Strategic modeling for Agri-Food Business in India

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Abstract

The food business in India is largely unorganized adding up to barely Rs.400 billion, with other large players adding another 50 per cent to that. The All India food consumption is close to Rs.9, 000 billion, with the total urban consumption being around Rs.3, 300 billion. This means that aggregate revenues of large food players is currently only 5 per cent of the total Indian market, and around 15-20 per cent of total urban food consumption. Most food is sold in the local 'wet' market, vendors, roadside push cart sellers or tiny kirana stores. According to McKinsey report, the share of an Indian household's spending on food is one of the highest in the world, with 48 per cent of income being spent on food and beverages. Recent Literatures have also highlighted the drawbacks in the existing supply chain system in the unorganized Indian wet retail market. At present, the unorganized retailers are linked with farmers through wholesalers / commission agents. Contemporary studies identifies the critical issues as- (a) Supply Chain, (b) Innovation and Marketing, (c) Complexity in Excise and Tax, (d) Workforce management practice is at nascent stage and (e) Sustainability and green marketing.

The research aims at designing an Alternative Strategic Model that can resolve the current issues in the retail industry in India.The research paper will help business houses to plan and decide at what level they can venture the present highly fragmented Indian market.

Key words: Agri-Food Supply Chain, Unorganized and Organized Retailing, Model, Latent and Observed Factors, F&V (Fruit and Vegetable), SC (Supply Chain)

Introduction

The total market size of the retail industry is approximately of $ 530 billion, of which 38 *%(as per India Retail Report Q3 2011, Business Environment Outlook)*is consisted of fresh food business. In spite of consistent initiatives of organized retail forces the market is highly dominated by the traditional players, stockists and local intermediaries.

On the other hand the traditional trade model leaves least benefits to the bottom dwellers of either side of the value chain (i.e Farmers and the local retailers in the wet market) while the maximum benefit is retained by the middle section of the value chain leading to inflation, exploitation of the either ends.

Added to the improper value chain distribution the poor post-harvest infrastructure and supply chain leads to huge post-harvest wastage which is 30% in fruits and vegetables and 6% in cereals as per India Retail Report Q3 2011, Business Environment Outlook, pushing the negotiating power of the bottom liners further down and boosting the inflation.

The *traditional unorganized model* of business involving different intermediaries between the producer and the consumer starting from the farmer to the cold storage owners and forwarding agents who in turn pass on the produces to the whole sellers in the *Mandis* and finally to the small retailers. The inefficient management of the value chain and the uneven accumulation of wealth along with loopholes for hoarding with vested interests at the intermediaries supplementing to poor post-harvest management practices and lack of effective supply chain have made the model inefficient and instrumental for increasing poverty at either end of the pyramid.

The last few years witnessed immense growth by this sector, the key drivers being changing consumer profile and demographics, increase in the number of international brands available in the Indian market, economic implications of the Government increasing urbanization, credit availability, improvement in the infrastructure, increasing investments in technology and real estate building a world class shopping environment for the consumers. In order to keep pace with the increasing demand, there has been a hectic activity in terms of entry of international labels, expansion plans, and focus on technology, operations and processes.

This has led to more complex relationships involving suppliers, third party distributors and retailers, which can be dealt with the help of an efficient supply chain. A proper supply chain will help meet the competition head-on, manage stock availability; supplier relations, new value-added services, cost cutting and most importantly reduce the wastage levels in fresh produce.

The research is aimed at finding an Alternative Operational Model by connecting all the parts of the trade process right from the harvesting stage to its sales in the local ‘Thelas’, under one administrative umbrella.

1. Literature Review

The retail market in India – the fifth largest retail destination in the world – was named as the third most attractive emerging market for investment in the retail sector in *management consultancy firm A.T. Kearney's annual Global Retail Development Index for 2010.*

The index described India as having 'immense potential', with organized retail sales forecast to double their share of the overall market to 10% by 2013. A.T. Kearney attributes the likely growth in organized retail to 'a fast-growing middle class demanding higher quality shopping environments and stronger brands'.

As of July 2009, foreign direct investment (FDI) inflows to single-brand retail trading stood at approximately US$46.60mn, according to the *Department of Industrial Policy and Promotion (DIPP).*

Local retailers are anxious to steal a march on multinational rivals, which are restricted by India's strict FDI regulations – single-brand retailers are able to own a 100% stake, but multi-brand retailers must operate through a franchise or cash-and-carry wholesale model or can have 51% majority stake with their local partners with a mandatory sourcing of at least 30 per cent would have to be done from the domestic small and cottage industries which have a maximum investment in plant and machinery of USD 1 million (about Rs 5 crore).

A Report on Indian Retail Sector as published in *Resurgent India Report 2011*, have tried to bring down the critical issues in Indian Retail Sectors and the probable impediments in its ongoing growth story. The report shows the critical issues as- (a) Supply Chain, (b) Innovation and Marketing, (c) Complexity in Excise and Tax, (d) Workforce management practice is at nascent stage and (e) Sustainability and green marketing.

Veena A, K Nagendra Babu and H R Venkatesha in their research works published in *The IUP Journal of Supply Chain Management, Vol. VIII, No.1, 2011,*further described supply chain as the key differentiator in marketing fresh produce in India. Supply Chain Management (SCM) not only helps in cutting costs, but also adds to maintain and improve the quality of fruits and vegetables (F&V) marketed. In marketing F&V, that are perishable in nature, Supply Chain can play a crucial role. The very nature of land holding by the farmers, varied climatic conditions, production spread over wide geographical area, mainly in remote villages, diversified consumption patterns and poor SC infrastructure makes SCM for F&V more complicated. In India, SCM is at its nascent stage in marketing of F&V. Marketing of fruits and vegetables is challenging due to the perishability, seasonality and bulkiness and consumption habits of the Indian consumers. In addition to this, poor SCinfrastructure, poor private equity in SC and conventional small-scale unorganized retailers, make stateof-the-art SC challenging in the present scenario. The Indian wet retail market is mainly dominated by unorganized retailers. The unorganized retailers are not a homogeneous group. Current supply chain catering mainly to the unorganized retailers is riddled with number of drawbacks. As per the study referredthe current drawbacks in SC are number of intermediaries, high level of wastage, quality degradation, poor

infrastructural facilities and high cost. The F&V market has huge influence on the socioeconomic and even political conditions. Close to 30% of the F&V grown is going waste. All the stakeholders will have to join hands to improve supply chain mechanism to take produce from the farmers to the consumers. This would help the consumers to get quality produce at economical prices. The middlemen and all the stakeholders in the supply chain benefit from the improved SC infrastructure. Government and private operators have to join hands to improve the physical infrastructure, information sharing, and the service required for quality improvement of the SC.

2.1 Current Unorganized Retailing Supply Chain Scenario

Recent Literatures have also highlighted the drawbacks in the existing supply chain system in the unorganized Indian wet retail market. At present, the unorganized retailers are linked with farmers through wholesalers/ commission agents as shown in Figure 2.1. Sometimes, there are instances where there would be more than one commission agent and wholesaler for the same produce to reach the retailer. Added to this, the commission agents and wholesalers' redundant SC practices make unorganized retailing further inefficient.The horticulture sector in India is facing several constraints. Major constraints in production and marketing in fresh F&V as listed in the literature (Kumar et al., 2004) are: Non-availability of quality seeds, inadequate irrigation facilities, inefficiency in pest management, credit availability constraint, high cost of production, lack of timely information, huge post-harvest losses, lack of roads, cold storage, inadequate space, poor market network and high transportation cost. Investment required to build the cold chain infrastructure is huge. Cold chain infrastructure will require an investment of 18,000 crore to 20,000 cr investment in the next five years (Cold Chain Summit, 2007). A study by Raghunath and Ashok (2005) has estimated that with the strengthening of SC, the benefits to consumers and producers can increase by 20-25% in the most perishable commodity like tomato. Due to inefficient SC, the price received by the farmers is only about 24 to 58% of the retail price paid by the consumer.

Post-harvest technology has immense influence on SCM. Post-harvest technology and management not only helps in reducing the level of wastage, but also facilitates to add value to quality of the produce. Post-harvest technology facilitates the stakeholders to get better returns.

Difference in prices between the farm and the retail in India is highest in the world. Improved handling methods and the resolution of regulatory requirements allow access to more distant domestic markets and also international markets. Changes in production methods can also affect post-harvest product quality. Post-harvest technology of fresh F&V gained enormous momentum to save losses during harvesting, handling, storage and transportation. The extent of loss of F&V is about 10,000 cr to 12,000 cr per annum, and the loss of quantity ranges between 10 and 80% in some of the most perishable fruits and vegetables (Mitttal, 2007). 30% of India's F&V produce goes waste because of the lack of cold storage chains.

Several research initiatives and considerable investments have resulted in the growth of supply and trade of fresh F&V during the past decade, but still a lot more needs to be done. Increased investment,

technology and managerial resources are essential to reducepost-harvest losses, to increase productivity of farmers and to ensure better returns to farmers. This also facilitates to increase the per capita consumption of F&V in the country. Indian horticultural sector has huge potential as it has a vast domestic market, labor, fertile land, varied geographical conditions and horticulture-dependent farmers. This can be used as a leverage to gain a leading position in the global market too. Immediate attention has to be given to the pre- and post-harvest practices with particular attention to SCM. In the existing traditional system of wholesale marketing, the commission agents and traders dominate the SC and are the major price setters, and most of the time, farmers have to depend on them for credit. Particularly, small farmers lack marketing power and have a low share in the final consumer price. Traditional wholesalers do not have the vision to make SC integrated. That is the way they have been functioning. The wholesale markets are poorly designed with non-existent infrastructure for packing, grading, sorting and cold storage. SCM needs proper business vision. It has to build a long-term collaboration between retailers and farmers. The SC has to provide services for transportation, packing, sorting, grading, cold storage and post-harvest technology. There is a strong need for government intervention in removing infrastructural constraints like setting up of distribution centers, cold chains, roads to the markets, etc. Ensuring quality and quantity of the produce to the stores is another basic requirement for the smooth functioning of SC.

F&V SC has traditionally been fragmented. Structural change is required to build and maintain SC infrastructure. For example, unorganized retailers do not have 'scale of operation' to build their own SC. It is necessary to integrate them with an ever increasing fraternity of organized retailers, as far as SC is concerned. This requires a paradigm shift in structural change. Business process reengineering is an answer to many of these problems. In order to make SC effective, it is necessary to segment different customers. Caterers, hostels, small town unorganized retailers, unorganized retailers in a metro, organized retailers and processors of F&V cannot be considered as one segment of buyers. In order to make SC more effective, it is necessary to have different approach to all these stakeholders.

Demand planning for F&V is difficult and challenging. Farmers, wholesalers, food manufacturers and retailers are not working with the philosophy of integration. Sourcing has gone strategic in industries. The competitive SCM in F&V also has to go for strategic sourcing. The cost of procurement, transportation cost, regularity of supply, quality of products, ethical practices of producers, terms and conditions of payment and road connectivity are important factors which influence strategic sourcing, which is crucial for the success of F&V SC in the long run.

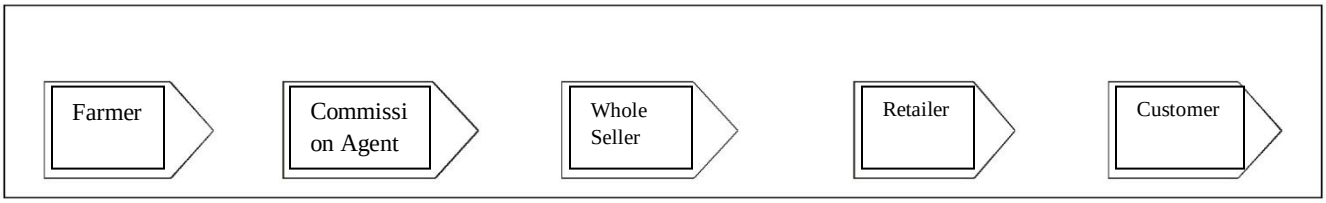
In order to keep track of SC performance, the performance measurement has to be carried on a continuous basis. All those involved with SC have to be made parties to assess the performance of any SC. New benchmarks have to be set from time to time to make the SC improve its performance. SC has to evolve beyond the confines of individualstakeholders. The biggest challenge to make any SC for F & V to work better is to make the stakeholders realize their role. This is a challenging task mainly because the work of one stakeholder overlaps with another, the role of each stakeholder is not defined, the

responsibility of each stakeholder changes with the change of scale of operation, and sometimes, the stakeholders perceive that their roles are conflicting.

The business to business relationship among different stakeholders makes cost sharing and collaborating a challenging task. Who has to share what cost is a big conflicting point in integrating SC. Who has to share the cost of construction and maintenance of roads? Who has to pay for cold storage and how much? Who has to bear the cost of processing and analyzing information which is useful to farmers and consumers? Who has to bear research and development expenditure and in what ratio? Incompatible organizational cultures make it difficult for different stakeholders to agree for one size solution.

Current SC catering mainly to the unorganized retailers is riddled with number of drawbacks. As per the survey, important drawbacks of the current SC are number of intermediaries, high level of wastage, quality degradation, poor infrastructural facilities and high cost.

Figure 2.1: Current Unorganized Retailing Supply Chain Scenario



2.2 Existing Organized Agri-Food Retail Sector in India

Michael Vinrald Samuel and Mrinalini Shah in there research *Comparative Study of Organized Agri-Food Businesses in India published in Paradigm, Vol. XIII, No. 2, July - December, 2009*suggested that organized retailing is a far-fetched dream in India as agri-food companies are still dependent upon spot markets to buy and sell their produce (Figure 2). These organized retail companies are operating their business from:

i. Growers to commission agents and

ii. Commission agents to consumers.

Growers to Commission Agents

Foremost agri-food retail chains from growers to commission agents are Fresh and Healthy Enterprises Limited (FHEL) (A subsidiary of CONCOR), Adani Group (with Adani Agri Fresh Limited) and MSSL for apples. These agri-food retail chains procure fresh fruits unswervingly from orchards, hoard these, and trade the same within mandis (spot price markets). These retail chains maintain cold supply chains throughout theshipment. Organized retail chains own CA (controlled atmosphere) stores which score over conventional CS (cold stores) as the former controls the entire atmosphere. The CO2 levels in these stores are contained within 0 to 20 per cent and O2 level is retained between 0 and ambient. The T (Temperature) and RH (Relative Humidity) are maintained at −2˚ C and 90−95 per cent respectively

(Samuel et. al. 2008). Modified atmosphere leads to retarding RoR (rate of respiration) of fruits thereby preserving critical attributes such as the aura, flavor, and appearance up to six months. These companies hoard fresh fruits and vegetables for trading during off seasons. Fresh fruits stored in CA stores score over those in cold storage as fruits turn soggy and shrink due to unrestrained high RoR. Introductions of CA stores have made it possible to in provide better quality fruits to consumers during off seasons. Organized agri-food companies ship hoarded fruits to mandis in refrigerated trucks across nation and trade the same through commission agents to wholesalers.

Commission Agents to Consumers

Companies dealing in this part of the supply chain include Reliance Fresh, Aditya Birla More, Big Bazar, Spencer's, Big Apple, 6-Ten, etc. These retail chains procure produce from commission agents and supply directly to consumers through company-operated stores. Emergence of these retail chains have brought about significant positive impact upon unorganized retailers in India as retailers have stopped resorting to malpractices in terms of weights and quality of produce. Retailers have begun telephone and door-to-door services in societies to lure as well as provide conveniences to customers. These retailers have also begun quoting competitive prices for customer loyalty.

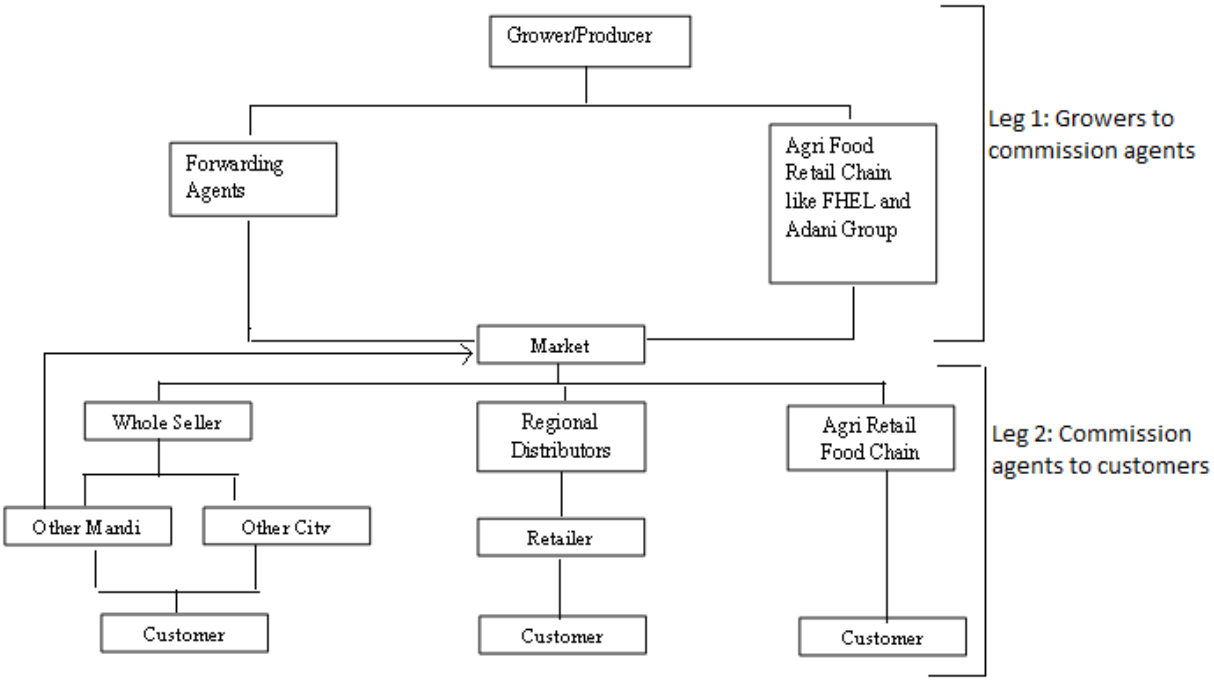


Figure 2.2: Legs of Agri−Food (Apple) Supply Chain Followed by Organized Retailers in India.

3 The Model

As evident from current operational model of the unorganized wet retail market, there is a

ISSN 2249-5908
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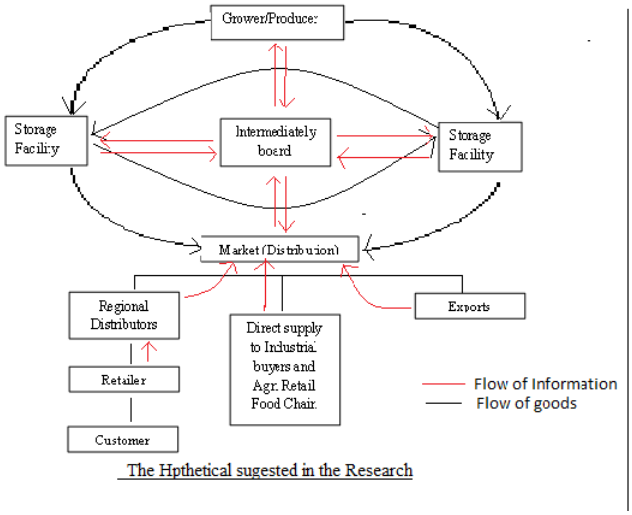
considerable accumulation of the value in the central part of the product flow of the operational cycle leaving a bare minimal to the bottom contributors of the cycle (farmers and the wet vendors). Moreover, to achieve a sustainable growth in Indian retail industry the corporates needs a better pervasive penetration both in the procurement and sales part, reducing the involvement of forwarding agents and other intermediaries and connecting the producer to the consumers directly to gain the economy of scale.

To resolve the current issues in the wet retail industry in India like uneven value distribution, poor post-harvest management, poor supply chain management, wastage and spillage etc. a hypothetical alternative operational model is proposed in the research work (Figure 3.1).

The key factors of the model are mentioned as under-

(i) Stock- Cold storage network for effective inventory management.
(ii) Market- Identifying the right market or transactional base in each agricultural hot spot annexed to the cold storage chain for effective procurement and distribution.
(iii) Vendor- Involving the local wet vendors in Indian cities under the model for pervasive penetration.



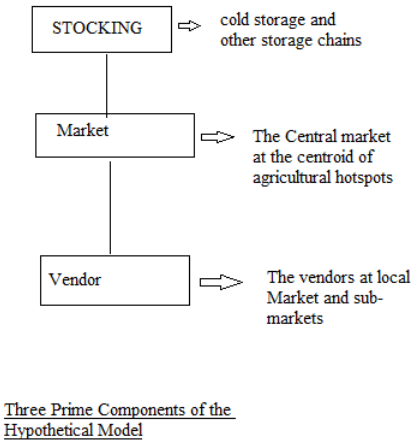


Figure 3

4 Exploring The New Dimension

Vegetable vendors across NCR were interviewed to understand the market trend and demand pool. The research is targeted towards understanding how the demand pool at the "Mandi' varies with the change in purchasing trend of the Industrial purchasers and whole sellers in the wet market. Considering the seasonal effect and the difference in nature of the purchasing trends of both of them the cases are treated separately.

Assuming that seasonal trend affects the purchasing trend it is first tried to understand how the buying behavior of the wholesale purchasers is influenced by it. Since the preference of stock keeping of the whole sellers and the retailers and their choice between "Perennial" and "Seasonal" vegetables in it can be considered as a determinant factor for understanding the effect of seasonality, the respondents were asked about the kinds of stock they keep and the segregation of the stock into

"Perennial" and "Seasonal".

Crosstab

		Among Them How Many Has Perinial Source						
		1	2	3	4	5	Total	Percentage
Total Types Of Vegitable Sold	Very Low(1)	0	0	0	0	4	4	4.00%
	Low(2)	0	3	8	7	0	18	18.00%
	Moderate(3,4)	0	10	11	16	0	37	37.00%
	High(5,6,7)	4	9	10	0	0	23	23.00%
	Very High(>7)	3	5	10	0	0	18	18.00%
	Total	**7**	**27**	**39**	**23**	**4**	**100**	**100.00%**

Table 4.1

The table perfectly shows that highest count is at the moderate rating indicating that in spite of seasonal effects in supply there is a steady demand pool in the 'Mandi' as well as local market for perennial produces.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	131.944a	16	0
Likelihood Ratio	75.251	16	0
Linear-by-Linear Association	27.962	1	0
N of Valid Cases	100		

Table 4.2

The Chi-Square test clearly suggests that there is a high statistical significance of the interpretation and the preference towards perennial product as illustrated in Table 4.1 is not due to mere chance variation.Further investigating on the stocking pattern and preference of seasonal products gives us the idea about the entire market scenario.

Crosstab

		Among Them How Many Has Seasonal Source					
		1	2	3	4	5	Total
Total Types Of Vegitable	Very Low(1)	4	0	0	0	0	4
	Low(2)	2	5	6	5	0	18
	Moderate(3,4)	12	9	13	3	0	37
	High(5,6,7)	0	5	7	7	4	23
	Very High(>7)	1	3	9	2	3	18
	Total	19	22	35	17	7	100
Percentage Variation		19.00%	22.00%	35.00%	17.00%	7.00%	100.00%

Table 4.3

However, the preference about the seasonal produce is also skewed towards moderate but however the preference for perennial produce holds a bigger claim than there seasonal counterpart.
The respondents were further enquired about the shifts in overall demand of the seasonal products both during season and off season. The responses as analyzed elucidated that though the demand of the seasonal product is overall consistent during the season, there is a moderately high demand for them during off season. The graph 4.1 gives a clear view of the fact.

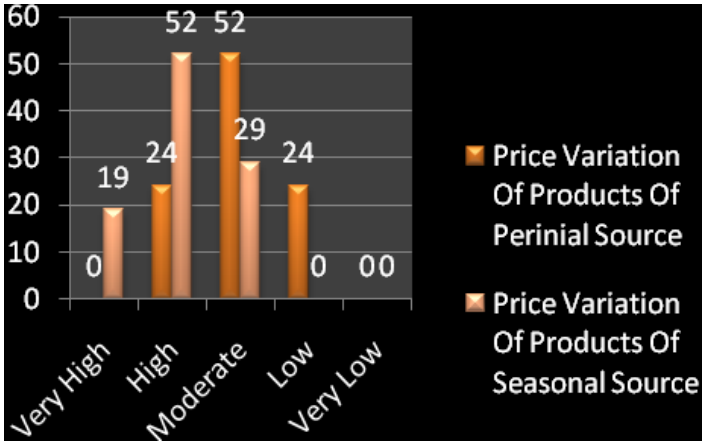
ISSN 2249-5908
Issue 2, Vol. 5 (september-2012)

Graph 4.1

To check the statistical validity of the data Paired-Sample t-Test was run between the responses against the two concerned data point.It is evident from the significance level of the of the test that the data does not hold much statistical significance at a confidence level of 95% and an $\alpha = 0.5$ in differentiating the data demand of the seasonal produce season and Off season.

As demand and price are implicitly related factor and the nature of the product being perishable the law of demand and supply can prove to be inefficient to analyze the dynamics of the market. Hence, price factor is separately handled while estimating the market nature.

The respondents were asked about the average price fluctuation pattern of the perennial and seasonal products. Graph 4.2 shows the summarized results showing that the price fluctuation of the seasonal product is higher that the perennial produces.



Graph 4.2

To ensure that the results are not due to any chance variation and holds statistical significance in interpreting the market price trends and its dynamics Paired Sample t-Test is performed between the two data points and their means are compared.

The results show that there is a considerable statistical significance of the data and the difference in price fluctuation as interpreted from them. So, it can be said that though there is no significant variation in demands of perennial and seasonal produce in the market, they display a considerable variance in price from season to season. The price fluctuation thus may not be a function of demand but a function of consumer buying behavior and its impact on seasonal variation of crop production cycle.

The respondents were further asked about price fluctuation of perennial produce in the market within the seasons of harvest and after it. The results showed also slight variation in the price range, though the supply of them is constant. The interpretation of the concerned responses is explained in graph Graph4.3.

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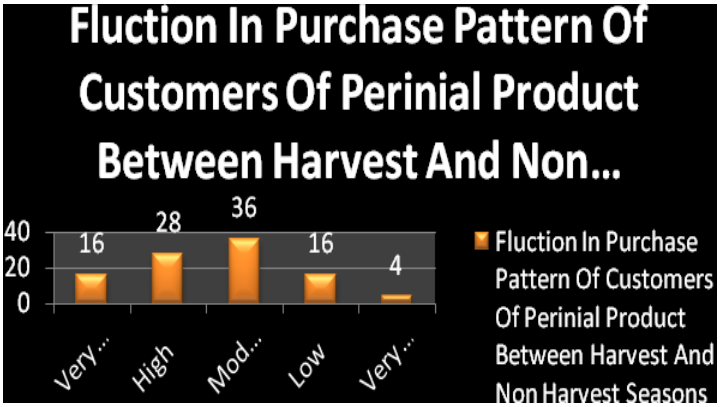
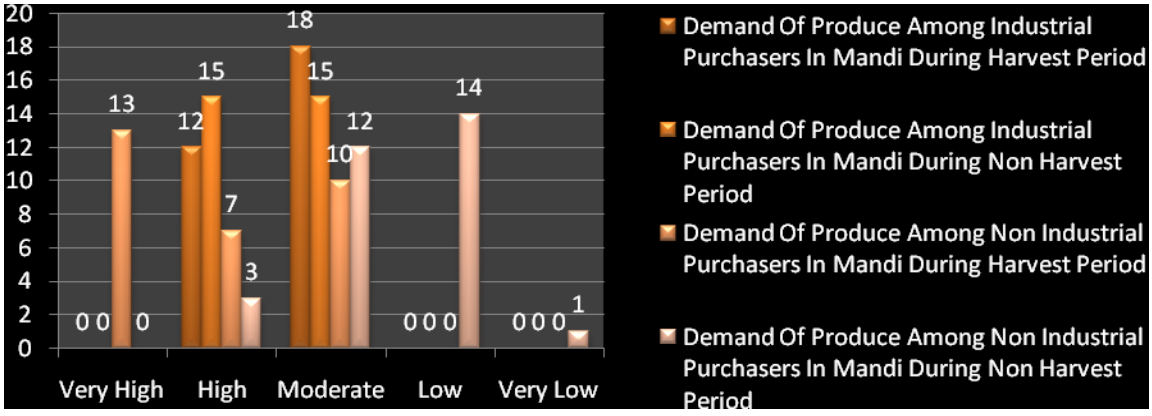
Graph 4.3



The study with the wet market vendors made it quite evident that though there is price fluctuation in the market depending on seasonal effects there is always a constant demand pool in the wet market for both the seasonal and perennial produces; And the price elasticity is not completely a function of the demand in this market but also a function of consumer buying behavior.
The research design intended to produce a model for the wet retail market that can come out with a better solution for the existing problems like poor supply chain, spillage due to poor inventory management and uneven value distribution across the entire system. One of the prime assumptions of the research is "The aggregate demand Pool of the purchasers in the submarket directly proportional to the total demand pool in the Hub (defined as Market in the model)" As it is evident that the demand pool in the submarkets and the local market is almost consistent for both perennial and seasonal produce through the above mentioned study; the research further strives to look into the dynamics of the Hubs or the Mandis.
For understanding the dynamics of demand in the Hub or Mandi, a sample of thirty cold storage owners are interviewed. Though the produce either seasonal of perennial reach the market through the intermediation of forwarding agents, the prime purchasers at the main market can be subdivided into two parts: Industrial Purchasers and Retail Whole Sellers.
Since the channel of distribution for both of them is different, it has been assumed that they should be contributing differently in the market dynamics and hence treated separately for interpretation. Graph 4.4 portrays the variation in the demand of both the seasonal and perennial produces with respect of both kinds of purchasers.

Graph 4.4



For understanding the statistical significance of the data paired sample t-test is used. The significance of the test deployed in four groups-

(i) Demand Of Produce Among Industrial Purchasers In Mandi During Harvest Period Vs Demand Of Produce Among Industrial Purchasers In Mandi During Non-Harvest Period

(ii) Demand Of Produce Among Non-Industrial Purchasers In Mandi During Harvest Period Vs Demand Of Produce Among Non-Industrial Purchasers In Mandi During Non-Harvest Period

(iii)Demand of Produce Among Industrial Purchasers In Mandi During Harvest Period Vs Demand Of Produce Among Non-Industrial Purchasers In Mandi During Harvest Period

(iv)Demand of Produce among Industrial Purchasers in Mandi During Non-Harvest Period and Demand of Produce Among Non-Industrial Purchasers In Mandi During Non-Harvest Period

The intention is to understand that whether there is any seasonal effect on the variance of demand among the industrial and retail whole seller purchasers. The test results are enlisted in Table 4.6. The first pair having a significance value of .375 (>.05) clearly accepts the null hypothesis. So it can be said that the industrial purchasers display a steady demand throughout the year irrespective of the seasonal effect.
The later three test results displays a clear disagreement with the null hypothesis stating- (a) Non industrial purchasers show significant variation in demand for produce under seasonal effect. (b) There is a considerable difference in variations in demand between Non-Industrial purchasers and Industrial purchasers in Mandi.

Since both at Hub and Mandi, the retail whole sale market is showing a positive correlation with seasonal effect and the Industrial purchasers do not show any significant demand elasticity with seasonal effect it can be considered that the aggregate demands in the local wet market is proportional to the total demand in the Hub or Mandi; And thus the primary assumption of the model is proved in agreement with the data and outcomes of the research.

The suggested Model as hypothesized and Suggested above as a matter of modeling is and conducting a path analysis is segregated into three parts- (A) Stocking, (B) Market and (C) Vendors.The Figure 3 exhibits the suggested model and their components.

The three components are treated as latent factors for path analysis and understand the dimensions of the model and its efficiencies. The assumption defines aggregate demand at the market as the function of the demand in submarkets-

$$\text{Market Aggregate Demand} \propto \sum F(\text{Demand at submarkets})$$

Hence the success of the model lies in the operation and the process flow between the first two latent factors i.e. stocking and Market.
The sampling and data collection exercise was directed towards collecting suitable imputes from the cold storage owners and vegetable vendors. From the different data points collected and sorted the observed factors for the Confirmatory Factor Analysis (CFA) are selected and carefully related to either of the two latent variables. Table 4.4 gives a tabulation of different Observed and Latent variables.

ISSN 2249-5908
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Observed Variable	latent Variable
Quality Of Transportation Facility Between Villages and Cold Storage	Stocking
Rate Of Involvement Of Cold Storage Owners In Sales Of Products To Forwarding Agents	Stocking
"*Most of The Stored Material Are Sold In the Nearest Mandi*"- Rate in Agreement	Stocking
Spoilage Due To Dearth Of Shelf Space	Stocking
Number Of Cold Storage Within A Radius Of 100KM	Stocking
Average Month Of Hoarding	Market
Probability Of Getting High Price	Market
Demand Of Produce Among Industrial Purchasers In Mandi During Harvest Period	Market
Demand Of Produce Among Industrial Purchasers In Mandi During Non-Harvest Period	Market
Demand Of Produce Among Non-Industrial Purchasers In Mandi During Harvest Period	Market
Demand Of Produce Among Non-Industrial Purchasers In Mandi During Non-Harvest Period	Market
Price Fluctuation Between Harvest Period and Non-Harvest Period At Mandi	Market

Table 4.4

For analyzing the Model and verifying the contribution of the observed variable to the latent variable and the interrelation and loading between them Confirmatory Factor Analysis is performed. For the exercise LISREL 8.80 is used the analysis is performed by fixing a ligand value of 1 for each of the observed and latent variable. The Structured equation is discussed in Figure 4.1 and the report appended. The chi-Square value though is quiet high at 64 but the goodness of fit value with RMSEA at .030 which is below .05 and ir shows considerable support on the strength and validity of the model.

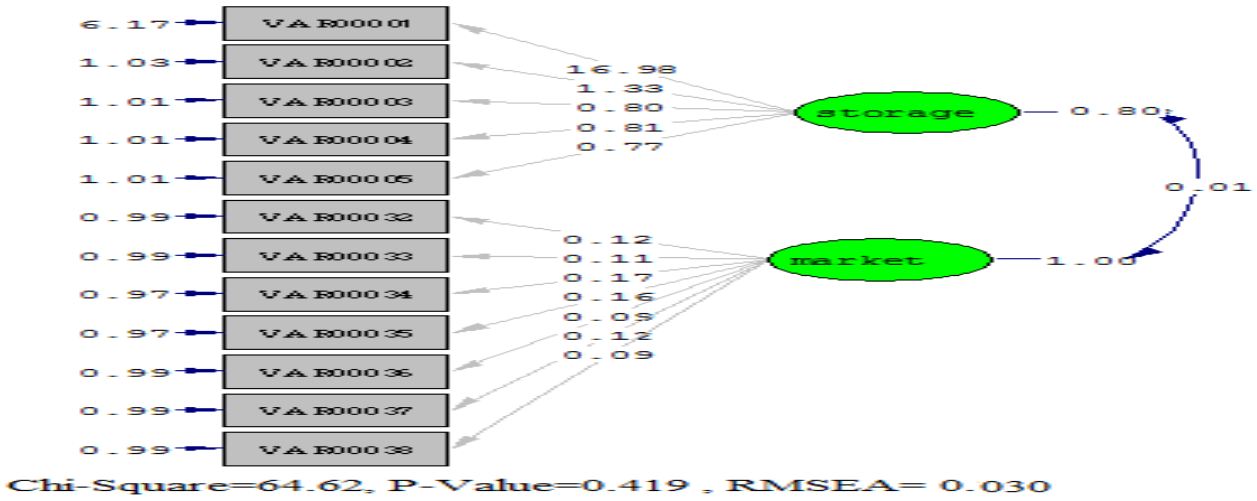

Figure 4.1

As evident from the Model as derived through CFA, 'Var001' that is transportation is of the highest determinant on the success of the model as a ligand of 16.98 is attached to it which is quiet high than the others. The next important factor in determining the success in the first stage as envisioned through the model is the distance between the storage place and the Market. The other variables

being at .80, .81 and .77 for storage and varying from .9 to .12 for market have almost nearly equal importance. The latent relationships though are not very strong but show a positive association showing flow of value from one to another. The largest challenge in the model is to increase the value association between the latent variables and thus adding more value to the model. However, the associations and the Model can be developer by suitable screening and selection of more non-correlated observed variables.

The model though describes the dimensions of interactions of different factors with the two latent variables and there relative impacts on the model; it does not provides any idea about the latent variables themselves. Considering the significance of the transportation it has been assumed that *each agricultural hotspot has at least one 'stocking' location and one 'market' in its vicinity.*

Hence, 19 markets in different agricultural hotspots in the state of Uttar Pradesh have been identified to create a model by application of *Centre of Gravity Method* to identify the probable approach towards determining the *ideal central market spot* within the proposed model.

Markets in Each Agricultural Hotspot	Latitude	Longitude
Ghaziabad	28.42	77.26
Ghazipur	25.38	83.35
Kashipur	29.15	79
Hathras	27.36	78.06
Kanpur	26.28	80.2
Etawah	26.48	79.06
Pratapgarh	25.56	81.59
Budaun	28.05	79.1
Ujhain	28	79.6
Sadabad	27.43	78.03
Farrukhabad	27.38	79.58
Gorakhpur	26.47	83.23
Meerut	29.01	77.42
Aligarh	27.55	78.1
Hardoi	27.26	80.06
Moradabad	28.5	78.5
Mirzapur	25.15	82.59
Agra	27.17	77.58
Rae Bareli	26.18	81.2

Table 4.5

Further the respondents *(cold storage owners from the respective hotspots)* were asked to rate each of the markets on four different parameters- (a) Distance from the nearest Mandi, (b) Transport facility, (c) Spoilage and (e) Number of cold storage within a radius of 10 km in a scale of 1 to 5. The responses were analyzed and there mean value was considered to provide each of the concerned markets associated with each hotspot with a particular weightage.

The weighted value of each of the hotspot was considered along with their respective latitude and longitude values for determination of the location of the *Ideal Central Market* for a region as specified as *Market*in the concerned model by use of *central of gravity method* as per the following formula-

$$Xc = \frac{\sum_{i=1}^{n}(Xi) * Wi}{\sum_{i=1}^{n} Wi}$$

And

$$Y^{c} = \frac{\sum_{i=1}^{n}(Yi) * Wi}{\sum_{i=1}^{n} Wi}$$

(Xc, Yc) in the equation represents the Latitude and Longitudinal coordinates of location of the identified *Market*in a given region as per Centre of Gravity Method for Location Planning.

The calculation for the identification of the Ideal Central Market for Uttar Pradesh is explained in Table no. 4.6. The identified market place can provide a perfect location for mapping the point of distribution of the produce among the retailers and also for mapping the nodal points for planning an effective supply chain network as it indicates the ideal location on the grid map that would ensure that the weighted distance travelled is minimum.

Markets in Each Agricultural Hotspot	Avg Wt.(W)	Latitude	Longitude	XiWi	YiWi
Ghaziabad	3.25	28.42	77.26	92.37	251.10
Ghazipur	3	25.38	83.35	76.14	250.05
Kashipur	2.75	29.15	79	80.16	217.25
Hathras	3.25	27.36	78.06	88.92	253.70
Kanpur	3.5	26.28	80.2	91.98	280.70
Etawah	2.25	26.48	79.06	59.58	177.89
Pratapgarh	2.5	25.56	81.59	63.90	203.98
Budaun	3	28.05	79.1	84.15	237.30
Ujhain	3	28	79.6	84.00	238.80
Sadabad	3	27.43	78.03	82.29	234.09
Farrukhabad	2	27.38	79.58	54.76	159.16
Gorakhpur	2.5	26.47	83.23	66.18	208.08
Meerut	3.25	29.01	77.42	94.28	251.62
Aligarh	2.75	27.55	78.1	75.76	214.78
Hardoi	2.5	27.26	80.06	68.15	200.15
Moradabad	2.25	28.5	78.5	64.13	176.63
Mirzapur	2.5	25.15	82.59	62.88	206.48
Agra	2.5	27.17	77.58	67.93	193.95
Rae Bareli	2.75	26.18	81.2	72.00	223.30
Total	**52.5**			**1429.54**	**4178.97**
		Coordinates of Xc,Yc=		**27.23**	**79.60**

Table 4.6

5. Measures for implementation of the Model

Implementation of the model in Indian unorganized retail market (F&V)requires a concerted effort of all the stakeholders. For the successful implementation of the model it is essential to have a structural chance at different levels— farmers, intermediaries and consumers. The government,

private, public-private partnership, cooperatives, technology providers, and even media can play a significant role in this. Since, supply chain does not work in vacuum, infrastructure like roads, transport, Information and Communication Technology (ICT) and cold storages are basic requirements for success.

- Demand forecasting is one of the important requirements for effective functioning of the model and the associated supply chain activity. Imbalance between supply and demand may happen due to poor forecasting. In some months, some vegetables are either not plucked from the farm or allowed to rot, due to lack of demand. In some seasons, producesare not available and hence, prices rocket up. In order to overcome this problem, proper mechanism has to be evolved to forecast the demand.

- Vertical coordination of farmers through cooperatives, contract farming can facilitate better delivery of output, reduce market risk, provide better infrastructure, attract more public investment, acquire better extension services, and could create awareness regarding the prevailing and new technologies.

- Customized logistics can be considered as another important immediate requirement to make logistics effective. This can reduce the cost, facilitates the maintenance of quality of the produce and fulfills the requirements of targeted customers. However, all F&V does not fit into one basket and so vary all cutting edge sellers'requirements. In this consideration customized logistics can be considered as a priority.

- The sharing of cost of building infrastructure can be considered as a major issue in supply chain development for F&V. This is mainly because many infrastructures, like roads are put to multiple uses. In addition to this, it is the social responsibility of government to see that food produce is continuously available to the consumers, and farmers get proper reward for their produce. In this scenario, Activity-Based Costing (ABC) can give answer to some of the questions of cost sharing.

- Infrastructure for effective supply chain from farm to fork, like cold storage and all season roads are minimum requirements for success of the model. This infrastructure requires huge investment and government intervention and participation.

- An effective information system for better coordination among different stakeholders from farmers to consumers is the need of the hour. Information is strength. The Internet and mobile communications can also be used to enable information and financial transfer between the stakeholders.

- Public private partnership can be another strategic solution. Supply chain is a very important function to leave it only to the market forces. Government has to join hands with private players in building infrastructure which require huge investment and have long-term and multiple uses like roads and communication technologies.

6. Conclusion

Fresh produce market has got an immense influence on the socioeconomic and even political

conditions. The existing unorganized model in fresh produce business is not effective. Approximately 30% of the F&V grown every year is going waste. All the stakeholders have to join hands to improve the existing model and to take produce from farmers to consumers. This can not only improve the economic and social status of consumers, but can also facilitate the consumers to get quality produce at economical rates. In a country like India, where most of the population still lives in rural areas, the benefits of improved supply chain in this modelcan have its effect on a good number of people starting from the consumers to the producers. Private and Government operations will have to join hands to improve the physical infrastructure, information sharing, and the service required for effective implementation of the model.

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