



Supply Chain Analysis of Coriander Leaves in Coimbatore

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Introduction- India is one of the world's largest producer of many fruits, vegetables and spices (Rais & Sheoron, 2015). Coriander is one among the major spices in India cultivated in an area of 5.85 hectares. The annual production of coriander was 4.91 Lakh tonnes during 2015-16. Tamilnadu contributes to 2 per cent of the country's coriander production. In Tamilnadu, coriander is mainly grown in Ramanathapuram, Virudunagar, Krishnagiri and Thoothukudi districts (DEMIC, 2016). Apart from the seeds being used as a spice, the leaves of coriander also play an important role in Indian cuisine.

India is said to lag in terms of an efficient supply chain for the distribution of fruits and vegetables (Rais & Sheoron, 2015). The vegetable supply chain is inefficient due to the interference of intermediaries and as a result of these problems, both the farmers and consumers are being affected (Kalidas, 2013). Farmers across the country are complaining about not getting a fair share as a return on their investment of both money and labor. Bhimanna Dindalkoppa from Dharwad states "When we hear about the very high prices of onions, we wonder why we are not getting those prices. The retail price of onions had reached Rs 80 a kg in north Karnataka, but I couldn't reap its benefits. The middlemen did". He is not the only one. Ravidra Desai from Karnataka says "We have realized it's only retailers who make money when vegetable prices rise." This issue is shared by farmers across the country. A vegetable retailer in Tamilnadu states "If a farmer wants money for the crop in advance, he would be obliged to sell to a middleman at the price the latter wants. If the price goes up, the middleman might give a small percentage of the extra profit he makes through sales to the farmer, considering the relationship between them and the farmer's bargaining power,".

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I. INTRODUCTION

India is one of the world's largest producer of many fruits, vegetables and spices (Rais & Sheoron, 2015). Coriander is one among the major spices in India cultivated in an area of 5.85 hectares. The annual production of coriander was 4.91 Lakh tonnes during 2015-16. Tamilnadu contributes to 2 per cent of the country's coriander production. In Tamilnadu, coriander is mainly grown in Ramanathapuram, Virudunagar, Krishnagiri and Thoothukudi districts (DEMIC, 2016). Apart from the seeds being used as a spice, the leaves of coriander also play an important role in Indian cuisine.

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consumers who buy vegetables from retail outlets. They end up paying a huge cost for the produce, which they could have avoided if they had directly bought from the farmers.

This is a problem faced by both the producer (farmer) and the consumer and it is high time that it is addressed. In order to address this issue, this study chose to analyze the supply chain of coriander leaves supply chain in Coimbatore. By analyzing the supply chain, the study aims to identify the constraints that prevent farmers from getting a fair share of price for cultivating coriander leaves. Coriander (also known as Cilantro) was chosen as it has an important place in the Indian cuisine and has a lower shelf life. Coimbatore was chosen as it has a huge customer base and it sources the coriander leaves from the nearby farmers. The study aims to analyze the supply chain of coriander leaves, in order to meet the following objectives.

II. OBJECTIVES

- To identify and compare the distribution channels of coriander leaves in Coimbatore.
- To identify the constraints that prevent farmers from getting a fair share of price for cultivating coriander leaves.
- To recommend solutions to increase the returns for the farmers and reduce the price for the consumers.

III. METHODOLOGY

The authors have used both primary and secondary data to identify the share of farmers in different modes of supply chain. Field visits were conducted to identify different modes through which cilantro is supplied to the consumers in Coimbatore. Secondary research was conducted to identify the price fluctuations over a period of 3 months and the margins kept by each member of the supply chain. The primary data was collected from all the entities of the coriander supply chain namely farmers, wholesalers, commission agents, retail sellers and consumers. The details of the sample are shown in Table 1.

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Table 1: Sample Details

Entity of the Supply Chain	Number of Respondents
Farmers	15
Commission Agents	15
Wholesalers	15 from MGR Market
Sellers in Uzhavar Santhai (Farmer's market)	15
Retailers	18 Kirana Stores; 18 Vegetable Shops; 5 Super Markets; 5 Weekly Markets, 1 Online Store; 4 Cart Vendors
Consumers	100

The instruments used were interview and questionnaire. The questionnaire included questions about the preferred retail points. Secondary data like price of Coriander leaves at Uzhavar Santhai (Farmer's market), cost of cultivation of coriander leaves were obtained from the administrative office of Uzhavar Santhai and the TNAU website respectively. Comparisons were made between the share of the farmer and other supply chain members.

IV. FINDINGS AND DISCUSSIONS

a) Coriander Market in Coimbatore - An overview

The Coriander leaves supply for the Coimbatore market takes place through the MGR market located on Mettupalayam road. The daily average supply during the season of the crop ranges from 6-7 tons per day and averages around 2-3 tons during the offseason months of May-October. The prices are fixed based on the daily supply of Coriander leaves. The MGR market is the only wholesale market in Coimbatore. The main farmers growing Coriander leaves in Coimbatore are situated in Senjeri malai, Thadagam and in some villages around Annur. Around 350 farmers cultivate Coriander leaves in Coimbatore.

b) Players in the supply chain of Coriander leaves in Coimbatore

Farmers: The farmer is a person who is the first in the supply chain of vegetables and also the person who does the majority of work among the different players in the supply chain. The factors which contribute the cost of produce for a farmer with respect to Coriander are: field preparation, nursery and planting/sowing, weeding, plant protection, fertilizers, wages. The total cost incurred by the farmer for a hectare of land for growing Coriander leaves is Rs.32000 (TNAU website). The leaf yield per hectare is around 7 tons. The cost incurred per kg is approx. Rs. 4.5. If the farmer directly sells to the wholesaler, the total cost incurred per kg is approx. Rs.5.8. If the farmer sells at Uzhavar Santhai the cost incurred per kg is Rs.4.95.

Coriander farmers are concentrated in the districts of Coimbatore, Thoothukudi, Virudhunagar and Ramanathapuram. Coriander is grown both for its seeds as well as for its leaves. The Coriander leaves are widely used in the Indian cuisine. It is one of the few leafy

vegetables that has high price fluctuation in various times of the year as Coriander is susceptible to weather changes which leads to early bolting, rotten roots etc. Most farmers prefer the hybrid variety of Coriander as it gives better yields.

Commission Agents: These are the mediators between the farmers and the wholesalers. Sometimes the wholesalers themselves act as Commission agents. The role of a Commission agent varies from procuring the produce from farms to a mere transporter to the wholesaler. The various costs incurred by the commission agent are wages, packaging costs, transport costs including entry charges inside markets and wastage costs. The cost incurred per kg is approx. Rs.1.6.

Wholesalers: The wholesalers either directly buy from farmers or buy through the commission agents. The various costs involved for the wholesaler are the storage cost, labor for unloading and loading, storage space rent, electricity bill. The cost incurred per kg is approx. Rs.2. The wholesalers are the ones who deal with the highest quantity of produce. In Coimbatore the MGR market is the wholesale market for all vegetables.

Retailers: These are the players who deal with the least produce and sell to the consumer. They procure Cilantro leaves through various supply chain modes. The main retailers are located inside the MGR market and the nearby vegetable markets. The main retailers buy from the wholesalers at the MGR market and sell the produce to the final retailers or to the consumers directly at retail prices. The final retailers sell the produce to the consumers.

c) Price fluctuations in Coriander

The wholesale price is determined by the supply of coriander leaves at the MGR market. The Uzhavar Santhai prices are fixed by the market committee which decides the rate by taking into account the wholesale and retail rates prevailing. The commission agent takes a Rs.3/kg fixed price whereas the wholesaler takes a Rs.5/kg fixed price as commissions.

The 3-month price data between November 1st 2017 and January 31st 2018 collected from Uzhavar Santhai for the Coriander leaves is shown below:

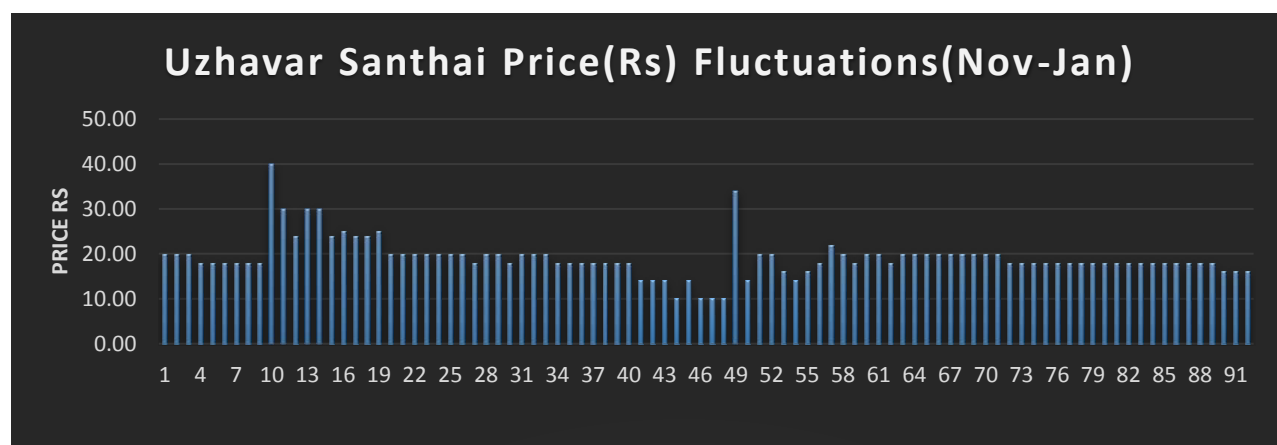


Figure 1: Price (/kg) in (Rs.) fluctuations at Uzhavar Santhai from November 1(2017) to January 31(2018)

On an average the price difference between the Retail and Wholesale is 195%. While comparing the farmer's markets with the retail points the farmer's market prices are 61.1% lower than the cheapest retail

point which is the weekly markets, 62.9% cheaper than cart vendors, 66.6% cheaper than super markets, 85.1% cheaper than the vegetable shops, 88.8% cheaper than kirana stores and 103% cheaper than online retailing.

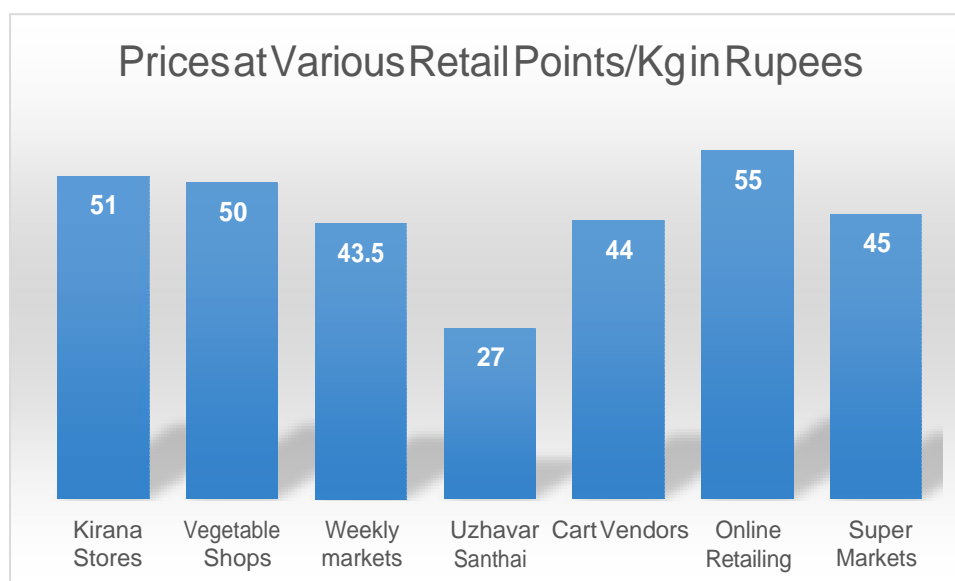


Figure 2: Price of Coriander leaves at various retail points in comparison with Uzhavar Santhai

It is evident from the graph that Uzhavar Santhai is by far the cheapest place to buy coriander leaves for the consumers. The consumers must be made aware of the huge price variations existing which would lead to more people buying at Uzhavar Santhai and which would lead to other retail points, reducing the prices.

d) Distribution Channels of Coriander

Supply chain analysis was used to examine the different channels of Coriander leaves. The models are described below (All costs incurred are in Rs./kg)

Model 1:

This model involves a commission agent and a wholesaler as middlemen. In this model the farmer gets a 17.3 % share out of the total price (i.e.) (Rs.8.3/Rs.48). The Commission agent gets a 6.3% share (Rs.3/Rs.48);

the wholesaler gets a 10.4% share (Rs.5/Rs.48) The retailers get an average of 66.0% share (Rs.31.7/Rs.48). The average 3-month price at which the farmer sells to the commission agent is Rs.8/kg. The commission agent picks up the produce from the farmland, packs it and then supplies to the wholesaler at Rs.11/kg. The wholesaler stores temporarily at the space available in MGR market, sells at Rs.16/kg and is picked directly by large departmental stores and vegetable chains and sold for an average retail price of Rs.45/kg in the case of super markets and departmental stores and Rs.50/kg in the case of vegetable shops. In this model farmers faced losses for 9 days out of the total 91 days studied.



Figure 3: Supply Chain of Coriander Leaves-Model 1

Model 2:

This model involves a total of 4 players the farmers sells his produce directly to the wholesaler at a 3-month average price of Rs.11/kg. The wholesaler stores and sells the produce at Rs.16/kg to the main retailer who are mainly vegetable markets sellers and

sell at an average price of Rs.25/kg to the final retailers. The final retail point sells at an average price of Rs.48/kg. The farmer gets a 23.5% share, the wholesaler gets a 10.4% share, the main retailer gets a 18.1% share and the final retailer gets a 47.9% share.

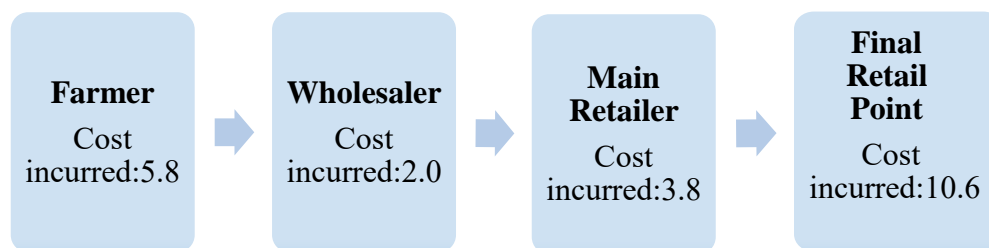


Figure 4: Supply Chain of Coriander Leaves-Model 2

Model 3:

This model involves a total of 5 players. The farmer sells at a 3-month average price of Rs.8.3/kg. The commission agent procures the produce and sells at an average price of Rs.11.3/kg to the wholesaler who in turn sells at a price of Rs.16.3/kg. The main retailer

buys from the wholesaler and sells at Rs.25/kg to the final retailer who sells at average price of Rs.48/kg. The share of the farmer is 17.3 %, the commission agent gets a 6.3 % share, the wholesaler gets a 10.4 % share, the main retailer gets an 18.1 % share while the final retailer gets a 47.9 % share.

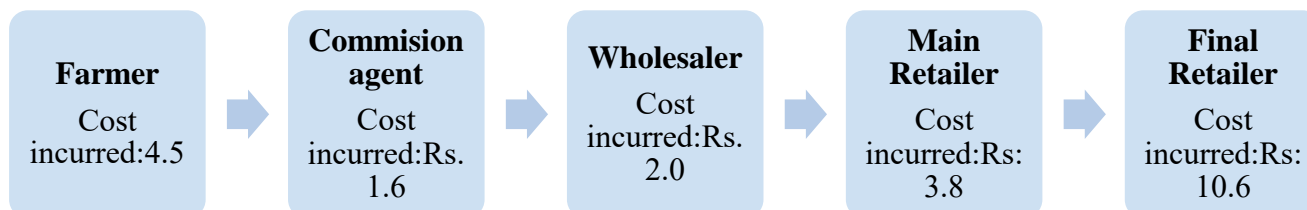


Figure 5: Supply Chain of Coriander Leaves-Model 3

Model 4:

This is a model in which the retailers buy from the farmer markets and sell them to the consumers. It is a convenient model for the retailers as the farmer's market are located at different places in the city. Based on the convenience they buy from the nearby market.

The farmers sell at average price of Rs.19.2/kg and the final retailer sells at an average price of Rs.48/kg. The farmer gets a 40.0 % share and the retailer gets the remaining 60.0 % share. This is one of the most profitable models for the farmer.

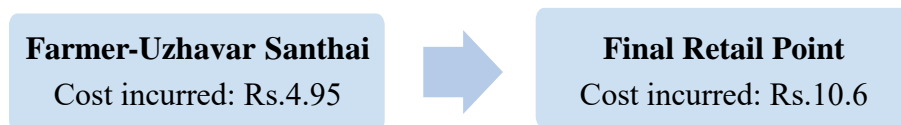


Figure 6: Supply Chain of Coriander leaves-Model 4

Model 5:

This is a model in which the farmer directly sells at the Uzhavar Santhai to the consumers. The average 3-month price of the sale is Rs.26.6/kg. The farmer gets

a 100% share in this model. Based on the convenience the farmers register themselves at an appropriate farmer's market. The farmer's market operates daily usually from 5.30 am till 11 am.

Farmer-Uzhavar Santhai
Cost incurred:Rs: 4.95

Figure 7: Supply Chain of Coriander leaves-Model 5

Model 6:

This is a new model in which the farmer sells directly online through several ecommerce websites. The websites usually get a commission. This model

involves slightly higher marketing and packaging costs. This model sells at average price of Rs.55/kg and the farmers gets a 74.9 % share.

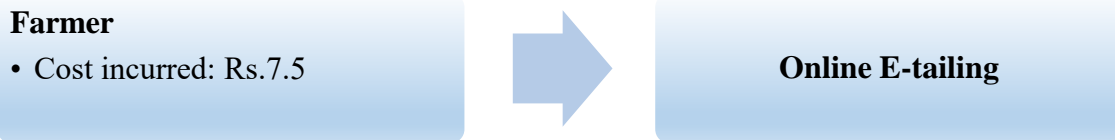


Figure 8: Supply Chain of Coriander leaves-Model 6

e) Comparison of various supply chain models of Coriander leaves

i. Based on value added, non-value added activities and essential non value added activities

Value added activities are those activities customers are willing to pay for, non-value adding activities are wastes and do not add any value whereas the essential not value adding activities aids in achieving value and hence difficult to eliminate.

Production, cleaning and processing were identified as value adding activities in previous researches on agro-supply chains (Rubayet Karim and Jony Biswas, 2016). Production (Farming) is the only value adding activity identified in the supply chain of Coriander leaves as cleaning and post processing are not applicable to Coriander leaves. The list of non-value added and essential non value added activities between various supply chain linkages are listed below.

Table 2: Non value added and essential non value added activities in various linkages

Linkages	Non value added activities	Essential non value added activities
Farmer- Commission agent	Wastage, waiting, storing the produce	Procurement, Transportation, packing, loading
Commission agent- Wholesaler	Unloading, grading, waiting, excess transportation	Transportation
Wholesaler- Retailer	Storing, unloading, loading wastage, waiting, excess transportation	Transportation
Retailer to Consumer	Storing, wastage	Transportation, bundling, loading, unloading, waiting
Wholesaler to Main retailer	Loading, unloading, waiting, wastage, excess transportation	Transportation
Main Retailer-Retailer	Wastage	Transportation, waiting, loading, unloading
Farmer- Wholesaler	Storing, waiting	Transportation, loading, unloading
Farmer- Retailer	Wastage	Packing, loading, unloading, waiting, transportation
Farmer- Direct selling	Wastage	Packing, waiting, loading, unloading, transportation, bundling
Farmer-E-Tailing	Wastage	Cleaning, packing, bundling, delivery

The table below lists the total number of non-value added and essential non value added activities in the different supply chain models.

Table 3: Total number of non-value added and essential non value added activities in various models

Model	Number of Non- value added activities	Number of Necessary Non- value added activities	Total of Non-value added and necessary non value added activities	Non-value added activities (%)
1(F-C-W-R-CO)	3+4+6+2=15	4+1+1+5=11	26	57.6
2(F-W-MR-R- CO)	2+5+1+2=10	3+1+4+5=13	23	43.5
3(F-C-W-MR-R- CO)	3+4+5+1+2=15	4+1+1+4+5=15	30	50.0
4(F-R-CO)	1+2=3	5+5=10	13	23.0
5(F-CO)	1	6	7	14.3
6(F-E)	1	4	5	44.4

F-Farmer, C-Commission agent, W-Wholesaler, MR-Main Retailer, R- Retailer, CO-Consumer, E-E-tailing

The total number of non-value added and necessary non-value added activities are highest in model 3 and lowest in model 6. The percentage of non-value added activities are highest in model 1 and lowest in model 5.

ii. *Based on Price Spread and Marketing Efficiency*

The table below compares the price spread and marketing efficiency of the various supply chain models identified for Coriander leaves. The Price Spread is calculated by subtracting the price paid by the consumer and the net price received by the farmer. The marketing efficiency is calculated by Acharya method. Marketing Efficiency= (Net price received by producer)/

(marketing cost + marketing margin). (Kalidas K, 2016). The net price received by the farmer is found by subtracting the price received by the farmer (Rs./Kg) and the cost incurred by the farmer(Rs /Kg) as shown in section 5.2. The marketing cost is the sum of all costs incurred by the players in the supply chain model applicable and the marketing margin is the profit margin for each player in that supply chain mode. The difference between price paid by the consumer and the net price received by the farmer gives the sum of marketing costs and marketing margin of all the players in the supply chain model.

Table 4: The price spread and marketing efficiency of various supply chain models of Coriander leaves

Model	Price Received by farmer (Rs./Kg)	Price at which commission agent sells (Rs./Kg)	Price at which Wholesaler sells (Rs./Kg)	Price at which Main Retailer sells (Rs./Kg)	Price at which the retailer sells (Rs./Kg)	Price Spread (Rs./Kg)	Marketing Efficiency
1	8.3	11.3	16.3	-	45-50	39.7	=3.8/44.2=0.09
2	11.3	-	16.3	25	43.5-51	36.7	=5.5/42.5=0.13
3	8.3	11.3	16.3	25	43.5-51	39.7	=3.8/44.2=0.09
4	19.2	-	-	-	44-51	28.8	=14.25/33.75=0.42
5	26.6	-	-	-	-	0	=21.65/4.95=4.37
6	41.2	-	-	-	55	13.8	=33.7/13.8=2.44

From the above table it is evident that the marketing efficiency is highest in the supply chain model 5 and least in the models 1 and 3. The price spread is lowest in models 5 and highest in models 1 and 3.

iii. *Based on Share of Entities*

The table 5 compares the share of various players in the models.

Table 5: Comparison of different models of Supply Chain for Coriander leaves in Coimbatore

Model	Share of Farmer (%)	Share of Intermediaries (%)	Share of Retailer (%)	Final price (Rs)
Model 1	17.3 %	16.7	66.0	45-50
Model 2	23.5	28.5	47.9	43.5-51
Model 3	17.3%	34.8	47.9	43.5-51
Model 4	40.0%	-	60.0	44-51
Model 5	100	-	-	26.6
Model 6	74.9	25.1	-	55

From the above table, it is evident that the Models 1, 2 and 3 offer the least share to the farmer. The models 1, 2, 3, 4, 6 are unfair to the consumer as the final prices are too high. Thus the most suitable supply chain model for both the farmer and the consumer is model 5 in which the farmer directly sells the produce through Uzhavar Santhai.

f) *Constraints preventing a fair share for the farmers*

The following are the observed constraints which prevent the farmer from getting a fair share:

- Less Bargaining power for farmers during coriander season due to excess supply
- Less Government intervention to regulate retailers
- Multiple players in supply chain, each keeping a good margin

- No MSP for Coriander leaves farmers
- The nature of the produce, unlike onions can't be stored due to its perishable nature forcing farmers to sell produce immediately on harvesting.
- The sudden bolting nature of Coriander leaves leading to premature harvest, reducing yields
- Not enough farmer's markets and a study conducted among 100 consumers showed that the farmer's market is not preferred by consumers as compared to retail points due to factors such as location of farmer's market, not enough awareness about huge price difference between retail outlets and farmer's market, non-availability of all fruits and vegetables required by a consumer, ambience, and influence of buying at a known shop.

g) *Factors leading to high price for consumers*

The following are the factors leading to a high price of Coriander leaves for the consumers presented in the form of a cause and effect diagram.

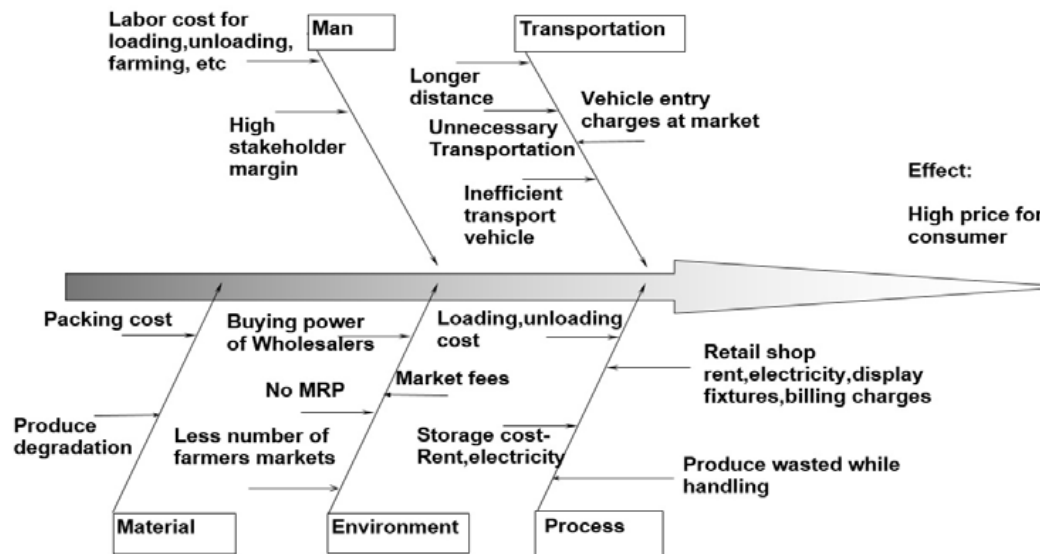


Figure 9: Cause and effect diagram - high price for the Consumer

h) *Recommendations to solve the issues in the Coriander Supply Chain*

The following are the recommendations to solve the issues in the supply chain models of Coriander leaves.

- Cross-Docking at wholesalers to reduce unloading, loading, storage, wastage and waiting activities
- Managing supply and demand through analytics to directly transport the produce from the commission agent to the main retailer which eliminates/reduces excessive transportation, waiting, loading, unloading, wastage and storage activities
- Provide MSP for Coriander leaves farmers
- Regulate the Retailers by Government Intervention
- Adopt efficient supply chain modes with less price spread and with less/no intermediaries
- TNAU must help farmers grow crops according to demand through efficient forecasting to prevent excess supply
- Mulching techniques to prevent bolting must be employed
- The Government must open more Farmer's markets
- Awareness must be created about low vegetable prices in Farmer's markets by publishing the Farmer's market prices in public domain
- Improve the standards of the Farmer's markets by improving cold storage facilities, improve parking

facilities, extend timings, include more variety of fruits and vegetables, sufficient stock of low denomination notes, maintaining cleanliness.

i) *Proposed future model*

Hydroponic farming and vertical farming techniques are slowly entering India. A farmer who practices such techniques would get better quality produce and would fetch better prices if sold directly by the farmer. (Indian Express-10th February, 2018). Hydroponic farming means feeding liquid nutrients directly to plants and vertical farming is farming above ground level using various types of structures.

The main advantages of adopting hydroponics and vertical farming is the farming activities are more simplified, it eliminates the need to remove weeds, ploughing land, less labor intensive harvesting, consumes less water, faster crop cycle. The produce is of better quality as the essential nutrients are given directly to plants without the need of soil. Growing in a controlled environment eliminates the need to use pesticides. The produce can be grown atop of buildings in the city or in nearby regions and can satisfy the region's food requirements. This drastically reduces lot of non-value added activities like transportation, storing, handling etc. and also provides a better share to the farmer.



Figure 10: Supply Chain of Coriander Leaves-Future Models



Figure 11: Image of a Hydroponics setup in Coimbatore

V. CONCLUSION

The different distribution channels of the Coriander leaves in Coimbatore were identified and compared. The results show that the number of non-value added activities and essential non value added activities are high in several models leading to low price for farmers and a high price payable by the consumer. Further, price spread is too high in several supply chain models of Coriander leaves and the marketing efficiency is very low in several models. On comparison of the shares received by the players in the different models, direct selling gives the highest shares to the farmer. There exists a huge price difference between the wholesale and retail points indicating that consumers are paying very high prices when buying through retail outlets except Uzhavar Santhai. Direct Retailing through Uzhavar Santhai and E-tailing give a fair share to the farmers whereas Uzhavar Santhai offers the consumers at the cheapest price; it is a win-win situation for the most important players in the supply chain. If the same price difference is seen in other vegetables also then, Uzhavar Santhai would be an ideal supply chain model for both the farmers and consumers. Several constraints which lead to low share for the farmers and several factors which lead to the consumer paying a high price for the Coriander leaves were identified and several recommendations have been made to solve the same. A Hydroponics model was recommended as a future model to increase the share of a farmer and reduce the intermediaries.

VI. CONTRIBUTION

This study contributes in the area of supply chain of vegetables. The study identifies the best model for both the farmer and the consumer. This study points out the inefficiencies in several supply chain models leading to high price for the consumer and a poor share to the farmer and adds to the claims by several

newspapers regarding the high difference in wholesale and retail prices. This study identifies the constraints leading to inefficiencies in the supply chain and identifies the factor for a high consumer price. Further, it gives several recommendations to solve the inefficiencies in the supply chain of Coriander leaves and the need for government intervention.

VII. FUTURE DIRECTIONS FOR RESEARCH

This research was done only for the Coriander leaves. If similar researches are conducted for other crops, the supply chain models existing for such crops can be found out and it can be checked whether such inefficiencies exist in Coimbatore for other crops also and solutions for rectifying the same can be identified.

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