BIM Village Immersion Program 2019 – Case Study – Carrots in the Nilgiris

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This case study is written based on the experiences of the author and a team of students during the BIM Village Immersion Program visits on August, 2019. The author thanks all the members involved in the program for this case study.

CARROTS IN THE NILGIRIS:

Carrot is a British bequest to Udhagamandalam (Ooty) from some 150 years ago. Carrots can be grown throughout the year at an elevation above 1500 metres with assured irrigation. The elevation of Udhagamandalam is 2240 metres and there is sufficient water available – making it a favourite and viable crop that is widely grown by the farmers there.

HOW MUCH CARROT IS PRODUCED IN OOTY?

The Tamil Nadu Horticulture Department estimates that in 2016-17, carrot was cultivated on 2,554.96 hectares of land in the Nilgiris district. The total production of carrot in the Nilgiris in 2016-17 was 58749.29 tonnes. On an average, the productivity of carrot was 22.93 tonnes / hectare.

AREA, PRODUCTION AND PRODUCTIVITY OF HORTICULTURE CROPS - 2016-17(FINAL)
VEGETABLES

Area:Ha, Prodn: Tonnes Pty: Tonne

Sl. No.	BLOCKS	1.POTATO			2.TAPIOCA			3.SWEET POTATO			4.YAM			5.CARROT			6.BEETROOT			7.ONION			8.BRINJAL	
		Area	Prodn	Ptvy.	Area	Prodn	Ptvy.	Area	Prodn	Ptvy.	Area	Prodn	Ptvy.	Area	Prodn	Ptvy.	Area	Prodn	Ptvy.	Area	Prodn	Ptvy.	Area	Prodn
1	Udhagamandalam	1232.88	27123.36	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2175.66	50040.18	23.00	462.11	10998.22	23.80	0.00	0.00	0.00	0.00	0.00
2	Coonoor	138.01	2829.21	20.50	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00	305.34	7022.82	23.00	15.27	351.21	23.00	0.00	0.00	0.00	0.00	0.00
3	Kotagiri	9.81	201.11	20.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.96	1686.29	22.80	9.80	225.40	23.00	0.00	0.00	0.00	0.00	0.00
4	Gudalur	4.00	76.00	19.00	59.46	1902.72	32.00	0.00	0.00	0.00	6.21	192.51	31.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	2.00	25.00
5	District Total	1384.70	30229.67	20.50	59.46	1902.72	32.00	0.00	0.00	0.00	6.21	192.51	31.00	2554.96	58749.29	22.93	507.18	11574.83	24.93	0.00	0.00	0.00	2.00	25.00

HOW LONG DOES CARROT TAKE TO GROW?

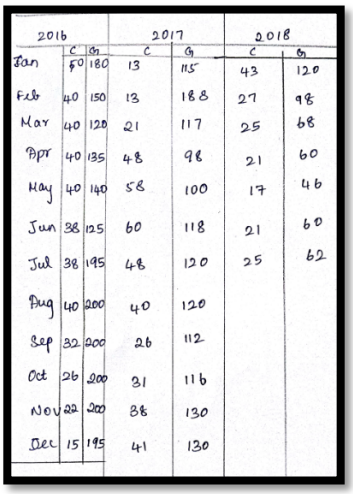
100-120 days

(Source: http://agritech.tnau.ac.in/horticulture/horti_vegetables_carrot.html)

HOW MUCH IS A KILO OF CARROT SOLD FOR?

The average price for one kilo of Carrot is 35.75 Rupees (Based on price data from Ooty Uzhavar Sandhai – average for 2016 and 2017)

Picture – Price Data for a Kilogram of Carrot and Garlic (From the Ooty Uzhavar Sandhai)



	2016		2017		2018	
	C	G	C	G	C	G
Jan	50	180	13	115	43	120
Feb	40	150	13	188	27	98
Mar	40	120	21	117	25	68
Apr	40	135	48	98	21	60
May	40	140	58	100	17	46
Jun	38	125	60	118	21	60
Jul	38	195	48	120	25	62
Aug	40	200	40	120		
Sep	32	200	26	112		
Oct	26	200	31	116		
Nov	22	200	38	130		
Dec	15	195	41	130		

CARROT GROWING VILLAGES IN NILGIRIS:

We visited carrot growers in the following villages in the 'Nanjanad' and 'Adikaratti' taluks -

1. M-Palada
2. Thambatti
3. Kollimalai
4. Kappathorai

We had administered 2 surveys to the villagers in the villages that we'd visited. Simple random sampling methodology was employed in administering these surveys. A first survey was to create a baseline data for the villages and a second survey that was focussed on understanding the carrot growers and their business in these villages. Kindly find the summary of the data collected from the second survey here -

- **Carrot Farmer Survey**

1. **Seasonality of Carrot Production**: The carrot yield is obtained 4months after sowing which is categorized as a single cycle. The seasonality of carrot production is majorly 3 cycles in M Palada, Kollimalai and Thambatti. Kappathorai on the other hand, has 4 cycle carrot seasons. This is due to the fact the farmers in Kappathorai predominantly use the 90-day variety of carrot seeds.
2. **Carrot yield across seasons**: Carrot yield varies from best to poor across the seasons. Upon surveying carrot farmers, it was found that the best yield was obtained during the summer season (i.e.) from January to April. The worst yield was obtained during the rainy season (i.e.) from September to December. The regular yield was obtained during May to August. This was found to be common for all the 4 villages.
3. **Input Cost involved in carrot production**: Seeds, Manure (Natural), Fertilizers, Pesticides were the common input costs involved in carrot production in M Palada, Kollimalai and Thambatti. Kappathorai had weedicide sprays and lease of land (if the land is not owned by the farmer himself) as additions to the above costs.
4. **Variation of Carrot price since last year:** Thambatti had the highest selling price last year, at Rs. 100/kg, while Rs. 60/kg is the maximum selling price for this year. Thambatti's lowest selling price was at Rs. 20/kg last year and is at Rs. 15/kg for the current year. Kollimalai recorded a selling price of Rs. 70/kg last year and is selling at a price of Rs. 60/kg this year. M Palada and Kappathorai had a selling price of Rs. 60/kg and Rs. 80/kg last year and are currently being sold at Rs. 40/kg.
5. **Mapping of the supply chain:** All the four villages had a similar framework of supply chain involved with respect to carrot production. The chain starts at Farmers who sell their produce to Middlemen. These middlemen collect the produce and take them to the auction where it is sold to buyers. The buyers who buy the carrots, then sell it to various shops in and across the state. The supply chain finally concludes when the shops sell the carrots to the customers.
6. **Is crop rotation performed:** Thambatti, M Palada and Kappathorai had a positive response to crop rotation. Matter of fact, it is a preferred activity among the farmers in these villages. The reason behind this would be the fact that crop rotation helps improve soil fertility. Beetroot and Potato are some of the common crops used for crop rotation. On the other hand, crop rotation was not majorly performed in kollimalai and carrot is the only crop that is grown by farmers for all the 3cycles in this village.
7. **Is Intercropping done**: Upon surveying, all the four villages had a strictly negative answer for intercropping. The insecticides/weedicides used are of selective nature and hence can affect the other crop when intercropping is done.

8. **Are Government subsidies available for seeds:** All the four villages conveyed that government subsidies were available for the seeds, and they amounted to 50%.
9. **Diseases that affect carrot production:** Nematodes is the most widespread disease that occurs in vegetable farms across The Nilgiris. Carrot farms in Kollimalai, M Palada and Kappathorai were predominantly affected by nematodes. Farms in Thambatti, had other diseases like Powdery mildew fungus and leaf spot in addition to nematodes.
10. **Shelf life of carrot post-harvest:** The shelf life of carrots across The Nilgiris is longer compared to other places in Tamilnadu and this is mainly due the low temperature that exists there. The shelf life of the carrots produced from the four villages more or less were the same with minor variations. Carrots from Kappathorai had the maximum shelf life as they lasted 12 days post-harvest while those from M Palada had a shelf life of 5days which was observed to be the minimum. Carrots from Thambatti and Kollimalai had a shelf life of 10 days and 7 days respectively.
11. **Approximate harvest per hectare:** The harvest per hectare remained almost similar in all the four villages. Thambatti, Kollimalai and M Palada had a harvest of 30 tonnes whereas Kappathorai had a harvest of 40 tonnes.
12. **Popular brands of seeds which are preferred:** Zubera F1 (120 days), Romance (90 days), Champion (120 days), Nantindo (120 days) were the popular brands of seeds that were preferred by farmers of the four villages.
13. **Cost involved in washing and transportation of carrots**: Carrots post-harvest are subjected to washing before transporting it to the auction place. The washing is done mostly using a carrot washer machine. The cost involved in the washing and transportation of carrots are handled by farmers themselves in Thambatti and Kappathorai. However, in kollimalai and M Palada, it is the middlemen/buyers who handle the transportation and washing costs.
14. **Major issues in carrot production:** The major issues in carrot production across the 4 villages were heavy rains, carrot diseases and soil quality.
15. **Any value addition to carrot has been done in your village:** No value addition to carrot has been done in the past in all the 4 villages.
16. **Handling of carrots that get wasted:** Farmers in Thambatti, Kappathorai and M Palada sell the wasted carrots at whatever price it fetches even if it means incurring a loss. Farmers in Kollimalai convert the wasted carrots into manure and use it for the enriching the soil.
17. **How is the involvement of middlemen seen:** Carrot farmers of all the four villages preferred the involvement of middlemen in selling their produce when compared with direct selling as they feel that there is a guaranteed return of money when sold through middlemen. However, direct selling does occur minimally in all the 4 villages.

Here is an indicative profile of a typical carrot grower (based on the interaction we had with carrot growers from the above mentioned villagers) –

1. Land holding – 5 to 9 acres (On an average)
2. No. of workers employed – 5 to 20 (across different stages)
3. Yield of Carrot per acre – 9283 Kg (9.28 tonnes)
4. The total input cost per acre is Rs. 1,66,200/-
5. The total profit per acre is Rs. 1,65,667/-
6. The total profit per kg of carrot is Rs. 17.84/-
7. At present, many carrot growers sell their produce to the Mandi. No value addition of any sort is done.

Table – Costs vs Benefit for Carrot Cultivation (Source: Data from Nilgiris Horticulture Office)

Carrots - Cost vs Benefit of Cultivation for one acre	
Activity	**Cost**
Preparatory Cultivation	
Ploughing / Forking	7,200
Breaking of clods and levelling	2,200
Cleaning	1,000
Making / Raising beds	5,000
Total	**15,400**
Seeds and Sowing	
Cost of FYM 12 MT	26,000
Cost of Seeds 2 Kg x Rs. 30000 spacing	60,000
Lining and sowing	1,800
Cost of No.4, 500 KG application	10,000
Total	**97,800**
After Cultivation	
Weeding and Thining	12,000
Total	**12,000**
Plant Protection	
Application of M45 - 5 Kgs	2,500
Other plant protection	3,200
Total	**6,000**
Irrigation	
Irrigation	10,000
Total	**10,000**
Harvesting	
Harvesting	10,000
Grading & transporting	15,000
Total	**25,000**
Total Cost of Cultivation for one acre	**1,66,200**
Total yield per acre(kg)	**9,283**
Total Revenue per acre (at 35.75 rupees per kg)	**3,31,867**
Total profit per acre	**1,65,667**

WHAT COMMON PROBLEMS DO CARROT GROWERS FACE IN CARROT CULTIVATION ACTIVITY?

From our interactions with the Carrot growers and from the official data from Uzhavar Sandhai, we observe that in the last year (2017), the price varied from a minimum of Rs. 13 per Kg to a maximum of Rs. 60 per Kg. These vagaries in price is the major problem for growers. In addition, the carrot crop has the problem of 'branching'. Such carrots with branches fetch even lesser rates in the market. At times, over / undergrown carrots are just wasted (thrown away).

Being seasonal, as well as perishable due to high moisture content, carrots farming is a risky affair.

Picture – Branched and Deformed Carrots being wasted

CARROT CUBES AND FLAKES:

To preserve the carrots over a period of long time for use during off-seasons, dehydration is one of the most important methods, because it lowers the cost of packaging, storage and transportation by reducing both the weight and volume of the final product. The apparatus used is also simple. On an average, dehydrated carrots sell between Rs. 660/- per kg to Rs. 800/- per Kg (data taken from the top sellers in Amazon).

Picture – Dehydrated Carrots

WHAT OTHER PRODUCTS CAN BE MADE FROM CARROTS?

1. Carrot Toffees,
2. Carrot Milk,
3. Carrot Pickle,
4. Carrot Powder,
5. Carrot Capsules.

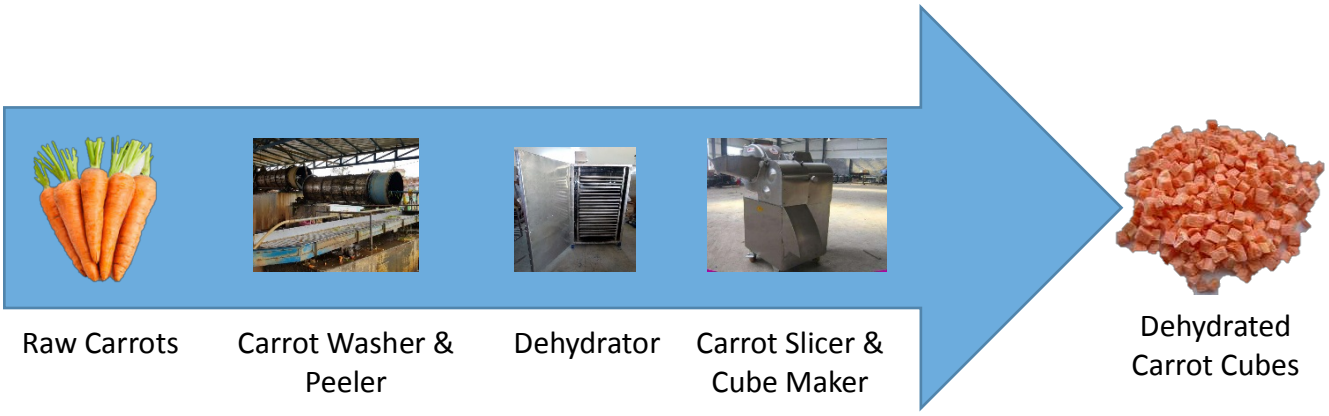
QUESTIONS:

1. Using the data in the case and other relevant secondary data, come up with a sustainable solution to help improve the livelihood of the carrot farmers in the Nilgiris.

2. Create an enterprise plan for the solution that you propose. Take necessary assumptions wherever needed.

ANNEXURE -1

PROCESS FLOWCHART:



NOTE: There is a step before dehydration called 'Blanching' which involves dipping the carrot cubes in hot water for 4 minutes. This process kills the enzymes and helps retain the colour of the carrot. This step is skippable.

ANNEXURE - 2

1. **Semi-automatic Carrot washer & peeler:** This machine takes raw carrots as the input (after cutting the carrot stem). It has brush rollers and a low pressure water jet. The rolling action of the brushes combined with the water being poured on the vegetables cleans them. The dirty water comes out of the machine via an outlet. The capacity of the machine is 500 Kgs of carrot per hour.

2. **Dewatering Machine:** This machine removes the excess water from the earlier machines. This is done using a high speed rotor and a centrifuge. The cubes are put into a 'washing machine' like drum with holes in the sides. The drum revolves at a high speed – due to which water separates from the carrot and escapes the drum through the holes. This water is then pumped out of the machine.

3. **Carrot Cubes Cutting Machine:** This machine has a rolling blade and a high power motor. The washed and peeled carrots are put inside this machine which slices them into cubes. Depending on the final usage, we can use either cube cutting machine or coin cutting machine (for cubes and chips respectively).

4. **Electric Tray Dryer:** This is the final and most important machine in the entire process. The tray dryer has a dehydration chamber (that is lined with galvanized iron) and an electric heater (made of stainless steel) and powerful fans that supplies hot air into the dehydration chamber. This hot air circulates over a series of shelves / trays made of 'SS 304 – Food grade stainless steel'. The actual carrot cubes are placed on this tray. The machine has controls for time and temperature of the hot air being circulated.

5. **Continuous Band Sealer** - Band sealers are suitable for sealing individual pouches/bags automatically. The machine has a variable temperature controller and speed control, to suit different grades of plastic materials Three types of models are available Horizontal type, Vertical type with foot stand type. Other special models include Nitrogen filling attachment, vacuum option, Printing attachment, and for heavy bags sealing

ANNEXURE - 3

INFINITY ENGINEERING

ENGINEERING & TECHNOLOGY SOLUTIONS

No-275/19/09/18
Date-19/09/18

GST: 33ASMPR2976C1ZJ

To.

Mr.Sudharsan Sezhian
Sudharsens90@gmail.com +91 9445728293.

Dear Sir,

Regarding the 500 kg per hour carrot processing plant we have given below our best solution.

SL	DESCRIPTION	QUANTITY	UNIT	RATE	VALUE(Rs)
1	**Electric Tray Dryer.** Electrictrays dryer machine standardmodel. **Technical specification.** Dryer size - (5x8x4.5)'HxWxB. Drying Area- **600square foot.** Capacity- **500 Kg** Total no of trays- 60 Nos. No of wire mesh trays –60 Nos. Tray size-2"x4" Heaters -10kw SS. Dryer/Tray-Materials-MS/GI/SS 304 mesh tray, Working temperature -30-200C. Structure - Rectangular, Power - 3phase, Fans -02Nos, Exhaust motor -01 nos Control system - Digital electric with timer, Total power -13kw. Working power -13kw*. Insulation -50mm Glass wool.	1	No	5,42,000.00	5,42,000.00

2.	**Semi-automatic carrot washing and peeler.** Type –wet type. Capacity- 500kgs per hour. Power -1.5 kw.	1	No	3,75,000.00	3,75,000.00
	Carrotcubes cutting machine Capacity - 500kgs /hour, Power -2HP 3phase,	1	No	2,30,000.00	2,30,000.00
3.	**Dewatering machine.** Capacity -250 kgs per hour. Power -1.5 kw.	2	No	1,15,000.00	3,30,000.00
4.	Material –Stainless steel.				
	CGST@09%				1,32,930.00
	SGST@09%				1,32,930.00

					17,42,860.00
	Transportation charges				25,000.00
	Installation charges				25,000.00
				TOTAL	**17,92,860.00**

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- Labors required to process – 5 persons
- Area required – 400 sqft

Terms and conditions.

- ✓ Delivery five weeks from date of confirmation.
- ✓ 50 % Advance with purchase order rest before delivery.

Our Bank Details.

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200000561120.

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For: INFINITY ENGINEERING
Er. Raj Agnesh.M Proprietor.

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