

Past Efforts on Postharvest Loss Reduction of Fresh Produces in Nepal and Ways Ahead

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Abstract

Commercialization of fruit and vegetables farming and long-distance travel of fresh produce to market centres warrant the proper postharvest handling to minimize the losses. Despite high postharvest losses, systematic interventions in this area have not yet been made. Many projects supported by donors and development partners (directly implemented by public entities and projects in collaboration with public entities) contributed on the postharvest loss reduction of fresh produces. The losses after production have direct affect on the food sufficiency and low level of nutritional contribution as expected from fresh produces due to quality losses. Upon reviewing the past endeavours and their results, recommendations are made for future considerations to reduce the postharvest losses of fresh produces considering the current socio-economic context of Nepal. These includes, awareness raising from policy making level to growers, nationwide loss assessment using standard methodology for prioritization of the interventions, establishment of a dedicated institution for postharvest research and development, devising a separate approach for postharvest technologies rollout, critical mass development and mobilization for knowledge development and dissemination, formulation and execution of regulatory frameworks for quality standard, establishment of small scale processing plants in production blocks, mechanism to involve market intermediaries in postharvest loss reduction, mechanism to share economic advantages of postharvest technologies adoption and adoption of value chain thinking on postharvest management.

Keywords: Fresh produces, fruit, interventions, postharvest loss, vegetables

Introduction

The agrarian setting of Nepal is employing its majority of the population and significantly contributing to the national economy. However, dependency of employment on agriculture is gradually reducing. In the context of reducing involvement in agriculture in general, horticulture sector is ever growing. The national statistics clearly depicts that area under fruit cultivation

increased to 38.4% in 2018/19 in comparison to 2000/10 (MoALD, 2020). Likewise, area, production and productivity of vegetables increased by 14.4%, 25.2% and 12.6% respectively in the current decade (MoALD, 2020). The yearly production records also demonstrate the steady growth pattern of fruit and vegetables (potato is also included) in ten-year time (Table 1).

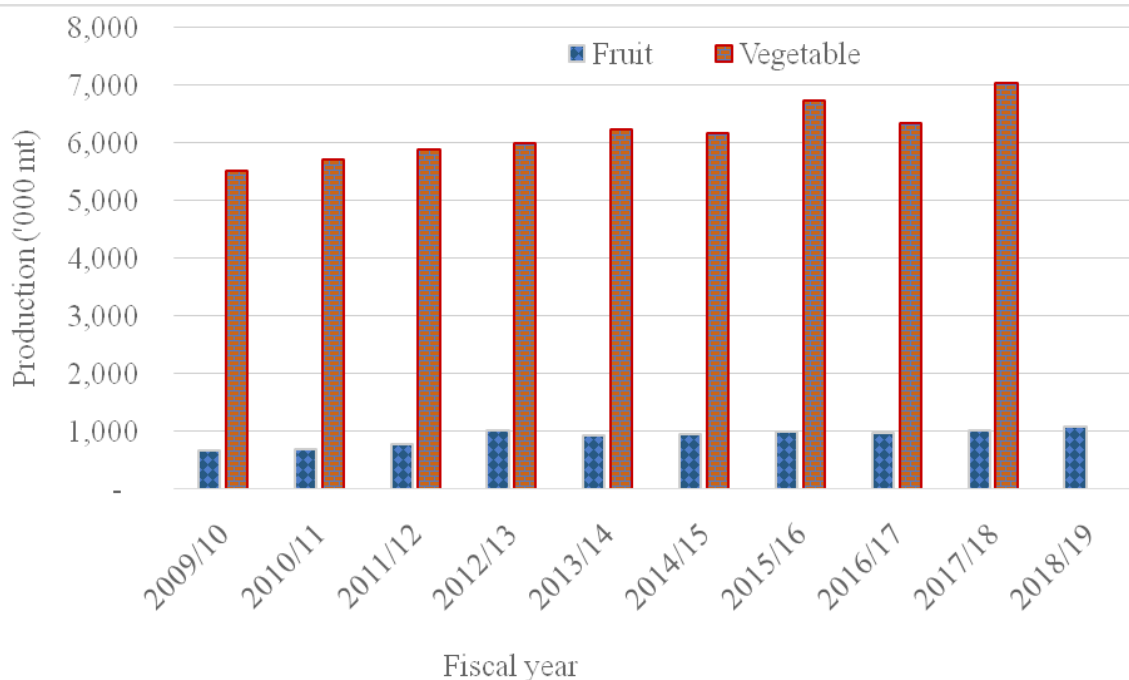


Figure 1. Production of fruit and vegetables (including potato) in the recent decade in Nepal.

The increase in production and productivity of vegetables along with the increased amount of fruit provide sufficient ground to argue on increasing trend of their volume of transactions. The analysis of market arrivals of fruit and vegetables in Kalimati market shows an increasing trend in totality along with narrowing gap between domestic and imported products (Fig 2). The increasing volume of imported products but almost constant supply of national produces shows the need of quality maintenance of fresh produces to be competitive in the central market.

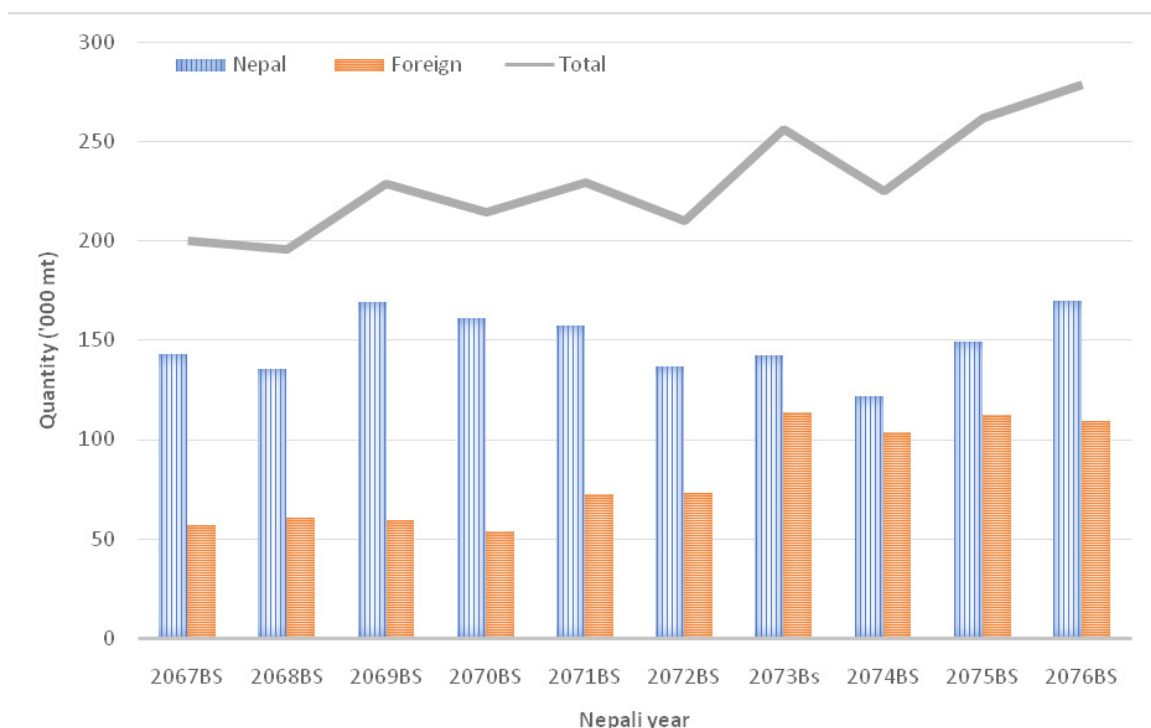


Figure 2. Market arrivals of fruit and vegetables in Kalimati fruit and vegetables market in the recent decade (2067-2076BS)

The contributing factors for increased production and productivity are development of commercial sites, adoption of new technologies, realization of more profit per unit area of time and investment, and development of hinterlands and new cities. Rapid urbanization and decreasing trend of peri-urban vegetable production forced to travel fresh produces from far distance production sites to the major cities. The movement of fresh produces further enhanced due to opening of new road networks and exploitation of different agro-ecological diversity. It is obvious that commercialization of fruit and vegetable farming and long-distance marketing simultaneously increase the postharvest losses. Despite growing need of postharvest interventions, few national guiding documents like Agriculture Development Strategy (2015-2035), Nepal's Agricultural Perspective Plan (1995–2015) and Tenth Five Year Plan (2002–2007) focused on postharvest related interventions like value chain development and physical facilities development in market centres. But the explicit directives for postharvest loss reduction of fresh produces in supply chain is not evident. Considering the context of low priority of postharvest interventions in the country, this paper attempts to document the past sporadic initiatives and actions to be taken for systematic momentum on postharvest handling of fresh produces.

Postharvest interventions on fresh produces:

Rural Save Grain Project (1980-1994) found to be the first postharvest initiative taken from the public sector in collaboration with Food and Agriculture Organization of the United Nations (FAO, 2011). The project created a foundation to establish a dedicated entity to work on postharvest management. On the same ground, Postharvest Loss Reduction Division was established in 1992, which was upgraded into 'Postharvest Management Directorate' in 2003 (PHMD, 2068 BS). But the office was abolished in 2017 during the course of structural

reform after federalization. Though the entity was under DoA, it played role on postharvest technologies development primarily on cereal crops further encompassing vegetables, fruit, flower, and spices. Perusal of its publication list revealed that 10 out of 79 publications were on the postharvest management of fruit and vegetables (PHMD, 2067 BS). Review of core functions of the current entities functioning under DoA does not give clear picture about the responsibilities of postharvest handling of fruit and vegetables. As two national centers under DoA, namely; National Fruit Development Centre and National Potato Vegetable and Spice Crop Development Centre have broad mandate for their overall development, these two centers seem to be responsible for postharvest handling interventions. Department of Food Technology and Quality Control, one out of three departments under MoALD, has been primarily engaging in research and development on processing aspect of fruit and vegetables.

Aiming to carry out focused research and develop dedicated cadre for agricultural research, Nepal Agricultural Research Council (NARC) was established in 1990 primarily taking human and physical infrastructures from Department of Agriculture. A clearly mandated entity to carry out postharvest research was only established in 2012 in the name of then Food Research Division (FRD, 2013) and recently renamed as National Food Research Centre (NFRC). Because of its genesis, more focus has been paid to cereal and processing aspect. Other national centres working on horticultural commodities mainly National Horticulture Research Centre, and horticultural commodity programmes (National Citrus Research Programme and National Potato Research Programme) are also involving in postharvest research. Perusal of NFRC's major technologies list showed three technological information related to postharvest management (except processing) out of listed 40 publications from FY 2052/53 to 2075/76 BS

(FRD, 2019). The paucity of the publications on fruit and vegetables postharvest management clearly demonstrates that the mandated entity of NARC does not putting equal emphasis on fresh produces postharvest handling research.

Commercialization of vegetables farming took momentum after embarking FAO/HMG-N Vegetable Seed Production Project (phase I and II during 1980-1987) followed by Fresh Vegetable and Vegetable Seed Production Project (phase III and IV during 1988-1995). The project only considered postharvest handling and marketing in the third phase, where activities like postharvest orientation training, couple of field studies, three technical reports and an extension video were the reported outputs (Rana, 1995). The project was simultaneously succeeded by two projects supporting to vegetables value chain. The first one was New Kalimati Market Technical Cooperation Project (1995-2000) focusing to strengthening the physical facilities and effective functioning of the market, which is still operating as the central market. Few attempts were also made for the quality improvement of the vegetables through commissioned studies (Gurung, 2053 BS). The second one was Small Marketing Infrastructure Project (1995 - 2000), which indulged on strengthening 19 farmers managed vegetable collection centres all across the country (FAO, 2011a) along with the technical focus on postharvest interventions. 'Capacity building in agricultural marketing and market management' (2008-2009) was launched with the FAO's TCP (technical cooperation Project) with an aim to increase efficiency of agricultural marketing taking considerations of postharvest aspects. The project produced five publications, of which two were on postharvest management of fresh produces.

Agricultural projects led by INGOs have also contributed on postharvest loss reduction of fresh produces. 'Small Holder Irrigation Market Initiative' jointly implemented by International

Development Enterprises (iDE) and Winrock International (WI) from 2003 had a component of postharvest handling and processing using clean energy (Luke, 2004). Similarly, Nepal Economic, Agriculture, and Trade (NEAT) project (2010-2013) supported by United States Agency for International Development (USAID) introduced voluntary quality standards and developed pictorial posters for vegetable, cauliflower, cabbage, onion, cowpea, chilli, and cucumber partnering with Federation of Fruits and Vegetables Entrepreneurs Nepal (USAID, 2013).

Reduction of post-harvest losses in horticultural chains in SAARC Countries (2014-2016) implemented in the leadership of Postharvest Management Directorate was one of dedicated project for postharvest loss reduction of selected vegetable crops in Nepal. It has contributed on two technical publications, capacity building of public sector technicians (overseas training of trainers and national level training) and postharvest inputs support (FAO, 2018 and the project document, 2013). AVRDC-USAID postharvest Project in South and Southeast Asia (Bangladesh, Nepal and Cambodia - BNC) was Implemented by Agriculture and Forestry University (2014-2016) aiming to introduce new varieties for postharvest quality improvement, introduce of good agriculture production system, research on cold chain management and adapt the low-cost production technologies. The project contributed many scientific publications on tomato and cauliflower and an extension booklet on vegetables postharvest management. 'Establishment of Network and Model Manual on Postharvest Technology of Horticultural Crops' (2012 to 2018) was a project executed under Nepal Agricultural Research Council with financial support from Asia Food and Agriculture Cooperation Initiatives of Rural Development Administration South Korea. The project to reduce postharvest losses and improve quality of tomato, chilli, pear, carrot and

apple and contributed on postharvest manual development, few laboratories equipment support and develop network among the postharvest research scientists collaborating countries.

Unlike vegetables, very few projects focused on fruit crops. 'Hill Fruit Development Project' (1988-1996) had small component of postharvest with construction of on-farm cellar type of fruit storage and processing demonstration cum training centres (APROSC, 1999). Horticulture Development Project (1955-2017) made considerations on postharvest aspect during the second phase and many postharvest technologies were recommended of the ear-tagged (sweet orange, pear, persimmon, chestnut, and grapes) commodities (HDP, 2017). Contribution of High Value Agriculture Project in Hill and Mountain Areas (HAVP) was expressed in the public forums, but its evidence could not be traced out (HVAP, 2018). Postharvest

Management and Value Addition of Fruit (2013-2017) funded by South Asian Association for Regional Cooperation (SAARC) Development Fund focused on postharvest management of mandarin in Syangja, Lamjung, Tanahu and Gorkha districts, which constructed, developed, and handed over six zero energy cold storage (ZECS) to the farmers communities in Nepal. Visits to Sindhuli and Kavre revealed that these ZECS are not in operations.

Situation of postharvest losses of fresh produces:

Perusal of literature revealed that the postharvest losses of fruits and vegetables in Nepal are based on guesstimates. Since the country has not yet gone through the systematic studies of postharvest loss assessment, localized surveys seem to be the basis of the estimations, which has resulted wide range of figures from 15 to 50% losses of fruit and vegetables (Table 1).

Table 1. Scenario of national postharvest losses statistics of Nepal

S. No.	Reported loss	Reference
1	25% for vegetables, 20% for fruits and 32% for potatoes (including tuber seed) on weight basis	MHD, 1991
2	15% to 30% in Nepal	Warner & Shrestha, 1992
3	25 to 30% postharvest losses in Nepal	Shrestha, 1995
4	UNCDF estimated 25% postharvest losses of fresh produces	Shakya, 1995
5	12 to 35% based on crop yields	Warner & Kaini, 1997
6	25 to 50 percent loss	Gurung, 1998
7	20-35% for fruits, 15-30% for vegetables and 15-20% for potatoes	Kaini, 2000
8	20-30% loss of perishable fruit and vegetables and in some cases as high as 50 percent	Karki, 2002; Adhikari, 2006
9	20-50% postharvest loss of fresh produces	Bhattarai, 2005; Gautam & Bhattarai, 2006
10	20-30% postharvest loss of perishable commodities like fruits and vegetables	PHMD, 2007
11	20-30% of fresh fruit and vegetables	Bhattarai, 2018
12	15-35% in fresh produces	Gautam et al., 2019

Commercialization of fruit and vegetables and long-distance transport with less focus on postharvest handling should increase the postharvest losses. However, postharvest loss percent estimated at the begin by MHD (1991) and in the recent document prepared by long contributing professionals after about three decades clearly indicated that we are only relying on crude estimate of postharvest losses. Change in production and marketing systems should have increased level of postharvest losses of fresh produces.

In addition to general estimates, few localized studies were made to assess the postharvest losses during postharvest handling. Studies conducted by Market Development Directorate of Department of Agriculture revealed apple transported from Bhairahwara to Gorakhpur was 26.3%, mandarin transported from Bhairahawa to Gorakhpur had 74% loss and cauliflower transported from Birgunj to Patna was 18.7% loss (MDD, 2000 recited from Paudel, 2006). It gives clear message that physical loss measurement turned to be high than that of recall basis loss measurement. The baseline survey conducted (recall basis) by Value Chain Development of Fruit and Vegetables Project conducted in three road corridors (BP highway, Prithvi highway extended up Syangja and Hetauda – Dumkibas section of East-West highway) found 20.7% postharvest losses in vegetables (mainly in farmers to collector and collector to whole seller nodes) and 26.3% in fruit (mainly in collector to whole seller level) (VCDP, 2018). In this regard, Kitinoja et al. (2015) based on review of recall basis and physical verification assessments reports concluded that loss percent was found lower in survey/interview than that of sampling/direct measurement. Likewise, postharvest loss of citrus is reported to be the least for Nepal among other SAARC countries even in very crude harvest methods prevalent in Nepal (Khatiwada et al., 2017BS). The low estimation of postharvest losses may

be due to existence of salvage markets in end market centres. Since salvage markets exist in all developing countries, FAO is reporting higher (>50%) postharvest losses in developing countries than that of (<45%) developed (Europe and industrialized Asia) countries (FAO, 2011b).

Government has been putting emphasis on development of wholesale markets in cities, organized collection centers in major production zones and collection sheds at the production sites. WFP and FAO (2007) reported seven urban wholesale markets and 14 collection centers at production areas. The situation of markets and the number must have changed by now, but authentic information is not readily available. From postharvest perspective, neither the markets supported by the government, nor the private sectors are functioning as packhouse and do have the cooling facilities.

Private sector engagement on postharvest loss minimization is pivotal particularly on storage, transportation, cold chain maintenance and processing. Short-term storage of imported fruits and seed potato are more common. Mr. Dev Das Mandhar, the Chairperson of Cold Store Association of Nepal shared that they are not fully updated about the capacities of cold storages in Nepal and all cold stores are surviving only due to storage of potato (per. com, 2021). Cold store is a step of cold chain but cooling facilities in subsequent supply chain is extremely poor. Investment has not yet been made on the functioning of entire cold chain. It may be due to pre-dominance of open space retailing of fruit and vegetables at current situation.

Impact of postharvest losses:

The impact of postharvest losses and food waste is immense globally. Considering the fact, United Nations kept agenda of food losses in Sustainable Development Goals. The article 12.3 reads “By 2030, halve per capita global food waste at the retail and consumer levels

and reduce food losses along production and supply chains, including post-harvest losses (UN, 2021). Generalizing the loss percent of fresh produce is not straightforward because of mix of subsistence and commercial farming. It is experienced that postharvest loss of fresh produces is higher in commercial farming and lower in subsistence farming. If we consider the 25% losses on an average of production of 2018/19 (MoALD, 2020), a total of 1846 MT of vegetables and 271.3 MT of fruit can be estimated as the loss amount. This amount can be regarded significant in the context of food deficit in the country.

Ways ahead:

Despite high postharvest losses of fresh produces, dedicated sustained efforts have not been made for the reduction of postharvest losses of fresh produces. Considering its impact on food and nutrition security, reduction on food loss and waste has become a global agenda. But this issue is not getting a priority in national policies. Since commercialization of fruit and vegetables are ever increasing in Nepal, main causes of postharvest losses reported by Aramyan and van Gogh (2014) are relevant to our context (Fig 3) but their gravity seems to be different because of emerging value chain.

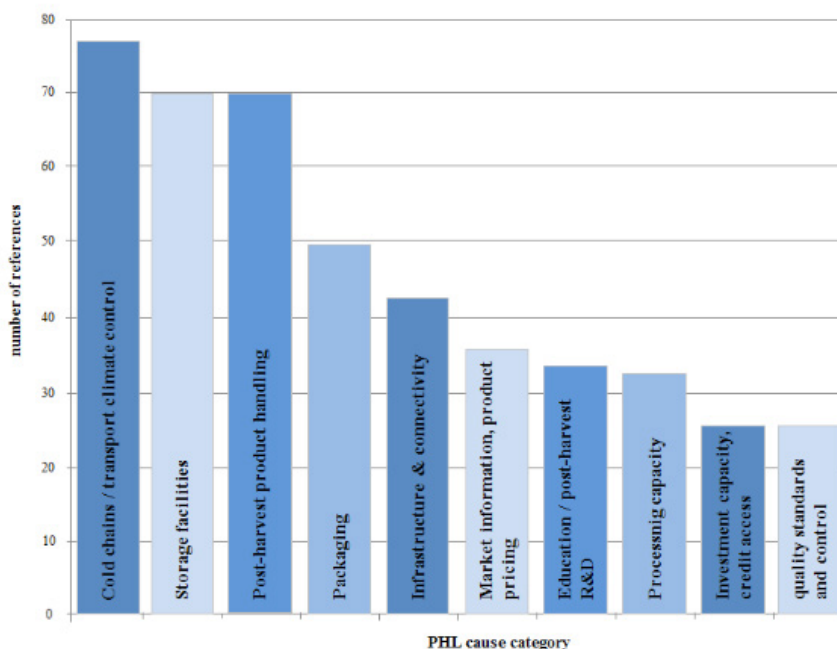


Figure 3. Top10 ranking main categories postharvest loss causes (adopted from van Gogh, J. B., & Aramyan, L. H., 2014)

Thus, not indulging to the generic challenges and recommendations already made on new frontiers for Nepal (packhouse and cold chain by Gautam et al., 2019), following actions have been suggested considering economic and socio-cultural environments of Nepal for short to medium term planning.

Awareness raising: Being a signatory of UN resolutions, Nepal needs to put food loss and waste reduction actions including the

postharvest loss reduction of fresh produces. While reviewing agricultural policy papers, the challenge of postharvest loss reduction is not clearly flagged on. This could be due to low level of awareness among the stakeholders acting in local, provincial, and federal governments. Thus, awareness raising on the benefit of postharvest loss reduction should be launched in policy making entities and responsible persons. Not only in the policy level, are the actors involved in postharvest handling are not

realizing its economic loss. Growers would like to sell their all (even small sized, deformed, over matured etc.) to collectors or whole seller but buyer fix price based on the market price of low-quality produces. Losses occurred due to this will add to the subsequent transactions. As a result of that farmers would not get better prices and consumers need to pay more price. In addition to monetary losses, high amount of garbage in wholesale markets and end markets will add the environment challenges. In order to reduce the postharvest losses of fresh produces, awareness in value chain thinking among the chain actors is pivotal.

Postharvest loss assessment using standard methodology: In the context of having very few localized postharvest loss studies in selected crops, Nepal has not yet gone through the systematic loss assessment of fresh produces. The extent of postharvest losses of fresh produces reported so far seems to be crudely estimated. Focused interventions on the priority issues for postharvest loss reduction can only be executed upon carrying out systematic studies. For this, Nepal should go through the Commodity System Assessment Methodology (La Gra et al., 2016).

Dedicated institution for postharvest research and development: The institutional arrangement for postharvest research and development of fresh produces are extremely weak. Postharvest laboratory virtually does not exist with the academia. Abolishment of Directorate of Postharvest Management terminated the legacy of postharvest research and extension under Department and lost the focal entity for the same. The situation of research is not very bright because of its genesis. The mandated research entity for the postharvest research of durables and perishables is the National Food Research Centre under Nepal Agricultural Research Council. Since only food technologists are deputed under the centre, more focus has been paid on processing

aspect emphasizing on cereals and legumes. In the context of not having strong institution under research, education and extension, establishment of a national postharvest center should be initiated. The national centre will also work as knowledge repository. We have been facing the problems to get the information of past efforts because of poor information archiving system.

Separate approach for postharvest technologies rollout: Different actors from farmers to the retailers are involved in the process of postharvest handling of fresh produces. Despite having common goal to minimize the physical and physiological losses, the roles and technologies to be adopted are different for the different actors. Thus, devising technology extension approaches for postharvest loss reduction is not as straightforward as other aspects. It is generally considered that pre-harvest, harvest and grading technologies are related to farmers. In the case of commercial fruit farming, orchard contract out after fruiting is a common practice in Nepal. In this case, the contractor should be the technology recipient for maturity index, harvesting methods, grading and packaging. Considering our socio-economic context, a separate approach should be devised to the extension of postharvest technologies.

Human resource development: Professionals working in postharvest of fresh produces are extremely few in the country. Horticulturists are involving in postharvest interventions on occasional basis, which led to not having abundant number of experts. Erratic involvement of professionals also hindered to develop expertise and insight on the discipline. This situation can be tackled by long-term human resource development planning. For the short run, a consortium of the practitioners working under research, education and extension should be formulated to prioritize the issues and develop intervention approaches.

Formulation and implementation of quality standard: Voluntary quality standard was piloted in few crops by a USAID supported project with the support from Federation of Fruits and Vegetables Entrepreneurs Nepal. Despite indicating better response, it did not last long because of token involvement of government entities. Taking lessons from this intervention, formulation, and implementation of quality standard of fruit and vegetables with government direct involvement seems necessary. Since this take long to implement across the country, this could be initiated with few commodities in the main market like Kalimati with direct involvement of federal government entities.

Small scale processing in production blocks: Fruit and vegetables based micro-level processing plants were established in the production sites in the past. Experiences of establishing these types of processing units are not encouraging. To make the commercial farming returnable, the processing plant should be tied up with the processing of culled produces. Processing tied up with culls further ease to implement the grading and sorting of fruit and vegetables.

Involvement of market intermediary in postharvest loss reduction: Market intermediaries are not regarded as the beneficiaries of agriculture extension. It might be due to major focus on productivity enhancement, where

growers are kept in the centre. But in the case of postharvest handling, market intermediaries are the one, who has major role after assembling for quality maintenance. Thus, involvement of market intermediaries is equally important to consider while designing and implementation of postharvest interventions.

Technology with economic advantages: The multiple actor involvement in postharvest handling of fresh produces needs extension beyond farmers. Except farmers (very few farmers have economic calculations), other chain actors are very much serious on economic advantages of any actions. Thus, to make the new interventions convincing, all technologies should have information of economic advantages.

Value chain thinking for postharvest loss reduction: The supply chain of fresh produces is not being operating in value chain thinking. Rather than supportive and cooperative to the associated actors, all actors try to maximize their profit by taking out of others. Since postharvest quality of fresh produce cannot be improved but only maintained with proper handling, value chain approach is crucial to maximize the profit by the chain actors. A holistic approach with cold chain facility should be the motto of intervention for future to reduce the postharvest losses of fresh produces (Fig 4).

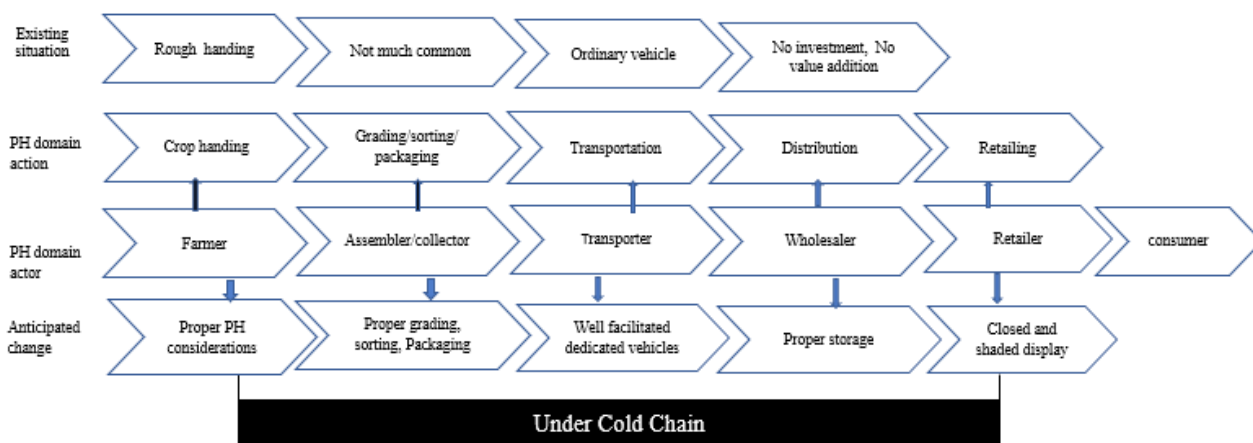


Figure 4. Postharvest loss minimization approach for fresh produces

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