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Supply Chain Logistics and Waste Management at a Food Industry

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Abstract - Today, establishments around the globe are competing for a cutting-edge advantage by streamlining their supply chain performance. Global supply-and-manufacturing networks need driving strategies to manage the product, information and financial flows on which these businesses run. This is a challenge for supply chain management, where achieving the targets of both cost cutting and higher service has several implications at every stage of the supply chain and in distribution center operations.

This paper condenses the effective methodology to address the problems like, availability of distribution centers, supplement arrangements, transportation cost minimization, stock underflow and lack of sheltered centers.

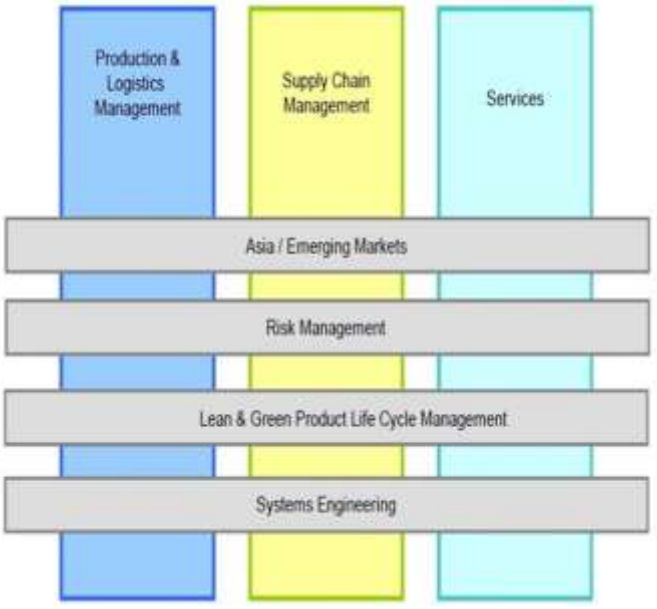
1. Introduction

The aim of this project is to identify prominent opportunities in the food and storage in our nation India and present ways in which challenges of the present market can be improved using technology and experience. Particularly, opportunities for logistics are identified.

The food supply chain in India is complex with perishable goods, and numerous small stake holders. The infrastructure involving these partners is pretty weak. India is an agriculture predominant country. The fruit and vegetable sector are the key inflation indicator. Many companies and governments have collapsed because of the failure to deliver in the F&V sector. There is also a sensitive issue of farmers killing themselves because of various reasons like lack of rainfall, onus of loans etc. The total domes-tic consumption is approximately USD 60 Billion. Indian agriculture sector accounts for 26% of country's GDP, produces 64% employment and 18% of country's export. India is the 2nd largest producer of fruits & vegetables in the world and it is also the 2nd largest vegetable exporter (17% in the world vegetable market)., India accounts to about 30 million tons(total world production is 370 million) Of the 450 million tons of vegetables produced in the world, India produces as much as 59 million tons. Namdhari's Fresh is a group of grocery stores which deals with production and distribution of fruits and vegetables, started in 2000 in the city of Bengaluru. The chain was started with the intention of filling the segment of premium green grocers. There are 40 varieties of fruits and vegetables which are sold are grown at the company's own production farms and part of them are collected from farmers. Besides the Domestic market, the produce is also exported to Europe, Oceania and the Middle East. At present, companies are facing increasing challenges in operational costs cutting, increase profit margins and remain relevant due to global economic crisis. managers leap upon the opportunity to make their business process more efficient and improve the performance of the entire supply chain. The purchasing of raw material and other component parts from supplier's accounts for a majority expenditure for manufacturing firms. it is being stated that outsourcing of manufacturing activities will be prominent in the near future.

2. Supply Chain General Scope

In the organizational arrangement for research strategies at the ETH Zürich. Supply Chain Management (SCM), is situated between Production & Logistics Management and Services. SCM intersects with Asia / Emerging Markets, Risk Management, Lean and Green Product Life Cycle Management and Systems Engineering, as to be seen on the on the image below. The area of application is visibly wide.



2.1 Logistics Management.

Logistics management is a supply chain management component that is used to meet customer demands through the planning, control and implementation of the effective movement and storage of related information, goods and services from origin to destination. Logistics management helps companies reduce expenses and enhance customer service.

The logistics management process begins with raw material accumulation to the final stage of delivering goods to the destination.

Logistics management involves numerous steps, including:

1. Proper Planning

2. Adopt Automation

3. Value Relations

4. Warehouse Management

5. Efficient Transportation

6. Measure and Improvise

Logistics management functions include customer service, sourcing and procurement, production planning and scheduling, packaging, and assembly. Logistics management is part of all the levels of planning and execution, including strategic, operational and tactical. It coordinates all the logistics activities, and it integrates logistics activities with other functions, including marketing, sales, manufacturing, finance and information technology.

2.2 Problem Area

Firstly, its distribution centre located at Bidadi caters to the entire outlet chain across Bangalore. This leads to a very high logistics cost. Also, the procurement of produce to Bidadi from various far off villages adds to logistics cost. Due to the unplanned routing, the transportation cost increases and thus the prices of commodities go higher.

Secondly, Namdharis's Fresh does not use any scientific tools to forecast the demand. They rely on previous years' data to predict the demand for the current year. This leads Our objective function is to minimize the total transportation cost. We have 42 outlets to be served by 4 distribution centres with minimum number of trucks. Total transportation cost is the sum of total fixed cost and total variable cost.

to supply demand mismatch. Also, the information flow is very inefficient. The synchronization between procurement centres is still lagging. These all factors are affecting the final selling price of the commodities.

Thirdly, almost 30% of the F&V produced go into wastage. Waste Management isn't given much priority as the transportation cost of bringing back F&V is very high and hence not feasible.

Major loses caused to farmers due to the bullwhip effect and lack of coordination between farmers and distributers. No proper inventory management to support supply and to satisfy the demand.

2.3 Methodology

The required data that affects the logistics for F&V circulation was obtained from a distribution centre stationed in Bidadi. Collection of data includes both primary and secondary sources. Direct approach to distribution centre is used as a means of primary data collection. Cost and distance minimisation is sought through the study by obtaining the approximate transportation data. The principle of Reverse Logistics are utilised for business enhancement. It stands for all operations related to the reuse of products and materials and is the process of planning, implementing, and controlling the efficient, cost effective flow of products and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. More precisely, reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal. Basic steps followed throughout the research include:

1. Identification of problem

2. Defining and analysing the problem

3. Generating potential solutions

4. Finding solutions in parts

5. Decision-Making

6. Implementing Solution

2.4 Model

2.5 Constraints

1. An outlet can be served by one and only one distribution centre.

2. A distribution centre can supply to any outlet, only if it is selected.

3. The sum of all quantities supplied by all the distribution centres to all the outlets should be equal to the total demand.

4. No more than 4 distribution centres can be selected out of 10 potential sites

5. One and only one truck can supply to any outlet.

6. Any vehicle cannot cater to more than 3 outlets

7. Any vehicle cannot travel more than 15 kms. (Vehicles travelling from Bidadi centre are an exception as it is already an existing distribution centre).

8. Any vehicle should start at a distribution centre and end at the same distribution centre.

9. Any truck can originate from a distribution centre if that distribution centre is selected.

10. The total supply by any vehicle should be less than or equal to the capacity of that vehicle.

11. The distribution centre located at Bidadi should be considered in the final solution.

This problem is a combination of Warehouse Location Problem and Vehicle Routing Problem which is a NP hard problem (Non deterministic Polynomial-time hard problem). Every additional constraint added to a NP hard problem increases its complexity exponentially. Thus, it is impossible to solve this problem. Therefore, we use heuristics to obtain an optimal solution for this problem.

In order to reduce the complexity of the problem, we have assumed certain conditions which are enumerated as follows:

2.6 Assumptions

1. Outlets are classified into two types based on their daily demand. The demand at each regular outlet is assumed to be 300kgs every day. The demand at each mega outlet is assumed to be 1000kgs. This assumption is based on the fact that Namdhari's Fresh handles around 70tonnes of F & V daily.

2. 12 mega outlets are assumed across city, based on most sales. They are Koramangala, Jayanagar, Vijaynagar, Banashankari, Nandini Layout, Malleshwaram, Rajajinagar, Hebbal, Rajarajeshwari Nagar, Indiranagar, JP Nagar and Yelahanka.

3. There are two kinds of vehicles that are considered. A LCV (Light Commercial Vehicle) is assumed to have a capacity of 1000kgs and a MCV (Medium Commercial Vehicle) is assumed to have a capacity of 3000kgs.

4. To reduce the complexity of the problem, we have consolidated two outlets and three outlets which are very close to each other into one outlet. The distance between these consolidated outlets is not more than 500 meters. Since a one ton vehicle can cater to maximum of 3 outlets, the maximum number of outlets that can be consolidated are restricted to three. 4.We have ignored infrastructure costs and assume that the infrastructure already exists.

2.7 Heuristic approach to solve a problem

Rules Followed:

1. Bidadi should be selected as one of the distribution centre, because it is an existing traditional centre.

2. There should be a distribution centre for each zone- north, south, east and west.

3. The distance between the distribution centre and an outlet should be less than or equal to 5kms.

4. No distribution centre should be within 12kms from another distribution centre.

5. Each distribution centre should cater to at least 7-8 outlets

3. Cost Benefit Analysis

3.1 Benefits to the Farmers

In the proposed solution, some routes minimize the existing distance travelled whereas some routes make little or no change at all (Table 1).

The farmer's transportation cost, distance travelled, and time will be reduced enormously as they will not have to travel too far to reach Lal Bagh. They can sell their produce at any of the 4 Distribution and Procurement centres. As the distance travelled and time for procurement is reduced, there is no degradation in quality of the produce and they can demand better prices for their produce. Also due to the time saved, they can sell their surplus produce elsewhere avoiding wastage.

3.2 Benefits to the Consumers

The customers will pay lesser for superior quality produce as the transportation costs are minimized. Availability of fresh vegetables and fruits as the distance between the

distribution centers and the outlets are minimized. Better and faster Mobile sales of fruits and vegetables at their door-steps as specialized trucks are allocated to it.

3.3 Benefits to Namdhari's Fresh

By establishing four different distribution centers, the competition increases. The zone wise administration eliminates monopoly and results in improved service. Due to the lesser transportation costs incurred, the money saved can be utilized effectively for other purposes.

Distribution center	Distance saved by LCV (in kms/ day)	Cost Saved (Cost per km = Rs 5) (in Rs/day)	Distance saved by MCV (in kms/day)	Cost Saved (Cost per km = Rs 7) (in Rs/day)	Total Cost Saved (in Rs/ day)
Bidadi	0	0	0	0	0
Jaynagar	0	0	84	588	588
Hebbal	48	240	70	490	730
Rajajinagar	28	140	52	314	454
Total	76	380	206	1392	1772

Annual Distance Savings = 102930kms

Annual Cost Savings = Rs. 646780.

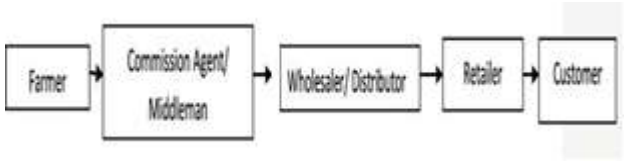


Fig. 1 Fruits & Vegetables supply chain.

4. Conclusions

The implementation of the proposed solution will result in savings of Rs.646780 per annum of their logistics cost when compared to the existing solution. The additional cost of investing in the infrastructure of new distribution centers can be further minimized by using the idle trucks as storage areas Logistics and supply chain stages of distribution of F&V were adopted. Logistics solutions steps were followed as an approach to the problem. Through direct approach method primary data was collected from retail stage and also secondary data was collected on press and supplier stages. Data regarding simple problems of logistics management was gathered, that is, distance data, cost data, failure data, supply data, transport data, labour data, etc., to provide simple solutions that can be adopted at the both producer level (farmers) and retail level to optimise and enhance profitability, and simultaneously reduce cost.

The introduction of 3 new distribution centers also helps to better waste management as the transportation will be minimal or nil. The wastage can be given back to the farmers who in turn can use the F&V wastage as fertilizers after composting it. This results in reduced cost of fertilizers.

After analyzing the result we also can conclude that using(R, Q) policy goes well with less amount of safety stock or else reorder point. So it depend on the retailer to choose the appropriate level of inventory, safety stock and reorder point to strengthen the relation with customer and also with other retailers. Now we can also conclude that retailers should have their interrelationship and if they are close by to each other they can also satisfy each other's customer demand by sharing their own inventory.

Acknowledgments

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