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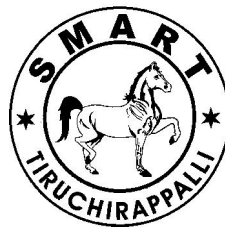
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**ANALYSIS AND EVALUATION OF DISTRIBUTION AND CONSUMPTION
OF VEGETABLES IN MUMBAI METROPOLITAN REGION**

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Abstract

In this research paper, the Researchers have analyzed and evaluated the distribution and consumption of vegetables, in Mumbai Metropolitan region as well as that of the existing agricultural supply chain, from farmers supplying to this region till APMC and further to the consumers. The project also comprises of designing an organized, efficient and effective Agro-Supply Chain Model. The methodology, for implementation in the MMR region, was also studied and worked out. The objective was to reduce or eliminate intermediaries, wastages and cost, leading to a more effective and efficient supply chain management model, for agricultural product, leading to the development of a profitable enterprising business activity, reducing inflation and offering better value for money product i.e. vegetables for consumers.

Keywords: *Vegetables, Agricultural Supply Chain, Agricultural Products Marketing Corporation (APMC), Mumbai Metropolitan Region (MMR), Agro-Supply Chain Management Model, Small Scale Industry (SSI), Gujarat Consumer Milk Manufacturing Federation (GCMMF)*

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1. Introduction

Since 2010, the world has consistently produced less food products than it has consumed, thereby continuously depleting the food reserve. Gone are the days when India was importing food products. India is the second largest food producer in the world. Today the productivity of Indian Agricultural Sector is comparable to the rest of the world's leading countries. Thanks to Dr.Swaminathan and the Green Revolution, India is one of the few countries, which produces more vegetables than it consumes, even after the spending on vegetables had increased from 15% to 25%, between 1993-94 and 2003-04.

However, India is still at a nascent stage of developing the agricultural supply chain. It has one of the poorest infrastructures and management of fruits, vegetables and other firm produces, beyond harvesting, that is from the fields to the consumers. The average wastage of fruits and vegetables, globally, is around 20-22% whereas in India, it is a whopping 40-46%, which is almost double. It implies almost half the fruits and vegetables India produces, are wasted. The annual value of wastage of food products, stands at a whopping figure of Rs. 46,000 crores and in the sectors of fruits and vegetables alone, it is Rs.13,000 crores per annum. The reasons are lack of proper logistics and supply chain facilities, like warehousing facilities and cold storage, transportation of vegetables and fruits in refrigerated temperature and humidity-controlled vehicles as well as the absence of organized food processing industries. The basic, for any industry, is finance. The other industries can have bank finance at 1- 1.25% per month and about 12-16% per annum. An agriculturist has no such facilities and hence he is forced to take loan, from money lenders and micro finance sharks, at 4-5% p.m. i.e. about 48-60% per annum. Agriculture is also a high risk business. More rain, less rain, untimely rain, flood, drought, insect invasion, inadequate price

realization are all multiple risk factors. Every industry has its minimum price protected, whether in private or government sector. They know their costing and they know their likely sales price and estimated output and likely profit. An average poor farmer is oblivious of such factors. If everything goes well, there may be excess crops, coming out at a time, in the market and the farmer may be forced to sell, at a price below his costing, as his produce has no shelf life. There is no food processing industry near about, which can convert it into value added product, similar to how cold storage tanks and refrigerated vehicles increase shelf life of milk products and milk powder, cheese, butter etc. and they become value added products. The tomato farmers can have similar temperature and humidity-controlled warehouses, at least at APMC, to increase the shelf life and converted into value added products like Tomato Puree, Tomato Ketch ups, Soups etc. The analogy can be applied to any vegetable like potato, onion etc.

The endeavor, in our project, was to understand the consumer behaviour, through primary survey of 1200 consumers, in various income groups and strata of the society, to study, analyse, evaluate and develop an efficient and effective model of distribution of vegetables. There are various successful models, in the sector of vegetables and allied farming sector, like that of Milk by GCMMF (Amul), Pepsi Foods(Frito Lays Potato Chips), Gherkin manufacturers by Avantha Group in Karnataka, HOPCOM in Karnataka, Safal by Mother Dairy in Delhi and Bangalore, Sugarcane Farmers in Western Maharashtra, McDonalds India etc.

2. Review of Literature

Nowadays, almost all the land and water, that is economically suitable for agriculture, is fully utilized. To meet the food and energy requirements of increasing population, the requirement of food products is valued at over Rs. 900 Crores (9.0 Billion) or USD \$134 million,

by 2050. This has to be met by constant growth in agricultural sector (**Conway, 2012**). India is having one of the highest rates of rural poverty in the world. It is also facing a severe per capita land constraint and the pressure on agricultural systems is also increasing because of rapid urbanization and changing diets, predominantly the shift toward increasing stresses for energy and industrial crops, greater consumption of livestock products, growing struggle for water between agriculture, household, industry, and ecological uses and environment change (**Conway, 2012**). For example, fee-for-service arrangements, for extension services, show promise for making service providers more accountable to farmers (**Anderson & Feder, 2007**). But as **Jack (2013)** sees, poor may be excluded if they are less eager or not able to pay although there are a few evidences on influence of value chain linkages for poor, women, and socially marginalized farmers. **Campbell (2013)** concludes that the value chain interferences can considerably contribute to poverty reduction, by increasing the keenness of specific value chains and their service markets. According to **NABARD Report (2015)**, the issue of profitability of small holding-based agriculture, has assumed importance in view of increasing proportion of small and marginal farmers in the country. The Researchers propose to supplement NABARD's producers' organization development fund, for producers' development and upliftment, called PRODUCE, with a sum of Rs. 200 crore, which will be utilized for building, 2000 producers' organizations, across the country, over the next two years. **The Report on Global Food Waste (2013)** found that as much as 50% of all food, produced around the world, never reaches a human mouth. There was no case to restructure crop loans in Andhra Pradesh as yield in areas, declared calamity-hit, pointed to a different story. The Andhra State Government had considered loan recast as an alternative to the difficult and expensive process of loan waiver. The

alternative, to the loan recast, will mean depositing the money directly into the accounts of borrowers. Non-corporate, small businesses are the backbone of the country, with 5.77 crore enterprises, contributing 45% to the national GDP vs 15% by the corporate sector. It provides 90% of employment, in the country to 46 crore people of which 24 crore are self-employed. The non-corporate sector consists of Service (34%), Manufacturing (30%) and Trading (36%) and their percentage share of contribution to GDP was 45% (**Business Standard, 2014**). Maharashtra's farmers are passing through a critical situation since both the Kharif and Rabi crops were completely damaged due to the drought and unseasonal showers. Financial assistance of Rs 8,000 crore has been released by the Maharashtra Government, to create a new platform called the Public Private Partnership for Integrated Agricultural Development (PPP-IAD), which was initiated with the help of World Economic Forum, in 2013. Ten value chains, 20 corporate partners and a few lakhs of farmers have been roped in. The corporate partner, in each value chain, chips in with inputs on processing to marketing. Now in the third year, the platform has grown to 30 value chains, 60 corporate partners and five lakhs of farmers. Currently, half-a-million farmers, against a total number of 13 million farmers in the State, are part of the value chain (**Marpakwar, 2015**). **Suresh (2014)** maintained that the cost for rolling out the project in India, has been built with the sales. Though the entire programme revolves around the mission to grow more with less input, our business is expected to improve due to the enhanced reach. The company has created MaxVeg, a tried and tested solution for farmers, growing vegetables. It is working with farmers on cauliflower, hot pepper, tomato and watermelon in Maharashtra, Andhra Pradesh, Madhya Pradesh and Karnataka. Creating warehouses can save Rs.50,000 crore (500 billion) or USD \$ 7.5 Billion worth of post-

harvest losses annually. **Amit Mitra (2014)** reported that creating warehousing capacities and concomitant supply chain infrastructure, can be an effective weapon to combat food inflation. Further, the creation of storage infrastructure is backed by the requirement of huge capital. An investment of at least Rs.12 crore is needed, to set up a five-acre warehousing facility, that can store about 20,000 tonnes. But the payback time could stretch to 12-14 years. The credit requirement is thus huge. NABARD estimates that just to bridge the supply gap of two million tonnes, for cold storage capacity for horticulture products, the credit support (of 75 per cent) should be Rs.1,125 crore, with borrowers' contribution being Rs.375 crore (3.75 Billion) or USD \$ 56 million.

3. Statement of the Problem

India's total annual vegetable production is more than the total annual consumption, although the overall cost of production, on vegetables, has increased from 15% to 25 %, between 1993-94 and 2003-04. The average wastage of the total vegetable production in India is 13000 crores per annum. This is around 28% of total food wastage. Experts say that reasons for such a huge wastage percentage are poor infrastructure and management of food items and vegetables. Other reasons are inefficient logistics and improper supply chain facilities, cold storage, transportation etc. Therefore, India needs to work upon the reduction of wastage of its food production, by increasing the efficiency of its distribution channels.

4. Need of the Study

Agricultural supply chain has relevance to the entire population, as consumption of food products, including vegetables, forms a basic necessity for humans. In a country like India, almost 70% of the population is dependent on this sector, which contributes 17% of the GDP. Due to inadequate earnings, majority of small farmers live below the poverty line and there

are a number of incidents of farmers' suicides and rampant cases of depression. This is an extremely important research, relevant to the human society, in India. The understanding of the front end supply chain of the vegetables and its efficient and effective implementation, would lead to the prevention of wastage of vegetables and also to the achievement of better price realization for the farmers. This would also lead to lower price for the consumers, leading to lower inflation and better consumption of vegetables, in terms of higher quality and better availability.

5. Objectives of the Study

The main objectives were to study the consumer behaviour, for vegetables, in Mumbai region and to design the front end supply chain management, from the farm to the consumer. Further, the Researchers wanted to understand, per family consumption of the vegetables and estimate the total demand.

6. Hypotheses of the Study

NH- 1: People do not consider distances for buying vegetables from their place of residence.

NH- 2: Consumers do not have any preference for vegetable under certain criteria.

NH- 3: Consumers do not have any pattern of consumption, in terms of types of vegetables and their quantity.

NH-4: There is no fixed consumption pattern of vegetables and its correct estimation that can be linked to the production of vegetables, to reduce wastage.

NH-5: The front end supply chain management of supply chain is disorganised and needed to be structured properly.

7. Research Methodology

7.1 Sample Selection

1200 respondents, to the questionnaire, were various personnel, living in different parts of Mumbai Metropolitan Region, in various income groups and strata of the society.

Researchers obtained input from the people, living in various cooperative housing societies and from different salaried groups. Respondents were buyers of vegetables, from different vegetable markets or super markets or hand cart vendors.

7.2 Sources of Data

Primary data were collected, by using a questionnaire, administered to the respondents, and by a personal visit by the research team of post graduate management students, in and around Mumbai. Secondary data were collected from various literature like research articles, internet, books, magazines etc.

7.3 Period of the Study

Responses were collected, during the period of November 2015 to October 2016.

7.4 Tools Used

Statistical tools like mean, median and mode were used, along with the SPSS package and Excel spreadsheets, for data analysis and validation as well as hypothesis testing. T-test methodology was also used for hypothesis testing.

8. Analysis of Data

Table-7 shows that across various income groups, around 68% to 75% people preferred to buy vegetables within a distance of one kilometre and around 25% to 32%, from 1 to 2 km distance and very few, from the income group of more than Rs. 50000 per month, purchased vegetables, from above 3 km distance. It is quite clear that people did give due consideration, to distance, for buying vegetables. Usually, they preferred to buy vegetables from short distances, less than one kilometre. Hence null hypothesis **NH-1**, People do not consider distance for buying vegetables, from their place of residence, is rejected.

Table-3 reveals that out of five criteria, price of vegetable per kg, quality of vegetable,

ease of access to vegetable, freshness, and quantity of vegetable purchased, consumers gave preference to quantity of vegetable purchased (over 4 in a scale of 1 to 5) and very low priority to quality of vegetable. Consumers have definite preference of certain criteria of vegetables. Hence null hypothesis **NH-2**, Consumers do not have significant preference of certain criteria of vegetables, is rejected.

Table-1 indicates that consumption of Potato is relatively high in comparison to other vegetables although the percentage difference was marginally higher. Hence researchers concluded that consumers did not have any pattern of consumption, in terms of types of vegetables and their quantity. Hence null hypothesis **NH-3**, Consumers do not have significant pattern of consumption, in terms of types of vegetables and their quantity, is accepted. **Table-1** also exhibits that consumption of Tomato, Potato and Onion constituted around 45%, indicating that the consumption pattern, for these three vegetable, was relatively higher than for other vegetables. It was found that at least 40% of all fruits and vegetables was lost in India between the grower and consumers. Non-corporate small businesses are the backbone of a country. Agriculture comes under non-corporate, which contributes around 17% of our total GDP. Correct estimation can be linked to the production of vegetables, to reduce the wastage. Since there is a well-defined consumption pattern of vegetables, its correct estimation can be linked to the production of vegetables, to reduce wastage (**Business Standard, 2014**). Hence null hypothesis **NH-4**, there is no fixed consumption pattern of vegetables and its correct estimation that can be linked to the production of vegetables, to reduce wastage, is rejected.

Table-2 shows the price expectation of vegetables (per kg), across different income groups of consumers. **Table-4** depicts the different sources of buying vegetables (in percentage). **Table-5** indicates the frequency

of purchase of vegetables (in percentage) by consumers. **Table-6** indicates that at what time of the day, people buy vegetables (in percentage). Considerably greater levels of tonnage loss exist in larger developing nations, such as India, where about 21 million tonnes of wheat annually perishes, due to inadequate storage and distribution, equivalent to the entire production of Australia. Overall, wastage rates in vegetables and fruits are even higher than for grains. At least 40% of all fruits and vegetables is lost in India, between the grower and consumer, due to lack of refrigerated transport and adequate warehousing facility, at the front end supply chain management of the supply chain. Since the front end supply chain management of supply chain is disorganised, it should to be structured properly. Hence null hypothesis **NH-5**, the front end supply chain management of supply chain is disorganised and needed to be structured properly, is accepted.

9. Findings of the Study

Out of all the vegetables' consumption, Tomato, Potato and Onion constituted almost 40% to 45% for all the income groups. Green Peas was consumed more by higher income group as compared to lower income group. Cabbage and Cauliflower were consumed more by lower income group than by higher income group. Other vegetables like Bottle Gourd, Pumpkin, Bitter Gourd, Ladies Finger etc. constituted moderate consumption at less than 10%, with small variance in all the segments. Therefore, the supply chain management has to be organised, for these top 12 vegetables in general, out of so many varieties of vegetables. The top three, namely, tomato, potato and onion, constituted around 50% of the consumption. Therefore, farmers also should produce these vegetables maximum i.e. almost half of their total production in the segment.

10. Suggestions

A weekly newsletter, where statistics of

land under cultivation for different vegetables and fruits and quantities of produce, expected to be available for sale, could be published. SMS service should be started, with a nominal subscription fee. The SMS service should give information on selected crops. Statistics, on vegetable and fruit prices, at various APMCs, all over Maharashtra and wholesale markets, should be published. A networked computer system should be set up, with a computer available in each village, at the Panchayat Office. Information system can be set up for a consumer, that offers price guidelines about various vegetables, on a daily basis, based on wholesale prices, in different markets. MSAMB should set up vegetable and fruit retail counters, at intervals of 1 km, on a grid, across the Mumbai - Thane - Navi Mumbai Region, identical to Food Bazaar and Reliance Fresh. A web portal should be created, to enable individuals to place orders and make payments.

11. Limitations

The entire study and research was on a particular area of the agricultural sector, namely vegetables. However, analogy can be drawn with other related sectors like fruits in particular and other agricultural products in general. The study was also limited to Mumbai Metropolitan Region and surroundings. This was a sample, representative of India only. This did not take into consideration, the situation in other parts of the world.

12. Conclusion

Therefore, the first step in the Supply Chain Management (SCM) has to be focused upon developing proper transportation, warehousing and packaging system for these products as well as matching the supply with demand. In the case of any imbalance, in the supply chain of these products, it will lead to increase in the price at the consumer end. During the harvest time, more supply than the demand will lead to drop in price i.e. realisable value of the products for the

agriculturalists. They will not be able to recover the cost of production. This leads to farmers' suicide, from these three sectors. Incidentally, maximum number of price variants was observed in these products. In certain parts of the year, the prices shoot up for these products, leading to consumers buying these products, at 5 to 6 times the price, prevailing during the harvest time. All this can be eliminated through development of warehousing facility for the vegetables, for extending their shelf life, better packaging, warehousing and transportation, reducing wastages in the process.

13. Scope for Further Research

Further research has to be carried out, in the areas of warehousing, transportation, packaging and overall logistics management, for the vegetables. Research work will involve study and analysis of the gap in the above stated areas. The research outcome would be development of an effective and efficient logistics, in supply chain management system, from the farm to the consumers, reducing wastages as well as making the vegetables available of the right quality, in the right quantity, in the right time, at the right place and at the right price.

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Table-1: Consumption of Vegetables Across Different Income Groups-Family per Week (Kg)

Amount (Rs.)	Pota-toes	Oni-ons	Green Peas	Cauli-flower	Cabb-age	Bottle Gourd	Pump kin	Brin-jal	Bitter Gourd	Ladies Finger	Beans	Tomato
Below Rs. 10000	1.09	1.03	0.44	1.25	1.06	0	0	1.68	0	0.78	1.17	1.82
Rs. 10000 to Rs. 30000	2.45	2.36	1.32	1.08	0.93	1.46	0.7	0.84	0.9	0.98	1.1	2.35
Rs. 30000 to Rs. 50000	2.09	2.27	0.96	1.15	0.97	1.09	1.13	1.02	1.01	1.4	0.96	2.39
Above Rs. 50000	2.75	2.72	1.95	1.37	1.27	1.38	1.18	1.26	1.54	1.4	1.15	2.64

Source: Primary Data using SPSS20

Table-2: Price Expectation of Vegetables Across Different Income Groups (per Kg)

Amount (Rs.)	Pota-toes	Oni-ons	Green Peas	Cauli-flower	Cabb-age	Bottle Gourd	Pump kin	Brinjal	Bitter Gourd	Ladies Finger	Beans	Tomato
Below Rs. 10000	27.14	65.7	63.5	54.8	54.3	0	0	38.33	0	53.57	69.3	30.33
Rs. 10000 to Rs. 30000	26.43	55.3	68.4	49	38.14	38.7	35	37.57	46.1	50.79	58.75	41.14
Rs. 30000 to Rs. 50000	27.85	48.36	61.16	47.77	44.07	41.18	35	39.85	45.38	51.92	49.08	45.58
Above Rs. 50000	33.25	58.71	67.45	50.22	42.8	41.57	37.43	44.13	46.76	52.4	50.6	48.52

Source: Primary Data using SPSS20

Table-3: Order of Preference of Buying Vegetables

Income Group	Price	Quality	Access	Freshness	Quantity
Below Rs. 10000	2	1.71	3.2	2.8	4
Rs. 10000 to Rs. 30000	2.64	2.21	3.07	2.22	4.58
Rs. 30000 to Rs. 50000	2.43	2.14	3.06	2.67	4.26
Above Rs. 50000	2.57	1.86	3.04	2.76	4.5

Source: Primary Data using SPSS20

Table-4: Source of Buying Vegetables (%)

Income Group	Wholesale Market	Retail Store	Vegetable Market	Cart Vendor	Street Vendor	Weekly Market
Below Rs. 10000	0	20	26.7	26.7	26.6	0
Rs. 10000 to Rs. 30000	8.5	12.7	19.7	23.9	25.3	9.9
Rs. 30000 to Rs. 50000	9.6	26.5	24.1	14.4	19.3	6.1
Above Rs. 50000	9.6	22.5	16.3	17.5	28.3	5.8

Source: Primary Data using SPSS20

Table-5: Frequency of Purchase (%)

Income Group	Daily	2 - 3 Times a Week
Below Rs. 10000	50	50
Rs. 10000 to Rs. 30000	26	74
Rs. 30000 to Rs. 50000	18.75	81.25
Above Rs. 50000	10.64	89.36

Source: Primary Data using SPSS20

Table-6: At What Time of the Day People Buy Vegetables (%)

Income Group	Morning	Afternoon	Evening
Below Rs. 10000	16.6	0	83.4
Rs. 10000 to Rs. 30000	40	13.3	46.7
Rs. 30000 to Rs. 50000	22.2	5.6	72.2
Above Rs. 50000	28.2	10.7	61.1

Source: Primary Data using SPSS20

Table-7: Distance Travelled to Purchase Vegetables (%)

Income Group	Under 1 KM	1 - 3 KM	Over 3 KM
Below Rs. 10000	75	25	0
Rs. 10000 to Rs. 30000	68	32	0
Rs. 30000 to Rs. 50000	69.2	30.8	0
Above Rs. 50000	68.5	29.4	2.1

Source: Primary Data using SPSS20