Detailed Project Report on

Cold-Chain Development for Orchid flower

CONTENTS

ABBREVIATIONS

APEDA	Agriculture and Processed Food Products Export Development Authority
BIS	Bureau of Indian Standards
CFB	Corrugated Fibre Board
DSCR	Debt Service Coverage Ratio
DG	Diesel Generator
GOI	Government of India
HMNEH	Horticulture Mission for North East and Himalayan States
IRR	Internal Rate of Return
MoA& FW	Ministry of Agriculture & Farmers Welfare
MIDH	Mission on Integrated Development of Horticulture
MoFPI	Ministry of Food Processing Industries
MT	Metric Tonnes (one tonne = 1000 kg.)
NCCD	National Centre for Cold-Chain Development
NCDC	National Cooperative Development Corporation
NHB	National Horticulture Board
NHM	National Horticulture Mission
RH	Relative Humidity
SSERC	Sikkim State Electricity Regulatory Commission
SIMFED	Sikkim State Cooperative Supply and Marketing Federation
NRCO	National Research Centre for Orchids

Executive Summary

Sikkim is a land blessed by nature with bountiful resources, manifested in rich biodiversity, perennial water sources, diverse soil profile, extremely varied climate and wide ranging topographical variations. In recent years, Indian floriculture industry had gained a momentum in exports of cut flowers. Adoption of new and advanced technologies in production, post-harvest and marketing techniques has resulted in growth of production of crops like gerbera, gladiolus, tuberoses, roses, carnation etc. Likewise, Orchids are potential ornamental crop which are yet to be fully exploited. Demands for orchids in North Indian market are extremely high and these demands are met by import of cut flowers from International market like Bangkok. Development of technologies for mass production, scientific cultivation, post-harvest techniques and marketing strategies are need of the hour.

2. Looking at the importance of the Cold-Chain, the project proposal envisages development of a Cold-Chain at Gangtok, Sikkim east district for marketing Orchid flower of members of XYZ Orchid Cooperative society at higher prices in Ghazipur flower market at Delhi. It also proposes to reduce post-harvest losses of Orchid and benefit the members of society on one hand and also benefit distant consumers of Delhi by making orchid, especially temperate orchid (Cymbidium variety) available to them at a reasonable price with good quality.

3. Cold-chain is an environmentally controlled logistics chain, ensuring uninterrupted market link from farm to fork. To ensure the supply of fresh orchids to Ghazipur flower market, Delhi, the project proposes establishment of one Integrated Pack-House (with a 25 KVA DG set) of 25 MT/day capacity, 4 reefer vehicles of 15 MT capacity each and a cold store of 100 MT capacity in Gangtok, Sikkim. The project will be able to handle 8295 MT orchid per year at 100% capacity utilization. Society has sound financials with elected board earning net profits for the last 5 years, having Audit classification “A” status. The total capital cost of the project is Rs.326.75 lakh. Besides, the project will need Working Capital of Rs.275 lakh. Sikkim being a North-East State, the pattern of assistance for capital cost pertaining to cold-chain components

will be on 50% subsidy available from the GOI i.e. MIDH / NHB. The society proposes to finance the project through State Government. NCDC with more than 55 year experience in the cooperative sector and vast reach in the rural areas can be a nodal agency in boosting the high value and value added agricultural exports, perishable commodities, and other agricultural and allied sector items through the cooperatives.

4. The project envisages capturing the Orchid market in Sikkim i.e. 22.7 MT per day of Orchid within 3 years. The project is found to be technically feasible, socially desirable and financially viable. The detailed assumptions and calculations of which are given in the chapter titled "Feasibility Assessment" and at Annexure-I. The economics shows that the project will have an IRR of 80% and DSCR of 5.60 when the final market price of each orchid stick is kept at just 120 per stick.

5. NCDC may be requested to approve proposal for setting up a cold-chain infrastructure proposal by the society in Gangtok, Sikkim at a project cost of Rs.326.75 lakh and provide assistance as under:

i) Cold-Chain Infrastructure : Rs.208 lakh
ii) Land levelling and development, and renovation cost of existing building to make it fit to be used for Integrated Pack-House purposes : Rs.50 lakh
iii) Margin Money (25% of Working Capital) : Rs.68.75 lakh

The Society will abide by all the Standards and specifications prescribed by the GOI/BIS/MIDH/NHB/MoFPI/NCCD for such projects, including the norms for providing subsidy. The NCDC may further assist the society in procuring technical know-how, and various components required for establishment of a Cold-Chain infrastructure. The Society also agrees to follow the pattern of financial assistance of NCDC for such projects.

6. Pattern of Assistance:

Sl. No	Item	Amount (Rs. in lakh)	Percentage
1.	Term Loan	190.075	58.17%
2.	MIDH / NHB Grant	104.00	31.82 %
3.	Society Contribution	32.675	10%
	Total	326.75	100%

Introduction

Urbanisation has ensured that farmlands are distanced many kilometres away, entry points into our cities are becoming bottlenecks and transit time to reach markets is ever increasing. No more can the harvest reach the consumer within its natural life cycle. What now reaches the consumers' homes, was harvested a previous couple of days or more ago! This extended 'in-transit' time is compounded by the perpetually growing demand, wherefore the increase in handling volume adds to the delays. In case of perishable produce, the marketable life cycle is under pressure, and food quality is degraded rapidly without recourse to enablers such as cold-chain. Lack of cold-chain systems force farmers to monetise their produce at first instance by selling into food processing units, inefficient wholesale markets; and these sales are the only opportunity, low down in the value chain system, and do not empower the farmers. Cold-chain has colloquially been equated with refrigerated warehousing, and has been interpreted as yet another medium to store agricultural produce to meet delayed or deferred demand. Whereas this model may be applicable for a small range of perishable produce, the far larger opportunity from cold-chain arises when it is applied as a dynamic integration of a chain of logistics activities, to extend the marketing range of perishable produce.

2.1 Global Floriculture Scenario

The world production of floriculture is budding at on an average rate of 10 percent per year. Presently nearly about 50 nations are actively involved in production of floriculture on a large scale. In terms of value of production, the Netherlands, the United States, Japan, Italy, Germany and Canada are the leading producers of cut flower and plants. China and India having the bulk of the world acreage under cut flowers and plants production in the world. Asia-Pacific region has the major share (77 percent) of the total world area under floriculture production. Europe, the USA and Japan are the major consumers of floriculture products. There has been an increase in the per capita consumption of floricultural products in the developed and developing countries. This led to increase of world floriculture market and has reached to the level of billions of dollars in last few decades and it is growing annually at 10-15 percent.

2.2 India's Scenario

In India floriculture is becoming a major source of employment and income. There is vast scope at growing floriculture product in India, because total area under floriculture is very small. Last two decade there is an increasing demand and supply of various types of flowers. According to Agriculture and Processed Food Products Export Development Authority (APEDA, 2013) about 253.65 thousand hectares area was under Cultivation in floriculture during 2011-12. The country has exported 27,121.88 MT of floriculture products to the world worth of Rs. 423.46 crore in 2012-13. There is high demand for these products in the domestic and international market and India has significant ability in floriculture and it has been identified as focus area of exports.

2. The North Eastern region of India is blessed with beautiful natural flora throughout the year due to its unique physiographic, distinctive weather and agro climatic condition. Large number of farmers grabs this natural advantage of region by adopting floricultural activity in commercial pattern for cut flowers such as rose, orchids, gladiolus, carnation, anthurium, gerbera and lilies. . Sikkim is one of the state in NE region of India which has great potential to develop floriculture industry.

3. A study done by National Centre for Cold-Chain Development (NCCD) has estimated that there is a big gap of 99.6% and 85% respectively in the availability of Integrated Pack-Houses and Refrigerated Vehicles in the country. Same study found out that the Sikkim requires about 36 Integrated Pack-Houses as against 2 are available so far. The estimated requirement of funds during the next five years for Cold-Chain Development in the country is Rs.6100 crore comprising of, among others, 249 Integrated Pack Houses (Rs.2450 crore) and 20,000 reefer vehicles (Rs.1850 crore). A table showing State-wise requirement of pack-houses in the country, as assessed by the NCCD, may be seen at Annexure-II. The Government of India is committed towards doubling of farmers income and helping the farmer members in reducing post-harvest losses and to this end has declared logistics as an infrastructure sector and allocated huge funds for establishment of Cold-Chain infrastructure in the country, including subsidy of 35% for various components of Cold-Chain in the general States and 50% for the States located in North-East/Hilly/Scheduled Areas.

4. Sikkim with only 0.2 percent of the geographical area of the country shelters around 25 percent of the flowering plants of India. It appears that 10 largest plant families of Sikkim account for around 40 percent of the flowering plants of the state. According to NRCO, there are over 1300 different species of orchids in India. Arunachal Pradesh, with more than 550 species, boasts of the largest number of orchid species. Next comes Sikkim with 500 plus species which also include famous Nobile Dendrobium (consider as state flower). It has 35 poly houses which keep more than 800 varieties of orchids found all over the world. There is huge demand for orchid flowers in Delhi and other distant markets where lucrative prices for orchids are available. This, however, requires cold-chain development from Sikkim to the Ghazipur flower Market, Delhi, as chosen for the present project.

Orchids and Sikkim

Sikkim is a land blessed by nature with bountiful resources. Diverse agro-ecological situations ranging from sub-tropical in the lower valleys to alpine in very high elevations present an extremely congenial environment for floriculture diversifications. Sikkim has a diverse climate. It is predominantly wet and moist almost throughout the year with average annual rainfall of 2000 mm to 5000 mm. Situated in the lower Himalayas, Sikkim is home to around 5,000 species of flowering plants. Main flower which are grown in commercial manner are Cymbidium Orchids, Carnation, Anthuriurm, Gladioli, Lillium, Gerbera etc. Climatic advantage coupled with a skilled workforce gives Sikkim a definite edge in the business of floriculture. Realizing the potential of this sector, many budding entrepreneurs are taking up floriculture. It has good potential to develop as state for the leading producer of special and geographically suitable flowers, which have potential to grab the international market. State Government also has positive response for the development of this sector. Just need is to start cultivating flowers in a commercial manner.

3.1 Soil Profile

The soils of Sikkim are generally acidic, pH ranging from 4.3 to 6.4 with mean value of 5.37. The soil texture is silty to clay loam with depth varying from a few inches to several feet. Organic matter content is high with a mean value of 2.74%.

3.2 Floriculture in Sikkim

Floriculture is an extremely important sub-sector under horticulture for Sikkim. Flowers not only are items having sentimental value to the people of the State but can be developed as products to augment rural economy. The relevance of floriculture in the rural economy has multiplied over the years. Multifarious activities have been launched under HMNEH for development of this sub-sector. The result of all these initiatives is the growth of floriculture to unprecedented heights within a short span of 4-5 years. The tangible impacts of floriculture programmes in transforming hobby floriculture into commercial venture are manifested in increased usage of flowers for different local functions, development of floriculture clusters in many corners of the State, increased and sustained supply of flowers to various domestic markets and greater degree of floriculture entrepreneurship amongst educated youths. Some of the important flowers included for commercial purpose include cymbidium orchids, rose, lilium, alstroemeria, zantedeschia, gerbera and carnation. In addition to enhanced growth in area and production, there has been great enhancement in quality as well.

As per 2016-17 data from NHB, 240 hectares of land is available for floriculture and 16590 MT of Cut and Lose flower is being produced in Sikkim. About 515 orchid species found in Sikkim. Sikkim is the largest grower of Cymbidium orchids in India

3.3 About Orchids

Orchids account for a large share of global floriculture trade and are estimated around 10% of international fresh cut flower trade. They have taken a significant position in cut flower industry due to its attractiveness, diversity in forms, shape and colour, high productivity, right season of bloom, and easy packing and transportation. Post-harvest life of orchid cut flowers is influenced by pre-harvest factors like varietal or species differences light intensity, sugar level of flowers, temperature and water loss. It is also affected by harvest factors such as time and stage of harvest and post-harvest factors viz. ethylene production, pre-cooling, pulsing, use of preservatives, packaging and storage. Cool growing orchids are stored at lower temperature

less than 5°C in cold chambers whereas tropical and subtropical orchids are stored at 7-10°C and 90-95% relative humidity.

Types of cymbidium cultivated: Intermediate, Standard & Miniature.

3.4 Importance of orchids In India

- ✓ Highest selling flower in Indian cut flower industry.
- ✓ Most popular variety is Dendrobium.
- ✓ Temperate Orchid: Cymbidium.
- ✓ Main Import Cities: – Mumbai, Delhi, Bengaluru, Kolkata.
- ✓ Popular Colour: – White, Violet, Yellow and Pink.
- ✓ Potential: – Good demand in the Indian Flower market.

Post-Harvest factors

Post-harvest life of orchid cut flowers is influenced by pre-harvest factors like varietal or species differences light intensity, sugar level of flowers, temperature and water loss. It is also affected by harvest factors such as time and stage of harvest and post-harvest factors viz. ethylene production, pre-cooling, pulsing, use of preservatives, packaging and storage. Ethylene is the main factor responsible for early senescence. In Cymbidium hybrid 'Red Princess' pulsing with 5% sucrose increases vaselife upto 56 days. In orchids, cut spikes are inserted in tube containing water or water with preservatives and bunch of 5 or more individual spikes are placed inside the CFB box in alternate fashion. Cool growing orchids are stored at lower temperature even at 5°C in cold chambers whereas tropical and subtropical orchids are stored at 7-10°C and 90-95% relative humidity.

4.1 Pre-Cooling

It was an important operation in post-harvest handling and transport of cut flowers for the fast removal of field heat wherever flowers were held dry pack. All flowers are pre-cooled immediately after harvest by placing them in cold storage without packing or in open boxes until they reach the desired temperature. Desired temperature of various species and cultivars are: Cattleya (7-10°C), Cymbidium and Paphiopedilum (0.5 to 4°C), Dendrobium (5-7°C). Pre-cooling lowered respiration rate and decreased the breakdown of nutritional and other stored

materials in the stems, leaves and petals; delays bud opening and flower senescence. It also prevented rapid water loss and decreased flower sensitivity to ethylene. Several pre-cooling techniques such as room cooling, forced air cooling, vacuum cooling and ice bar cooling etc. were available.

4.2 Grading

Grading was done based on the basis of parameters like appearance, stage of maturity, blemishes or injuries due to diseases, infestations caused by insect pests, colour and size of the bud, straightness, strength as well as length of stem. Flowers were generally grouped into bunches of 5, 10, 12 or 20 stems and loosely tied with rubber bands. Before placing them in the package, individual flower bunches were wrapped with suitable packing materials like cellophane paper, kraft paper, newspaper, tissue paper or corrugated cardboard sheet. For local markets, the bunches were held in buckets containing water or preservative solution. It was advisable that for long distance transport and storage, flower bunches are held in dry cardboard boxes. The minimum length of boxes should be about twice the width and it's width about twice the height. Use of telescope-style boxes made of CFB was ideal.

Grading Details of Cymbidium Orchids:

Cymbidium	Grades	Flower count	Spike length	Other consideration
Cymbidium Standard	AAA	>12	1.25m	(i) Strong straight stems, uniform length, no marks on flowers. (ii) Bent & crooked spikes but with perfect flowers.
	AA	8	90cm	
Cymbidium Miniature	XL	>15	65+	
	L	12-14	55-64	
	M	8-11	40-54	
	S	<5	30-39	

4.3 Packaging of orchids

Cut flowers were inserted in tube containing water or water with preservatives or simply wrapped in wet cotton swab and the same was covered with a piece of plastic and tied with rubber band to keep in its place. Flower spikes were bunched into bunch of 5 or 10 or so. Bunches or individual spikes were placed inside the box in alternate fashion. Ethylene scrubbers with $KMnO_4$ or Purafil could also be kept in the level of CO_2 and lower level of O_2 to

reduce the respiration rate and production and action of ethylene. Generally, the concentration of CO2 was maintained higher than 4% and not below 0.4% in CA storage.

4.4 Storage of Cut Flowers

Low temperature treatment during storage or shipment period reduced the entire metabolism in the tissues, slowed down the respiration, transpiration and ethylene action and retarded the multiplication of bacteria and fungi. In general, temperate orchids were stored at lower temperature even at 5°C in cold chambers whereas tropical orchids were stored at 7-10°C. A 90-95% relative humidity was necessary during storage to minimize moisture loss and to prevent wilting. There are two types of cold storage methods, namely 'Wet storage' and 'Dry storage'. In wet storage, flowers were stored with their bases dipped in water or preservative solution for a short time. Dry storage methods were used for long term storage. In this method, fresh flowers were harvested in the morning, graded and sealed in plastic bags or boxes to prevent the loss of moisture. In Controlled Atmosphere (CA) storage, cut flowers were kept in gas tight cool chambers equipped with cooling systems at a higher level of CO2 and lower level of O2 to reduce the respiration rate and production and action of ethylene. Generally, the concentration of CO2 was maintained higher than 4% and not below 0.4% in CA storage.

Below table shows the range of temperature in which Orchid can be stored along with period of time :-

Name of Orchid	Storage Temperature	Storage Period
Oncidium, Phalaenopsis, Odontoglossum, Cattleya	7 – 10 deg C	2 weeks
Dendrobium	5 – 7 deg C	10-14 days
Cymbidium	1- 4 deg C	14 days
Paphiopedilum	-0.5 - 3.0 deg C	20 days
Arachnis, Aranda, Aranthera Ascocenda, Epidendrum	8-13 deg C	10~14 days

Project and the Proposal

Cold-Chain development for perishable commodities is an important issue before the "Doubling of Farmers Income Committee" and its recommendations. Till now, the focus of the cooperative sector has been on setting up of cold storages. To extend marketable life span of perishable commodities, there is urgent need for creation of large network of Cold-Chain facilities in the country. Cold-Chain is nothing but a modern agri-logistic system basically comprising the minimum infrastructure components such as (i) Integrated Pack House (ii) Reefer transport (iii) Cold Storage (Bulk-near farm gate) (iv) Cold Storage (Hub-near terminal markets) and Ripening Chambers. Cold-Chain is an important agri-logistics component, which helps in bringing about greater value to the farmers, the producers in terms of what they earn on their products and simultaneously helps the consumers to get better thing in a proper shape and time in which they would like to have the same.

2. The project proposal envisages development of a cold-chain infrastructure in Gangtok area of Sikkim East district to reduce post-harvest loss of ornamental flower thus benefit producer members on one hand and on another hand, benefit distant consumers of Delhi by making Orchids (especially temperate orchids-cymbidium) available at reasonable price and good quality.

5.1 Cold-chain in Floriculture

- Cold-chain is an environmentally controlled logistics chain, ensuring uninterrupted market link from farm to fork.
- Cold-chain includes pack-houses near farm for pre-conditioning (sorting, grading, packing, pre-cooling), reefer vehicles, cold storages, etc.

3. Thus, the project proposes establishment of one 25 MT/day capacity Integrated Pack-House with a 25 KVA DG Set, provision of four refrigerated vehicles (15 MT each) and a cold store of 100 MT capacity. The total project cost is Rs.326.75 lakh, Sikkim being a North-Eastern State, the pattern of assistance will be coming with 50% subsidy from the GOI i.e. MIDH / NHB scheme and rest as a term loan from NCDC. Society has 1.2 acres of free hold land at Gangtok for establishment of Cold Chain infrastructure. Society has applied for all the necessary statutory clearances (pollution, factories etc.) required to start the project. In addition to above,

society is having 11 kv High tension electricity supply from the State Electricity Board and piped water supply.

The project proposal will need following facilities:

Land levelling and development, and renovation cost of existing building to make it fit to be used for Integrated Pack-House purpose: Rs.50 lakh

5.2 Cold-Chain Components:

- Integrated Pack house
  - ✓ Components included: Conveyor belt sorting, Grading, Washing, drying and weighing facilities including Diesel Generator:
  - ✓ Requirement: 25 MT/day
  - ✓ Equipment Cost: Rs.50.00 lakh for 16 MT.
  - ✓ Total Cost: 78 lakh

- Cold-Storage
  - ✓ Temperate Orchids: 1~5 degree C, Tropical Orchids: 7~10 degree C with 90~95% RH for both varieties.
  - ✓ Requirement: Multi temperature Cold Storage with sections.
  - ✓ Cost: 10000/MT
  - ✓ Size: 100 MT
  - ✓ Total Cost: 10.00 lakh.

- Reefer Vehicle:
  - ✓ Requirement: 4 no's of 15 MT capacity (3 will run on full capacity and one as spare)
  - ✓ No of days for round trip: 4
  - ✓ Cost: Rs.30 lakh per vehicle
  - ✓ Total: Rs.120 lakh

- Total capital cost of the project: Rs. 258.00 lakh.

- Back-ended subsidy available from MIDH / NHB: = Rs.104 lakh

5.3 Margin Money for Working Capital

The implementing society will need working capital for 5 days in respect of Orchid flower. The society may also need to keep in its reserves, fuel expenses for 6 days for every reefer vehicle along with a spare truck and one month wages for labour and miscellaneous expenses to meet its requirements. For the purpose, the society will have to raise working capital for operating its activities, the requirements of which have been worked out as under:

i) Working capital for purchasing orchid for 5 days
@ Rs.100/- per Stick. (Rs.100*5*51780): Rs.259 lakh

ii) Working capital for fuel charges for 06 days for
3 vehicles (Rs.52500*2 trips*3) : Rs.3.15 lakh
Spare Truck : Rs.0.15 lakh
Total : Rs. 3.30 lakh

iii) Working capital for one month labour wages as per Delhi Wage board rules : Rs.12.479 lakh

- Total Working capital required: Rs.275 lakh

- Margin Money @ 25% of Working Capital: Rs.68.75 lakh
- Expenditure to be met from NCDC: Rs.190.075 lakh

5.4 Pattern of Assistance

Sl. No	Item	Amount (Rs. in lakh)	Percentage
1.	Term Loan	190.075	58.17%
2.	MIDH / NHB Grant	104.00	31.82 %
3.	Society Contribution	32.675	10%
	Total	326.75	100%

About the Society

XYZ Orchid Cooperative Society Ltd, Gangtok, Sikkim is the implementing society. The society is registered with Registrar of Cooperative Societies on 12/08/2016 with Registration No:2 (ORC)/CD/77-78. Society is presently operating from Gangtok which markets orchid flower in the nearby areas. Meanwhile depending upon the market conditions, society proposes to sell the flowers to prominent markets of Delhi by which our members will get increased price for their produce. This initiative will also encourage nearby farmers to become members of XYZ Orchid Cooperative Society by which distant consumers will be benefitted with availability of temperate orchid of good quality at reasonable price.

Membership and share capital position of the society as on 31.08.2018 is as under:

(Rs. in lakh)

Type of membership	No.		Share Capital
	Male	Female	
a) Growers			64.00
• General	200	300	
• SC	20	50	
• ST	50	20	
Sub Total	640		
b) State Govt.	1		1.00
Total	641		65.00

The society has an elected Board of Management. Last election was held on 02/12/2017. Board consists of 10 members including 3 Woman with tenure of 5 years. Name of the Chairman is: Sh. Namgyal and key executive person (Manager) is Sh. Pangthang. Society is presently procuring different types of orchids from members and sells the same in nearby markets after packaging. Society has a manual flower processing unit with packaging plant of capacity 3 Mt/hr. Capacity utilization of the plant is 100% and plant is operating for the past five years. Society has sound financials by earning net profits for the past 5 years with Audit

classification “A” status and has business relationships with NCDC for many years, and has never defaulted on NCDC’s loan.

Vision / Mission / Goals / Objectives

Vision

Empower rural economy by adding value to the ornamental flower.

Mission

To double the farmers income in the state of Sikkim

Goal

To organize cooperatives having Orchid producers as members so that they can act as aggregators and arrival of produce in the cooperative sector increases resulting in achieving the mission and vision

Objectives

- To reduce loss of orchid flower and benefit the producer members.
- To benefit existing members through increased price for their produce and encourage nearby farmers to become members of our cooperative society by which scale and quality of orchid produce can be increased.
- To benefit distant consumers by making temperate orchids available at reasonable price to them.
- To arrange education and training for members, technical staff and employees of the cooperative society for successful functioning of Cold-Chain

Products and Markets

8.1 Production and Market Details

- ✓ Total area for floriculture in Sikkim: 240 hectares
- ✓ Total flower production (Both Cut and Lose): 16590 MT per Year
- ✓ Orchid Cultivation and Production area: 120 hectares and 8295 MT per year. (Assumption).
- ✓ Orchid Output per 1000 Sq. feet: 1144 Sticks.
- ✓ Farm gate Price per Stick: Rs.80 /-
- ✓ Price at which Producer Organization Cooperative procuring from farmer: Rs.100 /-
- ✓ Average Selling price: Rs.120~150 /- per stick (Indian Markets)
- ✓ Average Selling Price: Rs.150~200 /- per Stick (Global Markets)
- ✓ For Selling Price of 120 per Stick/Stem IRR and DSCR ratio is found to be 80% and DSCR 5.6.

8.2 Global Scenario

The Netherlands is the top orchid exporting country in the world (39.67% of world orchid market) followed by Thailand (28.41%), Taiwan (10%), and New Zealand (6%). Importing countries are mainly Japan (30%), UK (12%), Italy (10%), France (7%) and the USA (6%). The total orchid cut flower trade of the world mostly consists of 85% Dendrobium species and 15% Phalaenopsis and Cymbidium species, and Asia is the main source of orchid to enter the world market. Major markets for orchids in Asia are occupied by Japan and Singapore. The total imports of orchids by Japan accounted for US$ 57.4 mn in 2008 making it the largest importer of orchids in the world. The main sources for these imports include Thailand, Taiwan, New Zealand and Malaysia which together account for as much as 96.5% of the total orchids imports by Japan in 2008. Imports by Singapore of fresh orchids amounted to US$ 6.5 mn in 2007 with Malaysia, Thailand and Taiwan being the main sources of imports for the country. In contrast, imports of fresh orchids by Singapore from India were only US$ 1379.3 representing a share of 0.02% of the country's total imports of the product in 2007. This clearly indicates that there are

vast possibilities for increasing India's exports to Singapore particularly considering the proximity of the country and India's East Policy.

8.3 Demand

Sikkim Government should go for a nationwide brand promotion of its temperate Orchid variety (Cymbidium) – particularly. Metros like Mumbai, Delhi, Bengaluru import orchid from various countries and consume in large quantities. With Pakyong airport opened, government should help farmers to export their produce to the nations like Japan, United Kingdom and Singapore where there is huge demand for Cymbidium variety of Orchids.

India's Cold-Chain Scenario

This chapter dwells upon the India's Cold-Chain scenario bringing about the importance of the sector for protection of green products of the farmers, adding value to their produce and capturing full value of their produce. It also finds out that there is a big gap between availability and requirement of Cold-Chain infrastructure in the country, Government's thrust for the rapid growth of the sector and incentives being given for establishing Cold-Chain infrastructure. The findings of studies show that the present project proposal is the need of the hour.

9.1 Cold-chain Infrastructure Gap – NCCD study 2015

Type of Infrastructure	Infrastructure Requirement (A)	Infrastructure Created (B)	All India Gap (A-B)	% share of Gap to Required
Pack-house	70,080 nos.	249 nos.	69,831 nos.	99.6%
Reefer Vehicles	61,826 nos.	9,000 nos.	52,826 nos.	85%
Cold Storage (Bulk)	341,64,411 MT	318,23,700 MT	32,76,962 MT	10%
Cold Storage (Hub)	9,36,251 MT			
Ripening Chamber	9,131 nos.	812 nos.	8,319 nos.	91%

9.2 Five Year Plan for Cold-chain development

(Rs. in crore)

S. No.	Component	Existing Capacity (2015)	Approximate Requirement in next 5 years	Funds required for five years as Government support
1.	Integrated Pack Houses	249 numbers	14,000 numbers	2450.00
2.	Cold Room	--	20000	1050.00
3.	Cold stores (Bulk & distribution hubs)	32.5 million tonnes	2.5 million tonnes	700.00
4.	Reefer Trucks	<10,000 numbers	20,000 numbers	1850.00
5.	Ripening Chambers	800 numbers	4000 numbers	56.00
	Total			6106.00

9.3 Challenges and Opportunities

- Cold-chain support is designed as a demand driven activity.
- Huge funding gaps: Rs. 6100 crore required in next five years.
- Disproportionate focus on cold storage capacity limited to long term storage crops only.
- Strengthening of integrated cold-chain will reduce post-harvest losses, add to farmer's income, stabilise prices, and create near-farm jobs and provide quality produce to consumers.

9.4 Financial assistance for cold-chain under MIDH (NHB / NHM)

Credit linked back ended subsidy @ 35% of the project cost in general areas and 50% in case of NE, hilly and scheduled areas is available.

Feasibility Assessment

Economics and feasibility of the project proposal have been worked out in the following paragraphs:

- Area in which Integrated Pack-house to be established: Gangtok, Sikkim.
- Distance between Gangtok to New Delhi- 1,500 kms.

10.1 Production Data:

- ✓ Production in Sikkim: 16590 MT (both Cut and Lose flower in 240 hectares of floriculture land)
- ✓ Assuming Per Annum production of Orchid flowers through cooperatives: 8295 MT
- ✓ Orchids processing per month: 691.25 MT
- ✓ Per day processing: 23.04 MT (appx.) production of Orchid

For it, following facilities are needed:

10.2 Cold-Chain Components:

- ❖ Land levelling, development and renovation cost of the existing building to make it usable as Integrated Pack House:Rs.50 lakh

- ❖ Integrated Pack house
  - ✓ Components included: Conveyor belt sorting, Grading, Washing, drying and weighing facilities including Diesel Generator:
  - ✓ Requirement: 25 MT/day
  - ✓ Equipment Cost: Rs.50.00 lakh for 16 MT.
  - ✓ Total Cost: 78.00 lakh

- ❖ Cold-Storage
  - ✓ Temperate Orchids: 1~5 degree C, Tropical Orchids: 7~10 degree C with 90~95% RH for both varieties.
  - ✓ Requirement: Multi temperature Cold Storage
  - ✓ Cost: Rs.10000 per MT
  - ✓ Size: 100 MT
  - ✓ Total Cost: 10.00 lakh.

- ❖ Reefer Vehicle:
  - ✓ Requirement: 4 no's of 15 MT capacity (3 will run on full capacity and one as spare)
  - ✓ No of days for round trip: 4
  - ✓ Cost: Rs.30 lakh per vehicle
  - ✓ Total: Rs.120 lakh.

- ❖ Margin Money @ 25% of Working Capital of Rs.275 lakh (to be arranged by the society): Rs.68.75 lakh

- ❖ Total project Cost:Rs.326.75 lakh (Rs.258.00 lakh for Infrastructure and Rs.68.75 lakh for Margin Money)

- ❖ Back- ended subsidy available from Govt. Of India: 50% of components cost = Rs.104.00 lakh (through MIDH/NHB Scheme)

- ❖ Capital expenditure: Rs.258.00 lakh.

10.3 Running Costs (Diesel):

- ✓ Diesel cost: Rs.70/- per litre (appx.)
- ✓ Distance between Gangtok to New Delhi: 1,500 kms.
- ✓ Round trip: 3,000 kms.
- ✓ No. of Round Trips per year per truck : 185
- ✓ Total load handled by a truck for an year: 2765 MT
- ✓ Average Mileage: 4.00 km per litre
- ✓ Fuel Cost per year per truck: 9,712,500 /-
- ✓ Fuel Cost for three trucks: 29,137,500 /-
- ✓ Fuel Cost for Spare truck: 10 Lakh
- ✓ Cost of fuel for handling 8295 MT: Rs. 300 lakh / year

10.4 Manpower Expenditure:

- ❖ Modern Pack houses:
  - ✓ Estimated Manpower requirement for 25 MT Pack-house: 60 (48 unskilled, 6 semiskilled, 6 skilled)
  - ✓ Labour Cost: Rs.33,048 per day (As per Delhi Minimum Wage rules)
  - ✓ Labour cost for 360days : Rs.120.62 lakh

- ❖ Cold-Storage of 100 MT capacity:
  - ✓ Total: 4no's (Record keeper-1, Technicians-1 and Helpers-2)
  - ✓ Cost: Rs.2304/- per day
  - ✓ Cost for 365 days:Rs.8.40 lakh

- ❖ Reefer Trucks: 3 no's (2 Drivers and 01 Helper) per truck
- ❖ Spare Truck: 01 no (1 Driver and 01 Helper)
  - ✓ Total Manpower required: 7 drivers and 4 Helpers
  - ✓ Cost: Rs.6252/- per day
  - ✓ Cost for 365 days : Rs.22.81 lakh

Total manpower Cost: Rs.151.83 lakh

10.5 Electricity cost: (25 KVA DG set required for the project)

- ✓ Diesel Generator Cost: 3.20 lakh
- ✓ Units consumed per day : 300
- ✓ Per unit tariff : Rs.6.67 /- (Considered on Higher side as per SSERC tariff)
- ✓ Yearly cost : Rs.730,365 /
- ✓ However, if DG is used then per unit cost : Rs.11.48
- ✓ Yearly cost including lubricant
  Oil charges and maintenance: Rs.13.62 lakh

So average of both: Rs.10.46 lakh

Water charges : Rs.2.00 lakh

Maintenance Cost @ 5% of total capital cost: Rs.16.33 lakh

Contingency (3%) :Rs.9.80 lakh

Spoilage during transportation: 2% of flower purchased

10.6 Existing cost of Orchid per stick during season and its economics:

- ✓ Farm price on an average: Rs.80~100/Stick
- ✓ At Terminal Markets: Rs.120~250/Stick.

2. The project is technically feasible, socially desirable and financially viable as may be seen from the calculation sheets at Annexure-I wherein IRR and DSCR have been calculated at 80% and 5.60 respectively.

Risk Analysis and Risk Management

The implementing cooperative is financially sound, is in profit, has business relationships with NCDC for many years, and has never defaulted on NCDC's loan earlier as has been brought out in detail in the chapter titled "About the Organization". Hence, there is low credit risk in the project.

2. The produce, i.e., Orchid has a great demand in the metros and in other countries. India itself is a net importer of Orchid and hence no problem is envisaged on the demand front. However, the implementing cooperative will have to recruit new manpower at managerial level

or train their own existing staff in handling of integrated pack-house, cold storage, etc. and also recruit staff in the field of electricity as the Cold-Chain infrastructure is a technical area. For salary and wages of technical staff, the economic viability of the project has been calculated after making enough provisions/amount required for this purpose in the project and therefore the society undertaking Cold-Chain Development will recruit, if required, all types of technical staff. After taking into consideration the minimum selling price, the IRR, DSCR ratios of the project are found to be in line showing the viability of the project.

3. The project is strategically located where the produce (Orchid) is available in abundance. However, the cooperative will have to maintain a good relationship with their members by making regular and timely payments for their produce so that regular supply of Orchid is maintained to the implementing cooperative which is the most important factor for the success of the project proposal.

4. The financial feasibility has been worked out separately which shows that it will be viable and the commitment of the promoter cooperative is evident from the fact that they are contributing working capital requirement out of their own sources.

Plan Implementation, Monitoring and Evaluation

The scheduling of the levelling and development of the site and renovation of existing building will be started immediately and completed within eight months. Identification of suppliers and developers of the Cold-Chain infrastructure has been started. The orders for delivery of the same will be placed within one month of the receipt of financial assistance from the NCDC. Thereafter, erection and commissioning, start-up and trial runs, training of staff, etc. is likely to take 8 to 12 months. The implementation of the project and its performance will be monitored both at the State level by the Registrar of Cooperative Societies Office, State Cooperation Department and NCDC.

SWOT ANALYSIS

Strength

- Orchids one of the most fascinating creation of the nature are one of the most widely distributed groups of flowering plants on the earth. The bewildering colours, shapes, and sizes of the flowers coupled with longer shelf life make them one of the top ten cut flowers in the international markets. They are having great demand and high price in the international markets.

Weakness:

- Natural calamity may prove to be the only weakness

Opportunities

- As per 2016-17 data from NHB, 240 hectares of land is available for floriculture and 16590 MT of Cut and Lose flower is being produced in Sikkim. About 515 orchid species found in Sikkim. Sikkim is the largest grower of Cymbidium orchids in India. If they are connected with consumer markets in India through Cold-Chain infrastructure as this connection will fetch the farmers of Sikkim a better price and encourage more farmers to go for production.

Threat

- Large scale demand of medicinal orchid is posing serious threat to orchids in natural habitats due to pressure of collection and sale of whole uprooted plants. Before recommending any orchids for medicinal use, extensive research on bio efficacy is essential. This will be helpful to fully exploit the potential of medicinal orchids in livelihood security of growers.

Annexure-I

COLD-CHAIN DEVELOPMENT OF ORCHID FLOWERS

CASH FLOW STATEMENT

(Amount in Rs.lakh)

Items	Year	1	2	3	4	5	6	7	8
INVESTMENT (including		326.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rs.50 lakh site dev charges)									
INCOME/CONTRIBUTION	Capacity		70%	80%	90%	100%	100%	100%	100%
Purchase Price (8295 MT * Rs.1.14 lakh per MT)			6619.41	7565.04	8510.67	9456.3	9456.3	9456.3	9456.3
Selling Price (8295 MT * Rs.1.35 lakh per MT)			7840	8960	10080	11200	11200	11200	11200
Marketing Expenses (5% of Sales Amount)			392	448	504	560	560	560	560
Total (B)		0.00	828.59	946.96	1065.33	1183.70	1183.70	1183.70	1183.70
OPERATIONAL EXPENSES									
Maintenance (5%)			16.33	16.33	16.33	16.33	16.33	16.33	16.33
Water & Electricity charges			12.46	12.46	12.46	12.46	12.46	12.46	12.46
Contingency (3%)			9.80	9.80	9.80	9.80	9.80	9.80	9.80
Interest on Working Capital		0.00	41.25	41.25	41.25	41.25	41.25	41.25	41.25
Project Management (Labour and Diesel Cost)		0.00	451.83	451.83	451.83	451.83	451.83	451.83	451.83
Spoilage during transportation (2% of Orchid Purchased)			132.39	151.30	170.21	189.13	189.13	189.13	189.13
Interest @ 15%		38.13	38.13	38.13	31.78	25.425	19.06	12.71	6.36
Depreciation (20%)		0.00	65.35	65.35	65.35	65.35	65.35	65.35	65.35
Total Operational Exp.		38.13	767.54	786.45	799.01	811.57	805.21	798.86	792.51
NET PROFIT (B-C)		-38.13	61.05	160.51	266.32	372.13	378.49	384.84	391.19
Cash Flow for IRR (D27+D23+D24-D6)		-326.75	164.53	263.99	363.45	462.90	462.90	462.90	462.90
IRR =	80%								
DSCR		0	4.32	3.28	4.90	6.83	7.54	8.40	9.50
Avg DSCR		5.60							
Loan		254.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Repayment		0.00	0.00	42.37	42.37	42.37	42.37	42.37	42.37
Loan Balance		254.25	254.25	254.25	211.88	169.51	127.14	84.77	42.40
Interest		38.1375	38.1375	38.1375	31.782	25.4265	19.071	12.7155	6.36