

**An Insight
of
Redesigned Vegetable Supply Chain in Bihar
Through Co-operatives**



**Dr. K. P. Ranjan
Director**



D.N.S. Regional Institute of Cooperative Management
(National Council for Cooperative Training, New Delhi)

Shastri Nagar, Patna – 800 023

Phone – 2283907, 2287851 (Office) Fax – 0612- 2287851

e-mail: dnsricmpatna@gmail.com / dnsricmpatna@rediffmail.com

Website: <http://ricmpatna.bih.nic.in>



D.N.S. Regional Institute of Cooperative Management Patna – 800 023

Abstract

The present study undertakes a thorough review of basic facilities available and attempts to identify the business problem in the supply chain of vegetable sector in Bihar. To the best of our knowledge, the concept of efficient supply chain of Vegetable sector in Bihar is still in a nascent stage and several possible future research directions can be defined. Developing a project operation and maintenance framework to improve the supply chain efficiency of vegetable sector can be a very interesting area of study. Considering the importance of Vegetable crop in the cluster and in the state of Bihar as a whole, there is a need to provide adequate level of finance and technical support to promote vegetable Supply Chain development in the State. The proposed strategy calls for an integrated approach adopting a program mode for development of various production clusters in the State. Along with the enhanced levels of financial assistance and timely disbursement, the state may also have to build physical infrastructure along the supply chain as also supplement the efforts/assistance to strengthen value chain activities.



INTRODUCTION

In Bihar, agriculture contributes about one-fifth to the state GDP and provides employment to 70% of labor force. The agricultural commodities that are being produced at one location are made available to the final customers through different channels. The stakeholders engaged in the supply chain are farmers, agents, distributors, retailers and others functionaries. There has to be efficient co-ordination between these stakeholders for transfer of commodities from the producer to the consumer.

Considering the supply chain management of agricultural perishables i.e. vegetables & fruits managing the freshness and profitability of these are major issues. The Supply Chain Management (SCM) of agricultural perishables plays a more important role since the perishables have to be consumed within limited time after its production.

Supply chain deals with all the activities/ functions involved from the transfer of products / commodities from the initial producer to the ultimate customer. Supply chain management is the effective co-ordination between the functions in the supply chain for getting more profit for the producer / manufacturer / organization and improving their performance. These functions include all the activities from procurement of goods, exchange of information, logistics, to the final delivery of the product to the ultimate customer. This helps in producing / delivering high value products for the end user or the customer.

Supply chain management is a set of functions which is used to bring together manufacturers, suppliers, warehouses and stores in order to distribute the products / commodities to the current location at the right time in right quantities (Simchi-Levi *et al.*, 2008). This helps in reducing the overall costs while satisfying all the service requirements. Supply chain is a two direction flow of information, materials and services in addition to the managerial and operational activities. It also allows in gaining a competitive advantage along with giving customers more value along with resource allocation (Cooper *et al.*, 1997).

The producers/firms will attain more competitive advantage by enhancement of productivity and value. Productivity improves when the amount of resources used are



reduced when compared to others. By providing the customers with customized products and services, the final value gets emanated. This helps improving the reliability and responsiveness which requires innovation and resources (Christopher, 1998).

Objective and Methodology



The specific objective of the study aims at evaluating the redesigned supply chain in vegetable marketing through co-operatives in Bihar. The effectiveness of supply chain can be studied by comparing various interventions.

The supply chain models followed in Bihar organized for vegetables are studied and comparisons are made with the practices followed in other markets in order to suggest scope for improvements.

This paper uses case based approach where instead of relying solely on the knowledge of problem domain or making association with generalized relationships between problem descriptor and conclusion, we used the previous experience, knowledge and concrete problem situations or cases. The methodology also helped in

incremental and sustained learning which can again act as solution of future problems, if arises.

This research is exploratory in nature and includes research instruments like in depth interviews with players in the vegetable supply chain. Approach made possible to find out issues faced in this business, its logistical processes and what instruments they use to tackle them. The primary data were collected through interview with the members of primary vegetables co-operative society (PVCS) and by observations also. The secondary data were obtained from government offices, co-operative union and other relevant publications. Analyzing these data we could understand the challenges faced in the supply chain (perishables such as vegetables) and innovations introduced in redesigned supply chain in vegetable marketing and this can be used as a point of reference for further research in this industry.

Vegetable supply chain-prevailing practices



Bihar ranks third after Uttar Pradesh and West Bengal in terms of vegetable production in the country. The alluvial soil of gangetic plains of Bihar is highly fertile and suitable for production of vegetables at low cost.



Progress in production in horticultural products depends critically on marketing infrastructure available to farmers whereas efficient marketing with effective supply chain is essential for development of horticulture sector.

The efficiency of marketing for fruits and vegetables in Bihar has been significant concern in the recent years. Poor efficiency in the marketing channels and inadequate marketing infrastructure are believed to be the cause of not only high and fluctuating consumer prices, but also too little of the consumer rupee reaching the producer-farmers.

In Bihar, farmers are typically heavily dependent on middlemen particularly for fruits and vegetable marketing. The producers and the consumers often get a poor deal and the middlemen control the market, but do not add much value. There is also massive wastage, deterioration in quality as well as frequent mismatch between demand and supply both spatially and over time.

The market size is already large and is continuously expanding. The farmers' market linkages (both backward and forward) have also increased manifold, but the marketing system has not kept pace. Private trade, which handles more than 80 per cent of the market surplus, did not invest in marketing infrastructure due to excessive regulatory framework and dominance of unorganized sector. Increased demand for value-added services and geographic expansion of markets require lengthening of the marketing channel, but this has been hampered by poor rural infrastructure. Direct farmer-consumer marketing remains almost negligible. In most of rural periodic markets, where small and marginal farmers come to sell their agricultural produce, facilities for efficient trade are still absent.

Food processing industry has a high multiplier effect and employment potential. But in India, the value addition to food production has been only around 7 per cent. Due to lack of proper handling (cleaning, sorting, grading and packaging) at the farm gate or at village level, about 7 per cent of grains, 30-50 per cent of fruits and vegetables, and 10 per cent of seed species are lost before reaching the market. An estimated **Rs.50,000** crore is lost annually in the marketing chain due to inadequate infrastructure and inefficient system of marketing activity.

According to one estimate, Indian food market comprises 10 per cent processed segment, 15 per cent semi-processed segment and 75 per cent as fresh food segment.



Processing is reported to be around 2 per cent in fruits and vegetables, 37 per cent in milk. Fruits and vegetables processing is estimated to grow by 20 per cent by 2025, taking the food-processing segment to 32 per cent of the total food market. The overall value addition in food products, which is currently 7 per cent, is likely to increase to 35 per cent by 2025.

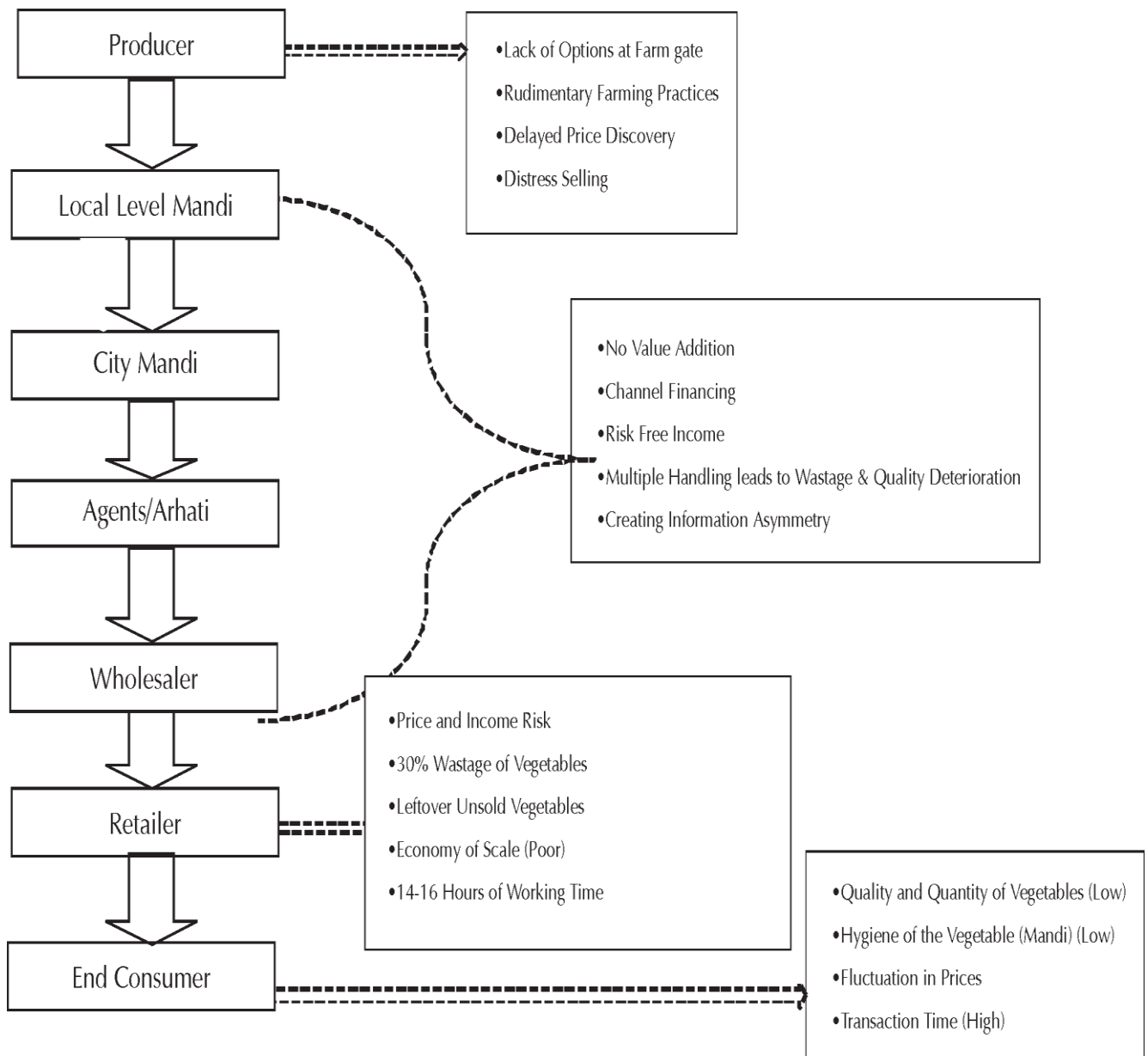
The marketing of vegetable produce is more complicated. The majority of farmers are marginal and small, largely illiterate, unorganized and scattered. They do not have exposure, knowledge, skills and access to marketing of their produce. Further, they do not have strong bargaining strength due to their financial strength and storage capacity. Hence, they are forced to sell their marketable surplus immediately after the harvest at a low price.

The existing marketing system is largely unorganized and manual. As a prevailing practice, it is mostly middlemen driven. On an average the **production** changes at least six to seven hands before it reaches to the end consumer. The perishability of the production, such multiple handling adversely **affects** the quality and finally the retail prices of the **production**. On an average, the retailer sells 60-70% of his **production** at market rate and rest 30-40% below the market rate. Since he has the compulsion to sell the **production** same day, such kind of selling pattern is quite prevalent in vegetable retail. Primary survey shows following major problems faced by farmers in the existing market arrangement.





Exhibit-1 : Traditional Vegetable Supply Chain in Bihar



In the present value chain, the flow of information is restricted to certain levels only. The producer **does** not have proper information about the demand supply situations in the consumption market and hence **he is** not able to capture the price arbitrage.

Indicative price build-up along the supply chain of vegetable produce

Farm gate price / Agent cost-Agent margin / Traders purchase price-traders cost-traders margin / wholesaler purchase price-wholesalers cost-wholesalers margin / retailers purchase price-retailers cost-retailers margin / consumers' price.



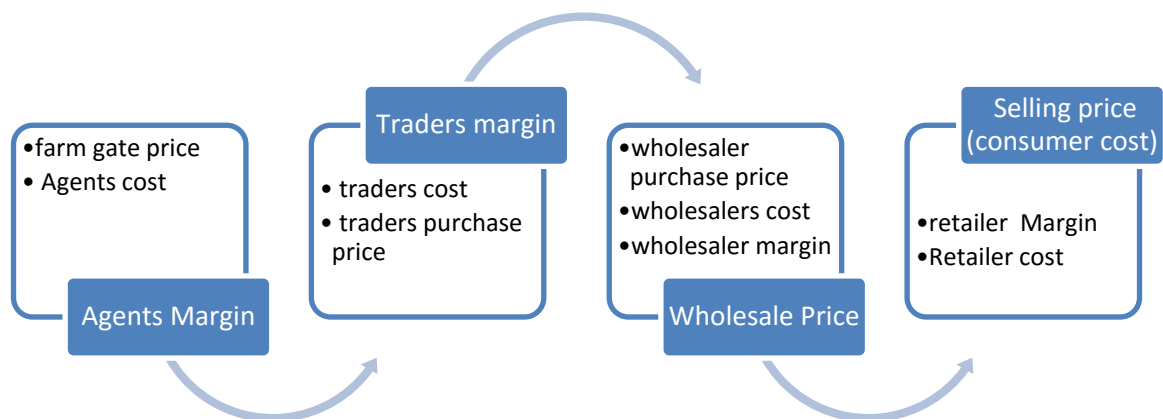


Exhibit – 2 : Indicative price build up along the supply chain of vegetable produce

However, the tendency has been adhoc in planning of post-harvest infrastructure and marketing infrastructure, often with objective prioritization. It has been challenge to address the needs of marginal and small holders who are often left out in development intervention.

SUPPLY CHAIN EFFICIENCY



Efficiency is according to Beamon (1998) is the measurement of how well the resources expended are utilized. In general, it describes the extent to which time, effort or cost is well used for the intended task or purpose. It is often used with the specific purpose of relaying the capability of a specific application of effort to produce a specific outcome effectively with minimum amount or quantity of waste, expense, or unnecessary effort. Supply chain efficiency is how well the resources are utilized in the supply chain. The most efficient Supply chain has the lowest possible cost and at the same time meets the customer's expectations on services like delivery precision and lead-time. Various authors discuss and define supply chain efficiency as shown in **Exhibit-3** and it can be inferred from their viewpoint that high customer service, less lead-time, low cost, less wastage, high value, quality, resource utilization, and profitability are the main factors that defines supply chain efficiency.

Exhibit- 3 : Defining Supply Chain Efficiency

Authors (Years)	Inference
Collin (2003)	Success of Supply chains is composed of Customer service, capital employed, total cost
Hoover et al. (2001)	Excellent Supply chain when a company provides requested customer support .
Bowersox et al. (2000)	Three perspectives to create value for customers are economic market and relevancy value
Simchi-Levy et al. (2000)	Efficient Supply chain strategies must take in account the interactions at the various levels
Beamon (1999)	Efficiency is the measure of how well the resources are utilized .
Christopher (1998)	The future market leaders will be the ones that have achieved cost and service leadership
Dornier (1998)	The overall objective of any logistics system is to maximize profitability .
Bowersox & Closs (1996)	Relationship between customer services level and cost is important.
Haug (1985)	Excellent Supply chain when a company provides products with short lead-time .



Mentzer & Konrad (1991)	Effectiveness is defined as the extent to which goals are accomplished.
Goonatilake (1990)	Excellent Supply chain when a company provides products at low cost .
De Meyer et al. (1989)	Excellent Supply chain when a company provides products with high quality

The present supply chain in vegetable sector connects the farmers to both the organized, as well as manual handling. The result is lots of wastage as much as nearly 30% and also less remuneration for the farmers (Viswanadham, 2007). Large share of a farmer's realizable value is lost as commission, supply chain mishandling and losses (Narula, 2011). Due to inefficient supply chain, price received by farmers is only about 24% to 58% of the consumer price. It is the inefficient supply chain that costs middlemen, consumers and more dearly the farmers (Veena *et al.*, 2011).

Without an efficient supply chain, there is a high cost of wastage for the companies (Rathore *et al.*, 2010). Inefficiency in the supply chain of vegetable sector leads to high losses and wastages which results in the availability of inferior quality commodity to the consumer and less prices to the farmers. Due to inefficient supply chain the extent of loss of **F&V** is about Rs. 10,000 crore to Rs. 12,000 crore per annum, and the loss of quantity ranges from 10% and 80 % in some of the most perishable F&V (Mittal, 2007).

Estimates of Post-harvest losses in developing countries vary from 1% to 50% or even higher (Kader, 2005). According to the calculation of ASSOCHAM (2013) India, the producers have to forgo every year Rs. 2.13 lakh crore due to losses in the supply chain of fruits and vegetables.

Redesigned vegetable supply chain

Therefore, a holistic planning is necessary which takes in to accounts all possible supply chain systems and prioritize them with objectives criteria through



wide participation of beneficiary community in an inclusive way and then plan accordingly.

Bihar's fruits and vegetables sector has much potential for growth but is constrained by traditional agricultural practices and lack of post harvest management, storage and marketing facilities. It is imperative to make serious efforts to address the twin issue of input supply and productivity through appropriate interventions to improve the production sub-system and the problems of post-harvest management and market linkages need to be addressed. The inefficient fruit and vegetables value chain needs to be replaced with a modern ecosystem with well-functioning backward and forward linkages. A professionally managed institution providing comprehensive post-harvest management services and an alternate marketing structure which allows farmers to sell their produce at remunerative prices is the need of the hour. Such an establishment would improve marketing efficiency by promoting direct contact with the farmers and providing the much-needed infrastructure.

With this in mind the Government of Bihar has started a noble initiative to provide a stimulus to the sector by devising a scheme – “Bihar State Vegetable Processing and Marketing Scheme”

Priority area of Support

The proposed scheme will focus on three major gaps in the existing value chain of vegetable sector, summarized as follows:

1. Post Harvest Management Infrastructure

There is lack of sufficient post-harvest management processing infrastructure for vegetables in the state. Post-harvest management practices like sorting, grading and packaging are done manually at the farm level. This leads to increased post-harvest losses and lowers the self life and quality of the production.

2. Marketing Infrastructure



The marketing infrastructure in the state is inadequate and inefficient leading to poor market linkages. Presence of multiple layers of intermediaries between the farmer and end consumer results in lower price realization to the farmers. Further, the APMC model has not been successful in the state and there are currently no functional regulated markets in the state. Majority of the farmers are dissatisfied with the current marketing systems and like to have access to alternative markets and marketing channels.

3. Institutional Infrastructure

There is a complete absence of institutions providing technology including vegetable seeds and input support to farmers leading to poor quality and low productivity of vegetables in Bihar. Further, there is limited access to credit and finance services leading to low adoption of technology and improved cultivation practices among the farmers in the state. There is a willingness among farming community to be linked to appropriate organizations/institutions.

The inadequacies in the existing value chain of fruits and vegetables have necessitated the development of a modern marketing and processing system with appropriate backward and forward linkages. The concept of a vegetable supply chain with the capacity to process certain vegetables would be developed by the Department of Co-operative, Government of Bihar with the objective of creating the much needed post-harvest management and marketing infrastructure in the state and three-tier co-operative society structure as institutional arrangement with adequate professional manpower. The project is the first of its kind and will facilitate creation of additional investment in agri-infrastructure in the state.

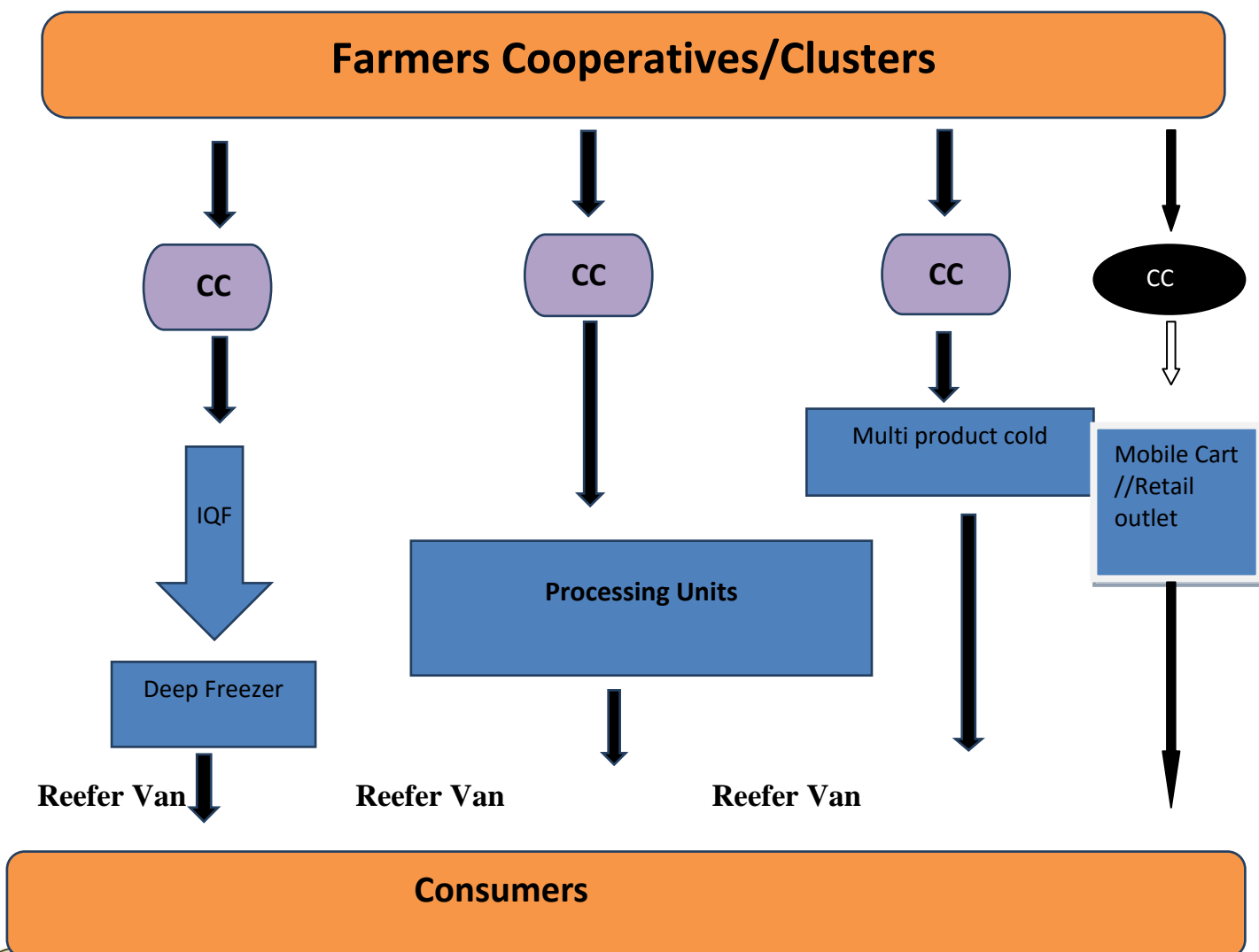
Suggested Process flow

Fruits and vegetables from the respective hinterland will be aggregated at the collection centres / PVCS where primary sorting /grading will be done. The **production** will be then weighed and sent to the central processing hub by refrigerated



vehicles / pick up van, environmentally control (0-6 degree) van to reduce wastages. Some production will also be directly procured from the farms. At the central processing hub, the production will be either stored in the plus temperature chambers of the cold storage or would be processed in the Individual Quick Freezing (IQF) line as per the requirement. The production stored in plus cold storage chambers will be either eventually processed in the IQF line or will be directly sold to the wholesalers for fresh market. The IQF processed products will be stored in the minus temperature chambers of the cold storage for future distribution. From the storage the production will be sent to the end users (such as organized retail chains, hotels, caterers, wholesalers, processors etc.) by refrigerated vehicles and hence maintaining the cold chain from the farm to the consumers. The proposed process flow is indicated in below diagram.

Exhibit - 4 : Process Flow:



Strategy



To achieve the defined objectives, the proposed scheme will **strategize** by focusing on end-to-end solution in vegetable supply chain, namely.

- ✚ Collection centre/PVCS and grading hub,
- ✚ Rural Markets,
- ✚ Retail outlet network,
- ✚ Mobile units,
- ✚ Vegetable processing hub,
- ✚ 3-tier co-operative institution arrangement,
- ✚ Efficient farm level applications,
- ✚ Extension services on new technologies & market information,
- ✚ Professional manpower support.

Having studied the challenges and constraints faced by the sector, a holistic approach comprising of combination of both **soft and hard interventions** is proposed to be implemented for increasing vegetable production and productivity in Bihar, develop and integrate required supply chain and facilitating higher value addition.

Soft interventions are proposed to be implemented across the districts and would consist of short term training & exposure visit related to production, post-harvest management and processing/value addition etc, envisaged to enhance the technical skill for farmers as well as extension of workers, and other operating in the sector. Such interventions are proposed to be delivered through institutions specializing in the subject area.

Hard interventions are majorly being proposed to meet cluster specific requirements based on the assessed need. Hard interventions under the programme shall cater to all the value nodes of the vegetable value chain and primarily aim at creating tangible common assets to support the developmental requirement of vegetable supply chain in Bihar.

An effort has been made to align the activities with the overall initiatives being undertaken by various agencies.

Integral with the objective of the interventions, the proposed soft & hard interventions are focused on forging the vertical as well as horizontal linkage along the vegetable supply chain. Placing the proposed interventions in the value chain context, the soft and hard interventions have been categorized into 5 components viz.

- ✚ Production related
- ✚ Post-harvest
- ✚ Market infrastructure & cold chain
- ✚ Processing
- ✚ Overarching (horizontal / vertical linkage)

Present status

In this context the Bihar state vegetable processing and marketing scheme is fostering an environment for developing a 3-tier co-operative structure-Primary Vegetable Cooperative Society (PVCS) at block level, one District Co-operative structure for five districts named **Harit Vegetable Processing And Marketing Cooperative Union Ltd. (VEGCOMAUN)** and federation at state level. In the first phase; the five districts that have been selected for the scheme implementation are Patna, Nalanda, Begusarai, Samastipur and Vaishali. Currently, the union presence is in 93 blocks of Bihar, where Primary Vegetable Co-operative Societies has been formed with a large base of more than 3000. The union is focused in approach for



establishing a brand of quality and trust “**Tarkari**” in similarity to the milk product’s brand Sudha of COMFED.



The role of Primary Vegetable Co-Operative Society at block level is for collection / purchase of vegetables from producers, short-term storage of vegetables, sorting, grading, marketing and supply of vegetable requirement to the union. The union formed for five districts is responsible for storage of vegetables in cold storage, Modified Atmospheric Chamber (MA Chamber), Controlled Atmospheric Chambers (CA chambers), Individual Quick Freezing (IQF), Deep Freezer, Air Cooled Sorting, Grading Processing and Packaging Hall, Fleet Management (Refrigerated Vehicles and other vehicles), Pre-cooling Chambers, Processing Facility and other Ancillary Infrastructure.

All the unions so formed will be federated to State Vegetable Processing and Marketing Federation. The federation would provide a professional guidance to the union in forward and backward linkages, ensuring marketing of vegetables within the state or outside the state and even to the international markets.

Currently, Harit Vegetable Processing and Marketing Co-operative Union Ltd. intend to safeguard the interest of vegetable growers and consumers by building a direct vegetable supply chain network with-in and outside the state. this aim of the



union is to remunerative price to the vegetable producers on the hand and provide quality vegetable products to the consumers on the other at reasonable and affordable price by adopting sustainable models of vegetable productions and sale of fresh & processed vegetables through setting exclusive vegetable retail outlets, door to door services, mobile retail vans, online buying option via mobile application.

Union has started receiving vegetables by establishing a collection centres at the block level. The civil infrastructure facility is being established in a 10,000 sq. ft. Area, with a cleaning, sorting, grading and temporary storage facility. A distribution center with a handling capacity of more than 5 tonnes of vegetable is already established at Zero Mile, Patna. The fresh vegetables are sourced directly from the active societies and the same is being sold by 12 mobile vans in Patna.

Apart from mobile vans, union is also selling vegetables by linking with the different institutions like Hostels, Hotels, and other institutional buyers. Within a very short span of time union has reached sales volume of vegetables worth Rs. 7-8 lakh per month and this is expected to go multifold with the upcoming processing and packaging hub at Hajipur.

Future Research Directions /Recommendations



The present study undertakes a thorough review of basic facilities available and attempts to identify the business problem in the supply chain of vegetable sector in Bihar. To the best of our knowledge, the concept of efficient supply chain of vegetable sector in Bihar is still in a nascent stage and several possible future research directions can be defined. Developing a project operation and maintenance framework to improve the supply chain efficiency of vegetable sector can be a very interesting area of study.

The operation and management of common infrastructures/project assets is a critical component of the overall value chain development related activities. Given the structuring of the project, the following classes of assets will be developed during the course of the project implementation.

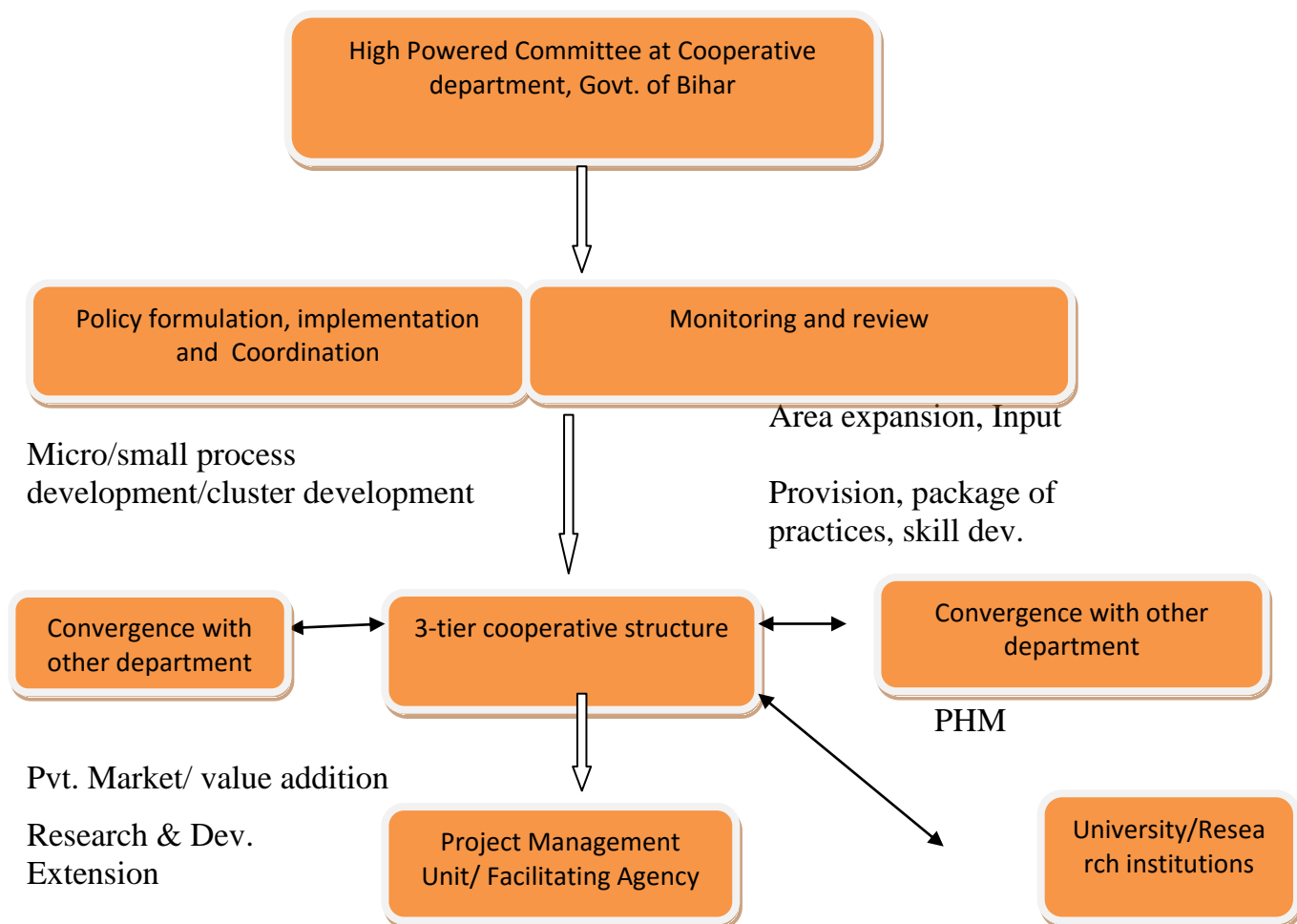
- ✚ Individual Assets: These would include vegetables farms, any farming equipments, implements, etc.
- ✚ Common Infrastructures/Assets: These may include post-harvest infrastructures such as collection center, sorting/grading yard, transport vehicle, etc.
- ✚ Community Infrastructure: This will pre-dominantly include rural market yards at block level and processing hub at union level.

The common infrastructures shall be operated and maintained by a group of farmers. In order to bring in some degree of accountability among the users, it is proposed that nominal user charges may be collected from the farmer users towards using such assets.

In order to develop the Vegetable Value Chain (VVC), it is essential to create a strong, responsible, and responsive institutional structure. This is more important when we consider the fact that core value chain actors (vegetable farmers) do not have adequate resources both in terms of finance and knowledge to improve their current situation. Thus, in the absence of a dedicated institutional structure the core objective of value chain development in the cluster may not be achieved



Suggested Institutional Structure



Considering the importance of vegetable crop in the cluster and in the state of Bihar as a whole, there is a need to provide adequate level of finance and technical support to promote vegetable Supply Chain development in the State. The proposed strategy calls for an integrated approach adopting a program mode for development of various production clusters in the State. Along with the enhanced levels of financial assistance and timely disbursement, the state may also have to build physical infrastructure along the supply chain as also supplement the efforts/assistance to strengthen value chain activities.



References

1. G.P. Reddy, M. M. (2010). Value Chains and Retailing of Fresh Vegetables and Fruits, Andhra Pradesh. *Agricultural Economics Research Review* , 23, 455-460
2. APEDA. (2014, August 10). *Fresh Fruits and Vegetables*. Retrieved August 8, 2014, from Agricultural & Processed Food Products Export Development Authority:http://www.apeda.gov.in/apedawebsite/six_head_product/FFV.htm
3. ASSOCHAM. (2013). *Horticulture Sector in India- State level experience*. New Delhi: The Associated Chamber of Commerce and Industry of India
4. Ballou, R. H. (2004). *Business logistics/Supply chain management :planning, organizing, and controlling the Supply chain*. Upper Saddle River, N.J.: Pearson Prentice Hall
5. Beamon, B. M. (1998). Supply chain design and analysis: models and methods. *International Journal of Production Economics*, 55,281-294.
6. Bhardwaj, S., & Palaparthi, I. (2008). Factors Influencing Indian Supply Chains of Fruits and Vegetables: A Literature Review.*The Icfai University Journal of Supply Chain Management*, V(3), 59-68.
7. Kader, A. (2005). Increasing food availability by reducing postharvest losses of fresh produce. *V International Post-harvest Symposium, International Society for Horticultural Science*. Italy:Verona.
8. Modi, P., Mishra, D., Gulati, H., & Murugesan, K. (2009, April-June). UTTARAKHAND STATE COOPERATIVE FEDERATION:CAN IT HELP THE HORTICULTURE FARMERS?*VISION—The Journal of Business Perspective*, 13(2), 53-61.
9. Mittal, S. (2007). *Can Horticulture be a success story for India? Working Paper*. Retrieved March 21, 2013, from <http://www.eaber.org/>:
http://www.eaber.org/sites/default/files/documents/ICRIER_Mittal_2007_02
10. Viswanadham, N. (2007). *Can India be the food basket for the world?, Working Paper series, IBS, Hyderabad*. Retrieved from http://www.cccindia.co/corecentre/Database/Docs/DocFiles/Can_
11. India_be.pdf



Comments:

1. Yellow color letters or words indicate the correction made by me
2. **F&V** write **full form** first time
3. Align as per CP Journal Norms both body and references
4. Remove Header and footer

