique of production; to examine the construction of Radhanagari Dam and its effect on crop pattern; and to assess the impact of new form of technology. The indicators adopted were pattern of land used; cropping pattern; techniques of production and the capital accumulation of agriculture section. Published and unpublished data from different administration wings were compiled. Land holding has been divided into three categories viz.,
small, medium, and large. The study revealed that the change in geographical area amounts to 10 to 15 percent; the crop pattern controlled by agro-climatic conditions; farmer prefer to grow Ragi and Groundnut in drought area; technology impact in seed and fertilizer; 80 percent of the land holders had less than 2 hectors of land; number of carts increased from 2431 (1960) to 2746 (1987); increase in irrigation area (8.5%) and employment (8%). The study concluded that a modern method, which can balance between the forest and the agriculture land.

Subhash J. Bargir\textsuperscript{64} (1990) studied the measures adopted for increasing sugarcane production at Rajarampur Patil S.S.K. Ltd. during 1982 to 1989. The main objectives of the study were to find out what are the measures adopted by the mill to improve cane production and the impact of measures on sugarcane production. The primary data was obtained from the agriculture department of the mill during the study period. The mill had taken the several measures to improve the sugarcane production viz., distribution of quality seed; trail of new varieties; lectures, seminars and conference for farmers; development of selected farms; water supply scheme like irrigation, new pipe lines, bore wells, sprinkler, drip irrigation and water management; infrastructure fertilizers like road soil testing and mobile labs; protection measures to members such as supply of fertilizer, press mud, transfer facilities, subsidy to small holders and demonstration of new method.

A.D. Shinde\textsuperscript{65} (1991) examined the management and economics of selected lift irrigation schemes of Shetkari S.S.K. Ltd. situated at Sangli in Maharashtra,
during 1981 to 1989. The objective of the study was to analyse the lift irrigation scheme includes well, bore well, water ponds etc. The efforts put by the farmers and the sugar mills in consultations with bank and irrigation departments have been put together to arrive conclusions. The study concluded with remarks that the study area has achieved its targeted plans; lift irrigation helped both sugarcane cultivation and other crops and the joint venture of farmers and other agencies led to the economics development of the Sangli farmers. A pre-tested structured questionnaire was used to collect primary data and the secondary data was gathered from irrigation and agriculture departments.

R.R. Hasure\textsuperscript{66} et al (2005) examined the planting geometry and inter crops on yield contribution character, cane yield, quality and economics of seasonal sugarcane (Co.86032). The study was based on field experiments conducted for three years during the 2001-02, 2002-03 and 2003-04 on medium black clay-loam soils. The study disclosed that the process of skipping one raw after every two rows planting of sugarcane with inter crop of watermelon recorded significantly the highest yield of cane.

T.N. Tiwari\textsuperscript{67} et al (2005) examined the adverse effects of heavy rainfall and water logging during grand growth period of sugarcane. In the year 1998-99 relatively higher rainfall followed by water logging not only affected the growth of the cane crop, but also affected the recovery rate. In the present study the rainfall data between the periods of June to December of two consecutive years (1997-98 and 1998-99) and the dry matter production per plant of ten sugarcane varieties have been examined. The researcher came with the conclusion that the
after monsoon period the varieties showed appreciable increase in dry matter production to recover themselves. The delayed growth of crop resulted in delayed sugar accumulation in experimental varieties.

Virendra Kumar Gupta et al (2006) conducted a field experiment to examine the economics of seed sugarcane production as influenced by N and K fertilization during 2003-04 at Sugarcane Research Institute, Samastipur, Bihar. The researchers applied different doses of Nitrogen (N) and Potash (K) at different interval (T) and found that 150 kg N and 60 kg K 20 per hectare were suitable dose for higher seed cane yield.

A. Siddiqi et al (2006) studied the effects of multi micronutrients and press mud compost application on yields and nutrient up take of sugarcane ratoons sequence. The study conducted to examine the effect of micronutrients and sulphur applied in combinations with press mud compost on yield and uptake of sugarcane ratoons sequence. Field experiments were conducted on sugarcane (CV.Cos97016) at Mundia, Uttanranchal. It was found that the application of 25kg. Znso$_4$+ 215 kg Gypsum per hector gives an extra yield of 120.4+ MT/ha.

Rajendran B. (2006) analysed the benefits of Integrated Pest Management (IPM) practices for sugarcane. IPM is a widely accepted concept in plant protection for crops. An ideal strategy evolved to combat pests, with least interference to eco-system and assures environmental safety. The IPM focuses on the management of pests through cultural techniques, experimented at Cuddalore, Tamil Nadu during the seasons from 2002 to 2005. The study
revealed that an effective IPM practice increased the cane production to the extent of 36 percent with an additional cost of Rs. 6150 / ha.

K. Kannapan\textsuperscript{71} (2006) examined the effects of Sulphur application on sugarcane yield and quality. Sulphur is an essential plant nutrient in crop production Sulphur difference in soil and in crops is a worldwide phenomenon. The study was made to know the effects of Sulphur on the yield and quality of sugarcane during 2003-2004 and revealed that only the Sulphur content could not cause significant improvement in growth but with Ammonium Phosphate gave a maximum cane and sugar contents in cane.

V.P. Bhalerao\textsuperscript{72} et al (2005) studied the effects of different organics fertilizers on soil properties, nutrient uptake, yield and quality of sugarcane. A field experiment was undertaken at Central Sugarcane Research Station, Padegaon on medium black soil, and was observed for three years from 1999 to 2002. The research revealed that about 40 percent of chemical fertilizers could be substituted using either by 9 MT Press Mad Cake (PMC) + 2 MT Spent Wash Ash (SWA)+ Urea Blending with Neem Cake (UB NC) + Bio-fertilizers.

Dheer Singh\textsuperscript{73} and P.K.Tomar (2005) examined the critical period of weed removal in sugarcane ratoon. Sugarcane ratoon is an integral part of sugarcane cultivation. It occupies almost 50 percent of the total sugarcane average. However, the productivity of ratoon is only 45 percent that against the sugarcane 70-80 percent. Negligent attitude of farmers towards ratoon in general and its heavy infestation with weeds in particular is the main reason for poor productivity.
of ratoon in India. Reduction in cane yield was observed up to 30-45 percent. A field experiment was conducted during 2002-03 and 2003-04 at Crop Research Center, Patnagar Uttarachal to see the effect of duration of weed crop competition. A significant corresponding reduction was observed in cane yield where weeds were allowed to compete with the crop beyond initial 30 days. The study concluded with a notable finding that in ratoon crop critical period of weed removal was in between 30-60 days after planting.

V.P.Bhalerao et al (2005) analysed the effect of distillery's biomethanated effluent on yield, quality of adsali sugarcane and soil properties. Two-field experiments were conducted during 2002-04 in Pune. The soil chosen was medium black and calcareous in nature. The main purpose of the study was to find out the effect of pre-sowing application and fertilisation of secondary biomethanated effluent of spent wash on growth, yield, quality parameters and nutrient uptake by adsali sugarcane. The continuous pre-sowing application to adsali sugarcane was found beneficial.

B.L. Sharma et al (2005) analysed the effect of nitrogen inhibitors on sugarcane crop. The study was based on a field experiment, conducted at the research institute farm for consecutive three years from 2000-01 to 2003-04 by employing sugarcane (Cose95422) to evaluate the performance of neem cake, caster cake and neem oil blended with urea on cane growth and quality parameters. The study revealed that the application of Urea blended with 1.0 percent neem oil in cane crop would increase the germination, shoot population and yield.
G. Kathiresan\textsuperscript{76} and G. Ramdas (2005) examined the choice of intercrop for sustaining the ratoon sugarcane yield, quality and soil fertility under clay soil. The research work based on field experiments, conducted to study the effect of different levels of Nitrogen on sugarcane ratoon during early seasons of 2002 to 2004. The test ratoon crop was cosi-95671. The inter crop tested under ratoon crop was diancha (local variety) and Black Gram (vamban3). The pooled results revealed that in-situ incorporation of daincha significantly produced 124 MT/ha of cane yield, which was 9 percent higher.

B.L. Sharma\textsuperscript{77} et al (2005) conducted the field experiments and compared performance of Bio-compost for three years during 2001 to 2004 by employing to the sugarcane variety Cuse-95422 in the ratio of 1:1 to the inorganic fertilizer. The Bio-compost mixture not only increased the cane yield but also improved soil organic matter, soil texture and water holding capacity.

S.R. Misra\textsuperscript{78} and Manish K. Dubey (2005) examined the effect of moist hot air treatment on germination of sugarcane buds. The researchers conducted field experiments during 2004-05, the planting material of BO91 and COSE92423 were subjected to moist hot air treatment at 50\degree C for 2 hours and planted in a field during spring and autumn seasons respectively. The study revealed that the moist hot air treated material not only gave quicker and better germination than the untreated material but also almost all the buds on the whole and cut canes sprouted simultaneously.
A.M. Charai\textsuperscript{79} et al (2005) conducted a study in Pune district of Maharashtra, during 2004-05 in order to assess the knowledge and adoption of recommended practice for control of white woolly aphid in sugarcane crop by the sugarcane growers in the region. In all 124 sugarcane-growing farmers from two co-operative sugar factories were selected. The researchers found that most of the farmers had not adopted the practices for control of white woolly aphids like use of drip irrigation, removal and destruction of affected sugarcane leaves.

Rajala Chandran\textsuperscript{80} et al (2005) examined the moisture stress management practices, adoption pattern and constraints involved. The study sought information from 150 respondents of sugarcane growers. The knowledge level of the respondents was assessed through a knowledge index developed for the purpose during 2000 at Chingleput, Tamil Nadu. The formula used was: 

\[ K_1 = \frac{K}{P} \times 100 \]

where \( K_1 \) = Knowledge Index, \( K \) = Knowledge score obtained by the respondent, \( P \) = Possible maximum score. The study revealed that the overall knowledge level of sugarcane growers about the recommended technology was low. It was observed a wide gap between the recommended practices and their actual level of adoption. In order to bridge this gap public extension system should be made effective.

C. Shankaraiah\textsuperscript{81} and K.N. Kalyan Murthy (2005) examined some agro-techniques for sustenance of soil health and sugarcane production for Cauvery command area of Karnataka. The investigators analysed the field experiments conducted over a decade from 1990 to 2000. The study revealed that neither the mineral fertilizers nor the organic sources exclusively could sustain sugarcane
productivity. A judicious combination of both the components was the potential tool for sustaining the productivity of soil and crop.

R. Durai\textsuperscript{82} (2005) conducted field experiments during the seasons 2001-02 and 2002-03 in order to find out suitable nutrient chemical / growth regulator to induce drought tolerance. The pooled data of two years plant and one year ratoon collected from the experiments were tabulated. The study revealed that among the treatments, toiler spray of salicylic acid on sugarcane crop under water stress conditions favour for faster growth and there by recorded higher cane yield of 25 to 30 percent as compared to unsprayed.

\textbf{2.1.8 Critical Evaluation of Reviewed Literature}

The reviewed literatures revealed the following broad conclusions:

1. Some of the studies were emphasised on \textit{history of sugar industry in India} (S. Pruthi, 1995) or only on \textit{sugar industry in India} (Ram Vichar Sinha, 1998) or on the \textit{problems of sugar industry in India} (D.K Grover and S.S Grewal 1991). There was hardly an attempt made to analyse in detail the problems of co-operative sugar sector.

2. Some of the studies were noticed to have under taken on performance of sugar co-operatives by selecting one or two areas (cost, operational, financial, manpower or sugarcane growers) affecting the performance of the sugar factory. Daxa Gohil (2005) had studied \textit{comparative analysis of transaction cost vis-à-vis financial performance of sugar industry of India}; Hanchinmani S.N. (1996) studied on \textit{financial analysis of co-operative sugar factories in Belgaum district of Karnataka}; V.B. Kakade (1995) studied \textit{the capacity utilization of co-operative}
sugar factories in Maharashtra State; Mahadev G. Powar (1997) investigated the raising and utilization of finance by co-operative sugar factories in Satara District of Maharashtra; A.D. Shinde (1991) studied the management and economics of selected lift irrigation schemes of Shetkari Sahakari Sakar Karkhana Ltd. Sangli, Maharashtra; and Ramchari S. Nikam (1995) analysed the composition of various cost elements and their magnitude in total cost of sugar production. None of the studies was undertaken to study major key factors together that affect the performance of sugar co-operative factories.

3. A few studies were noticed to have emphasized the socio-economic impact of sugar mills by giving more stress on problems or benefits derived by the society and less importance to the sugar factories. V.A. Patil (2002) investigated the problems of seasonal workers working in selected sugar factories; K.D. Jadav (1991) analysed the socio-economic impact of sugar co-operatives in Satara District of Maharashtra. Waman Nimbagi (1990) also studied the socio-economic status of seasonal migrants in the co-operative sugar factories with special reference to Kolhapur District of Maharashtra State. Vandana S. Dandekar (2000) analysed an economic analysis to find out rate of returns to education due to the inception of sugar co-operative factories in Sangli District of Maharashtra.

4. The analytical tools and techniques were not made use abundantly in some of the studies. The tool like traditional method of ratio analysis was used to analyse the financial performance of the sugar mills instead of modern and universally accepted hybrid ratios.
5. The comparative studies were undertaken on one or two key areas with limited parameters.

6. Majority of the research works carried out on sugarcane varieties, sugarcane growth pattern and application of fertilizer as sugarcane is the major factor of production in the sugar industry. Other dominating factors such as cost of production, financial requirements and interest burden on temporary borrowings, managerial factors, farmers' perceptions, etc., were not given much more importance. This may be one of the reasons for poor performance of Indian sugar industry.

7. A few researchers have undertaken studies on performance analysis and comparative studies but concentrated either on cost variables or on financial factors. None of the researchers has made an attempt to consider four dominating areas together (Costing, Operational, Financial and Sugarcane Growers) to arrive a concrete conclusion to say a particular unit is performing well or poor. Performance of business units cannot be judged by looking from one or two angles. It is good to analyse the problems at micro and macro levels and that too from all dimensions, which are affecting the business environment of every production unit.

8. Most of the suggestions made by the researchers can be implemented and adopted by the sugar mills for the farmer members. But mindset of the cane growers is already fixed due to unfavourable price policy adopted by the Government and payment policy of the mills' management. Hence, there is a need to develop policy suggestions to melt the deep-rooted prejudices among
sugarcane growers, which would have taken care of in the above said research work.

9. Most of the field research on sugarcane was undertaken under the controlled situation in the field with created environment that may not yield the same results under uncontrolled situation in the actual fields. Hence, there is need to establish trusted relationship between the farmers and the factory, which was not stressed by the researchers.

It is observed that all these studies emphasized either a particular problem of a sugar mill or comparative study within the State. So far no research was undertaken to make a comparative study of key parameters such as financial, cost components, operational efficiency and problems of sugarcane growers of three different sugar factories situated in different States. Keeping in view the shortcomings of the earlier studies, all the key performance parameters were studied, analysed and compared in this research work.

2.2 RESEARCH DESIGN AND METHODOLOGY
The research design and methodology is presented under the following heads:

2.2.1 Description of the Study Area and Select Units

The core geographical area and the selected units for the study and their scenario are given as under:

(a) Sugar Industry in the State of Maharashtra

The state of Maharashtra has emerged one of the leading states in the sugar production. At present there are 143 sugar factories in Maharashtra. The
area under sugar cane cultivation is 5,30,000 hectares, the state produces 4,71,51,000 MT of sugarcane and 5.34 million MT of sugar. On the basis of recovery rate, the state has been divided into three zones viz. high, medium and low recovery zones and the Kolhapur district comes under high recovery rate zone.

*Chatrapati Shahu Sahakari Sakhar Karkhana Limited*, situated in Kagal Taluka of Kolhapur district, one of the best performing units in Asia, established in the year 1977. The unit crushes 3,500 MT per day with the help of 929 employees and produces more than 5.25 lakh quintals of sugar by maintaining a recovery rate at 12.6 percent.

(b) *Sugar Industry in the State of Karnataka*

There are 38 sugar factories in Karnataka State. The area under sugarcane cultivation is 3,12,000 hectares. The state produces 2,84,54,000 MT of sugarcane and 13,70,000 MT of sugar. A high recovery rate is observed in Kaverki belt and in Belguam District. In the recent past, the Govt. of Karnataka has withdrawn various taxes on sugar factories, which were hampering the growth of sugar factories in Karnataka.

The unit selected for the study is *Shri Malaprabha Sakkare Karkhane Niyamit*, situated at M.K. Hubli, in Belguam, one of the good performing units in the district. Shri Malaprabha Sakkare Karkhane Niyamit, was established in 1971 with a crushing capacity of 1250 MT per day. After a decade, looking at an increasing trend of sugarcane supply from 585 villages, the crushing capacity was increased to 3,500 MT per day in the year of 1982-83. The recovery rate of the unit was always above 10 percent because of the hard work of 1,200
MAP No. 2.1
LOCATION OF THE SELECTED CO-OPERATIVE SUGAR FACTORIES

State Capital ◆ District Head Quarter ≈ State Boundary ~~ District Boundary
employees of the unit and the sugarcane suppliers of the region. The unit produces more than 5.35 lakh quintals of sugar and has its own distillery unit.

(c) Sugar Industry in the State of Goa

The Sanjivani Sahakari Sakhar Karkhana Maryadit, is the only sugar factory in Goa, that was established in 1972 with a capacity of 1,250 TCD. The initial capacity remained the same for last 30 years but the land under sugarcane cultivation took a slight change from 1,200 hectares to 1,350 hectares in three decades and the total sugarcane cultivation from 40,000 MT to 80,000 MT. The unit purely depends upon gate-cane (60%), which comes from Karnataka. There are 447 employees in the unit. The recovery rate is less than 9 percent. The output of the factory is 1.2 lakh quintals of sugar. Sanjivani Sahakari Sakhar Karkhana could not make any significant gain for the last 30 years. The cumulative effect of accumulated losses did not allow the mill's management to go for modernization. The factory neither experienced any major repairs since its inception nor bumper profits in its entire life span.

2.2.2 Justification for Selection of Units

After doing a preliminary survey, it was observed that the Kolhapur, Belguam and South Goa districts are adjacent to one another; the age and initial capacity (1,250 MT per day) of the factories are almost the same. In spite of these conditions only the first two units are performing well but not the unit in Goa. The reasons for low performance of the Sanjivani S.S.K.L. and better performance of other two units are the focalised point of triangular comparative study. No research has been under taken in the past to analyse the actual
causes for the low performance of the sole unit in Goa. The measures that are adopted by the other profit making sugar factories in Maharashtra and Karnataka will be modified and suggestions can be made according to the length and breadth of the problems of Sanjivani Sahakari Sakhar Karkhana for its better performance.

2.2.3 Scope of the Study

Geographically, the proposed study is confined itself to the three co-operative sugar factories viz., Chatt. Shahu Sahakari Sakhar Karkhana Ltd., situated in Kagal Taluka of Kolhapur district of Maharashtra; Shri Malaprabha Sahakari Sakkare Karkhane Niyamit, situated at M.K. Hubli, in Belguam district of Karnataka and the Sanjivani Sahakari Sakhar Karkhana, situated at Darbandar in South Goa district of Goa. Hereafter the selected units are called as Chatt. Shahu S.S.K.L., Malaprabha S.S.K.L. and Sanjivani S.S.K.L. The study intends to assess the working and performance of the three selected co-operative sugar factories.

2.2.4 Period of the Study

Present study encompasses the performance of ten financial years of selected units from 1994-95 to 2003-04.

2.2.5 Nature and Source of Data

The study is based on both primary and secondary data. In order to achieve objective of the study, the necessary primary data are obtained from sugarcane growers of three units.
The required secondary data were gathered from the published Annual Reports, Manufacturing Reports and Agriculture Reports (from 1994 to 2004) from Chatt. Shahu S.S.K.L., Malaprabha S.S.K.L. and Sanjivani S.S.K.L.

Besides this, the required additional data also was collected from the departments like National Federation of Co-operative Sugar Factories of India, Indian Sugar Mills Association of India, National Cooperative Development Corporation of India, Training and Research Institutions for Co-operatives in Maharashtra, Karnataka and Goa, Directorate of Agriculture, Goa, University libraries viz., Goa University, Karnataka University, Dharwad and Shivaji University, Kolhapur, and sugar web sites.

2.2.6 Sampling Procedure

In order to elicit opinion from the sugarcane growers of selected co-operative sugar units, 30 sugarcane growers and members (comprising of large, medium and small) from each unit are randomly chosen for the study.

2.2.7 Parameters Used to Evaluate Performance

More than 47 parameters (this number does not include supporting parameters) have been used and a few of them are:

**Cost performance indicators:** Sugarcane procurement cost; manufacturing cost; administrative cost; salary and wage bills; depreciation and interest on key loan in total cost of production of the selected mills.

**Operational performance parameters:** Area under sugarcane cultivation; yield per hectare; sugarcane price; sugarcane supply; production of white crystallised sugar; duration of crushing season; rate of recovery; man and machine
efficiency; capacity utilisation and total number of hours crushed and hours lost of selected units.

**Financial performance parameters:** Equity Capital, Net Sales, Net Profits, Total Assets, Total Debts, Working Capital and Earning Before Depreciation, Interest and Tax (EBDIT) of the selected units.

**Sugarcane growers' personal profile:** Age; educational qualification; and family size.

**Sugarcane growers' agricultural profile:** Farmers' income; family members' participation in agricultural activities; total area of land holding; area irrigated; area under sugarcane cultivation; types of crops grown; cattle population; tools and machines used in cultivation; and types of fertiliser used.

**Sugarcane growers' problems:** marketing problems; cultivation problems, procurement of finance; degree of co-operation received from different related agencies, cane transportation; adoption of new technology; waiting in queue; and cane bill payment.

### 2.2.8 Tool Used to Collect Data

Pre-tested structured questionnaires containing open-ended, close-ended and ranking questions were given to the sugarcane growers for eliciting their personal profile, agriculture profile and problems. Opinions of the farmers also extracted during the personal interviews and in the farmers' meetings organised by the mills' management. The appropriate parameters emphasizing the performance of sugar units are identified and included in the questionnaire.
2.2.9 Analytical Tools Employed

In order to accomplish the objectives of the study, the collected primary and secondary data were analysed with the help of following tools:

So as to ascertain the degree of financial health of the selected units, Edward Altman's Z-Score Model \(^{83}\) \(Z\text{-Score} = 1.2 x_1 + 1.4 x_2 + 3.3 x_3 + 0.6 x_4 + 0.999 x_5\) is used. The financial consistency of the selected units is evaluated with the help of 'Mean', 'Standard Deviation' and 'Coefficient of Variation'.

(I) \(\text{Mean (} \bar{x} \text{)} = \frac{\sum x}{N}\)

(II) \(\text{Standard Deviation (S.D.) } \sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{N}} \text{ Where } X = Z\text{-score.}\)

Standard Deviation is an absolute means of variation and therefore it cannot be used to compare the variation present within two or more sets of data. For such a comparison, it is customary to use the corresponding relative measure of variation known as coefficient of variation (CV)

(III) \(\text{Co-efficient of Variation (CV)} = \frac{\text{S.D.} \times 100}{\text{Mean}}\)

In order to find out the trend relationship between price and sugarcane supply (local and gate cane), Karl Pearson's product movement co-efficient of correlation between \(X\) and \(Y\) (statistical tool) is found suitable and hence, used to find out the trend relationship of two variables \(^{84}\).

The formula used is: \(r_{x,y} = \frac{\text{cov.}(x,y)}{\sigma_x \cdot \sigma_y}\)

Where; (i) \(\text{Covariance between } x \text{ and } y = \text{cov.}(x,y) = \frac{\sum (x \cdot y) - (\bar{x}) \cdot (\bar{y})}{n}\)
(ii) **Standard Deviation of 'x'**

\[ \sigma_x = \sqrt{\frac{\sum x^2}{n} - \overline{x}^2} \]

(iii) **Standard Deviation of 'y'**

\[ \sigma_y = \sqrt{\frac{\sum y^2}{n} - \overline{y}^2} \]

The value of co-efficient of correlation is interpretable as:

(i) Perfect positive correlation if value = +1;

(ii) Perfect negative correlation if value = -1;

(iii) No correlation if value = 0;

(iv) Strong positive correlation if value is in between 0.7 and 1;

(v) Strong negative correlation if value is in between −1 and −0.7;

(vi) Weak positive correlation if value is in between '0' and 0.7; and

(vii) Weak negative correlation if value is in between −0.7 and 0.

Besides these tools, other statistical tools such as ranking, average, percentage, ratios are also used to evaluate the cost and operational performance and to analyse the farmers' profiles and problems.

**2.2.10 Limitations of the Study**

- As the study has covered sugar factories of three different States, the existence of differences with regard to language, culture, attitude and aptitude towards agriculture and factory was observed during the course of survey and hence, the conclusions of the study cannot be generalised.

- The method of data recording and publishing adopted by the selected units in the three different States has undergone a lot of modifications during the
study period and therefore, the conclusions of the study cannot be generalised.

2.2.11 Chapterisation

This research work is presented under the following six chapters:

Chapter I : Introduction

This chapter provides an introduction to history of sugar; origin of sugarcane and sugar products; classification of sugarcane and sugar; sugar scenario of world and India; colonial rulers and sugar industry in India; growth of sugar industry in co-operative and other sectors; sugar industry By-products; agriculture scenario of Maharashtra, Karnataka, Goa; objectives and hypotheses.

Chapter II : Review of Literature, Research Design and Methodology

Brief summaries of referred thesis and research articles pertaining to sugar industry in India and abroad; co-operative sector in India; cost and operational analysis of sugar factories; financial analysis of sugar factories; human resource in sugar mills; sugarcane; sugarcane cultivation, etc., are given in the first part of this chapter.

The second part of this chapter has covered the scope and relevance of the study; methodology employed; analytical tools like Edward Altman’s Z-Score model, Karl Pearson’s product movement co-efficient of correlation, other statistical tools like Mean, S.D. C.V.; and limitations of the study.
Chapter III: Cost and Operational Performance Analysis of Select Units

The first part of the chapter has included major cost components viz., sugarcane procurement cost, manufacturing cost, administrative cost, salary and wage bills, depreciation and interest on key loan in total cost of production of the selected mills. All these six major cost components have been analysed and compared in terms of their share in total cost, cost per bag (or per quintal) and in terms of percentage within the same unit and with other selected units. In order to arrive concrete results of key cost drivers, a comparative cost performance analysis of the selected units is prepared and presented with concluding remarks.

The second part deals with the operational performance of the selected sugar mills that are evaluated on the basis of ten effective parameters viz., (i) Area under sugarcane cultivation; (ii) Yield per hectare; (iii) Sugarcane price; (iv) Sugarcane supply trend; (v) Production of white crystallised sugar; (vi) Duration of crushing season; (vii) Rate of recovery; (viii) Man and machine efficiency; (ix) Capacity utilisation; and (x) Total number of hours crushed and hours lost in selected units.

Chapter IV: Financial Performance of Select Units

In this chapter, an attempt has been made to analyse and compute the consolidated effect of various ratios so as to ascertain the degree of financial health and to predict the corporate failures with the help of a universally accepted hybrid ratio, which is suggested by Edward Altman. The major components of annual reports such as Equity Capital, Net Sales, Net Profits, Total Assets, Total Debts, Working Capital and Earning Before Depreciation, Interest and Tax...
(EDIT) of the selected units have been tabulated. Based on those tabulated variables, the value of x in Z-score, Z-scores of each unit and comparative Z-score analysis of selected units have been tabulated. Mean Values, Standard Deviations and Co-efficient of Variations of Z-Scores of the selected units have been tabulated and the conclusions drawn are presented under the caption ‘Consistency in Financial Health’.

Chapter V: Profile and Problems of Sugarcane Growers

This chapter highlights the indicators relating to the farmer's personal profile, agricultural profile and problems. The personal profile consists of name, age, educational qualification and family size etc. The agricultural profile contains farmer's income, family members' participation in agricultural activities, total area of land holding, area irrigated and area under sugarcane cultivation, types of crops grown, cattle population, types of fertiliser used, etc. The multi dimensional farmers' problems have been discussed under various heads like marketing problems, cultivation problems, problems relating to the procurement of finance, degree of co-operation received from different related agencies, etc. Based on the consolidated survey report, suitable conclusions are drawn.

Chapter VI: Summary of Findings, Conclusions and Suggestions

This chapter summarizes the findings; conclusions drawn and suitable suggestions made to improve the efficiencies of various segments like cane procurement, cane development, marketing, production, flow of finance and the degree of relation with the sugarcane growers, etc.
REFERENCES


43. Waman Nimbagi (1990), A Socio-Economic Study Of Seasonal Migrant In The Co-Operative Sugar Factories With Special Reference Of Kolhapur District, Ph.D. thesis submitted to Shivaji University, Kolhapur.


47. S. Thangavelu and D. Subhadra (2005), Sugarcane Technology In The Last Eight Decades In India In Sugarcane Production, Co-operative Sugar, Vol.36, No.9, May 2005.


77. B.L. Sharma, Shayam Singh, Ved Prakash, Anil Kumar Mishra, P.N. Srivastav, D.N. Singh and S.B. Singh (2005), *Integrated Nutrient Management In Sugarcane Performance Bio-Compost And Press Mud Cake*


82. R. Durai (2005), Physiological Approaches To Alleviate Drought In Sugarcane, Co-operative Sugar, Vol.37, No.10, June 2006.
