

A Review on Post-Harvest Losses Assessment in Agri-Food Supply Chain

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Abstract:

Post-harvest losses in the agri food supply chain along with the food wastage are turning into expanded consideration so to overcome these losses are to be cut down by different ways. The perishable produces are highly susceptible for the wastages in off-farm or on-farm. Off-farm losses comprise lack of the reliable market knowledge, insufficient storage and transportation provisions, poor awareness of the farmers and processing units. The higher prices of food, insecurity in food and reduction of resources which utilized in their production process are all utilized in the post-harvest losses. Therefore, these losses require to be reduced at retail, farm and consumer levels in order to attain the food security. The main purpose of this paper is to present a literature review concerned with suggesting policies to reduce agri-food losses in post-harvest and recognizing cause for losses in post-harvesting agri-food supply chain.

Keywords: Post-Harvest Losses, Agri-Supply Chain, Fruits, Farmers, Horticultural Crops

Losses during the Post-harvest implied a measurable drop in the economic, qualitative, and quantitative [1]. Post-harvest losses indicate a sufficiency of food and agri-food also comes under it which might be consumed either at retail or consumer levels, but it's not utilized for a few reasons [2]. The post-harvest system comprises of the interconnected activities from marketing, the time of harvesting until the time of processing and food preparation. During the post-harvest chain, the quantitative, qualitative losses and other features can occur at any level. Because of depletion in quality or quantity of the produce there is loss within the financial worth

of the produce, and this considerably adds on to the economic losses as well [3]. Both quantitative as well as qualitative losses occurs together from pre-harvest to post-harvest management, handling, storage, and distribution to the buyer [4]. Losses in post-harvest not only lead to the minor accessibility on the consumer's side but also reduce the share of the farmers within the terms. This ends up with higher price which leaves the patron with very less options. The most operational problem that causes the losses in post-harvest includes harvest scheduling, internal control, transportation and logistics management and demand forecasting

[5]. The resources, money and time are constant to the cultivation of crops, irrigation facilities and all the fertilizers go wasted, lack of attention being paid to the issues of losses in post-harvest and hence elevating food insecurity and prices [6]. The main target is on increasing the food supply with the increasing world's population but rather the main target should get on less wastage of the scarce resources which are used during the assembly of crops which are lost as post-harvest losses should be managed. Lack of cold storage infrastructure, improper perishable produce handling by farmers, lack of capacity for processing produce, poor or undeveloped transportation network, hot temperature, lack of proper marketing information, moisture content, mechanical damages, damages to the produce by pests and diseases which results in the poor-quality produce losses, high rejection rate, loss during transportation, poor or inappropriate number of the post-harvest constraints [7]. Every agri-food type has its own level of wastages with fresh produce which results in one-third of the full global losses [8]. By estimating and recognizing the causes and the amount of those losses in post-harvest at different stages of assembling, handling of produce and harvesting of produce, storage of produce, distribution of produce, and their transportation can help in increasing food availability and getting obviate them. To minimize the losses in post-harvest indifferent stages of agri-food supply chain from the assembly to provide to the ultimate consumer this may help in making relevant measures and proper policies or strategies [6]. It becomes very difficult to cut back the post-harvest losses without the adequate policies and estimates at

different stages within the agri-food supply chain. Only a few studies are found related to the identification of the post-harvest losses in agri-food supply chain and estimation of their causes. Hence, this endeavour is to present a literature review for the identification and estimation of the causes in post-harvest losses in agri-food supply chain and suggesting the measures to cut back the losses.

A BRIEF LITERATURE REVIEW

The main purpose of this paper is to present a short literature review emphasis upon identifying the actual reasons because of which post-harvest losses occurs within the agri-food supply chain and proper strategies or policies to minimize these losses. The reference papers were mainly associated with perishable goods like horticultural crops. Leading author's works were reviewed, with very keen details like methods used for the study, objectives of the reviewed work and year of publication. Results were examined and observed carefully, and the pit holes were identified within the research.

Weinberger *et al.* [9] identified and observed the causes and to reduce the mentioned post-harvest losses researcher has also suggested the measures to be taken within the vegetable supply chain. They also investigated the quantity and together with it the worth of vegetable produce as losses in post-harvest along the vegetable supply chain and for the research information collected via surveys, interviews and the structured questionnaire technique. Together with this, an interview approach from the supermarkets, retailers and farmers was applied. For this a simple mathematical approach was made for the calculation purpose. Farmers were sustained most of the post-harvest losses of

vegetables followed by other supply chain personals. The farmers were faced the fresh produce physical losses and most of the monetary losses were faced by the retailers. The losses in post-harvest were mostly because of extreme or high temperature, high disease incidence, transportation losses because of cheap quality of the produce and oversupply of vegetables. The infrastructure for appropriate processing techniques, lessening the standard loss was provided. During the transportation time, the standard should be maintained. An integrated disease management system should adopt to increasing the vegetables disease resistance. Differences and similarities in post-harvest losses incurred in both fruits and vegetables the study further extended and could be investigated which would help in examining the reasons for postharvest losses in agri food supply chain.

Meena *et al.* [10] scrutinized the farmer's attitude towards the post-harvest losses of horticultural crops and together with this also studied the attributes of the demography and utilization of agricultural information sources of the farmers. The information was collected via performing the non-public interviews and a scale of Likert-type was developed with a five-point Likert continuum from eighty different horticultural crop growers. Cronbach's alpha coefficient of reliability test was also conducted. This study revealed that the farmers showed a positive attitude towards losses in post-harvest of horticultural crops. Environmental factors like temperature, moisture content, inappropriate or poor cold storage infrastructure or facility, mechanical damage, or injury to the crops while handling, poor post-harvest

sanitation, atmospheric condition not favouring the crops, inappropriate quality standards and there is lack of training programs for the adoption of improved post-harvest technologies or facilities for enhancing the information of small farmers were responsible for the post-harvest losses. It was suggested that farmers attitude should be boosted up which can be achieved by proving them with proper training and guidance related to new post-harvest technologies and their appropriate selection, financial endorsement, income-generation activities, primary education, connecting farmers with markets, proper planning and implementation of development, diversification in agricultural enterprises and extension activities. Identification of key causes in post-harvest losses in horticultural crops and development of proper strategies or policies for causes reduction.

Murthy *et al.* [11] in his research he identified the post-harvest losses of the major fruit crops at the different stages of handling, he also figured out the magnitude of losses at the national level and recommended proper policies and strategies to reduce these losses. In this research the crops selection was done regarding the importance of area of production and marketing. The data was collected from the different agencies which were involved during the process of post-harvest handling of the fruits which are season based. In this research Random sampling technique along with the multi-stage purposive were used. Via this study it was observed that every crop has its own marketing practices it like pre-harvest contracts, cooperative marketing, and direct selling of the produce by the farmers. The main causative agent which was causing the post-harvest losses

were identified as follows fungal diseases, discarding of the produce due to over-ripening, imperfection, better quality requirement, inadequate or poor irrigation facilities, improper or poor packaging, poor market knowledge and awareness of farmers. On an average a decrease of 1.2% of the agricultural GDP was observed. To overcome the losses the researcher recommended to strengthen up the infrastructure of market, training of farmers for post-harvest handling, development of processing units, optimum maturity index for harvest knowledge to the farmers, appropriate packaging for long distance transits a specialized cold storage transportation. The possible extension of this research could be management of the post-harvest losses at different agri-food supply chain levels.

Prusky [4] while researching he debated upon the causes which were occurring for the quantity as well as quality losses in agri-food chain from pre-harvest to post-harvest handling to the final delivery to the consumer. He also gave proper measures along with the proper methodologies to lessen these losses. The research was illustrative in nature. He gave the explanations that why these losses were occurring, and the causes are as follows, improper infrastructural facilities, very stern quality control standards, environmental factors, perishability of the produce, inappropriate packing of the produce, lack of demand in market, faulty facilities related to transit, inappropriate post-harvest handling and time of harvesting plays a very important role, mechanical injury during harvest, over-ripening etc. The researcher recommended the following measures to overcome the post-harvest losses,

appropriate cold storage infrastructure to maintain proper temperature and humidity, improved, very well maintained facilities of transit, training programs related to post-harvest handling techniques for producers, appropriate handling to overcome the physical injury of the produce, better packaging process, before harvest treatment facilities, development of processing units, direct farmers and buyers interactions for better income, and better marketing policies or strategies for matching demand and supply.

Tefera [12] in his research he worked in Africa and identified the degree to which the post-harvest losses in maize occurred and its effects on the ecosystem and food security. He also recommended certain strategies to overcome the losses. The research here was illustrative in nature. The researcher noticed post-harvest losses in both quality as well as quantity of maize grains. According to this research it was found that the post-harvest losses occurred due to unsupportive weather conditions, obsolete practises of harvesting, poor facilities of transit, poor storage units, and restricted approach to marketing knowledge, moisture or humidity and temperature. Certain policies or strategies for the reduction in post-harvest losses were suggested by the researcher such as, maintenance of moisture content, adopting the improvised storage facilities, transfer of information of latest technologies from researcher to farmer, low-cost post-harvest technologies, training programs for farmers etc. The possible extension of this research could be identifying the cause of post-harvest losses in selected vegetables and fruits and providing them with the possible strategies.

Adepoju [13] in his research he worked in Ogbomosho and observed the level or degree related to post-harvest losses in tomato production affected the wellbeing of the producers of that area, along with this, researcher also estimated the value of losses. The data for this research was initially collected via questionnaire method. Multistage sampling was used during the research. Certain analytical tools were used such as descriptive statistics, Ordinary least square model and regression models etc. He also enlisted the causes of the post-harvest losses as follows, improper storage facilities, poor facilities of the transit, poor processing units, poor packaging, inadequate access to credit facilities, poor marketing, the produce being perishable in nature, high moisture content of tomatoes, certain constraints like poor government support along with the low working capital. From this research it was found that the income and the welfare of farmers were affected negatively by the post-harvest losses. The researcher recommended certain measures for reducing the post-harvest losses such as, development of a proper infrastructure for the storage, development of proper road infrastructure and rail transit system, development of proper processing units, and investment in post-harvest processing technologies. The possible extension of the research could be using the recommended measures enlisted above.

Aidoo *et al.* [14] in his research he worked in the North district of Ghana, Offinso. He researched upon the inputs that were affected the level of post-harvest losses in fresh-tomatoes supply chain at farm. Data for this research was collected via proper structured questionnaire and

personal interviews. The techniques used were Purposive and simple random sampling. Multiple regression analysis was conducted along with the descriptive statistics. The researcher while working in Offinso found significant post-harvest losses in tomato production. The factors determining the level of post-harvest losses were gender of the plant, variety cultivation, farm size, and storage-time. The post-harvest losses can be reduced if these factors are properly managed then. The limitations noted during the research were identified and were as follows, limited access to credit, lack of facilities of storage for the produce, lack of post-harvest technology, lack of opportunities in the market, and inadequate facilities of transit. The researchers suggested small processing units for the alternative products, creating awareness for improved quality of produce among the farmers to improve the adoption rate, training of farmers, facilities of cold storage. The possible extension of this study could be determining the factors which reducing the quality of the tomatoes.

Minten *et al.* [15] in his research he evaluated the degree to which the food losses occurred at various stages of potato food supply in the Asian countries such as (India, Bangladesh, and China). The data for this research was collected via personal interview and primary survey. The techniques of random sampling were used. Among all the three countries India has the highest potato yield due to its high land productivity and large farms. A notable difference was seen among the three countries with respect to its retailers and wholesalers. It was observed that having an appropriate cold storage facility shows a hike in

consumption during off-season. In India lower wastage levels were seen in the value chain. The research was not limited to random selection rather it was limited to well-connected production area supplying potatoes. In future the research can be conducted by doing surveys of comparatively large samples at consumer level but not only on retailer's level and the wastage of the accounts of the consumers can be estimated. In Future, for doing the useful comparisons the research can be conducted in other countries as well.

Munhuweyi *et al.* [16] in his research he assessed the worth of the quality of the post-harvest cabbage along with this he also elaborated the context of occurrence of its losses during the consumer storage level and at retail level in South Africa. The data for this research was taken from the sample of cabbage from the three different retail outlets. The impact of the environment, nutritional value and quality value, physical losses, the economics losses were examined and the environmental impact which was occurring because of the post-harvest losses was done. Fisher's least significant difference-test and ANOVA were also used. While studying this it was noted that the post-harvest losses in case of cabbage at purchasing in the retail level were of an average of 21% and it was also the approximated that the dietary energy needs of thousands of people could meet the volume of physical losses at national level for a month. The factors due to which the post-harvest losses occur are such, the management of the storage temperature of the produce, mechanical damage, facilities of cold storage etc. The studies were also done on water resources, fossil energy, and food and nutrition security. The possible

outcome of this research could be recommendations of various policies related with the reduction level of post-harvest losses in cabbage and other.

Sibomana *et al.* [17] threw some light upon the challenges which were being tackled by the sub-Saharan Africa in the supply chain of tomato. Along with this also recognized the adequate technologies along with the opportunities via which the post-harvest management can be done in tomato supply chains. The research done by him was illustrative in nature. The challenges which were faced during the estimation the losses of post-harvest in tomato supply chains helped in developing the standard methods through which data of post-harvest losses can be collected. Due to the use of pre harvest treatments an impact on the quality of produce was noted, fertilizer applications by inadequate methods, inappropriate cold storage infrastructure and transit facilities, mechanical damages to the produce, increased microbial growth. The researcher recommended the following techniques to overcome the post-harvest losses such as, by using the proper techniques of post-harvest, the packaging material should be appropriate, there should be a good market hygiene, a farmer's association should be developed among small scale farmers for the quality management of produce, by developing the proper information system for the post-harvest losses estimation etc. There is always seen a significant difference between the small- and large-scale farmers post-harvest operations.

FINDINGS

Via this review, the causes of the post-harvest

losses in agri-food supply chain are enlisted below:

- Environmental factors: pests, mechanical damage, humidity, over-ripening etc.
- Unsuitable harvesting periods
- Absence of dependable maturity index
- Bad quality of produce
- Inappropriate packaging and sanitation
- Inappropriate on-farm storage infrastructure
- Inappropriate transit facilities and absence of proper processing units
- Contradiction among the demand and the surplus
- The dependable market absence
- Enough fresh food surpluses
- Dearth of consciousness of the post-harvest handling methods along with its improvised knowledge
- Inappropriate approach to the financial incentives
- Inadequate market information and less knowledge of the market demand

CONCLUSION

In most of the developing countries the vital origin of the food scarcity has been recognized as the post-harvest losses besides the agri-food supply chain. Farmers mechanize their bounded resources to the crop production hence they tend to loss in harvested produce before it reaches in the market due to the elements beyond their control heading to a notable loss in their anticipated income and threatening their well-being. The causes of the post-harvest losses which are responsible for food insecurity should be looked upon and handled with the prime concern, with an aim to acquire food autonomy,

increased market participation of the farmers, and adequate use of the natural resources. The study done in this research would help the scientists, policy makers, farmers, industrialists, etc. In the developing countries certain training programs are made so as to improve the production and as well as the handling methods of the produce pre-harvest and post-harvest so that the post-harvest losses can be minimized. From this research paper we enlisted the causes of post-harvest losses. Hence the following very important measures are recommended to lessen the post-harvest losses.

- The farmers should be given appropriate training to handle the post-harvest losses.
- Developing the processing units.
- Harvesting and attainment should be industrialized.
- There should be the development of suitable on-farm storage facilities and cold storage facilities during the transport of the produce.
- The rejection rate can be reduced by adhering the quality standards.
- The post-harvest losses can be reduced by appropriate packaging and sanitation.
- A very well framed and associated logistics network plays a very important role.
- By building up of a good marketing infrastructure.
- The time of harvest should be accurate, and the pre harvest management practises should be performed.
- The wastage of food can be reduced by processing of the nonmarketable produces.
- The appropriate policy making.

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