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SUPPLY CHAIN STUDY FOR POST-HARVEST ISSUES BASED ON AGRICULTURAL PRACTICES: A CASE IN AMRITSAR CONTEXT

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Abstract:

This study concentrates on post-harvest losses due to inefficiency in supply chain processes like storage, logistic and improper information flow. The first step was to study the various aspects of the supply chain which are involved in the post-harvest from farmers, agricultural department, government and middle-men point of view. The problems were categorized in the scope of logistics, storage and information system. Lag was found in interlinkage between the agricultural department, export department, Sarpanch, big and small farmers which were leading to exploitation of farmers by middle-men. Framers were lacking the bargaining power in Mandi. Due to lack of storage facilities and financial pressure they had to sell the harvest at a very low price when compared to the market. In order to fill the information gap between sections, a WhatsApp model is suggested. This model will facilitate the flow of information at different hierarchy and fill the gaps.

KEYWORDS: Supply Chain Efficiency, Post-Harvest Issues, Agricultural Practices, Punjab

1. INTRODUCTION

The qualitative and quantitative food loss when measured together along the supply chain are also referred to post-harvest food losses (PHL) and usually occurs after the crops are harvested and till the time they are consumed. The major focus of the countries is on improving the efficiency of their agricultural production and land used to cope with the increasing food demand. However, post-harvest loss (PHL), which is one of the critical issues, doesn't seem to receive the required attention.

Every year an approximate number of 1.3 billion tons, which accounts for one-third of the food production consumed by humans worldwide, is either lost or wasted globally during post-harvest operations [1]. In developed countries, significant waste occurs at the consumption stage, i.e. post-harvest losses are relatively higher at the consumer end, while in developing countries, food losses take place primarily during the early and middle stages of the supply chain normally at the farm level. One hundred and ten million smallholder farmers in sub-Saharan Africa that are currently facing losses up to 40 percent in each harvest [2].

In India, out of the 450 million tons of raw food materials of plant and animal origin that are refined, stored and transformed into various usable products, there is "10 per cent post-harvest losses in durables (Cereals, pulses and oilseeds), 20 per cent losses in semi-perishables (Potato, onion, sweet potato, tapioca) and around 25 per cent in products like milk, meat, fish and eggs" [3]. As per NABRAD report about 30 per cent fruits and 40 per cent vegetables are wasted annually due to missing links in the cold chain such as "poor infrastructure, insufficient cold storage capacity, unavailability of cold storages in close proximity to farms, poor logistics and lack of flow of information among the farmers" which ultimately leads to instability in prices and farmers cannot get remunerative prices that is leading to the exploitation of the farmers [4,5].

The losses occurring in post-harvest is majorly due to gaps in agricultural supply chain management. The various aspects of supply chain like demand, storage, logistics, information system follows a very uncertain trend. The communication network system is not well connected. Even though losses can occur across any stage of supply chain starting with production stage till consumer level, losses due to storage and information are assumed to be most critical in developing countries. Also, this paper focuses on the lack of reliable information on the post-harvest losses faced by farmers. This study attempts to provide practical solutions feasible at the ground level, on how to "minimize the post-harvest losses and ensure efficient procurement of different food grains, building up and maintenance of food stocks, their storage and efficient distribution of the food grains to the end users". Considering the urgency of PHL reduction for enhancing the food security. This study pertains to the post-harvest losses in agriculture confined only to the area of Punjab. The overall objective of the study in focus is to identify the key factors, which lead to post-harvest losses of cereals in Punjab and identify its causes and possible solutions.

2. LITERATURE ON POST-HARVEST AGRICULTURAL ISSUES

Negi and Anand [6] conducted a study on the supply chain issues and challenges of fruits and vegetables sector in India. Descriptive research approach was used to identify the issues affecting the supply chain of the sector. It was found that there were lot of issues with infrastructure facilities, integration, knowledge and awareness, quality and safety standards, demand and market information. It was suggested there is a need to develop proper supply chain models. In the same field of horticulture there was another study done by Meena et al. [7] on the post-harvest issues of horticulture crops to more behavioral context in the terms of attitude and psychology of farmers. The study was done in three sections namely environment, technology and economy. The result indicated a positive attitude on post- harvest although it was found that it will be more favorable if equipped with knowledge on diversification,

proper selection of appropriate technologies and financial assistance. Since, of the study was generic, Kitinoja et al. [8] emphasized on the postharvest technologies which was relevant from developing countries point of view. Key challenges identified were selection of indigenous crops in terms of their unique postharvest physiology, and evaluating cost effective approach of postharvest technologies in each locale considering each and every crop. It was recommended to integrate post-harvest science and education from grade school through trade school or universities, establishing a post-harvest working group, capacity building and developing R&D potential. However, in the field of agriculture, Ferroni and Zhou [9] conducted a very significant study related to achievements and challenges in agricultural extensions related to both primary production and market links. The major discussions were related to knowledge management, convergence of extension systems, the role of information and communication technology and mass media, public private partnerships and farmer market led extension systems. They studied various public as well as private departments and how it is mechanized to farmers. Also models were provided showing various framework involved in agriculture right from crop planning till it reaches the consumers. Technological advancement was recommended to spread community based knowledge and information services.

Gardas et al. [10] identified fifteen factors leading to post-harvest losses (PHL) and presented a causal model considering the fruit and vegetable (F&V) supply chain in India utilising the decision-making and trial evaluation laboratory (DEMATEL) method. The study identified the most critical factors, which needs to be addressed effectively in order to reduce the post-harvest losses. It tends to guide policy-makers by providing a suitable mechanism ultimately enhancing the performance of F&V supply chain. Raut et al. [11] identified sixteen causal factors responsible for post harvest losses and applied the analytic hierarchy process (AHP) to evaluate the relative importance of these factors on a comparative basis within the context of Indian fruits and vegetables (F&V) supply chain. The study identified 'lack of linkages between institution, industry, and Government (F8)', 'climate and weather conditions (F15)', and 'lack of linkages in the marketing channel, from farm gate to market because of small land sizing farmers (F9)' as top three significant causative factors. The results are expected to present more clarity to the decision makers in understanding the underlying challenges related to post harvest losses. Raut et al. [12] then analyzed the 'hard (operational and technology-based) and soft (human resource based)' performance indicators of the green value chain to analyse their impact on the business performance of agri-food sector within Indian context. The study employed Structural Equation Modelling (SEM) approach based on diverse set of 490 responses. The results of the study identified "Collaborative Green Transportation and Cold storages" as the most critical factor having significant effect on operational performance. The study is intended to guide managers and regulatory authorities by emphasizing the relationship between green supply chain factors and business operational performance.

Based on the literature review, it has been observed that efforts have been made by various researchers in identifying suitable barriers related to post harvest losses in different contexts along with some suitable recommendations. However, as per the best knowledge of the authors there has been no attempt in the literature wherein exploration has been made to strengthen the supply chain focussing on the existing communication channel throughout the supply chain. Hence, efforts have been made through our study of post-harvest losses to concentrate on very specific issue of communication network among farmers as well as agriculture extensions. Most of the above problems highlighted through literature in the supply chain framework can be avoided by proper communication channel. Through a technological model, an attempt has been made to connect various nodes in the agricultural extensions. A case of Amritsar has been considered to illustrate the existing communication channel and highlight inefficiencies in existing channel. Later, efforts have been made to propose suitable mechanism to improvise current communication channel based on which it is expected to eliminate various kind of exploitations.

3. PROBLEM DESCRIPTION

In order to analyze the problems at various level, interviews were conducted with farmers, middle-men and agricultural department. Mandi Framers put forward majorly the ill effects caused due to government inefficiency. Most of them were complaining of the Mandi exploitation and lack of government intervention. Also, they were worried about prices the margins or profits in agriculture were not in sync with the market inflation. Further problems on logistics, storage and awareness were discussed. Although farmers were getting tech-savvy but still proper framework was lacking. Agricultural department were well aware of the problems with farmers but were mostly talking about lack of reach and lack of awareness. But, they accepted things will change with the incorporation of technological advancement. Mandi people were mostly worried about lack of quality in Punjab crops.

Following post-harvest problems were identified in different fields:

Storage facilities

Regarding the storage facilities there is no cold storage available from government side and the available facility is having lack of proper maintenance and lack of proper management. The private storage facility is not affordable and the personal storage facility is very small and inefficient.

Logistic Network

Regarding the logistic side currently no government logistic facilities are available for farmers. Big farmers use their own tractor for transportation of crop purpose whereas small farmer has to depend on big farmer or any commercial players for logistics purpose.

Mandi Market

Mandi Market were basically selling ground for post-harvest. Normally Mandi were divided into different sections depending on the type of crops and vegetables. It worked normally till 3pm in the evening. The auction would start at 9 am in the morning. By understanding the working at Mandi the problem which were involved there can be understood.

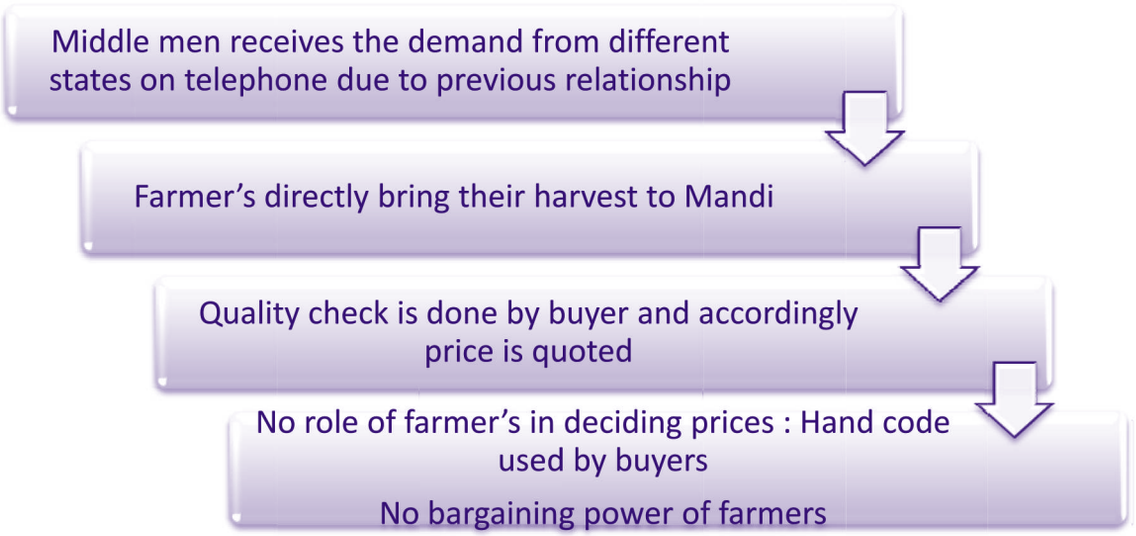

Figure 1. Working mechanism of Mandi

Basically, the Mandi was run by the middle-men. The middle man is already having tie up with other middle man from different Mandi from different states and cities, based on telephonic conversion the get the demand and accordingly they procure the demand from Mandi. Quality check is done while buying crops from the farmer and prices are set accordingly. The buying of crops from farmer happens through the auction process which is not transparent and farmer plays very less role in determining the prices. Most of the farmers were already under loan with the middlemen due to which there were very less room for any saying from their side.

Agriculture Department

Trying to evolve farmer's as an entrepreneur by engaging them in side businesses like honey, textile etc. Mandi price regulation is done in book but ground reality is different. They are trying their best to educate farmer and make them entrepreneur by diversifying them to honey bee, textile and other farming. The problem is that they are unable to reach the small farmer and the majority of policies that are formulated by the government is feasible for only big farmer having big land holdings.

Information System

Regarding the information system, it was found that there is a lack of proper information flow between different stakeholder like farmer, middle man, the end buyer and the government official. That is the major reason behind the inefficiency in the supply chain process in post-harvest. For example, in case of crop like paddy or wheat the prices and demands are set by government after one month of harvesting by the farmer and within that one month the middle took 70% of the crops with less price from the farmer and the rest 30% will be sold only in government regulated price. So because of this, the farmer has to suffer huge losses.

Table1. Price comparison of Market and Mandi in Amritsar

Crops	Government/ Market price	Mandi price	price difference (%)
Paddy	3000/quintal	2300/quintal	30%
Wheat	1600/quintal	900-1100/quintal	60%
Vegetables (Potatoes)	350/bag	120/bag	200%

As mandi is a free market and based on supply and demand price varies so there is a huge gap between the government price and mandi market price. For example, take the case of paddy it's 3000 per quintal in government price whereas it's 2300 per quintal in mandi price. So there is a 30% price difference.in case of wheat and potato it's 60% and 200% price difference between government and mandi.

After studying problems in different segments it was found that actual problem lies with the lack of information exchange. In order work effectively each section should have connected strongly. But as per the existing model there existed a lot of linking gaps.

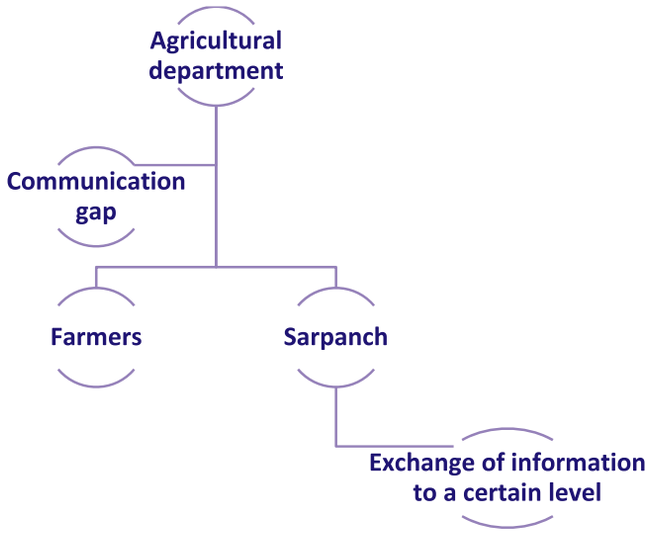

Figure 2. Existing model of connection between different stakeholders

As per the existing model it can be clearly inferred that the agricultural department was totally cut out with lower hierarchy. Farmers were not in direct or indirect contact with them which made their reach very limited. Also, there were limited exchange of information within farmers. Only nearby land holdings were a mode of relationship between them.

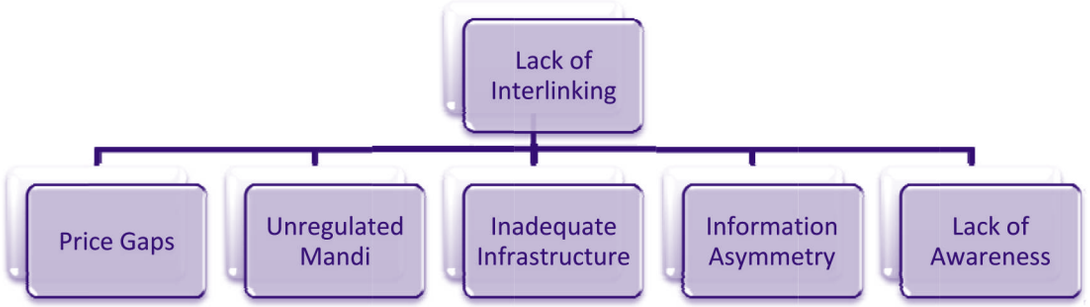

Figure 3. Major Problems identified

Due to lack of interlinking between different departments above major problems were identified. There were problems of price gaps in the Mandi price and market price. The Mandi was highly unregulated. There were lack of storage and logistics facilities for farmers. The information flow was not adequate and flow of information in the lower level of hierarchy was very low. Farmers were less aware about the policies which were framed in their favor by government.

4. RESEARCH METHODOLOGY

The above-mentioned objectives have been assessed by using both primary data and secondary data.

Primary Research

The source of Primary Data collection is mainly through Field Investigation which involved interview and discussion with the farmer, Middlemen and head of Agriculture Department. Basically farmers were targeted in two sections. The first were big land holding farmers and second were small farmers in order to get a broader prospective. The Vallah Mandi studied in order to understand the working and middle men for crops and vegetables were interviewed. Head of agricultural departments introduced various policies and future prospects planned for farmers.

Secondary Research

The secondary data was collected from Agriculture Office of Amritsar, Mandis, Research Institution and websites on Internet. The geographical scope of the Study was limited to Amritsar district only.

Data was collected regarding the Cropping pattern that is being practiced by the farmers and the major crops, the difference in prices that is set up by the government and the Mandis, and the lack of flow of information channel and also the inadequate storage facilities.

The collected information was then analysed and classified mainly into three parts:

1) Study of Post-harvest aspects with respect to the Farmers, Middlemen and Agriculture Department.
2) Identification of Problems that includes lack of proper Storage facilities, efficient Logistics Network and well functioned Information System.

3) Proposing Solutions that involves a practical proposed Model which will overcome the above-mentioned problems to a certain extent.

5. PROPOSED SOLUTION AND SUGGESTIONS

In order to connect the gap between different sections, there was a need for a framework, which could interlink them. To channelize the flow of information a WhatsApp model was proposed. This model was supposed to connect agricultural department, export department, Sarpanch, influential village people and farmers in order to facilitate the two-way flow of information.

Figure 4. Representation of new model connection approach

The first hierarchy will include connecting the agricultural and export department. Since, there is no existing linkage between these departments and villagers so we need to reach out to the village Sarpanch and connect them in the second hierarchy of model. The influential villagers who are existing in the same hierarchy can be connected by Sarpanch. Further, in the third hierarchy lies the big farmers who owns more than 3 acres of land can be connected by Sarpanch and big farmers themselves. Finally, in the fourth hierarchy lies the small farmers which constitute almost 70% of population. The small farmers can be connected by big farmers who have well maintained relationship with them.

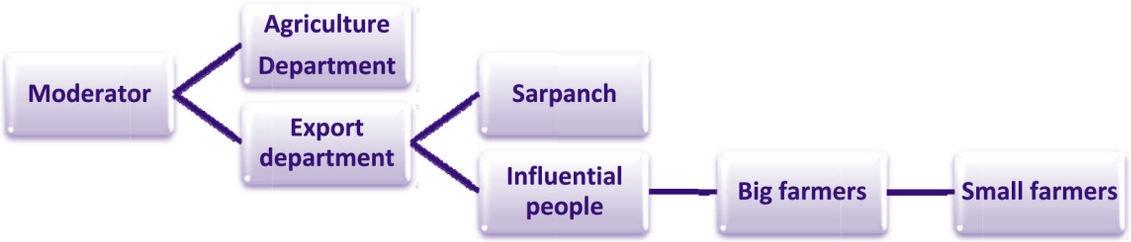

Figure 5. Hierarchy involved in WhatsApp Model

This depicts a basic flowchart of hierarchy. The flow of information can be facilitated at each hierarchy in both directions. There will be a moderator who will manage the group and facilitate the flow of information at each level. At the top of hierarchy lies agricultural department and export department. They are directly connected to Sarpanch and influential people who act as facilitator between famers and departments.

The information flow occurring at hierarchy will solve different issues at below nodes:

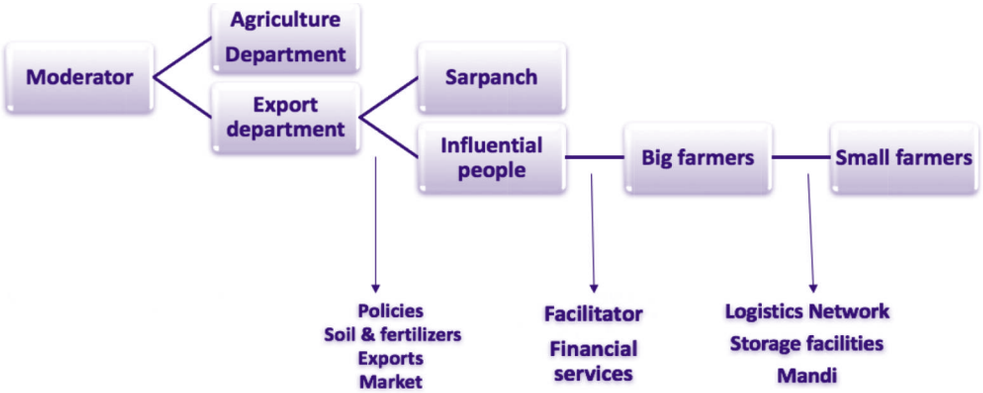

Figure 6. Nodes covered due linkage between sections

Policies: Agriculture department as well as export department can inform about the different government policies which can directly reach the farmers and Sarpanch. Farmers can plan and strategize their cropping pattern according to that. This could even help farmers in the terms of side business like honey, textile etc.

Soil & Fertilizers: Farmers can get information about the quality of soil and suitable fertilizers. Agricultural departments can announce the future dates of awareness camp or soil testing visits. Farmers can plan their schedule according to that. This will increase the number of farmers in awareness camps and facilitate better management.

Exports: Framers are usually not aware about the export items which are in high demand and can provide high profit to them. Since, there is a proper communication available through WhatsApp model export department can conveniently post the high demand export items. This will also increase the diversity of crops in Indian agriculture which normally sticks to traditional crop practices.

Market: Due to delay in the government quoted prices almost 70% of crops were already sold to the middle man. Since harvesting period is very much decided on the rain and need to be flexible. This can be informed by the farmers to the agricultural departments. Also, famers can get the correct rate of crops as per market prices and demands. They can have information about wholesale retailers and big players who can pay them good return.

Mandi: With the interlinkage between different farmers the problem of Mandi can be solved. As already discussed different Mandi have different prices quoted for crops. Famers normally get price information about one or two Mandi. As this model will bring together the farmers from different regions, price discussions can happen between them and they can enhance their bargaining power.

Financial Services: The interlinking between farmers, big farmers and Sarpanch can help in the financial services. Instead of taking loans from middlemen farmers can take loans from Sarpanch and big farmers. Even farmers can help each other in the time of crisis and can collectively demand for help from government.

Logistics network & storage facilities: By interlinking between big farmers and small farmers these two problems can be reduced to some extent. Big farmers who are having extra space available can lend it to small farmers for use. If some consignment or truck is going empty it can be informed in the group and utilized. Even small farmers can rent the tractors for use from big farmers at nominal rates.

6. CONCLUSION

The current study has been conducted with an aim to address the issues pertaining to post-harvest losses subsequent to challenges in the entire supply chain process. It started with the mapping down of entire supply chain stages with respect to a particular case in Amritsar context and further lead to identification of problems pertaining to logistics, storage and information system through interviews of respondents from farmers category and local agricultural department. Based on the issues identified, a proposal based on WhatsApp model for communication architecture has been suggested with suitable steps involved in its implementation. The introduction of new WhatsApp model is filling the missing linkages, which existed in previous model. It will ease the flow of information to various stakeholders and provide room for healthy discussions. The problems related to logistics and storage can be solved to some extent by exchange of space and proper coordination within farmers. The information exchange of policies will enhance to a large extent. The problems of farmers can be put forward in a systematic way to the departments through Sarpanch and the solution can be discussed. Problems of financial services could be handled easily. The needy farmers can directly contact Sarpanch or department whenever required. The Mandi can be made more transparent and flexible.

Basically, this model is using the power of communication to solve problems at different nodes, which is lacking in current structure. From the social context, it will create a relationship model among farmers as well as agricultural extensions and everyone can get their fair share. It will help improve the society by helping the needy and eliminating the exploitations by middlemen.

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