

**COMMODITY PORTFOLIO MANAGEMENT OF COLD
STORAGE UNITS IN HYDERABAD (A.P.)**

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I. INTRODUCTION

Horticulture, including fruits, vegetables, root and tubers, mushrooms, flowering, medicinal and aromatic plants, cashew, coconut and oil palm has emerged out as an important sector for diversification of agriculture. Presently, horticulture has established its creditability in improving income through increased productivity, generating employment and enhancing exports besides providing household nutritional security.

The varied agro-climatic conditions of India provide enormous scope for the cultivation of all tropical and sub-tropical fruits and vegetables by maintaining the inflows of almost all varieties of fruits and vegetables through out the year. The focussed attention on investment in the horticultural infrastructure and technological developments during the last decade has been rewarding in terms of increased production and productivity of horticultural crops with manifold export potential. India has emerged as the second largest producer of fruits and vegetables with an annual production of 123.26 million tonnes. The country has a predominant share in the foreign trade of spices and cashew. Horticulture has invariably improved the economic status of our farmers. The seasonal availability of fruits and vegetables has now extended to all the year round, increasing per capita consumption of fruits from 40 g to 50 g and vegetables from 96 g to 175 g. Fruits and vegetables have been identified as an important component of daily diet in all sections of the society. Fruits and vegetables play a predominant role not only in the maintenance of good health but also to improve the economic condition of the small and marginal farmers. It has also played a significant role in the empowerment of women by providing employment opportunities through mushroom cultivation, floriculture, processing, nursery raising and vegetable seed production.

The present annual growth rate of horticulture is more than 6.5 per cent, though horticulture occupies only 8.5 per cent of total cultivable area, it now contributes 29.5 per cent of the Gross Domestic Product (GDP). Recent developments in horticulture and technologies have substantially increased the world production of fruits and vegetables and foreign trade.

The importance of fruits and vegetables in human diet needs no emphasis. Our planned efforts envisage a balanced diet for every family. Apart from increasing in productivity and production of fruits and vegetables, it is very important to supply fruits and vegetables to consumers regularly at a reasonable price. The question that arises is how to ensure the proper balance between the incentive price to farmers and reasonable price to consumers.

Fruits and vegetables produced for human consumption are lost through microbial spoilage by more than 250 marked diseases and the primary causative agents of microbial spoilage are bacteria, yeast and moulds. The higher water content of vegetables (approximately 80%) and the acidic pH range of vegetables favour the growth of spoilage bacteria. Fruits and vegetables support dynamic and changing micro flora, which causes more than 20 per cent of loss by reducing shelf life and keeping quality.

Despite fast growing technological innovations in agriculture, hunger and malnutrition continue to be the twin alarming problems in underdeveloping economies, mainly due to unabated population growth and natural calamities. Though, India has achieved a near self-sufficiency in food grains, through green revolution, the subsequent white revolution, yellow revolution and blue revolution did not solve the problems of rural areas. A revolution in horticultural production has to be aimed and achieved to improve the nutritional status of the people and earn the much needed foreign exchange through exports. Horticultural products offer immense scope in this direction. Also, owing to the fast escalating cost of inputs, non-availability of adequate labour etc. farmers are now evincing interest in raising horticultural crops. As a result of this the area and production of horticultural crops is increasing year by year in India and as well as also in Andhra Pradesh.

In India, the magnitude of post-harvest losses in fruits and vegetables is estimated at around 40 per cent of the total horticultural produce worth about Rs. 25,000 crore per annum. It is necessary to reduce or diminish such a huge losses and wastages to ensure continuous availability of fruits and vegetables over a long period at favourable prices to the consumers and also to arrest distress sale by producers. In case of fruits, majority of the orchardists sell to the pre-harvest contractors whereas vegetables are sold by growers through the

commission agents in the market. Fruit orchardists and vegetable growers get low price for their produce; particularly in the peak seasons and the manipulating activities of the traders are often unbelievably high.

The low prices received by producers and high wastage in fruits and vegetables are observed due to the fact that the producers are unorganized and scattered, own small holdings which produces very small surplus. Lack of financial support and their poor access to market intelligence, the problem of preservation limit their ability resulting in lower prices for their produce. In order to overcome these problems one has to recognize the importance, usefulness and need for cold storage. Cold storage plays an important role in conserving fruits and vegetables, by providing remunerative prices, prevention of seasonal gluts in the market, availability of wide range of fruits and vegetables all round the year, orderly marketing, better returns to growers and also preserving the quality of these highly nutritious commodities. Besides, cold stores are also playing a laudable role in providing employment to rural unemployed and service to the growers in conservation of the perishables, stabilization of the prices, availability of foods etc. to the consumers over a longer period are some of its important contribution to the society.

Therefore, cold storage industries are popularly known as agriculture service oriented industry, in general; and horticultural service oriented industry in particular. Thus, cold storage serves as a vital link between the production and consumption of fruits and vegetables. The importance of cold storage of fruits and vegetables is to achieve the twin objectives of price stabilization and fair prices to producers and consumers who have long since been recognized. Concerted efforts have also been made to expand or increase cold storage capacity in our country but the efforts to study their performance and problems are very much lacking.

The cold storage capacity in the country has been progressively increasing during the last decade. Despite the present development, it has not been possible to touch even a fringe of enormous problems of preservation of these perishables. The potato glut of 1983-84 illustrates that the available cold storage capacity was inadequate. Apart from this, many other fruits and vegetables like onion, mango, tomato etc. are very much out of the purview of this industry. The cold stores in the country are mainly installed by the private sectors while co-operative and public sector's share is very little.

In general, it is also felt that the cold storage capacity is still required to be enhanced sufficiently in all the three sectors, but the existing cold storages in the public and co-operative sectors are not working to the optimum level. Therefore, it is imperative to investigate the functional efficiency of cold storage industry in order to find out the optimum solutions to the storage problems. The inadequate facility of cold storage in processing of fruits in general and vegetables in particular makes the demand for these products further inelastic. Therefore, adequate measures have to be taken by all the three sectors to provide cold storage facility in the production areas and the terminal markets. It is not enough to talk about storage but also there is a need to understand very clearly the working of cold storages.

The seven letters word 'storage' carries tremendous importance and it is not exaggeration if called the fifth essential element for the success of any production/manufacturing/processing activity. Cold storage facility forms an important chain in the pipeline of the storage structure. Even though the concept is old, it gained momentum only recently. Many players reported to have entered this segment by pumping high investments. As the players have realized the importance and started this huge investment activity, the government has provided credit-linked scheme for the development of these structures.

According to cold storage order 1960 and 1980, cold storage means Any chamber or chamber insulated and mechanically cooled by refrigeration machinery and used for storing food stuffs but does not include refrigerated chamber or coolers having capacity of less than 25 cubic meters.

The storage of products at strategic locations for efficient sales promotion and physical distribution is of prime importance. One of the indicators of economic development of a country is the industry and growth of its storage. Its necessity arises fundamentally out of

lack of co-ordination and adjustment between the time and place of production of goods and the time and place of their consumption. Further, the type, size and location of storage would depend on whether it is required for 'Inventory' or Transit.

The demand for storage (both inventory and transit) is essentially derived demand. It consists of two components.

1. The volume of commodity entering the storage (long-term demand).
2. The duration of its storage (short-term demand).

However, in actual practice, the demand for storage of a commodity is rather inelastic to its price of storage. This is being the cost of storage is a very small element in the final price of the commodity.

In general, the term cold or cooled storage as applied to fresh fruits and vegetables, refer to storage in the temperature range of -1.1 to 10°C or 30°F to 50°F employed for holding foodstuffs. If it is in the frozen state then it is in the frozen state and then it is known as freezer storage. Cold storage makes possible even placement of perishable commodities in the market. Cold storage can also help in price stabilization of perishables by removing the glut in the production season.

Cold storage scenario

The first cold storage unit in the country was set up in Calcutta in the year 1892. Although, a few cold stores were in existence in early thirties, yet a real beginning of this industry was made only after independence. The progress of this industry was very slow upto 1955 when there were only 83 cold stores with an installed capacity of 42,965 tonnes. With the launching of grow more food campaign in the first five year plan (1951-52 to 1955-56) and simultaneous increase in production of perishables attracted the attention of industrialists towards setting up of cold storage in the country.

The number of cold steadily increased to 355 by the end of the year 1960 with an installed capacity of 3.05 lakh tonnes. Realizing that the growth was not fast enough, the Government of India provided a number of incentives to the cold storage industry. Therefore, the number of cold stores are increasing in the country. At present, there are 4628 cold stores working in the country with an installed capacity of 16.10 million tonnes and of these 4189 are in the private sector, 268 in the co-operative and rest are in the public sector. The growth of this industry has been maximum in Uttar Pradesh followed by West bengal, Punjab, Bihar and Haryana.

The growth of cold storage industry in India is achieving significant progress keeping pace with its demand to match the production. Nearly 92 per cent of the cold storage capacity is being utilized for storage of potatoes alone, while for the fruits and vegetables, the share in the total cold storage is just one per cent. As far as total production of fruits and vegetables is concerned, the available capacity is insufficient. The available cold storage and frozen storage together meet only 14 per cent of potato production, 0.5 per cent of fruits and vegetables and 0.4 per cent of fish and dairy products.

Andhra Pradesh scenario

Andhra Pradesh is the second largest aggregate fruit producer, next only to the state of Bihar (1995-96). The area under fruit cultivation in Andhra Pradesh stood at 5.46 lakh hectares with an estimated aggregated production of 22.30 lakh tonnes, during 1997-98 compared to 5.33 lakh hectares and estimated aggregated production of 58.40 lakh tonnes in 1996-97.

The ICMR recommended per capita requirement of fruits and vegetables is 265 g per day. As against this, the current production allows a per capita consumption of 480 g, which is almost double the minimum requirement for the domestic consumption within the state. This indicates Andhra Pradesh is a surplus state as far as horticultural production is concerned and hence can mount a major effort to process the produce as well as export the commodities in a significant manner. But in reality, the average per capita consumption of these fruits and

vegetables is reported to be around 230 g which means that there is a greater wastage of both fruits and vegetables, which account for around Rs. 280 crores per annum.

This is mainly attributed to lack of infrastructures like cold storage, absence of transuancy cold storage services, bad transportation and lack of processing facilities.

It is worth mentioning that cold storage and cold chain facilities are an important linkage not only in the efficient agricultural marketing system but also in the growth and development of horticultural sector. Cold stores are being important linkages in the growth and development of Horticulture and Agricultural Marketing. The cold storages are working or operating under all the three sectors viz., private, public and co-operative, but due to many managerial and administrative problems, lot of criticisms have been made on the functional and working efficiency of co-operative undertakings.

Andhra Pradesh has a good potential for horticulture and has about 1.53 million hectares of area covered under horticulture crops. The total production of horticulture crops is 11.30 million tonnes in addition to 1052 million coconuts. Andhra Pradesh is the second largest producer of fruits and vegetables in India and it produces more of chillies, turmeric and oil palm than any other state.

The horticulture sector is expected to account for 10 per cent to 15 per cent of the State's gross state domestic product in the next 10 years, growing at an average rate of 15 per cent. Growth is expected to come mainly from exports and inter-state trade. The horticulture sector in particular offers maximum scope on moving up the value chain.

Area under horticulture crops during 1982 was recorded as 3.7 lakh hectares. In 2001, 13.78 lakh hectares was recorded with an annual production of 9.5 MTs and in 2002, 1.5 million hectares with an annual production of 10 MTs. Andhra Pradesh is the leader in production of mango, citrus, chillies, turmeric and oil palm and is also a major producer of cocoa, cashew, guava, coriander, banana, ginger and coconut.

Fruit crops occupy major portion of area coverage i.e., 7.60 lakh hectares in the state. The major crops are mango, citrus, banana, cashew, cocoa and plantation crops. During the year 2004-05 increase production, area and productivity is to be achieved through technology and management practices.

In Andhra Pradesh the total area under vegetables is 2.36 lakh hectares with an annual production of 3.31 million tonnes. The per capita consumption is quite low. The present production is not adequate to meet the present demand of 7.70 million tonnes. Andhra Pradesh holds first rank in chillies and turmeric in area, production and productivity.

Andhra Pradesh produces about 70 lakh tonnes of fruits and vegetables annually. It is a matter of great concern that more than 25 to 30 per cent of fruits and vegetables produced is lost due to improper handling, storage and processing facilities. Fruits and vegetables being highly perishable with short shelf life, suffer heavy losses in their availability and quality after harvest.

The production and marketing of the highly perishable commodities suffer greatly from uncertain and unstable market conditions. The lack of infrastructure for storage and processing leading to seasonal gluts and ample opportunities for market intermediaries to exploit farmers. Cold storages are most important which need an immediate attention. The distribution and availability of cold storage are important to the farming community for storing commodities during market gluts after harvest and to sell the produce when the prices are high. It not only prevents the post-harvest glut but also prevents the losses and safeguards the quality of the produce.

There are 119 cold storage units in the state with a total installed capacity of 3,28,677 MT, which is shared by co-operatives (9%), private sector (84%) and the public sector (7%). The cold storage capacity in Andhra Pradesh rose from 63,735 MT in 1990 to the present level of 3,28,677 MT (2004), cold storage capacity which has been created in the state and is mainly concentrated in Guntur district and Hyderabad city, which accounts for about 43 per cent of the total capacity in the state. The survey conducted by Technical Consultancy Services of Andhra Pradesh indicated that out of 119 cold storages in Andhra Pradesh, 50

units have good occupancy, 23 satisfactory and 14 have low levels of occupancy. The percentage of capacity covered by closed units is accounted for 27 per cent approximately.

The remaining 73 per cent have satisfactory or good occupancy level. Almost 20 to 25 of these units are engaged in storage of fruits, vegetables and their value added products. It is also a fact that the existing cold storages not only in the state but also in the country are not working to the optimum level. Even they are not able to utilize their full capacity because of small-scale production, lack of awareness, high cost of maintenance, lack of technical supervision, lack of infrastructure etc. The success of cold storages depends on its optimum utilization, regular and continuous supply of power. This is critical for the growth and viability of cold storages. There is a general dissatisfaction among the farming community that cold storage facilities are inadequate in the state on one hand, but the owners complain that cold storages are being operated at sub-optimal level rendering them unviable. It is in this context that the present study is designed to examine the selected cold storage units and to analyse their viability and performance in Hyderabad district (AP).

The study would provide an insight into the number of cold storage units existing with different installed capacities in Andhra Pradesh, profile of commodities stored, investment pattern structure etc. It will also provide valuable insights into the causes for problems in the storage of commodities in the cold stores, so that necessary corrective measures be initiated to make them more functional and viable for the development of horticulture and market economy in Andhra Pradesh.

The following are the specific objectives of the study.

1. To identify and document the profile of cold storage units in Andhra Pradesh.
2. To analyse the profile of different commodities stored in selected units.
3. To analyse the investment profile and financial feasibility of cold storage units.
4. To analyse the cost and returns in selected cold storage units.
5. To analyse the composition of users group.
6. To study the constraints faced by the users and cold storage operators in functioning of cold storage services.

II. REVIEW OF LITERATURE

The importance of cold storage of fruits and vegetables to achieve the twin objectives of price stabilization and fair prices to producer and consumer have long since been recognized and the concerted efforts have also been made to expand or increase the cold storage capacity in our country but the efforts to analyze their organization and operations are very much lacking. There are only a limited number of studies reporting the profile, investment pattern, cost and returns, users group and performance of cold storages. The available literature pertaining to the past studies on cold storages are presented under the following heads.

Documentation and profile of different commodities stored.

Agarwal (1976) reported that the viability of seeds storage may be affected by a number of separate but interacting factors. However, seed moisture or relative humidity of the atmosphere and storage temperature are the two most important factors influencing seed viability. Therefore, he analysed the data on mean relative humidity and mean temperature for the last 30 years (1931-60) for a few important towns in 14 states. For short-term seed storage upto 8 months or one planting season, 70 per cent relative humidity and 30°C have been considered as the upper limit of minimizing the loss in seed viability.

Lingamurthy *et al.* (1981) reported that regulated market provides storage facilities to the farmers who want to wait for a fair price. The Warangal Agricultural Market in Andhra Pradesh has 2100 metric tonnes storage accommodation which is sufficient to cater to the needs of the farmers of the market centre. Moderate rates are charged for storage. But this storage accommodation is only a temporary one, ranging between 15 and 30 days.

Mohan Doss (1987) developed two concepts of capacity utilization viz., net capacity utilization (NCU) to account for a few days storage and frequent withdrawals and economic capacity utilization (ECU) to account for the charging of fixed rates per unit time (mostly monthly rates), from the data collected from one private apple storing unit and multi-commodity co-operative store in Bangalore city.

Arora *et al.* (1996) in his study revealed that food processing units in Uttar Pradesh provides employment opportunity to under or unemployed family members. The performance of these food processing units is satisfactory but the performance in capacity utilization is very poor. Flour chakki, rice huller, rice huller-cum-sheller and oil expeller are found utilizing 34.50, 18.42, 22.50 and 16.67 per cent of installed capacity.

Grover *et al.* (1996) observed that for all agro-industries except village ghani oil and gur-khandasari, positive and significant growth rates in employment were observed. The industries like village pottery, processing of cereals and pulses, limestone, bee keeping, fruit preservation and leather industry experienced compound growth rates of 18.35, 16.5, 14.32, 12.03, 10.80 and 10.13 per cent per annum, respectively.

Singh *et al.* (1996) in their study on viability of processing units of fruits and vegetables in rural areas of Allahabad district revealed that there are two large scale canning companies viz., Allahabad, Canning Company and S. R. Cannery, Allahabad have been functioning for last three decades and making more than 150 products. In spite of these two, 10 processing units have also been installed in the city in private and co-operative sectors. The existing agro-processing units situated in the city are not in a position to handle much quantity of fruits and vegetables at one time. So that the establishment of agro-processing units are essential in potential area of the district.

Kasle *et al.* (1996) found that the initial investment for the establishment of oil industries, dhal mills and cotton ginning industries was Rs. 3.19, 4.81 and 5.63 lakh, respectively. The cost of machinery was the major items contribution, respectively. The average capacity utilization of oil industry, dhal mill and cotton ginning industry was only 41.67, 71.20 and 43.79 per cent, respectively.

Khatkar (1996) in his study of status and prospects for food processing industry in India, found the annual growth rate of 5.7 per cent in 1992-93. In India processing is less than one per cent of the total fruits and vegetables produced. The author suggested the need to develop the required infrastructure facilities and improved technology in marketing,

communication, post-harvest technology. The government should pay due attention to make this a viable industrial sector.

Rai *et al.* (1996) in their study of status and potential of agro-processing industries in Haryana found the potential and scope of agro-processing industries is tremendous, where supply of raw material is more and processing, marketing are not serious problems. The future potential of developing agro-processing lies in wheat milling, feed and concentrate industry, edible oil, cotton processing and vegetable processing.

Waris and Chowdhary (1997) in their study on economic efficiency of milk producers co-operative society in Northern Bihar concluded that the society was performing at a level far below the minimum levels prescribed for similar industries. They arrived at this conclusion by evaluating the ratios of liquidity, profitability and debt-equity for a period of five successive years.

Kavitha (2000) documented agro-processing units/industries in different taluks of Uttar Kannada district. Here, she stated about the number of agro-processing units/industries in different taluks of Uttar Kannada district with their investment has been documented.

Madan Mohana Reddy (2000) studied distribution pattern of agro-based industries. Commodity-wise distribution of agro-based industries in the district showed that jowar flour mills accounted maximum i.e., 64.07 per cent of the total agro-based industries. This is because, it is natural that in India most of the food grains, specially jowar was processed at the consumer level in small quantities whenever it was required.

Shivakumar (2000) studied the management of cotton ginning and pressing industries in Bellary district and found that out of the total number of 4302 agro-based units in Bellary district, the number of small scale units were 4296 and remaining 6 are large scale units. Thus in most of the agro-based units were in small-scale units, the total investment made for establishing 4296 small-scale units was Rs. 4,485.82 lakhs and employed 19417 persons and the establishment cost of large scale units was Rs. 8856.00 lakhs and they employed 2019 persons.

Shivashankar (2004) studied the documentation of the growth and status of agro-based small scale industries. The growth of small scale industries in Dharwad district was growing at the rate of 11.27 per cent annum over a period of time. The number of units during 1993-94 was 406 with investment of Rs. 1353.31 lakhs with an employment of about 2157 persons and increased to 860 number of units with an investment of Rs. 3171.37 lakhs, providing an employment to 3955 persons during 2002-03.

Investment pattern and feasibility

Lingamurthy *et al.* (1981) reported that regulated market provides storage facilities to the farmers who want to wait for a fair price. The Warangal Agricultural Market in Andhra Pradesh has 2100 metric tonnes storage accommodation which is sufficient to cater to the needs of the farmers of the market centre. Moderate rates are charged for storage. But this storage accommodation is only a temporary one, ranging between 15 and 30 days.

Bhatnagar (1985) reported that as high as 87.49 per cent of total installed cold storage capacity in India is exclusively used for potato storage. The existing cold storage capacity has been created in the private sector which owns 85.85 per cent of the cold stores and 92.58 per cent of cold storage capacity. The public and co-operative sectors put together hold remaining 14.15 per cent of the total capacity and most of them were under utilizing their installed capacity. Author opined that diversified utilization of cold storage facilities are necessary for improving the viability of cold storages

Rajendran (1987) opinioned that establishment of cold storages in general appeared to be economically unsustainable. It was observed from the study that 55 per cent of the project cost was involved in building materials and civil works. Machineries and power costs accounted for 22 and 36 per cent, respectively. He concluded that to make the project viable, reduction in installation cost and working cost were necessary.

Rao (1990) compared wholesale market price with cold storage economics in Bangalore district. Results of the study implied that storage beyond July might not be a workable proposition due to glut in the market. This type of situation adversely affect the economy of cold storage. He suggested that cold storage coupled with trading activity may be in a position to absorb losses and improve capacity utilization of the unit.

Dalvi *et al.* (1992) studied on economics of processing of cashewnut in Sindhudurg district of Maharashtra. They observed that the overall total capital investment was 40.44 lakhs, which consisted of Rs. 4.45 lakhs fixed capital (11.01%) and Rs. 35.99 lakhs working capital (88.99%). In the total capital investment, the share of land and building was 1.55 per cent. Finally, they concluded that the processing of cashew was a capital intensive business.

Venkatasheshaiyah (1992) evaluated the groundnut processing in Andhra Pradesh. He has studied the investment pattern of groundnut processing units and revealed that there was a direct relationship between the total capital investment and the size of oil mill. It was seen that the capital invested per quintal of oil production was Rs. 161.01 in baby expeller mills, Rs. 122.24 in 2-chamber mills and Rs. 83.86 in 3-chamber expeller mills.

Ravishankar (1993) while studying the economics of production and processing of Davana in the Eastern Dry Zone of Karnataka observed that from among the various items included under variable costs, the cost of the raw material stood at Rs. 7.2 lakhs accounted for 92 per cent of the total variable costs. The wages, which accounted for 4.60 per cent followed by the cost of fuel wood, which accounted for 1.84 per cent.

Saika and Talukdar (1996) studied the economic potential of commercial processing firms at farm level for major spices in Nagam district of Assam. It was observed that on an average capital investment in commercial processing units were Rs. 1.20 lakhs, Rs. 0.94 lakhs and Rs. 0.78 lakh, respectively. The investment in machinery and equipments shared the higher portion and it was followed by opportunity cost of own land. Out of total capital investment, 91.73 and 98.85 per cent were shared by raw materials in turmeric and chilly processing units, respectively.

Joshi *et al.* (1999) studied the capital investment in the home cottage, small and large scale of mango pulp making units in South Konkan region. In these, the fixed capital accounted to the tune of Rs. 1.0 lakh, Rs. 1.6 lakh, Rs. 1.8 lakh and Rs. 20.7 lakhs, respectively. The working capital accounted for Rs. 2.25 lakhs, Rs. 11.35 lakhs, Rs. 4.3 lakhs and Rs. 21.03 lakhs, respectively.

Korikanthimath and Hiremath (2000) studied the economic feasibility of cardamom cultivation on steep slopes of Western Ghats. The study revealed that the annual average maintenance cost was Rs. 53,664.86 per ha. Out of the various inputs, maximum expenditure was incurred towards labour indicating the labour intensive nature of cardamom. A net income of Rs. 74488.95 per ha was obtained with a production cost of Rs. 88.01 per kilogram (Dry). The economic feasibility measures such as NPV (Rs. 155476.33/ha) and BCR (2:1) indicated the viability of investment on cardamom even on steep slopes.

Patil *et al.* (2000) evaluated the economic feasibility of teak plantation in Nagpur forest circle in Maharashtra state. For testing the economic viability, project evaluation techniques were used. The benefit:cost ratio, net present value, profitability index, payback period and internal rate of return (at 12% discount rate) were 5.77, Rs. 102275, 9.49, 9 years and 34.24 per cent, respectively, while the corresponding figures at 15 per cent discount rate were 4.198, Rs. 52003, 6.30, 9 years and 33.24 per cent. This indicated that all the parameters of economic feasibility test turned out to be favourable, thereby justifying investment in teak plantations, which was found to be economically a viable proposition.

Singh *et al.* (2000) conducted an economic feasibility analysis of Acacia spices under agro-forestry system of plantation in Sultanpur district of Uttar Pradesh. To test the economic feasibility, the net present value, benefit:cost ratio and internal rate of returns of acacia were worked out. The benefit:cost ratio (1:3.72), IRR (44.22%) and net present value (Rs. 14836) showed a higher economic feasibility of acacia species.

Sukhjinder and Dhaliwal (2000) examined the economics of Poplar cultivation in Punjab state. Three types of agro-forestry systems (AFS) were studied : AFS-I (wheat-kharif-fodder), AFS-II (sugarcane for first three years and then wheat – kharif for the successive years) and AFS-III (potato-kharif fodder for the first year and wheat-kharif fodder for the successive years). The higher net present value of Rs. 1.16 lakhs per acre in Ludhiana was found for AFS-II in the sixth year while it was Rs. 1.27 lakhs per acre for AFS-II in both the districts : 53.82 per cent in Ludhiana and 231.72 per cent in Ropar district. The benefit-cost ratio was the highest in the sixth year (4.79) for AFS-II in Ludhiana 5.43 for AFS-III in Ropar district.

Veena and Tajinder (2000) had studied performance analysis of Bhogpur and Jargaon sugar mills of Ludhiana district in Punjab. They found that production cost of sugar in Bhogpur sugar mill was Rs. 12.37 per kg and it was Rs. 9.89 per kg of in Jargaon sugar mill. The expense on raw material was the major item of the total cost.

Gajanana and Subramanyam (2001) studied the marketing and exports of lemongrass oil in Kerala. The process involved filtration to remove sediments, moisture and blending for standardizing citral content. The processor observed shortage/loss of around one per cent during filtration of oil. The cost of processing of lemon grass oil was observed to be Rs. 4.70 per kg. The purified/standardized lemongrass oil was traded locally as well as in the international market.

Jayesh (2001) used NPV, IRR, BCR and PBP for analysing the financial feasibility of pepper and cardamom plantations in Kerala and Karnataka. The financial feasibility analysis revealed that the investment in pepper and cardamom plantations in the states of Kerala and Karnataka was economically sound even under the risks of increase in costs and decrease in returns.

Manjunath (2003) evaluated the performance of fruits and vegetable processing units of Bangalore district which revealed that the total cost of processing amounted to Rs. 31147.38 and Rs. 33890.37 per tonne of processed products in private and public sector units, respectively.

Siddaram (2004) studied the investment pattern in the processing units. It clearly showed that plant, machinery and equipments formed major component of investment accounting for 50.12 per cent of investment followed by building and civil structures 33.35 per cent and cost of land 9.02 per cent and infrastructure facilities to the extent of 6.69 per cent. The investment on plant, machinery and equipments was Rs. 150.36 lakhs followed by building and civil structures at Rs. 100.05 lakhs followed by cost of land to the extent of Rs. 27.05 lakhs. Investment on infrastructure facilities, office and fixtures and miscellaneous fixed assets contributed to an extent of 7.51 per cent, envisaging total investment of Rs. 300.03 lakhs in the co-operative processing unit. Investment on infrastructure facility structures, office fixtures and miscellaneous fixed assets contributed to an extent of 7.49 per cent, envisaging total investment of Rs. 500.98 lakhs in private processing unit.

Cost and returns

Dass *et al.* (1981) studied utilization pattern and costs and returns of cold storage in Karnataka. Results revealed that though the share of primary agricultural produce was greater, share of farmers was less in the cold storage units. The net capacity utilization of cold storages was found to be most unimpressive and calls for a serious thinking by the policy formulators. Only two private units were satisfied with their performance whereas co-operative units were running under loss.

Gill and Gill (1982) analysed the economics of cold storage of potato in Punjab. Results showed that cold storing of potato was economical throughout the net gain started period. However, from May onwards the net gain started increasing and it was maximum in the month of July and in November as compared to immediate post-harvest sales. The study thus brought out that it was advisable for the farmers to avail themselves of cold storage facilities and earn more profits.

Rao (1990) compared wholesale market price with cold storage economics in Bangalore district. Results of the study implied that storage beyond July might not be a workable proposition due to glut in the market. This type of situation adversely affect the economy of cold storage. He suggested that cold storage coupled with trading activity may be in a position to absorb losses and improve capacity utilization of the unit.

Subramanyam and Sudha (1992) worked out the costs and returns associated with processing one tonne of finished product of tomato (ketchup), it was observed that the benefit cost ratio was around 2.00 showing that processing of tomato was profitable.

Chatha *et al.* (1993) estimated the storage costs and economics of storage of potato in Punjab. The results of the study indicated that cold storage of potato was economical throughout the year. The cold storage capacity available in the state exceeded the actual requirements. However, the dearth of cold storage was felt due to faulty locations as well as due to ignorance of farmers about the space available in a particular cold storage. It was also

reported that only one third of the potato farmers, especially large farmers availed the cold storage facilities and the majority of farmers did not use this facility due to weak financial position, price uncertainty and risk of damage. The increased cold storage capacity in the state did not have much impact on seasonal price fluctuations of potato in the state.

Singh *et al.* (1994) based on the economics of marketing and processing of pulses in Bundel Khand region (Uttar Pradesh), revealed that the average cost of processing per quintal including cost of raw material worked out to Rs. 800.61. The processing cost of per quintal of arhar, gram and lentil dhal amounted to Rs. 831.67, Rs. 822.47 and Rs. 752.05, respectively.

Veena (1996) studied the economics of cold storage in Karnataka. The results of the study revealed that the annual cost per tonne of stored produce was highest in the public sector (Rs. 2242.82) followed by co-operative sector (Rs. 2249.82) and lowest in private sector units (Rs. 1979.30), of which the share of over head cost accounted to 80 per cent in all types of cold storages. It was also observed that among the overhead costs, establishment cost accounted for larger share of 25 to 29 per cent. However, it was highest in the public sector i.e., 29.07 per cent. The other overhead costs were interest (15.46%), depreciation (12.67 to 14.45%), others (9.47 to 10.51%). Operating cost accounted for about 20 per cent of the total cost of all types of units. Though, there was not much variation in the cost structure of all units, only private units were able to earn a profit and other two sectors were under loss. However, the losses in both sectors were attributed to high overhead cost and poor capacity utilization.

Babusingh *et al.* (1998) in their study on storage and its effects on economics of potato marketing in Furukabad district of Uttar Pradesh computed storage costs of potato including fixed and variable costs. The storage cost of potato was Rs. 49.66 per quintal. The fixed and variable costs accounted for 24.66 and 73.56 per cent, respectively. The net price spread in potato marketing in pre and post-storage period showed that the producer's share in the consumer's price was higher (17.59%) when the potato grower sold it in the off season after storing in cold storage. It was mainly due to the higher price during off-season. Against this, during pre-storage period the producers share in the consumer's rupee was 61.76 per cent because of low harvest price.

He also reported that the growers in the study area stored potato to get better prices during off-season. Therefore, he suggested to provide better and efficient storage facilities to the potato growers.

Ramandev (1998) in the study on management appraisal of cashew processing industry in Uttar Kannada found that the total capital investment directly varied with the size of the unit. Further, he concluded that the total capital investment was Rs. 117.5 lakhs for large-scale units and Rs. 36.32 lakhs for small-scale units. Wherein, the working capital accounted for about 75 per cent of the total capital investment. In the fixed capital investment about 80 per cent was accounted for building and machinery.

Shobha (1998) in her study on performance of fruit and vegetable processing units in co-operative and private sector in Uttar Kannada district found that the private sector processing unit procured fruits and vegetables to the tune of 187.098 metric tonnes valued at Rs. 8.37 lakhs.

Manjunath (2003) compared the private and public sector fruits and vegetable processing units in Bangalore district of Karnataka. He indicate that capital investment was higher on plant and machinery (80.58%) in private sector whereas in public sector, it was 74.65 per cent.

Chowda Reddy (2004) indicated that cost and returns structure, where the total variable cost was shown more than the total fixed cost in the cultivation of beans. The expenditure on variable inputs in the cultivation of beans formed nearly 90 per cent and remaining 10 per cent was constituted by fixed cost. This is due to high cost incurred on inputs such as human labour, FYM, seeds and chemical fertilizers. Among the fixed cost, the magnitude of cost incurred on rental value of land (9.63%) was the highest because the rental value of the land was high (Rs. 8000 per acre per year) in the Belgaum District.

Problems faced

Rehman (1985) observed that there were 107 agro-based industrial units in Baduan district of Uttar Pradesh based on crops like oilseeds, pulses, sugarcane, potato and mentha.

He pointed out that these agro-industrial units together provided employment for about 3,398 people annually. He also assessed a great potential for future agro-industrial expansion in the above district.

Hemachand (1989) in his study on economics of processing of arhar in Narasinghpur district of Madhya Pradesh found that the main problems of the processors were short supply of raw materials, frequent shedding of power and inefficient technology which together ultimately lead to lower capacity utilization and declining output.

Srivastava (1989) indicated that, with subsequent secondary and tertiary processing of various raw materials, the value added as well as the price of finished products would be increased. He observed that agro-processing units accounted for 39 per cent of the total factories in the study area. He noticed capital productivity ratio in agro-industries was almost the double (0.7) than the non-agro based industries (0.35). While labour productivity was less than half when compared to non-agro based industries.

Nagesh (1990) found that major problems faced by the groundnut processors in Karnataka were high competition among the existing processors, short supply of raw materials, frequent price fluctuations, non-availability of skilled labour and high taxes.

Venkatasheshiah (1992) in his study on groundnut processing units in Andhra Pradesh identified stiff competition among the processors for getting the required raw materials, frequent power shedding, high taxation, low product recovery and non-availability of efficient technology at an affordable costs as the major problems associated with their business.

Mangal Singh (1995) while studying the strategies for effective management of sugar factories in India found that lack of quality raw material, efficient technology and professionally trained management personnel at different levels of organizational structure as the main problems as depicted by the study. He carried these problems as firms internal problems and similarly pointed to the firms external problem such as governments pricing policies.

Sharma *et al.* (1995) studied marketing of vegetables in Solan district of Himachal Pradesh to study the problems of cultivators during storage, transportation and marketing of these crops. They pointed out some of the major problems like costly wooden boxes, time consuming manual grading, distant markets, high transportation charges, malpractices in the market and lack of market information. It was observed that about 90 per cent of growers were facing the problem of distant market, lack of standard grade was reported by about 37 per cent of cultivators and costly packing material was reported as a problem by 75 per cent of cultivators. It was thus suggested that the market information should be announced through mass media like radio/TV and also through pamphlets.

Rachpal Singh and Darshan Singh (1996) studied the performance of agro-processing units in Punjab and revealed that failure of these industries on the market front in terms of brand is the major problem. Further, he opined that any such failure ultimately put a question mark on the very survival of the industry or unit under consideration.

Rai *et al.* (1996) examined the potentials and problems of agro-processing industries in Haryana state and revealed that there is a tremendous scope for agro-processing industries in Haryana where the supply of raw materials, processing units and marketing are not serious problems. Infrastructural facilities in the state are reasonably well developed. The future potential of developing agro-processing industries lies in wheat milling, rice milling, feed and concentrate industry, edible oil cotton processing and sugarcane milling.

Brahmaprakash and Dineshkumar (1997) in their study on infrastructural requirements for establishment, development and operation of agro-based industries in rural areas opined that lack of market information systems, storage and transportation system, timely and adequate financial support and post-harvest technology were the major-problems to realize the rural projects in India.

Jagadish Prasad (1997) conducted a case study on three sets of marketing institutions viz., public institutions, co-operative organizations and private trade in Rachi district of Bihar to identify the problems and prospects of vegetables marketing and on the basis of findings to suggest suitable strategies for improving its efficiency. It was observed that in case of co-operative marketing institutions the financial position was not sound, lack of infrastructural facilities for better marketing of vegetables and also lack of storage facilities, which were highly essential to avoid market gluts.

Roy (1997) opined that lower capacity utilization of the agro-based industries was reasoned by lack of infrastructural facilities such as transportation, storage and technology for post-harvest handling. He also opined that lack of integrated network between the producer farmer and processor as an indirect problem of the agro-based industries.

Patil (1998) in her study on performance evaluation of fruit and vegetable processing units in North Karnataka indicated, lack of availability of raw material, irregular power supply, high taxation for the commodities and lack of modernization of machines to be the major constraints observed in fruit and vegetable processing units.

Raman Dev (1998) in his study on business performance analysis and appraisal of the cashewnut processing units in Uttara Kannada district of Karnataka identified high taxation, short supply of raw materials, non-availability of skilled labour, unfavourable government policies and marketing system as the major problems as conceived by the industry.

Chidri (1999) in his study on management of agro-processing units in Karnataka indicated that high taxation, high procurement cost, irregular power supply, inadequate finance, irregular labour supply and marketing of finished products are the major problems faced by the tur processing units.

Ashraf Ali (2000) in his study on business performance of co-operative oil mills noticed that non-availability of raw materials in sufficient quantity and in desired quality was the most important problem faced by the large and medium scale units followed by lack of infrastructural facilities as the second in order.

Kavitha (2000) documentation of agro-processing units/industries in different taluks of Uttar Kannada district. Here, she stated about the number of agro-processing units/industries in different taluks of Uttar Kannada district with their investment has been documented.

Here, totally 531 agro-processing units have been identified, which included rice mills, cashew processing units, bakeries (bread), soft drinks and ice-cream, flour mills, oil mills, papad and chips, processed (Scented) supari, medicine and aromatic plants processing units, areca leaf up units, honey processing units, pickle making units, poultry farm, aqua culture, textiles, wood and wood based industries and other industries which include 27 units.

III. METHODOLOGY

It is understood that methodology is the strong foundation for systematic and scientific research or investigation. It is imperative to give the details of investigation and methods adopted by the investigator or research in finding out the fact or problems. This chapter outlines briefly the characteristics of the area selected for the study, sampling methods, the nature and sources of data, the tools and techniques adopted in the analysis of data and evaluating the results.

The methodology followed is presented under the below heads.

- 3.1 Selection of the study area
- 3.2 Description of the study area
- 3.3 Nature and source of data
- 3.4 Collection of data
- 3.5 Analysis of data

3.1 SELECTION OF THE STUDY AREA

The study is confined to Hyderabad district in Andhra Pradesh state a number of cold storage units are located in the terminal markets of Hyderabad district in which major fruits and vegetables are grown in Hyderabad and hinterland. So, Hyderabad district was purposively selected for the study keeping in view of the area under fruits and vegetables and proximity to terminal market. Hyderabad is situated at 13⁰8' North latitude and 70⁰8' east longitudes. However, the districts of Medak and Rangareddy were taken into the consideration as they are being moderately good for cultivation of fruits and vegetables and finally the produce would be moved to Hyderabad district and local city only.

There is a growing interest in the cultivation of fruit and vegetable crops in Andhra Pradesh in view of increasing demand for horticulture products. Andhra Pradesh occupies the second position in the production of fruits and vegetables in India. The present study has been undertaken purposively in Hyderabad to explore the possibilities and of harnessing the potential of horticulture crops.

3.2 DESCRIPTION OF THE STUDY AREA

Andhra Pradesh state is situated between 16⁰30' North latitude and 74⁰12' and 78⁰41' East longitude and lies in the west-central part of the peninsular India and Hyderabad district is situated at 13⁰8' North latitude and 70⁰8' east longitudes. Its length from North to South is 974 kms and from east to west is 400 kms. Andhra Pradesh state covers an area of 2,43,845 sq kms and occupy 8.37 per cent of the total geographical area of the country. The state has been in the forefront in respect of both agricultural and horticultural production and is blessed with ideal agro-climatic conditions (7 zones) and enterprising farming community. The state with its salubrious and moderate climate, accounts for an enormous area under horticulture and also receiving an active support from the state as well as Central Governments.

The geographical area of Andhra Pradesh is 274.40 lakh ha. Of which an area of 112 lakh ha is cultivable area constituting 40.87 per cent of the geographical area. Out of the total cultivable area, about 15.60 lakh is covered under horticulture (Horticultural Crop Statistics for 1999-2000). Horticultural area in the state accounts for about 7 per cent of the total geographical area, forming about 15 per cent of the total cultivable area. Out of 15.60 lakh ha. Of horticulture crop area, 6.16 lakh ha. Comes under garden/plantation crops, 3.29 lakh ha under vegetables, 3.13 lakh ha under fruits 2.81 ha under spices and 0.21 lakh ha under commercial flowers.

The productivity of horticultural crops has improved due to introduction of high yielding varieties, improved technology and also due to commercialization of agricultural/horticultural technologies. Very recently, efforts were being made to boost agricultural exports, mainly of horticultural produce like fruits, vegetables and flowers by the

Table 3.1: Cold storage units selected for the study

Sl. No.	Particulars	Selected units			
		Unit-I	Unit-II	Unit-III	Unit-IV
1.	Name of the unit	Pavitra Agro Fresh cold Storage Pvt. Ltd.	Verdant Cold Storage Pvt. Ltd.	Foster Cold Storage Pvt. Ltd.	Samyukta Cold Storage Pvt. Ltd.
2.	Location	Dilsukhnagar	Bagh Hayatnagar	Jeedimetla	Nacharam, IDA colony
3.	Year of establishment	1993	1999	1998	1996
4.	Investment (Rs. lakhs)	80 lakhs	120 lakhs	240 lakhs	400 lakhs
5.	Installed capacity (MT)	1500	3500	5000	9230

ANDHRA PRADESH STATE

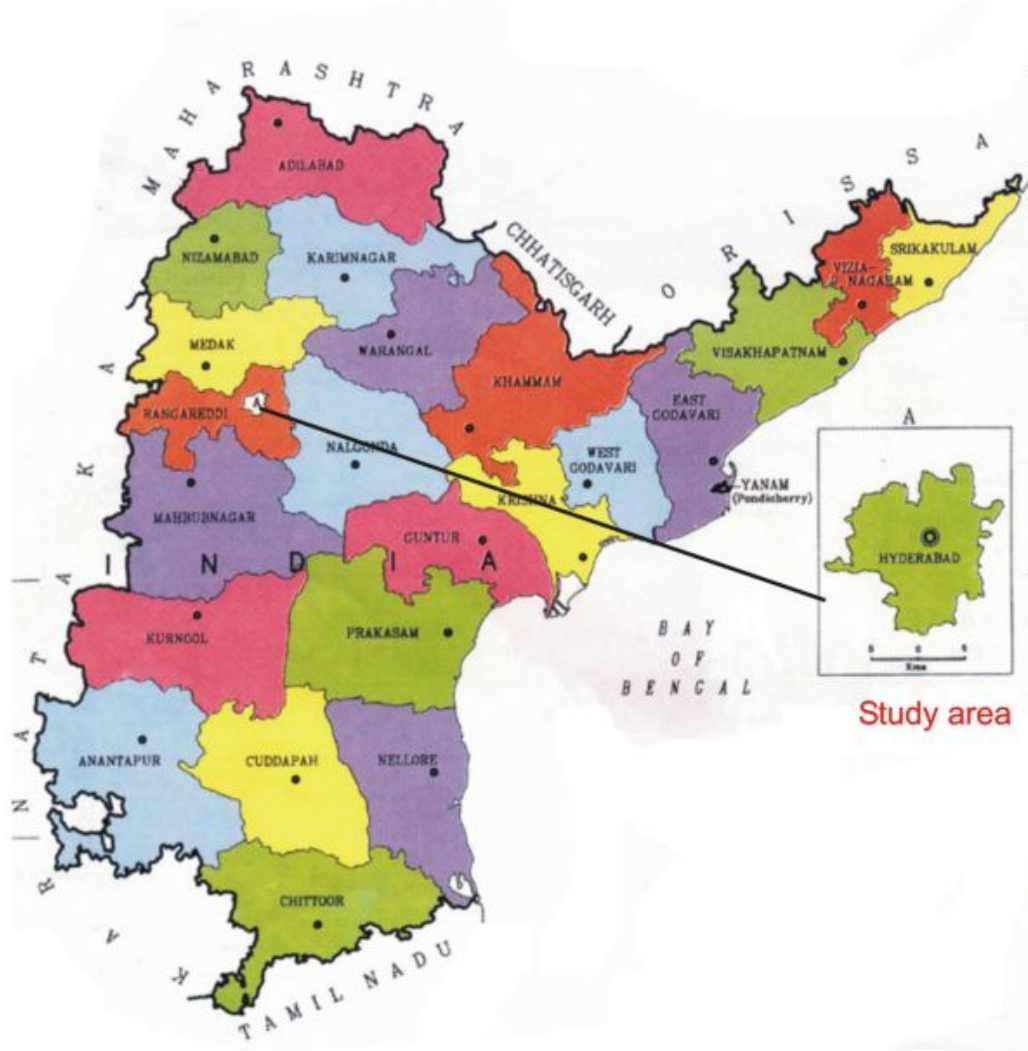


Fig 3.1 Map of AP State showing study area

Table 3.2: Crop-wise details on area and production of fruits in Andhra Pradesh State (2003-04)

Sl. No.	Name of the fruit crops	Area (ha)	Production (tonnes)
1.	Mango	323210	1426104
2.	Oranges	56953	699888
3.	Lemon	43293	317127
4.	Banana	53212	515379
5.	Grapes	1751	33147
6.	Guava	10506	186121
7.	Papaya	4480	416738
8.	Sapota	6794	33724
9.	Cashewnut	150077	37207
10.	Other fresh fruits	7797	-
11.	Other dry fruits	7	-
	Total	658085	3667435

Table 3.3: Crop-wise details on area and production of vegetables in Andhra Pradesh State (2003-04)

Sl. No.	Name of the vegetable	Area (ha)	Production (tonnes)
1.	Potato	2648	24049
2.	Tapioca	19456	122145
3.	Sweet potato	1263	9130
4.	Onion	29049	519481
5.	Cucumber	6489	-
6.	Gourds	9203	-
7.	Bhendi	18614	122982
8.	Beans	9861	60318
9.	Brinjal	21469	349421
10.	Green leafy vegetables	7529	-
11.	Cabbage	2039	-
12.	Peas	76	-
13.	Tomato	81501	815021
14.	Bottle gourd	1212	-
15.	Other vegetables	23836	-
	Total	234245	2022547

government. As per the agricultural policy, the state has both good resource and potentiality for developing horticulture industry. The development of horticulture has assumed importance in Andhra Pradesh after the reorganization of states and since then rapid development and expansion of horticulture activities have been made.

The major and important districts of Andhra Pradesh state growing horticultural crops are Krishna, East Godavari, West Godavari, Cuddapah, Nellore, Chittoor, Ananthapur and Guntur. Major fruit crops are the mango, banana, citrus, grapes, guava, papaya, sapota, pomegranate, amla and ber. The important and major vegetables are potato, onion, tomato, green leafy vegetables, bhendi, beans, radish, knolkhol, carrot, beetroots, brinjal, capsicum, carrot etc. The average level of productivity in Andhra Pradesh in case of fruits and vegetables is 15.22 tonnes and 14.78 tonnes, respectively.

Storage implies preserving. It is the process of carrying surplus production for future consumption. It includes all types of storage, whether traditional method or scientific methods of storage, whether controlled and maintained by the private or public agencies.

3.3 NATURE AND SOURCES OF DATA

Both primary and secondary data were collected from various sources to study the objectives of the study. The secondary data on number of cold storages, installed capacity, production of horticultural crops etc. were collected from different published sources. The main sources of secondary data were Andhra Pradesh at a glance, Statistical abstract, AP, 2004, NHB Chirag ali lane, Yojana, Kurukshethra, Crop season and report (published by Directorate of Economics and Statistics, Khairatabad, Hyderabad, AP) and Horticulture at a glance (published by Horticulture Department). There are totally 119 cold storages in Andhra Pradesh more than 60 units handle horticultural produce.

There are 11 cold storages in Hyderabad district and out of which four were selected within the city for the study, because of their efficiency and capacity utilization, these four cold storage units constitute to an aggregate capacity of 19,230 MT and remaining others were closed down due to no working efficiency of the units. Some of which dates back to 1979. Hyderabad district and city has an aggregate capacity of 32,530 MT.

Of the total installed capacity in Andhra Pradesh, Hyderabad accounts for about 25 per cent of the total capacity in the state. Rangareddy and Medak are the major fruits and vegetables growing area. All the selected four cold storage units are from the private sector were purposively selected for the study.

3.4 COLLECTION OF DATA

The detailed information regarding the profile of different commodities stored, investment pattern and its feasibility, cost structure, composition of users group and problems were collected by pre-tested schedules and also through personnel discussions with managerial staff. . Apart from this, as many as 120 farmers and 40 traders were interviewed in order to study the constraints and problems faced by them in the use of cold storage services. Out of 120 sampled farmers, 30 were selected from each cold storage unit in Hyderabad district. Similarly, 10 traders were selected from each cold storage unit by using random sampling procedure. The general information on cold storage units pertaining to occupation, ownership pattern, type of storage, year of establishment, total installed capacity and source of power etc. were obtained.

The information on cost structure and constraints of cold storage units were also obtained. Month wise storage details and different users of cold storage units, type of commodity stored, optimum storage conditions followed during (2004) were obtained in order to analyse operational efficiency. In order to study the storage practice and problems related to perishable commodities, vegetable growing farmers were purposively selected from the different markets of the concerned areas of the unit.

3.5 Analysis of data

Simple Tabular analysis was followed to identify and document the profile of cold storage units in Hyderabad district, (AP) and to analyse the profile of different commodities

stored, composition of users group and constraints faced by the users and cold storage operators in functioning of cold storage services. In order to study the investment profile and financial feasibility, discounted cash flow techniques involving internal rate of returns (IRR), benefit cost ratio (BCR) and net present worth (NPW) were employed, like-wise to analyse the cost and returns in the selected cold storage units sensitivity analysis was taken up.

Tabular analysis

The primary data collected were presented in tabular form to facilitate easy comparison. The identification, documentation and profile of different commodities stored in the selected units and users group and etc. others were presented in the form of tabular analysis. It was summarized with the help of statistical tools like averages and percentages to obtain meaningful results.

Cost concepts

1. **Over head costs:** It includes establishment charges, rent, taxes, depreciation, interest, salary and wages of permanent employees, repairs and maintenance and other costs like expenditure on communications, stationery, travelling and miscellaneous expenses.
2. **Operating costs:** It includes power and fuel charges, water charges, interest on working capital and other miscellaneous expenses. Simple analysis consisting averages and percentages were used as tools of analysis.

Net present worth

The net present worth is simply the present worth of net benefit of a project discounted at the opportunity cost of capital. The criterion ranks the alternatives. Generally higher the net present worth better would be the preference. In computing net present worth, the difference between the present value of cost streams and present value of the benefit streams were considered at a discount rate of 14 per cent. The general verbal and mathematical form of net present worth criterion is presented below.

$$NPW = \text{Present worth of benefits} - \text{Present worth of costs}$$

$$NPW = \sum_{t=1}^n \frac{B_t - C_t}{(1 + d)^t}$$

Where,

B_t = Benefits in each year

C_t = Costs in each year

t = 1, 2, 3.....n

n = Number of years

d = Discount rate

In order to select the project or to consider the worthiness of a project investment, the net present worth should be positive.

Benefit: Cost ratio

It is the ratio of discounted cash in flows (project benefits) to the discounted cash out flows (project costs), which must be unity or more for an enterprise to be considered worthwhile. The technique also ranks for selection. The minimum ratio required is 1:1. This ratio of 1:1 indicates the coverage of costs without any surplus benefits. But, usually the ratio should be more than unity in order to provide some additional returns over the costs for clear division. The benefit: cost ratio can be stated both verbally and mathematically.

$$\text{BCR} = \frac{\text{Present worth of benefits}}{\text{Present worth of costs}}$$

The mathematical form of benefit:cost ratio is as follows.

$$\text{BCR} = \frac{\sum_{t=1}^n \frac{B_t}{(1+d)^t}}{\sum_{t=1}^n \frac{C_t}{(1+d)^t}}$$

Where,

B_t = Benefit in each year

C_t = Costs in each year

t = 1, 2, 3n

n = Number of years

d = Discount rate

Internal rate of returns

The internal rate of returns is the rate of returns, which equates the discounted benefits with the discounted cost. It represents the average earning capacity of an investment from the project during its economic life period. The mathematical form of IRR is;

$$\text{IRR} = \sum_{t=1}^n \frac{B_t - C_t}{(1+d)^t} = 0$$

Where,

B_t = Benefits in each year

C_t = Costs in each year

t = 1, 2, 3n

n = Number of years or life period

d = Discount rate

The internal rate of returns also ranks the different investment proposals for preference in the order to the magnitude. The IRR should be more than the discount rate to be considered for viable investment and financial soundness.

Sensitivity analysis

In the evaluation of an investment project, we work with the forecasts of cash flows, forecasted cash flows depend on the expected revenue and costs. Further, expected revenue is a function of sales volume and unit selling price. The net present value or the internal rate of return of a project is determined by analysing the after-tax cash flows arrived at by combining forecasts of various variables. It is difficult to arrive at an accurate and unbiased forecast of each variable. We cannot be certain about the outcome of any of these variables. The reliability of the NPV or IRR of the project will depend on the reliability of the forecasts of variables underlying the estimates of net cash flows. To determine the reliability of the project's NPV or IRR, we can work out how much difference it makes if any of these forecasts goes wrong. We can change each of the forecast, one at a time, to atleast three values, pessimistic, expected, optimistic. The NPV of the project is recalculated under these different assumptions. This method of recalculating NPV or IRR by changing each forecast is called sensitivity analysis.

Sensitivity analysis is a way of analysing change in the project's NPV (or IRR) for a given change in one of the variables. It indicates how sensitive a project's NPV (or IRR) is to changes in particular variables. The more sensitive the NPV, the more critical is the variable.

The following three steps are involved in the use of sensitivity analysis.

1. Identification of all those variables, which have an influence on the project's NPV (or IRR).
2. Definition of the underlying (mathematical) relationship between the variables.
3. Analysis of the impact of the change in each of the variables on the project's NPV.

The decision maker, while performing sensitivity analysis, computes the project's NPV (or IRR) for each forecast under three assumptions (a) pessimistic (b) expected and (c) optimistic. It allows him to ask 'what if' questions. For example, what (is the NPV) if volume increase or decreases? What (is the NPV) if variable cost or fixed cost increases or decreases? What (is the NPV), if the selling price increases or decreases? What (is the NPV) if the project is delayed or outlay escalates or the project's life is more or less than anticipated? A whole range of questions can be answered with the help of sensitivity analysis. It examines the sensitivity of the variables underlying the computation of NPV or IRR rather than attempting to quantify the risk.

Procedure involved in the sensitivity analysis

Fairly simple, sensitivity analysis consists of the following steps.

1. Set up the relationship between the basic underlying factors (like the quantity sold, unit selling price, life of the project etc.) and net present value (or some other criterion of merit).
2. Estimate the range of variation and the most likely value of each of the basic underlying factors.
3. Study the effect on net present value of variations in the basic variables (Typically one factor is varied at a time).

$$NPV = \sum_{t=1}^n \frac{[Q(P - V) - F - D](1 - T) + D}{(1 + r)^t} + \frac{S - I}{(1 + r)^n}$$

Where,

NPV = net present value of the project

Q = Number of units sold annually

P = Selling price per unit

V = Variable cost per unit

F = Total fixed cost, excluding depreciation and interest

D = Annual depreciation charge

T = Income tax rate

r = cost of capital

n = Project life in years

S = Net salvage value

I = Initial cost

Table 3.4: Growth of cold storages in India

Year	Numbers	Capacity (tonnes)
1983	2495	4818336
1984	2488	5022568
1985	2522	5099115
1986	2607	5402160
1987	2659	5578442
1988	2749	6142014
1989	2797	6793377
1990	2942	7727849
1991	2970	7787599
1992	2973	770000
1993	3053	8090000
1994	3124	8170000
1995	3167	8580000
1996	3253	8730000
1997	3443	10353090
1998	3502	10739030
1999	3597	11328900
2000	3886	13621981
2001	4146	14952000

Sources: 1. Rana, R.S. (1992) Refrigeration for perishables an integral part of marketing. Agricultural Marketing Vol.xxx(3) 73

2. Economic Survey – 2001-2002

Table 3.5: State-wise distribution of cold storages in India

Sl. No.	State/union territory	Number of cold storages	Capacity (MT)
1.	Andhra Pradesh	118	327991
2.	Assam	3	1703
3.	Bihar	191	407120
4.	Gujarat	118	289469
5.	Goa	29	2500
6.	Haryana	168	212438
7.	Himachal Pradesh	13	9615
8.	Jammu and Kashmir	20	20953
9.	Kerala	134	18235
10.	Karnataka	86	21892
11.	Maharashtra	332	174634
12.	Madhya Pradesh	129	273222
13.	Nagaland	1	1149
14.	Orissa	50	99500
15.	Punjab	320	571000
16.	Rajasthan	50	67297
17.	Tamil Nadu	96	28917
18.	Tripura	3	4278
19.	Uttar Pradesh	927	3983000
20.	West bengal	278	2241790
21.	Delhi	99	124550
22.	Andaman and Nicobar	2	203
23.	Chandigarh	12	18387
24.	Lakshadweep	1	36
25.	Pondichery	5	201
	Total	3253	8900080

Source : Bist and Sharma (2001)

IV. RESULTS

The necessary data collected from various sources were analyzed and interpreted looking to the objectives of the study. In this chapter, the results of the investigation carried out, and they are presented under the following headings.

- 4.1 Identification and documentation of cold storages
- 4.2 Profile of different commodities stored
- 4.3 Investment profile and financial feasibility
- 4.4 Cost and returns in the cold storages
- 4.5 Composition of users group
- 4.6 Constraints faced by the users group and cold storage operators in functioning of cold storage units

4.1 IDENTIFICATION AND DOCUMENTATION OF COLD STORAGES

According to this objective, it may be noted that the state of Andhra Pradesh is divided broadly into three important regions like Telangana, Rayalaseema and coastal Andhra Pradesh. Here from the Table 4.1 shows that district-wise distribution of cold storage units in different regions of Andhra Pradesh. It is also observed that from the shown regions coastal Andhra Pradesh accounted for maximum number of units in the distribution.

In Andhra Pradesh, there are 119 cold storage units spread throughout the state with the total installed capacity of 3,27,991 MT. The complete identification and their documentation has been listed or given according to the region-wise.

The state is comprised of 23 districts among which Telangana region consists of 10 districts, Rayalaseema region consists of 4 districts and Coastal Andhra Pradesh region consists of 9 districts.

Here, according to the region wise the complete list of cold storage units spread throughout the state are mentioned.

There are totally 32 units from Telangana, 13 units from Rayalaseema and 74 units from Coastal Andhra Pradesh. Out of which, the total installed capacity of Telangana region accounts for 82,804 MT like wise Rayalaseema 31,000 MT and Coastal Andhra Pradesh 2,14m187 MT.

Here, the study has been confined to Hyderabad city and district, where the total installed capacity accounts to 32,530 MT with a per cent share of 39.28 to Telangana region and which comprises of 11 units, among them four were selected for the study.

The average installed capacity of Telangana region is 2,587.62 MT, like-wise Rayalaseema 2,384.61 and Coastal Andhra Pradesh 2,894.41 MT etc. and when the study was conducted, it was observed that there were no existence of cold storage units in the districts of Nalgonda, Karimnagar and Adilabad of Telangana region and like-wise no cold storage units are found in the district of Cuddapah from Rayalaseema region of Andhra Pradesh state.

Table 4.1: District-wise distribution of cold storage units in different regions of Andhra Pradesh

Sl. No.	Region/District	No. of units	Total installed capacity (MT)	Average installed capacity (MT)
A.	Telangana			
1.	Hyderabad	11 (34.37)	32530 (39.28)	2957.36
2.	Medak	1 (3.12)	620 (0.75)	620
3.	Mahaboobnagar	1 (3.12)	2000 (2.14)	2000
4.	Nalgonda	-	-	-
5.	Ranga Reddy	2 (6.25)	1900 (2.29)	950
6.	Karimnagar	-	-	-
7.	Nizamabad	2 (6.25)	4900 (5.91)	2450
8.	Warangal	8 (25.00)	22354 (26.99)	2794.25
9.	Adilabad	-	-	-
10.	Khammam	7 (21.87)	18500 (22.34)	2642.85
	Total	32 (100)	82804 (100)	2587.62
B.	Rayalaseema			
1.	Kurnool	1 (7.69)	2500 (8.06)	2500
2.	Cuddapah	-	-	-
3.	Ananthapur	7 (53.84)	17300 (55.80)	2471
4.	Chittoor	5 (38.46)	11200 (36.12)	2240
	Total	13 (100)	31000 (100)	2384.61

Note: Figures in parentheses indicate percentages to the total

Contd...

Sl. No.	Region/District	No. of units	Total installed capacity (MT)	Average installed capacity (MT)
C.	Coastal Andhra			
1.	East Godavari	2 (2.70)	5800 (2.70)	2900.0
2.	West Godavari	1 (1.35)	2500 (1.17)	2500.0
3.	Srikakulam	2 (2.70)	3260 (1.52)	1630.0
4.	Vishakhapatnam	8 (10.80)	18580 (8.60)	2322.5
5.	Vizianagaram	4 (5.40)	8760 (4.08)	2190.0
6.	Krishna	8 (10.80)	18630 (8.69)	2328.5
7.	Guntur	41 (55.40)	141577 (66.09)	3453.09
8.	Nellore	4 (5.40)	6280 (2.93)	1570.0
9.	Ongole	4 (5.40)	8800 (4.10)	2200.0
	Total	74 (100)	214187 (100)	2894.41
	Grand total (A+B+C)	119	327991	2756.22

Note: Figures in parentheses indicate percentages to the total.

Source : Rainbow revolution NHB- 2004.

4.2 PROFILE OF DIFFERENT COMMODITIES STORED IN THE SELECTED UNITS

It is observed from the Table 4.2 that all the selected four cold storage units, and they are Unit-I: Pavitra Agro-fresh Cold Storage Pvt. Ltd., Unit-II: Verdant Cold Storage Pvt. Ltd., Unit-III: Foster Cold Storage Pvt. Ltd. and Unit-IV: Samyukta Cold Storage Pvt. Ltd. These units are storing or going for storage of the commodities such as apple, orange, grapes and plums among the fruits almost round the year, with addition to some of the agricultural commodities like potato, chilli, jaggery, turmeric and tamarind etc and dry fruits, butter, ice cream, processed cheese, milk and milk products, Dhaniya are also seen in the storage units.

These commodities are maintained in the storage units with different storage temperatures, duration and relative humidity, to meet out the demand and its supply in the market throughout the year.

The different temperatures and varied months of storages and their relative humidities are shown in Table 4.2.

From the Table 4.2, it could be opined that maximum number of days of storage in the units was carried out for tamarind and butter (9-12 months), chilli, turmeric, dhaniya and dry fruits, storing for the duration of 6 to 9 months, potato (6-7 months) and followed by other commodities like apple, orange and grapes.

The commodities listed in the table were subjected to different temperatures and relative humidity. Most of the commodities like apple, orange, grapes, plums, potato, chilli, jaggery, tamarind, turmeric, dhaniya and dry fruits were stored in the range of 2 to 8°C with relative humidity of 50 to 90 per cent rest of the commodities like butter, ice cream, processed cheese, meat, milk and milk products were stored in the temperature range of -2 to -10°C with relative humidity of 90 to 100 per cent.

4.3 INVESTMENT PROFILE AND FINANCIAL FEASIBILITIES OF SELECTED COLD STORAGE UNITS

The different units selected for the study in Hyderabad district are Pavitra Cold Storage (Unit-I), Foster Cold Storage (Unit-II), Verdant Cold Storage (Unit-III) and Samyukta Cold storage (Unit-IV) with an installed capacity of 1500, 3500, 5000 and 9230 MT, respectively.

4.3.1 Investment profile

It may be observed from the Table 4.3 that around 55.86 per cent of the total cost in Unit-I, 53.14 per cent of the total cost in Unit-II, 51.94 per cent of the total cost in Unit-III and 54.89 per cent of the total cost in Unit-IV cold storages involved in the construction of building and other structure. While, the machineries cost was around 36.23 per cent in Unit-I, 39.63 per cent in Unit-II, 39.43 per cent in Unit-III and 37.58 per cent in Unit-IV, to the total cost, respectively and like-wise in case of electrification they were accounted to 7.9, 7.2, 8.6 and 7.5 per cent in Unit-I, II, III and IV, respectively.

It was observed in all the selected cold storage units that building share cost was maximum to the total cost, followed by machineries and electrification.

Table 4.4 indicated average annual working cost incurred by the selected units in running the units. It was observed that electricity and water charges accounted for about 74.95, 73.81, 74.19 and 74.81 per cent in Unit-I, II, III and IV, respectively to the total annual working cost. Fuel accounted to the second highest with 20.57, 20.96, 19.81 and 20.15 per cent in Unit-I, II, III and IV, respectively to the working cost. It was found that handling charges, interest on working capital and miscellaneous expenses accounts for remaining share to the working cost in all the selected cold storage units.

Table 4.2 : Profile of different commodities stored in the selected cold storage units of Hyderabad district (2004-05)

Sl. No.	Name of the commodity	Storage duration (months)	Temperature (°C)	Relative humidity (%)
1.	Apple	1	2 – 5	90
2.	Orange	3	6	90
3.	Grapes	1-2	2	90
4.	Plum fruits (Aalbukar, Naspathi, Cherry, Pears etc.)	15 days – 1 month	4	90
5.	Potato	6 – 7	6 – 8	85 – 90
6.	Chilli	9	4 – 6	65 – 75
7.	Jaggery	3 – 9 (upto 1 year also)	5 – 6	65 – 75
8.	Tamarind	9 – 12	4 – 7	60 – 70
9.	Turmeric	9	3 – 5	65 – 75
10.	Dhaniya (coriander)	9	3	90
11.	Dry fruits (Kishmish, Acrots, Anjeer, Jeera, Kurbani, Lavanga, Kaaju and dry grapes)	6 – 9	3 – 4	50 – 60
12.	Butter	9 – 12	-5 – -10	90 – 100
13.	Ice cream	3	-10	100
14.	Processed cheese	3	-5	100
15.	Milk and other milk products	3 – 4	-5	90 – 100
16.	Meat products	3 - 4	-5 - -15	100

Table 4.3: Break-up of cost on installation of selected cold storage units**(Value in Rs.)**

Sl. No.	Particulars	Selected units			
		Unit-I	Unit-II	Unit-III	Unit-IV
1.	Building	44,68,800 (55.86)	63,76,800 (53.14)	1,24,67,040 (51.946)	2,19,56,400 (54.891)
2.	Machineries	28,98,400 (36.23)	47,56,440 (39.637)	98,58,250 (39.433)	1,50,34,000 (37.585)
3.	Electrification	6,32,720 (7.909)	8,67,480 (7.229)	21,55,250 (8.621)	30,09,600 (7.524)
	Total	80 lakhs	120 lakhs	240 lakhs	400 lakhs

Note: Figures in parentheses indicate percentages to the total

Unit I = Pavitra Agro-fresh cold storage Pvt. Ltd. (1500MT)

Unit II = Verdant cold storage Pvt. Ltd. (3500MT)

Unit III = Foster cold storage Pvt. Ltd. (5000MT)

Unit IV = Samyukta cold storage Pvt. Ltd. (9230MT)

Table 4.4: Average annual working cost of selected cold storage units**(Value in Rs.)**

Sl. No.	Items	Selected units			
		Unit-I	Unit-II	Unit-III	Unit-IV
1.	Power and water charges	5,99,600 (74.95)	13,28,652 (73.814)	16,32,334 (74.197)	30,67,333 (74.813)
2.	Fuel	1,64,584 (20.573)	3,77,424 (20.968)	4,35,908 (19.814)	8,26,232 (20.152)
3.	Handling charges	3,832 (0.479)	9,774 (0.543)	17,534 (0.797)	37,597 (0.917)
4.	Packing materials	-	-	-	-
5.	Interest on working capital	15,872 (1.984)	32,634 (1.813)	43,406 (1.973)	71,012 (1.732)
6.	Others	16,112 (2.014)	51,517 (2.862)	70,818 (3.219)	97,826 (2.386)
	Total	8 Lakhs	18 Lakhs	22 Lakhs	41 Lakhs

Note: Figures in parentheses indicate percentages to the total

Table 4.5: Evaluation of investment in selected cold storage units**(In Rs.)**

Sl. No.	Particulars	Selected units			
		Unit-I	Unit-II	Unit-III	Unit-IV
1.	Net Present Value (NPV) Rs.				
a.	At 14%	-4824992	-966904	-13136079	-9230818
b.	12%	-4208072	950858	-11162863	-4039400
c.	8%	-1996454	7533649	-4283485	13575889
d.	4%	3755823	23595252	12851366	55841593
2.	Internal Rate of Returns (IRR)	6.096	12.915	6.565	10.79
3.	Pay Back Period (PBP)				
a.	At 14%	>50 years	>50 years	>50 years	>50 years
b.	12%	>50 years	24 years	>50 years	>50 years
c.	8%	>50 years	13 years	>50 years	18 years
d.	4%	28 years	10 years	24 years	12 years

Note: Figures in parentheses indicate percentages to the total

It was assumed from several research studies that the economic life of the assets were as follows:

Assets	Economic life (years)
1. Buildings	50-60
2. Machineries	15-20

4.3.2 Financial feasibility

For financing agricultural and allied activities, the lending agencies strongly consider the economic viability and financial feasibility of a project is generally an indicator of the capability of an investment to generate income sufficient to liquidate it over the period of its productive life. For assessing the financial feasibility of cold storage units, annual returns and annual expenditure is worked out.

To evaluate the feasibility of investment in the cold storage business, project evaluation criteria such as net present value (NPV), benefit: cost ratio, interest rate of returns and pay back period were worked out. The analysis was done based on the cost and returns of all the selected cold storage units and the results are presented in Table 4.5.

It was observed that the net present value of Unit-I was Rs. -48,24,992; Unit-II Rs. -9,66,904; Unit-III Rs. -1,31,36,079 and Unit-IV Rs. -92,30,818, respectively at 14 per cent rate of interest.

The net present value at 12 per cent was Rs. -4208012, Rs. 950858, Rs. -11162863 and Rs. -4039400 in Unit-I, II, III and IV, respectively.

The NPV at 8 per cent was Rs. -1996454, Rs. 7533649, Rs. -4283485 and Rs. 13575889 in Unit-I, II, III and IV, respectively.

The NPV at 4 per cent was Rs. 3755823, Rs. 23595252, Rs. 12851366 and Rs. 55841593 in Unit-I, II, III and IV, respectively.

The NPV was positive in Unit-II at 12 per cent and positive at 8 per cent in Unit-II and IV. The NPV was positive at 4 per cent in all the selected cold storage units.

The internal rate of return was positive at the discount rate of 6.096 in Unit-I, 12.91 in Unit-II, 6.56 in Unit-III and 10.79 in Unit-IV.

In case of pay back period, it was observed that the project was viable after 50 years at 14 per cent rate of interest in all the four selected cold storage units.

At 12 per cent rate of interest, the project was viable after 50 years in Unit-I, 24 years in Unit-II after 50 years in Unit-III and IV.

At 8 per cent rate of interest, it was observed that the project is viable after 50 years in Unit-I and III, 13 years in Unit-II and 18 years in case of Unit-IV.

At 4 per cent rate of interest, the project was viable after 28 years in Unit-I, 10 years in Unit-II, 24 years in Unit-III and 12 years in Unit-IV, respectively.

Cost increased By 5 and 10 per cent to the actual cost

When the cost was increased by 5 per cent to the investment patterns, the net present values were found in all the selected units.

The net present values at different rate of interest such as 14, 12 per cent, when calculated were found negative in all the units, whereas in case of Unit-I and III were negative at 8 per cent rate of interest and whereas at the rate of 4 per cent, the net present values were positive in all the units.

The results obtained could be shown from the Table 4.6 and 4.7 that while in case of cost increased by 10 per cent NPVs were negative at 14 and 12 per cent in all the units, whereas at 8 per cent Unit-I and Unit-III showed negative NPVs. Whereas at 4 per cent all the units have shown positive NPV.

Returns decreased by 5 and 10 per cent

It was noticed from the Table 4.7 that when the returns were decreased by 5 per cent, the NPVs were found negative in all the units at 14 per cent, like-wise it was negative NPVs in Unit-I, III and IV at 12 per cent, and similarly NPVs were negative in Unit-I and III at 8 per cent. Whereas, positive NPVs were found in all the units at 4 per cent rate of interest.

Table 4.6: Cost increased by 5 % and 10 % to the investment pattern of actual cost in selected cold storage units

(in Rs.)

Sl. No.	Particulars	Selected units			
		Unit-I	Unit-II	Unit-III	Unit-IV
Cost increased by 5 %					
Net Present Value (NPV)					
a.	At 14%	-5510298	-2208843	-15120671.4	-12693012.99
b.	12%	-4940252	-396547	-13276358.31	-7741822.23
c.	8%	-2885793	5832635	-6829168.91	9068025.35
d.	4%	2496536	21061855	9288326.07	49437745.37
Cost increased by 10 %					
Net Present Value (NPV)					
a.	At 14%	-6195604	-3450782	-17105263.61	-16155207.56
b.	12%	-5672432	-1743952	-15389853.15	-11444244.43
c.	8%	-3775133	4131622	-9374852.22	4560160.99
d.	4%	1237248	18528458	5725285.76	43033897.53

Table 4.7: Returns decreased by 5 % and 10 % to the investment pattern of actual cost in selected cold storage units

(in Rs.)

Sl. No.	Particulars	Selected units			
		Unit-I	Unit-II	Unit-III	Unit-IV
Returns decreased by 5 %					
Net Present Value (NPV)					
a.	At 14%	-4583742	-	-12479275.23	-8769277.49
			918558.6		
b.	12%	-3997669	903314.7	-10604720.31	-3837430.04
c.	8%	-1896631	7156966	-4069311.32	12897095.22
d.	4%	3568032	2241548	12208798.06	53049513.56
			9		
Returns decreased by 10 %					
Net Present Value (NPV)					
a.	At 14%	-4342492	-	-11822471.27	-8307736.57
			870213.5		
b.	12%	-3787265	855771.8	-10046577.13	-3635460.04
c.	8%	-1796809	6780284	-3855137.04	12218300.73
d.	4%	3380241	2123572	11566229.74	50257433.90
			6		

When the returns were decreased by 10 per cent, the NPVs were negative in all the units at 14 per cent and they were negative in Unit-I, III, IV at 12 per cent, at 8 per cent rate of interest it was found NPVs were negative in Unit-I and III. Whereas, NPVs were found positive in all the units at 4 per cent rate of interest.

4.4 COST AND RETURNS

Cost and returns analysis of selected cold storage units were calculated and presented in table 4.8. The costs were divided into (A) fixed cost and (B) Working cost/variable cost.

It could be observed from the table 4.8 that annual cost per tonne of storage was highest in Unit-I (Rs. 771.42), followed by Unit-II (Rs. 700.06), Unit-III (Rs. 681.74) and Unit-IV (Rs. 672.34), of which the share of overhead cost was about 35.46 per cent in Unit-III, followed by Unit-IV with the per cent of 33.93, Unit-I (30.86%) and Unit-II (26.54%) of the total cost.

Among the various items of overhead cost, depreciation in which machineries accounted to the highest in the Unit-III (50.81), followed by Unit-I (50.39%), Unit-II (45.50%) and 44.41 per cent in Unit-IV, respectively to the total overhead cost.

From the overhead cost of depreciation, buildings share accounted highest in the Unit-I (24.52%), followed by Unit-IV (20.43%), Unit-III (20.21%) and Unit-II (19.21%), respectively.

Remaining share of total overhead cost was occupied by salary to permanent employees, repairs and maintenance and license fee tax with different percentages in the selected cold storage units.

Operating cost accounted for 73.45 per cent in Unit-II, followed by Unit-I (69.13%), Unit-IV (66.06%) and Unit-III (64.53%), respectively. Among the working cost, power and water charges accounted to 74.95 per cent in Unit-I, followed by Unit-IV (74.81%), Unit-III (74.22%) and Unit-II (73.81%), respectively. The fuel accounted the next highest share in the Unit-II (20.96%), followed by Unit-I (20.57%), Unit-IV (20.15) and Unit-III (19.81%), respectively. The remaining share to the total working cost was occupied by interest on working capital, handling charges and others which include salary and wages of casual labour and office maintenance.

From the Table 4.8, it could also be known that the total return per tonne was highest in the Unit-II i.e., Rs. 931.42, followed by Rs. 914.28 in Unit-IV, Rs. 863.28 in Unit-III and Rs. 833.75 in Unit-I. It was observed from the table 4.8 that benefit cost ratio was highest in the unit-IV (1.36), followed by the unit-II (1.33), unit-III (1.26) and unit-I (1.03) respectively.

From the calculation, it was noticed that net gain per tonne was highest in Unit-IV i.e., Rs. 241.93, followed by Unit-II (Rs. 231.36), Unit-III (Rs. 181.53) and Unit-I (Rs. 62.32).

4.5 COMPOSITION OF USERS GROUP

The personnel interview conducted with the selected cold storage operators resulted that the composition of users group included both the traders and farmers. It could be observed from the table 4.9 that the composition of users group such as traders and farmers from the selected Units, the number of traders were with different figures like 90 traders in unit-I, followed by 100 traders from Unit-II, 80 traders in Unit-III and 70 traders from Unit-IV like-wise number of farmers storing their commodities were 30, 50, 60 and 30 from the selected cold storage units of I, II, III and IV, respectively. It was also found that the utilization capacities by the users group were 1500, 3500, 4500 and 9100 MT in the selected cold storages to the total installed capacities of 1500, 3500, 5000 and 9230 MT respectively, and the duration of storage was seen varied with the commodities stored in all the selected cold storage units.

Table 4.10 shows that the major commodities stored by the traders in the selected cold storage units were turmeric, potato, tamarind, apple, orange, chilli, jaggery, grapes, plums, dry fruits and dhaniya, like-wise the major commodities stored by the farmers were

Table 4.8: Cost and returns of stored produce in selected units

(Rs/tonne

)

Sl. No.	Particulars	Selected units			
		Unit-I	Unit-II	Unit-III	Unit-IV
A.	Fixed cost				
1.	Depreciation				
a.	Buildings	58.39 (24.52)	35.71 (19.21)	48.87 (20.21)	46.62 (20.43)
b.	Machineries	120.00 (50.39)	84.55 (45.50)	122.86 (50.81)	101.34 (44.41)
2.	Salary to permanent employees	30.24 (12.70)	31.88 (17.15)	33.76 (13.96)	37.08 (16.25)
3.	Repairs and maintenance	28.34 (11.90)	32.43 (17.45)	34.93 (14.94)	41.74 (18.29)
4.	License fee and tax	1.134 (0.476)	1.23 (0.662)	1.345 (0.556)	1.379 (0.600)
	Total fixed cost	238.104 (30.86)	185.80 (26.54)	241.765 (35.46)	228.159 (33.93)
B.	Variable cost				
1.	Power and water charges	399.73 (74.95)	379.61 (73.81)	326.46 (74.22)	332.32 (74.81)
2.	Fuel	109.72 (20.57)	107.83 (20.96)	87.18 (19.81)	89.51 (20.15)
3.	Interest on working capital	10.58 (1.98)	9.32 (1.81)	8.68 (1.97)	7.693 (1.73)
4.	Handling charges	2.55 (0.478)	2.79 (0.542)	3.50 (0.795)	4.07 (0.916)
5.	Others (incl. salary and wages of casual labour and office maintenance)	10.74 (2.01)	14.71 (2.86)	14.16 (3.218)	10.59 (2.38)
	Total working cost	533.32 (69.134)	514.26 (73.45)	439.98 (64.53)	444.183 (66.06)
	Total cost per tonne (A + B)	771.429	700.06	681.745	672.342
	Total return per tonne	833.75	931.42	863.28	914.28
	Benefit: cost ratio	1.08	1.33	1.26	1.36
	Net gain per tonne	62.326	231.36	181.53	241.93

Note: Figures in parentheses indicate percentages to the total

Table 4.9: Composition of users group in the selected cold storage units in Hyderabad district (2004-05)

Sl. No.	Users group	Selected units											
		Unit I (1500MT)			Unit II (3500 MT)			Unit III (5000 MT)			Unit IV (9230MT)		
		No. of users	Qty stored (MT)	Storage period (months)	No. of users	Qty stored (MT)	Storage period (months)	No. of users	Qty stored (MT)	Storage period (months)	No. of users	Qty stored (MT)	Storage period (months)
1.	Farmers	30	500	6 - 9	50	2000	6 - 9	60	2500	6 - 9	30	6200	6 - 9
2.	Traders	90	1000	1 - 3	100	1500	1 - 3	80	2000	1 - 3	70	2900	1 - 3
	Total	120	1500	6 - 9 1 - 3	150	3500	6 - 9 1 - 3	140	4500	6 - 9 1 - 3	100	9100	6 - 9 1 - 3

Note : Unit I = Pavitra Agro-fresh cold storage Pvt. Ltd.
Unit III = Foster cold storage Pvt. Ltd.

Unit II = Verdant cold storage Pvt. Ltd.
Unit IV = Samyukta cold storage Pvt. Ltd.

Table 4.10: Composition of users group in the selected cold storage units in Hyderabad district (2004-05)

Sl. No.	Users group	Selected units															
		Unit I				Unit II				Unit III				Unit IV			
		No. of users	Item stored	Qty stored (MT)	Storage period (months)	No. of users	Item stored	Qty stored (MT)	Storage period (months)	No. of users	Item stored	Qty stored (MT)	Storage period (months)	No. of users	Item stored	Qty stored (MT)	Storage period (months)
1.	Farmers	30	Jaggery Potato Chilli Tamarind	150 50 200 100	3-9 6-7 9 9-12	50	Chilli Jaggery Tamarind	750 600 650	9 3-9 9-12	60	Tamarind Chilli Potato Jaggery	800 600 400 700	12 6-9 4-6 6-9	30	Tamarind Chilli Jaggery Potato Turmeric	1200 750 1450 800 2000	9-12 9 6-8 6-7 9
2.	Traders	90	Turmeric Potato Tamarind Apple Orange Grapes Plums Dry fruits Dhaniya Others	150 40 100 150 175 150 75 100 10 50	9 6-7 9-12 1 3 1-1.5 1 6-9 9 6-9	100	Potato Jaggery Apple Orange Grapes Plums Dry fruits Others	100 400 250 175 125 150 200 100	6-7 6-9 1-2 2-3 1-2 1-2 9 9	80	Jaggery Turmeric Apple Plums Orange Grapes Dry fruits Dhaniya Others	620 260 350 150 150 200 150 20 100	9 6-9 1-2 1-2 1-3 1-2 6-9 6-9 6-9	70	Potato Chilli Oranges Plums Apples Grapes Dry fruits Others	600 1400 175 175 250 150 100 50	4-7 6-9 3 1-2 1-2 1 6-9 9

Note : Unit I = Pavitra Agro-fresh cold storage Pvt. Ltd.

Unit III = Foster cold storage Pvt. Ltd.

Unit II = Verdant cold storage Pvt. Ltd.

Unit IV = Samyukta cold storage Pvt. Ltd.

Table 4.11: Share of different commodities stored in the selected cold storages by the users group

Sl. No.	Commodity	Selected units (%)			
		Unit-I	Unit-II	Unit-III	Unit-IV
1.	Potato	6.42	2.85	9.66	15.38
2.	Chilli	14.28	21.42	14.49	23.62
3.	Jaggery	10.71	28.57	23.18	15.93
4.	Turmeric	10.71	-	6.28	21.97
5.	Tamarind	7.14	18.57	19.32	13.18
6.	Apple	10.71	7.14	8.45	2.74
7.	Grape	10.71	3.57	4.83	1.64
8.	Orange	12.25	5.00	3.62	1.92
9.	Dry fruits	7.14	5.714	3.62	1.09
10.	Plums	5.35	4.28	3.62	1.92
11.	Dhaniya	0.714	-	0.48	-
12.	Others	3.571	2.857	2.415	0.549

Table 4.12: Problems faced by the sample farmers in utilizing cold storage services as opined by them

(n=120)

Sl. No.	Description of the problem	No. of farmers	Percentage to total
1.	Inadequate cold storage space	4	3.33
2.	Price fluctuation	8	6.66
3.	High cost of storage	44	36.66
4.	Delay in getting cold storage space	7	5.83
5.	No proper guidelines	12	10.00
6.	Risk of damage	17	14.16
7.	Lack of awareness	28	23.33
	Total	120	100.00

tamarind, chilli, jaggery, potato and turmeric. The total quantity stored by the traders in the Unit-I was 1000 MT, 1500 MT in Unit-II, 2000 MT in Unit-III and 2900 MT in Unit-IV, like-wise the total quantity stored by the farmers was 500 MT in Unit-I, followed by 2000 MT in Unit-II, 2500 MT in Unit-III and 6200 MT in Unit-IV.

Though, the number of farmers going for storage of commodities was less but their per cent to the utilization capacity was high when compared to the number of traders in utilization of the selected cold storage units.

4.5.1 Share of commodities stored by the users group

From the Table 4.11, it could be concluded that major share of commodities stored by both the farmers and traders in the Unit-I was occupied by chilli (14.28%), followed by orange (12.25%), turmeric, jaggery, apple (10.71%) and grapes (10.71%) like-wise in case of Unit-II, they were jaggery (28.57%) followed by chilli (21.42%) and tamarind (18.50%). From the Unit-III, commodities were jaggery (23.18%), followed by tamarind (19.32%), chilli (14.49%) and potato (9.66%) and in the Unit-IV, storing produce were chilli (23.62%), followed by turmeric (21.97%), jaggery (15.93%) and potato (15.38%).

4.6 PROBLEMS FACED BY THE FARMERS, TRADERS AND OPERATORS

4.6.1 Problems faced by the farmers

Table 4.12 indicated that 36.66 per cent of the sampled farmers opined that the storage cost is high. Nearly 23.33 per cent of the farmers indicated that they were not aware of the cold storage. As much as 10.00 per cent of farmers indicated that they were not able to store their produce in the cold storage even though they had willingness to store as they did not have proper knowledge on cold storage. Further, 5.83 per cent of farmers indicated that they were not able to get the facility when required as and when they needed. In addition, nearly 14.16 and 6.66 per cent of the farmers felt that risk of damage and price fluctuation, respectively were the important problems.

4.6.1.1 Reasons for not use of cold storage

Farmers in the study area and not use of cold storage units facility. It could be observed from the Table 4.13 that about 25.83 per cent of farmers did not prefer because of immediate need of cash followed by no guarantee about future price (19.16%) and more deterioration of the commodity (18.83%), no easy access to take back the produce from the cold storage (14.16%) and having a small quantity of the produce.

4.6.1.2 Farmers preference for a particular agency

From the Table 4.14, it is clear that about 75.83 per cent of farmers had preferred to sell their produce to commission agent-cum-wholesalers, this was mainly because of the fact that most of the farmers get credit facility from the traders. It is also reported that about 20.00 per cent of the farmers preferred to sell their marketable surplus to the village merchants.

It can also be seen from the table that about 4.16 per cent of sample farmers preferred to sell their produce to the processors due to their personal consideration.

4.6.1.3 Farmers preference for commission agents

It is clear from the Table 4.15 that about 55.83 per cent of sampled farmers preferred commission agents-cum-wholesalers mainly because of credit availability followed by prompt payment (20%), better prices (15%) and personal consideration (9.16%).

4.6.2 Problems encountered by traders

It could be observed from the Table 4.16 that 45.00 per cent of traders indicated that the cold storage costs are higher and as such they do not prefer to store their produce in the cold storage.

Table 4.13: Reasons for not use of cold storage as opined by the sample farmers

(n=120)

Sl. No.	Descriptive reason	No. of farmers	Per cent
1.	Deterioration of the commodity	22	18.83
2.	Immediate need of cash	31	25.83
3.	Location is very far away	5	4.16
4.	No guarantee about future price	23	19.16
5.	Cold storage is not profitable because cold stored produce do not fetch good price	6	5.00
6.	Small quantity	16	13.33
7.	No easy access to take back the produce from the cold storage	17	14.16
8.	Lack of time to go to cold storage	-	-
9.	Lack of storage facility	-	-
10.	Consumers do not prefer this cold storage unit	-	-
	Total	120	100.00

Table 4.14: Problems of the traders in utilizing cold storage services

(n=40)

Sl. No.	Description of the problem	No. of traders	Percentage to total
1.	Quality deterioration	9	22.50
2.	High cost of storage	18	45.00
3.	Inadequate storage facility	6	15.00
4.	Poor demand for the cold stored product	7	17.50
	Total	40	100.00

Table 4.15: Description of the problems faced by the operators of cold storages

(n=10)

Sl. No.	Particulars	No. of operators	Percentage
I.	Financial problems		
1.	High rate of interest	8	80.00
2.	Paucity of working capital	7	70.00
3.	Delay in getting loan	-	-
4.	High rate of electricity	9	90.00
5.	Requirement of large capital	7	70.00
II.	Technical problems		
1.	Frequent power failure	6	60.00
2.	Inadequate technical supervision	3	30.00
3.	Repairs and maintenance	4	40.00
4.	Inadequate power supply	6	60.00
5.	Excess consumption of energy	2	20.00
III.	General problems		
1.	Competition among cold storage operators	6	60.00
2.	High cost of maintenance	9	90.00
3.	Lack of demand by users	9	90.00
4.	Lack of awareness	7	70.00
5.	Risk of damage	2	20.00
6.	Deterioration in quality and quantity	1	10.00
IV.	Administrative problems	-	-
V.	Others	-	-

As high as 22.50 per cent of traders felt that there could be quality deterioration when stored in cold storages. Seventeen and half per cent of traders indicated that consumer preference is low for cold stored produce and hence do not fetch better prices. Apart from this, 15 per cent of the traders indicated that the inadequacy of storage facility in the selected site/district

4.6.3 Problems faced by cold storage operators

As far as financial problems are concerned, most of the operators (90 %) felt that their businesses suffered mainly due to high working cost, which was mainly due to high electricity tariff and 80 per cent of the operators faced the problems of high rate of interest and requirement of large capital accounted to 70 per cent. As cold storage need costly compressors, about 40 per cent of operators indicated that they had problem in maintaining machinery and equipments. About 90% owners felt that, high cost of maintenance was one of the reason for poor performance, as they had to pay high tariff towards electricity.

It was observed from the Table 4.17, from the side of technical problem, both the inadequate power supply and frequent power failure were accounted to 60.00 per cent, 30.00 per cent operators complained there was an inadequate technical supervision and 20.00 per cent was seen that excess consumption of energy in the storage unit and finally from the interview it was found that there were no problems faced from administration sided.

From the viewpoint of general problems it is also observed from the Table 4.17 that 90 per cent owners were facing lack of demand by the users. About 70 per cent of owners indicated that there is a problem in creating awareness about these cold storage units. About 60 per cent of owners said there was high competition among cold storage operators in the selected district place. About 20 per cent of the operators indicated that they faced the risk of damage and deterioration in quality and quantity of the produce.

V. DISCUSSION

The results of the study presented in the previous chapter are discussed in detail in this chapter. The focus is to throw light on some of the causes responsible for the major trends in the last chapter. They are discussed under the following broad headings.

- 5.1 Identification and documentation of cold storages
- 5.2 Profile of different commodities stored
- 5.3 Investment profile and financial feasibility
- 5.4 Cost and returns in the cold storages
- 5.5 Composition of users group
- 5.6 Constraints faced by the users group and cold storage operators in functioning of cold storage units

5.1 IDENTIFICATION AND DOCUMENTATION OF COLD STORAGES

It could be observed from the Table 4.1 that, the state of Andhra Pradesh is broadly divided into three regions namely Telangana, Rayalaseema and Coastal Andhra Pradesh. From the three regions of the state, there are totally 119 cold storage units were on the existence.

Out of which, Telangana region consists of 10 districts, among them the total of 32 units are present. Hyderabad occupies first position in more number of cold storage units when compared to other districts of Telangana region. Hyderabad being capital city of the Andhra Pradesh, which found a terminal market where a large number of fruits, vegetables, agricultural commodities and other processed food products are brought and sold from different districts and states because of the perishability nature of these commodities and the consumption of the same is required throughout the year which calls for the storage. From the documentation of total cold storage units in the entire Telangana region it was found that there were no storage units in the districts like Karimnagar and Nalgonda and Adilabad. The districts of Adilabad and Karimnagar are adjacent to the Warangal, where the commodities produced are moved to the Warangal.

In Rayalaseema region, it was noticed that there are 13 units with total installed capacity of 31,000 MT from four districts, among which highest number of cold storage units were found in Ananthapur district (17,300 MT) 7 units followed by Chittoor (11,200 MT) 5 units, it may be because of movement of commodities from neighbouring districts, states and cities of Tamil Nadu and Karnataka. So, where there is need and necessity for existence of cold storage units to meet out demand and supply. It was also found that there were no cold storage units in Cuddapah district being the dry region, where the demand is comparatively less.

In Coastal Andhra Pradesh region, it is observed from the table (4.1) that this region covers nine districts with the total installed capacity of 2,14,187 MT among them, Guntur occupies maximum share with the total installed capacity of 1,41,577 MT followed by Krishna (18,630 MT) and Vishakhapatnam (18,580 MT).

Guntur district occupies highest number of cold storage units (41) in the state, which is attributed to coverage of the area in the district by chilli only. The district is completely occupied by chilli growers and maximum share of both traders and farmers have availed the facility of storage units, where it could be stored, throughout the year in the market and its demand is created.

Vishakhapatnam and Krishna districts were being very near and close to the sea shore areas storing the produce of fish and fish products at the maximum extent. It could be concluded that almost all the storage units in Andhra Pradesh, they are going for storage like multi-purpose, fruits, vegetables and other agricultural commodities.

5.2 PROFILE OF DIFFERENT COMMODITIES STORED

It was noticed from the Table 4.2 that, apple, orange, grapes, plum fruits, potato, chilli, jaggery, tamarind, turmeric, dhaniya, dry fruits, butter, ice cream, processed cheese, meat products and milk and milk products were the major commodities that were stored the cold storage units with varied temperatures, relative humidity operated almost throughout the year in order to meet out supply and demand. The major commodities were stored in the selected cold storage units to its full capacity during the months of February, March, April and May and remaining months the unit was not be fully utilized, because of their supply into the market was low i.e., lean period and fruits like apple, orange, grapes and plums for a period of 1 to 3 months. Remaining other commodities shown in the table were stored for a period of more than three months, where these commodities consumption requirement was spread over longer periods.

It was also found from all the storage units that the capacity utilization will be almost 70 to 80 per cent for the months of January to October i.e., full season and October, November and December months showed comparatively very less usage of the unit.

The temperatures and humidity maintained for different commodities in the selected cold storage units in Hyderabad district indicated that there were variations in maintenance of temperature and humidity for the same commodity in all the selected cold storage units.. There appears to be no uniformity in the temperature and humidity maintained for different commodities and they differ from the recommended temperature and humidity. It was observed during the study that cold storage units do not have any mechanism for measuring the relative humidity. Our enquiries however revealed that such variations from the recommended temperature did not seem to contribute much for the spoilage of the commodities stored. Incidentally percentage of spoilage observed was found to be within the normal limits. However, its is recommended that cold storage owners should have complete knowledge of storage conditions, Storage techniques, storage structures, and maintenance to run them on in the scientific way.

However, it is noteworthy to indicate that storage condition of temperature and humidity may have a little impact on spoilage. Therefore, it is recommended to measure the humidity and temperature in the selected cold storage units regularly.

5.3 INVESTMENT PROFILE AND FINANCIAL FEASIBILITY

5.3.1 Investment pattern

It was observed from the Table 4.3 and 4.4, in which it includes both the break up cost on installation and average annual working cost of the selected cold storage units says that contribution of the buildings/civil structures took major share to the total over head cost in all the selected cold storage units, thereby we can see that there is a decrease in the net returns in the units. To sustain the operations of cold storage business, financial Institutions should provide financial assistance at lower rates of interest rates.

The cost involved in the construction of buildings could be reduced which inturn makes these cold storage owners to charge at minimal rate to their produce. So that more quantity of commodity could be stored by the farmers and traders.

It was noticed that machineries and electrifications also contributed proportionally to the total overhead cost. Maintenance of machineries should be performed in such a way that there could not be any improper handling by the supervisors in the storage units. Appointment of technical operators may lead to the efficient usage of machineries.

While in case of average annual working of selected cold storage units, major share was occupied by power and water charges and fuel which lead to the decreased returns to the cold storage owners and also increased storage charges to the user's group. The similar results were found pertaining to the objectives of financial feasibility and cost and returns from the research study conducted by Chowda Reddy, 2004.

Due to the unnecessary usage of both power and water charges and fuel there is an increase in the cost, which has led to decreased returns. So, proper care and maintenance is to be assured.

But machineries of cold storage have to be used continuously so as to keep them in a running condition. Therefore, during off-season, cold storage operators need to pay towards electricity. Power charges badly has affected the profitability of cold storages. Once, the power charges and fuel concession are given, their working expenses could be minimized. If working expenses reduced, cold storage operators can charge nominal for the farmers produce, so that more farmers\ customers could be attracted to achieve the desired efficiency in the cold storage business. Hence, reduction in the power charges is essential in making out cold storages economically sustainable in the long run. If the industry is to survive and thrive, problems faced by the cold storage industry shall have to be identified, appreciated, analysed and removed not only by the government but also by the concerted efforts of all agencies in relation with the industry. Hence, a fruitful result could be expected.

5.3.2 Financial feasibility

The evaluation criteria such as net present value, interest rate of returns, B:C ratio and pay back period were employed to evaluate the financial feasibility of investment in cold storage business enterprise. These measures of evaluation were used for the selected units of cold storage. It could be observed from the Table 4.5. The net present value at 14 per cent rate of interest found was rupees negative. Hence, it can be concluded that the investment in the selected units is economically infeasible and financially unsound. Whereas, 12 per cent rate of interest, net present value was found rupees positive in Unit-II and rest shown as rupees negative. While in the case of 8 per cent rate of interest, net present value in the Unit-I and III were shown as rupees negative and Unit-II and IV shown as rupees positive. Similarly, at 4 per cent rate of interest, the net present value were shown as rupees positive in all the storage units. Hence, here we could conclude that at 4 per cent rate of interest, the selected units were economically feasible and financially sound.

Internal rate of returns

Internal rate of returns were found less than 12 per cent in the Unit-I, III and IV and hence that clearly indicated that investment and functioning of cold storage units is not profitable and in case of Unit-II the IRR was found more than 12 per cent and hence it is profitable.

Pay back period

It is the time period required to repay the loans borrowed, from the Table 4.5, it could be noticed that at 14 per cent rate of interest, the time required to repay the loan was more than 50 years in all the units, where as in the case of 8 per cent rate of interest, the PBP was found more than 50 years in the Unit-I, III and IV and more than 24 years in Unit-II. Like-wise at 8 per cent of interest, PBP was found more than 50 years in the Unit-I and III and more than 13 years and 18 years in Unit-II and at 4 per cent rate of interest the pay back period observed varied with the number of years such as 28 years in Unit-I, 10 years in II, 24 years in Unit-III and 12 years in Unit-IV.

It could be concluded that at 4 per cent and 8 per cent rate of interest, the payback period was comparatively less i.e., in the range of 10 to 28 years, when the rate of interest provided in these levels profits/returns could be achieved relatively early. Hence, it could be concluded that it is quite likely that one project might give higher net returns value, the second might promise the highest IRR, still the third might involve shorter pay back period so on.

It was noticed from the Table 4.6 that when the costs increased by 5 and 10 per cent to the investment pattern of the actual costs, the net present values resulted were found negative at 14 and 12 per cent. In case of 8 per cent net present values were negative in Unit-I and II and other units they were positive. At 4 per cent rate of interest, the net present values found positive in all the units and hence they are economically feasible and financially sound.

It could be seen from the Table 4.7 that when the returns were decreased by 5 and 10 per cent, to the investment profile of the actual costs, the net present values were found to

be negative at 14 per cent in all the units and the net present values were negative at 12 per cent in Unit-I, III and IV.

While in case of 8 per cent net present values, negative in Unit-I and III and similarly at 4 per cent net present values were positive in all the units. It is finally concluded that Unit-II at 12, 8 and 4 per cent as economically viable and financially sound. Similarly, Unit-II at 8 and 4 per cent was economically viable and financially sound.

5.4 COST AND RETURNS IN THE SELECTED COLD STORAGE UNITS

Cold storage is one of the important linkage in the post-harvest management infrastructure. The present scenario in the cold storage industry in Hyderabad seems very much encouraging.

It was also felt from the Table 4.8 that all the selected cold storage units are able to earn normal profits. Therefore, for assessing the economic viability of cold storages, an annual profitability of the cold storage units were calculated. The current annual expenditures are shown against the income that could be generated.

In general, it is felt that the net gain per tonne was highest in case of Unit-IV (Rs. 241.93), followed by Unit-II (Rs. 231.36), Unit-III (Rs. 181.53) and Unit-I (Rs. 62.32), respectively. The net gain per tonne was least in the Unit-I because of both total overhead cost and working cost when compared to others due to more installation cost on buildings and machineries and also the capacity utilization throughout the year may not be to the extent of 100 per cent. The results were on par with the study conducted by Chowda Reddy, 2004.

It was noticed that eventhough, the installed capacity in the Unit-III (5000 MT), the net gain per tonne was less when compared to the Unit-II (Rs. 231.36), which may be because of not using to the full extent of the capacity created and improper management. It was observed from the Benefit cost ratio was high in case of unit IV due to low total fixed cost and working cost, like wise unit-II occupied moderately high, and remaining two units were low Benefit cost ratio with 1.36,1.33,1.26 and 1.08 respectively.

It is evident from this objective of cost and returns per tonne of stored produce in the selected cold storage units that on an average they are performing well with annual normal profits. Hence, it could be concluded that the units are financially viable. Given the relatively lower return generated by small unit, they could consider minimizing the cost of construction especially of the civil structure compounds for ensuring viable returns to the unit.

5.5 COMPOSITION OF USERS GROUP

5.5.1 Type of users

As it was observed from the Table 4.9 and 4.10 that, users of selected cold storage units were broadly classified into two categories as farmers and traders. It was observed during investigation that the farmers in selected cold storage units had stored major part of the produce and the percentage of farmers was less when compared to the traders. However, it was also observed that farmers share was higher in all the selected cold storage units. When the personal interview conducted with the farmers, it was noticed that medium and small farmers were not utilizing the storage facilities mainly because of high charges, poor financial background and lack of awareness among the farmers regarding the benefits of storage. The traders were also the customers in all the selected cold storage units. Chilli, jaggery, tamarind, turmeric and potato were the main commodities in the cold storage units. During last few years, traders mainly stored apples, oranges, grapes and dry fruits etc., but this trend has been continuing at present also. As we have already discussed small and medium farmers share in the total was less. However, these farmers can be encouraged to store their produce by advancing loans either on pledge of produce in the cold storage or on pledge of cold storage receipts in organized financial institutions. Most of the operators opined that financial institutions should come forward to give the assistance by advancing loan on the pledge of cold receipt. The facility of giving pledge loan by the ware housing

corporation could also be extended to the cold storage industries so that farmers can be encouraged to store their produce.

5.5.2 Share of commodities in the cold storage units

It is indicated in the Table 4.11 that, major share was occupied in the Unit-I were chilli (14.28%) followed by orange (12.25%), jaggery, turmeric, apple and grapes (10.71%) each. Chilli being first in the position in this storage by most of the farmers as this commodity is grown in large areas, which was brought from the neighbouring districts. Fruits like orange, apple and grapes contribute to maximum share due to the prevalence of many fruit markets adjacent to this cold storage unit where traders could use the facility of storage.

While, in the case of Unit-II, jaggery (28.57), chilli (21.42%), tamarind (18.57%) and apple (7.14%) accounted for the maximum share to the total produce stored, this is mainly because of the storage unit was very nearer to the farmers fields, market yards, processing units and fruit markets.

In case of Units-III and IV, the maximum share was occupied by commodities like chilli, jaggery, turmeric, potato and tamarind due to the storage units are located outside the main city on the National Highways. So, here the farmers could have an easy access to these storage units who are residing in the villages, nearer to the storage because of easy transportation, handling, supervision, maintenance of their commodity and others.

5.6 PROBLEMS FACED BY THE FARMERS, TRADERS AND COLD STORAGE OPERATORS

If the industry is to survive and thrive, the problems faced by farmers, traders and cold storage operators shall have to be identified,, analyzed and documented. It is not important to identify or analyse the problems, but serious efforts should be made to overcome these problems. However, we also feel that only concerted efforts of all the cold storage units connected with the industry can bring some fruitful results.

Farmers, traders and cold storage operators were interviewed in order to ascertain their views on different aspects of storage practices.

5.6.1 Problems faced by the farmers

The discussion held with farmers (Table 4.12) indicated that most of the farmers opined that they did not have awareness about cold storage facility. Majority of the farmers were also opined that high cost of storage keeps away from the cold storage practices hence preferred to store on farm.

It was also indicated that most of the time price varied from day to day, from hour and from to week. As a result, farmers cannot expect higher price in the future as they did not anticipate price variation, storage of produce may not be advantageous. It also revealed that sometimes farmers did not get adequate cold storage space immediately, due to this, farmers needed to keep the produce outside the cold storage. Therefore, it caused lot of spoilage and waste. It was very paining to listen to the mourning talk of the farmers especially, small farmers that cold storage owners did not give response during the time of storage. If big farmers with neat shirt comes to cold storage will get more weightage it is therefore, advised that cold storage owners have to treat all the customers are equal.

As most of the farmers get the loan from the moneylenders need to pay the loan immediately after harvesting is over. Due to the pressure from the moneylenders or traders, farmers were not able to store their produce in the cold storage for longer period.

Therefore, storage facilities at market and easy availability of storage facilities at cheaper rate to farmers be made available so that they may store the produce till they secure the price expected by them.

5.6.1.1 Farmers preference to traders/commission agents

It was observed from the Tables 4.13, 4.14 and 4.15 that farmers preference to the traders. It was most common practice in the marketing practices since many years. This was mainly because of the fact that, farmers did not know the marketing channels to sell their produce. Lack of knowledge about market condition, poor financial background, poor retention capacity, small surplus, need for cash, makes the farmer unable to go for a distant market and sell their produce. Due to this, manipulative activities of the trader starts in the market with an intention to get higher margin of the farmers by providing some sort of assistance in the form of cash and other inputs to the farmers and thereby exploiting farmers innocence and ignorance.

It was most common practice of selling the produce either to commission agents or wholesalers where they got credit on the standing crop. As majority of the farmers opined that there were no alternatives for marketing except traders, because in the critical stage of sowing, traders would provide the required credit facility. Hence, they shall have to dispose their produce to traders or commission agents, inevitably.

It was also observed that many farmers did not prefer to get loans from the financial institutions, as they need to follow many procedures of bank. It is felt that this kind of marketing will continue until farmer gets higher retention capacities.

5.6.2 problems faced by the traders

It is observed from the Table 4.16 that high cost of storage facility was one of the most serious and important problems faced by commission agents-cum-wholesale traders. At present, the cost of cold storage is so much due to high cost of storage they are not getting margin in the business.

It was also opined that due to perishable nature of the produce, they hesitated to purchase large quantities at one stretch. Hence, storage facilities were required to be provided at a cheaper rate. It was also expressed that some times cold stored produce did not fetch better prices and prices dropped rapidly. The price fluctuation was also the problems, as they could not anticipate higher prices for perishable commodities. Hence, measures of price stabilization at least on some important commodities were necessary.

The traders also reported quality deterioration to some extent. The quality deterioration may be attributed to some factors viz., grading of the produce, produce stored with mud may cause wastage/spoilage and also improper management of cold storage conditions where required optimum temperature and humidity is not maintained. If the quality deterioration is continued to persist, there is a possibility of still poor demand for cold storage units by the users. Therefore, it is suggested to maintain required storage conditions in order to minimize spoilage/deterioration in quality of products stored in cold storages.

5.6.3 Problems faced by the operators

It is indicated from the Table 4.17 that as it was most important to study the problems faced by the cold storage operators in running of these cold storage units. The discussion held with cold storage operators indicated that most of the cold storage operators expressed that high rate of electricity was the major problem. This high rate of electricity caused for higher expenditure on working of cold storage units due to this fact, and had to increase the storage charges in order to cover the losses, even though, they were not able to cover their annual expenditure incurred during the operation. Lack of demand and lack of awareness about cold storage facility caused for under utilization. Lot of things need to be done in creating awareness about cold storages. There is a greater scope for cold storage industry if and only if the awareness is created among the users especially among farmers. It is not only the duty of government/cold storage operators, but also educated people who are willing to serve the farming community. Awareness should be created through advanced audio visual aids so that it could have an impact, otherwise savings cannot result. Providing credit facility could also attract more farmers to store their produce. There was a need to encourage them to store the produce in order to get better prices. It was also important to make the processing

units strong so that cold storage could have an interlink between cold storages and processing units.

It is also reported that inadequate power supply and frequent power failure, inadequate technical supervision, higher working expenses case for under utilization etc. continuous power supply played an important role in keeping the produce in a good condition. It is necessary to provide power supply to cold storage without any interruption in power supply. As far as technical supervision is concerned, there were no technical personal to look after the storages. Therefore, it is suggested to appoint technical persons to look after the cold storages and regular maintenance job.

It is not just enough, if the owners appoints only ITI graduates to look after the machine and all, but there is also an immediate need to provide training to cold storage operators or owners on storage details, storage techniques, maintenance to run in the scientific way. This could be done in collaboration with processing industries. Training and workshop should be conducted on cold storages at least once in six months interval so that operators can have better understanding on cold storages and their operations. Once upon a time, it was argued that financial institutions made delays in providing the financial assistance, but this was not reported by any complaints against the delayed loans. However, most of the owners of the cold storages indicated that high rate of interest on borrowed capital was also one of the important hinderance that caused for poor performance of the cold storages. Therefore, it may be necessary to reduce the rate of interest on borrowed loans. Majority of the owners opined that paucity of working capital was an important problem faced by the cold storage operators as many of the cold storage users paid storage charges at the time of delivery but the owners had to incur day to day expenses quit regularly which became difficult for the farmers.

VI. SUMMARY AND POLICY IMPLICATIONS

Horticulture has emerged in the last decade as the focal commercial sector among all agricultural activities in the country, which is witnessing a pacy growth. While we have been successful in producing, we have not done so well in protecting what is grown. No one knows for sure how much production is lost due to poor post-harvest handling and storage. But some estimates run as high as 30 per cent. Therefore, it is very important to recognize the need and importance of cold storage, because it serves as a vital link between the production and consumption of fruits and vegetables. Hence, it is a pre-requisite for the development of horticulture sector.

The present scenario in the cold storage industry in India in general and Andhra Pradesh in particular, is moderately encouraging. The existing units have been facing a number of problems, which have been highlighted on various occasions and on various platforms. But unfortunately, there is no common national or state body to look after the interest of the cold storage industry to give a proper direction for well balanced development of this industry. As a result, the development of this industry has taken place quantitatively but development has retarded qualitatively and there seems to be no way out of this situation unless a new approach is evolved to encourage the industry.

In Andhra Pradesh, the total number of cold storage units are 119 were on the existence. The state is divided into three important regions viz., Telangana region, Rayalaseema and Coastal Andhra Pradesh. Among these three, Telangana region occupies the total installed capacity of 82,804 MT, where the study was taken up in the Hyderabad district with an installed capacity of 32,530 covering 11 units, out of which four were purposively selected.

OBJECTIVES OF THE STUDY

1. To identify and document the profile of cold storage units in Andhra Pradesh.
2. To analyse the profile of different commodities stored in selected units.
3. To analyse the investment profile and financial feasibility of cold storage units.
4. To analyse the cost and returns in selected cold storage units.
5. To analyse the composition of users group.
6. To study the constraints faced by the users and cold storage operators in functioning of cold storage services.

METHODOLOGY

The study was taken up purposively in Hyderabad district of Andhra Pradesh, where the total installed capacity was 32,530 MT covering 11 units out of which four were selected based on their installation capacities, performance and good working nature. The secondary data related for the study purpose has been collected from MANAGE Institution, Rajendranagar, Hyderabad, National Horticulture Board, Directorate of Economics and Statistics, Khairtabad and some of the Journals like and Magazines Annadaatha, Rainbow revolution, Financing Agriculture and Eastern Economists.

The primary data relating to the profile of different commodities stored, investment pattern, cost and returns, composition of user groups was obtained from the relevant records maintained by the selected cold storage units, for the period 2004-05.

Primary data regarding selected cold storage units considered the sample size of the farmers, traders and storage operators with the size of 30 farmers, 10 traders and 5 operators from each unit interviewed through pre-tested schedule/questionnaire.

The following analytical tools were used for the study

- ◆ Tabular analysis like averages, percentages were used to compute identification and document the profile of cold storage units in Andhra Pradesh, to analyse the profile of different commodities stored in the selected units, composition of users group and to study the constraints faced by the users group.

- ◆ Financial tools like net present value, internal rate of returns, benefit: cost ratio and payback period were used to compute investment profile and financial feasibility of the units.
- ◆ Sensitivity analysis has been taken up to know the cost and returns in the selected cold storage units.

Findings of the study

1. From the study, we came to know that there are 119 cold storage units in Andhra Pradesh. It was noticed that high number of units were found in Coastal Andhra Pradesh region (74), followed by Telangana and Rayalaseema with different installed capacities. It was also observed that there were no cold storage units found in the districts of Adilabad, Nalgonda, Karimnagar and Cuddapah.
2. In the selected cold storage units, the major commodities stored were turmeric, tamarind, chilli, apple, orange and other with varied relative humidities, temperatures and storage duration. It was found that the units were full in the months of January to October where season for these commodities was seen.
3. In case of break-up of cost on installation of selected cold storage units, buildings/civil structures occupied major share of the investment, among these units it was found that Unit-I cost of construction of buildings was high followed by Unit-IV.
4. Machineries was the second major share to the total overhead cost in all the selected units.
5. In case of average annual working cost, power and water charges and fuel took major share.
6. In the same power and water charges, it was noticed that Unit-I percentage was high followed by Unit-IV.
7. From the evaluation pattern of investment noticed that at 4 per cent rate of interest all the selected cold storage units were shown positive net present value.
8. It was also found that at 8 per cent rate of interest, net present values were positive in the Unit-II and IV.
9. At 12 per cent rate of interest, only Unit-II was found positive.
10. In all the units, it was observed that at 14 per cent rate of interest the net present values were negative.
11. Internal rate of returns was found positive in the Unit-II at 12.91 per cent and remaining were negative.
12. Pay back period was observed more than 50 years at 14 per cent in all the selected units and at 12 per cent, the Unit-II, pay back period found was 24 years at 8 per cent rate of interest Unit-II and Unit-IV were 13 and 18 years pay back period and similarly at 4 per cent rate of interest the pay back period for Unit-I was 28, Unit-II (10 years), Unit-III (24 years) and Unit-IV (12 years), respectively.
13. It was observed from the evaluation of investment that Unit-II was positive found feasible at 12 per cent rate of interest.
14. Total variable cost was found high when compared to total fixed cost. Total return per tonne of stored produce in the selected units was observed high in the Unit-II and followed by Unit-IV.
15. Composition of users group comprised of both farmers and traders, in which farmers share to the storage was comparatively high eventhough their number was low.
16. In view of the different circumstances under which cold storages are operating, the constraints faced by operators were elicited. The major problems found were high power charges, high rate of interest, paucity of working capital, risk of damage to some extent, lack of awareness among the users, lack of demand by the users were also important problem expressed by the owners. Hence, power being the important item of

the cost structures, government should consider cold storage industry as a priority sector and supply electricity at concessional rates.

17. It is felt from the study that the farmers need to be educated on the benefits of cold storages, a larger utilization which reduces the cost and render the investment viable. The present rate of interest was high, at a time where there is an all-round reduction in interest rate. At the same time, the problem of farmers in using cold storages was also studied. They were of the view that charges should be reduced and that spoilage during storage was high. This could be reduced by providing uninterrupted power supply and by training farmers on how to properly harvest, clean and pack their produce before storage.

POLICY IMPLICATIONS

1. The documentation of cold storages as revealed by the research study showed that a large number of cold storages concentrated in and around coastal Andhra Pradesh and sparsely scattered in other areas of the state. The state has high potential of many important crops of horticulture scattered and strong efforts needed to be made by the government in locating cold storages in other regions also, where there is high requirement for growth of horticulture and other agricultural products which need cold storage facilities. This may go a long way in stabilizing supply and prices in the long run.
2. It reveals from the study that a majority of the commodities stored, the humidity and temperature essential for the commodities is not maintained according to technical requirements. Hence, employing the technical operators to supervise standard norms prescribed by the institutions regarding temperatures, maintenance of machineries and relative humidity will help to maintain the shelf life of the stored produce.
3. The lending institutions are charging high rates of interest for investment into construction and maintenance of cold storages as revealed by the findings. Hence, the financial institutions should come forward to give the assistance to the users group by advancing loan on the pledge of cold receipt. The facility of giving pledge loan by the warehousing corporation could also be extended to the cold storage industry so that users group could be encouraged to store their produce.
4. The results of the survey shows that the cold storages are working under unviable conditions as a result of high input costs specially power and lending rates. In order to provide boost to the cold storage industry and provision of good and reliable infrastructure, the government may devise policy changes like provision of power and capital requirements at concessional rates to improve their financial feasibility and economic viability.
5. The study on composition of users group in the sample cold storages showed that among farmers and traders, the farmers utilization of cold storages was more in terms of quantity and also the length of time. The results have shown a good signs of progress helping the farmers in the right direction. Hence, the farmers community may be provided with extension knowledge on utilization of such facilities through proper policy measures and may show signs of increased utilization by the farmer's groups in future.
6. The results of the investigation show that, the respondents opined that the cold storages be located very near to the market place during the opinion survey. As the concentration of cultivation of horticultural crops, especially fruits and floriculture, which is a booming industry, is concentrated in hinterland of Hyderabad. Private organizations should make efforts to establish some more cold storages in the very vicinity of the market place to improve the market logistics for fruits and floriculture products.

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Annexure I :

Recommended storage conditions for different fruits and vegetable

Name of the fruit/vegetable	Storage temperature (°C)	Relative humidity (%)	Storage period (Weeks)
Fruits			
Banana	15.5-21.0	80-85	1-2
Pineapple	8.0-10.0	85-90	1-2
Apple	0.0-1.66	85-90	17-34
Mango	7.2-8.80	85-90	4-7
Grapes	0.0-1.66	85-90	6-8
Santara	3.9-5.5	85-90	10-14
Papaya	8.3-10.0	89-85	1-2
Guava	8.3-10.0	80-85	4
Vegetables			
Potato	3.0-4.4	85	34
Onion	0.0	70-75	20-24
Tomato (unripe)	8.9-10.0	85-90	4-5
Cauliflower	0.0-1.7	85-95	7
Carrot	0.0	95	20-24
Cabbage	0.0-1.7	92-95	4-6
Bhendi	8.0-9.0	90	2
Brinjal	10.0-11.0	92	2-3

Annexure 2

Average maintained and recommended temperature and humidity for different commodities in cold storages

Sl. No.	Commodity	Maintained Temperature (°c)	Maintained Humidity (%)	Storage Period (months)	Recommended Temperature (°c)	Recommended Humidity (%)	Storage Period
1	Potato	2.5	-	6.3	3-10	90	1-3 weeks
2	Chilli	4.0	-	9.3	0-10	90	5-8 months
3	Tamarind	3.5	-	9.6	4-6	90-95	-
4	Dhaniya	3.0	-	4.5	-	-	-
5	Clove	3.0	-	5.5	-	-	-
6	Jay pal	3.0	-	6.0	-	-	-
7	Menthi	3.0	-	9.6	-	-	-
8	Jeera	3.0	-	6.0	-	-	-
9	Apple	3.0	85	4.75	-	-	-
10	Orange	2.2	85	2.5	-	-	-
11	Dry grapes	4.0	-	9.0	0-9	85-90	1-3 weeks
12	Ananus	-	-	9.0	0	50-60	9-12 months
13	Mango Juice	3.0	-	-	-	-	-
14	Grape Juice	3.0	-	10.5	-	-	-
15	Tomato Ketchup	3.0	-	10.5	-	-	-
16	Butter	3.0	-	4.0	4.0	65-70	6 months
17	Processed Cheese	3.0	-	4.0	4.0	65-70	12 months
18	Cut Flowers	-	-	-	-1 -7	90-95	1-3 weeks
19	Bulbs	-	-	-	3-20	70-75	2-5 weeks

COMMODITY PORTFOLIO MANAGEMENT OF COLD STORAGE UNITS IN HYDERABAD

PANKAJ ASHWINI

2005

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ABSTRACT

Horticulture has emerged in the last decade on the focal commercial sector among all agricultural activities in the country, which is witnessing a pacy growth. The present scenario in the cold storage industry in India in general and Andhra Pradesh in particular, is moderately encouraging. The study was taken up purposively in Hyderabad district of Andhra Pradesh, where the total installed capacity was 32,530 MT covering 11 units out of which 4 were selected boned on their installation capacities, Performance and good working nature. The primary and secondary data pertaining to study has been taken up from Farmers, traders, cold storage operators, NHB, DES, MANAGE, Rainbow revolution Annadaatha etc., from the study, were came to know that there are 119 cold storage units in Andhra Pradesh. It the state is divided into three important regions such as Telangana, Rayalaseenas coastal Andhra Pradesh occupying different no. of cold stores with varied installed capacities. The major commodities stored were turmeric, tamarind, chilli, Apples orange with varied relative humidities, temperatures storage duration. The study revealed that cost on installation of selected units, buildings occupied major share followed by machineries. Evaluation pattern of investment noticed that at 4% sate of interest all the units were shown positive NPVS, and at 12% rate of interest, only unit-II was found positive, and total variable cost was high when compared to total fined cost. Composition of users group comprised of both farmers traders, but farmers share to the storage was comparatively high, the problem encountered by the users group and operators were high power charges, high rate of interest, paucity of working capital lack of awareness among the users, to necessary measure was taken up.