Agri- logistics and Post-harvest Losses of Horticulture – A Study in Kalaburagi, Karnataka

Bondita Saikia
Ph.D. Research Scholar
Central University of Karnataka
Department of Economic Studies and Planning, SBS
Saikiabondita432@gmail.com

Trinadh Nookathoti
Assistant Professor
Central University of Karnataka
Department of Economic Studies and Planning, SBS
trinadhnookathoti@cuk.ac.in

Abstract

The looming global problem of food scarcity is worsened by the persistent increase in the population, with no corresponding increase in agricultural yield. This has, over the years, become a primary focus of most Governments to provide enough food for its teeming population with an optimum value chain. There is a need for greater attention to Post-harvest Losses (PHLs) in addressing the world's food challenges. Why have such significant losses persisted due to continuous undernourishment and hunger? PHLs mitigation is a way to achieve sustainable agriculture. The empirical field study traces the Agri-logistics and PHLs of crops in the Kalaburagi district of Karnataka. The PHLs are estimated by **descriptive statistics.** The findings of the analysis are that the loss due to logistics is more for the farmers compared to the field-level loss.

Keywords: *Food Scarcity, Post-harvest Losses, Hunger, Sustainable Agriculture, Agri-logistics*

Introduction

The problem of Food Security and Hunger - Worldwide

"Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (World Food Summit, 1996). This definition is widely accepted and reinforces the multidimensional nature of food security and includes **availability, adherence to the food supply, accessibility to food, and utilization**. It has enabled policy responses focused on the promotion and recovery of livelihood options. Reduced food production results in food insecurity which leads to when "people do not have adequate physical, social or economic access to food'' (Food and Agriculture Organization, 2003). Globally, the number of food-insecure individuals rose from 804 million in 2016 to 821 million in 2017 (FAO, 2018). 1/3rd of the people in the world, i.e., 2.37 billion, did not have access to adequate food in 2020. After remaining virtually unchanged from 2014 to 2019, the Prevalence of Undernourishment (PoU) climbed to

ISBN: 978-93-83302-57-4

around 9.9 per cent in 2020 from 8.4 per cent in 2019 - an increase of almost 320 million people. Sustainable Development Goals - 2 (SDGs -2) aims at Zero Hunger by 2030 worldwide. Despite some progress, the world is not on track to meeting global nutrition targets. To ensure that these people are adequately fed, insufficient local food supplies are augmented with food aid. There are policy challenges for agricultural research and development to feed over 9.1 billion people with safe food by the year 2050 (Parfitt et al., 2010).

India and Food Security - Hunger

According to the Food and Agriculture Organization,[1] (FAO) estimates in **'The State of Food Security and Nutrition in the World', 2020 report**, 189.2 million people are undernourished in India, i.e., 14 per cent of the population. Also, 51.4 per cent of women of reproductive age between 15 to 49 years are Anemic. Further, according to the report, 34.7 per cent of the children under five in India are stunted, while 20 per cent suffer from wasting, meaning their weight is too low for their height. Malnourished children have a higher risk of death from common illnesses such as Diarrhea, Pneumonia, and Malaria. The Global Hunger Index[2] (GHI) 2020 ranks India at 101 out of 116 countries based on three leading indicators -- prevalence of wasting and stunting in children under 5 years, under 5 child mortality rate, and the proportion of undernourished in the population. In the past decade and a half since India successfully embraced economic reforms, a curious problem has haunted the country and vexed its policymakers: India's high growth has had little impact on food security and the nutrition levels of its population. At the macro level, foodgrain availability in India is calculated as 87.5 per cent of gross production (the rest is estimated as the requirement for seeds, farm animal feed, and waste) plus net imports minus changes in government stocks. Assuming no net change in private stocks, this can be a good proxy for overall foodgrains consumption in the country.

Food Loss and Food Waste

According to the United Nations FAO: "Food loss and waste is the **"decrease in quantity or quality of food".** Food waste is part of food loss and refers to the discarding or alternative (non-food) use of food that is safe and nutritious for human consumption along the entire food supply chain, from primary production to end household consumer level. Some authors distinguish between these two concepts according to the supply chain stage in which the losses occur (Schulze et al., 2016). **Food losses** are defined as loss or damage in early parts of the supply chain, for example, during harvesting, transportation, or storage. Food waste refers to any raw or cooked food mass that is discarded at the retail, catering and consumption stages of the supply chain. The definition of the US Department of Agriculture's Economic Research Service (ERS), "'Food loss represents the amount of edible food that is available for human consumption but is not consumed for any reason; it includes cooking loss and natural shrinkage (e.g., moisture loss); loss from pests, or inadequate climate control…etc. **Food waste** is a component of food loss. It occurs when an

[1] **FAO:** The food and Agriculture Organization (FAO) is an international effort to defeat hunger to achieve food security for all and make sure that people have regular access to enough high-quality food to lead active healthy lives with 95 members – 194 countries and the European Union, FAO in over 130 countries worldwide.

[2] **GHI:** Global Hunger Index (GHI) is a tool designed to comprehensively measure and track hunger at global, regional, and national levels, reflecting multiple dimensions of hunger over.

ISBN: 978-93-83302-57-4

edible item goes unconsumed, such as food discarded by retailers due to undesirable color or blemishes and plate waste dumped by consumers.

Post-Harvest Losses and Food Security

While considerable attention is directed toward increasing food production to meet the world food target, one essential and complementary factor often forgotten is reducing food loss and food waste (Hodges et al., 2011). It is suggested that about one-third of the food produced globally is lost or wasted (FAO–World Bank, 2010), representing a loss of 1.3 billion tons of food annually worldwide. In addition, such losses are estimated to be equivalent to the annual caloric requirement of 48 million people. Based on these reasons, experts and analysts agree that investing in PHLs reduction is an effective intervention for enhancing food security. Reducing food losses, therefore, offers an essential pathway to availing food, alleviating poverty, and improving nutrition. Moreover, reducing PHLs positively impacts the environment and climate as it enhances farm-level productivity and reduces the utilization of production resources or expansion into fragile ecosystems to produce food that will be lost and not consumed (Hodges et al., 2011).

History of PHLs

Interest in PHLs dates back to the first World Food Conference of 1974, which resolved to bring about a 50 per cent reduction by 1985 (Parfitt et al., 2010). Consequently, the FAO established the Special Action Programme for preventing Food Losses in 1977. The initial focus targeted reducing grain losses, but by the early 1980s, the scope was broadened to cover roots and tubers and fresh fruits and vegetables (FAO, 1989). There is, however, no account of progress toward the 1985 PHLs reduction target. Many global food security initiatives and organizations such as the Comprehensive Framework for Action of the United Nations, the High-Level Task Force for Food Security and Nutrition, the World Bank's Global Agriculture and Food Security Program, the Reformed Committee on World Food Security, and the United States Department of Agriculture, have positioned themselves to tackle PHLs. As per an estimate of the Swaminathan Committee (1980), post-harvest handling accounts for 20-30 per cent of the losses at different stages of storage, grading, packing, transport and finally, marketing. According to Chadha (2009), India loses about 35-45 per cent of the harvested fruits and vegetables during handling, storage, transportation…etc. leading to a loss of Rs. 40,000 crores annually. Severe losses occur because of inadequate storage facilities, poor transportation facilities, lack of know-how, poor management and improper market facilities or due to careless handling of the produce by farmers, market intermediaries and consumers (Singh *et al*., 2008).

Developed and developing countries - PHLs

Almost 1/3rd of all food produced is lost before it reaches consumers. Food loss is more severe in developing countries. In contrast, food waste is more potent in developed countries (FAO, 2011). On average, 30-50 per cent of what is produced is lost in the postharvest value chain of horticultural crops in developing countries before it reaches consumers (Kitinoja et al., 2015). When harvested food does not reach consumers, productive resources are wasted, food supplies decrease, and there is extra pressure on scarce natural resources to meet food demand. Efforts to minimize this loss of already-harvested food are as important as efforts to increase the total

ISBN: 978-93-83302-57-4

food supply. Still, almost 95 per cent of agricultural research investments go to the latter, while there is very little investment in loss reduction (Hodges et al., 2010).

Post Harvest Management

The post-harvest management encompasses a sequence of activities and operations that can be divided into two groups- **technical and economic**. The technical activities include harvesting, field drying, threshing, cleaning, additional drying, storage and processing. The economics include transportation, marketing, quality control, nutrition, extension, information and communication, administration and management. Spurgeon (1977) has identified the following twelve stages of the whole post-harvest system, starting right from the harvesting to the consumer education, i.e., harvesting (handling), threshing, drying (transport and distribution), storing, processing – primary processing (cleaning, classification, dehulling, pounding, grinding, packaging, soaking, winnowing, drying, sieving, whitening, milling) secondary processing (mixing, cooking, frying, molding, cutting, extrusion), product evaluation (quality control: standard recipes), packaging (weighing, labeling, sealing), marketing (publicity, selling, distribution), use (recipes elaboration: traditional dishes, new dishes), consumer preferences (product evaluation, consumer elaboration). The entire system encompassing the delivery of the crop from time and place of harvest to the time and place of consumption place of harvest to the time and place of consumption should involve a minimum loss, maximum efficiency, and maximum return for all involved in the post-harvest system. Food loss is a result of infrastructural incapacities, primitive technology, and absence of refrigeration facilities, lack of space and other logistic issues (Khanna, 2016). The causes of food losses and waste in low-income countries are mainly connected to financial, managerial and technical limitations in harvesting techniques, storage and cooling facilities in difficult climatic conditions, infrastructure, packaging and marketing systems (Food and Agriculture Organization, 2011). The main concern of our study is related to the PHLs due to the logistics activities throughout the supply chain from the point of production to the point of consumption, i.e., transportation, storage, material handling, packaging as well as the flow of information and fund. PHLs vary from crop to crop and from region to region. Even for the same crop and same region, PHLs are different from period to period. Empirical studies are related to the PHLs for reasons like insects, climate…etc. There are minimal studies related to PHLs due to ineffective logistics services and no studies in our study area.

Logistics

Agricultural Logistics is the Backbone of Agri-Business Agricultural Marketing is the Brain behind Value Realisation. logistics connects the produce to destination points, where they can conclude the desired transaction. The marketing system, on the other hand, provides information to direct the flow of produce to issues of demand and facilitates the transaction. Marketing is therefore expected to be the brain that ensures production and post-production activities are appropriately market-linked. Market channels are expanded to absorb future production growth. To maintain a demand-linked agenda, an inverse approach is needed to work backward from Fork-to-Farm, to ensure that demand is integrated with the supply side, rather than only selling at a convenient market at available prices or pushing production into storage merely for unplanned and deferred returns. A fork-to-farm approach has to be adopted. The reverse flow of information from markets to farmers would also enable the farmer to make informed decisions about what to call,

ISBN: 978-93-83302-57-4

when to market, and to whom. For connecting with needs, logistics is the backbone and functions to bridge supply to consumption centers. Avoiding food loss in the post-harvest supply chain to increase the saleable quantity of produce is vital to fulfilling this agenda. It also requires integration of the value chain segments that connect fork to farm while providing farmers the options to participate in post-production activities.

National Institution for Transforming India (NITI) Aayog, Government of India, had constituted a Working Group on Crop Husbandry, Agricultural Inputs, Demand and Supply projections, which submitted its reports titled "Demand & Supply Projections Towards 2033 (Crops, Livestock, Fisheries and Agricultural inputs) in 2018. To synchronize the demand and supply, the Department of Agriculture, Cooperation & Farmers Welfare (DAC&FW) has been encouraging diversified production of crops such as pulses, coarse cereals, Nutri cereals, commercial crops, oilseeds…etc. under National Food Security Mission (NFSM). Assistance is being provided for various interventions like different types of demonstrations on the latest crops production technologies, promotion of newly released High Yielding Varieties (HYVs)/Hybrids, climate-resilient varieties/ stress tolerant/bio-fortified varieties, Integrated Nutrient Management (INM) & Integrated Pest Management (IPM) techniques, water conservation devices, improved farm implements/tools and capacity building of farmers…etc., through state governments. Horticultural crops are promoted under the Mission for Integrated Development of Horticulture (MIDH). To maintain the supply chain and support the farmers in selling their perishable produce, the Government has also rolled out a scheme "Creation of Integrated supply chain for Fruits and vegetables in Major cities" during 2020-21. In addition, the Crop Diversification Programme (CDP), a sub-scheme of Rashtriya Krishi Vikas Yojana (RKVY), is being implemented in original green revolution states viz. Punjab, Haryana and western Uttar Pradesh to diversify paddy area towards alternative crops and shift tobacco farming to alternative crops/cropping systems in tobacco growing states. To support organic farming through Paramparagat Krishi Vikas Yojana (PKVY) and to support the creation of a unified national agriculture market to boost farmers' income.

Further, to mitigate risk in the agriculture sector, a scheme, "Pradhan Mantri Fasal Bima Yojana" (PMFBY), was also launched in 2016. The government has taken several steps with adequate budgetary provisions to develop robust and integrated Agri logistics systems in the country for the transportation of agri-produce. The government of India has launched the "Kisan Rath" mobile application to facilitate the Farmers, Farmer's Produce Organisations (FPOs) and Traders in hiring vehicles for the transportation of agri-produce. This mobile application is also integrated with the National Agriculture Market (e-NAM) portal for facilitating load requests of traders registered in the e-NAM portal.

Further, per the details from the Ministry of Railways, Indian Railways have operated 208 Kisan Rail Services on 24 routes for transporting fruits, vegetables and other perishables. Further, to facilitate the storage of perishables, temperature-controlled Perishable Cargo Centres have been established at Nashik, Singur, New Azadpur, Raja Ka Talab/Varanasi, Ghazipur and Fatuha. In addition, cold storage Reefer Park has been developed at Inland Container Depot, Dadri and a cold storage facility have been established at Rai, Sonipat.

ISBN: 978-93-83302-57-4

In addition to the above, as per the information received from the Ministry of Civil Aviation, Government of India, the policy, the regulatory and legal framework has been strengthened through the measures and initiatives envisaged in the National Civil Aviation Policy 2016, the National Air Cargo Policy Outline 2019, and the Krishi Udaan Scheme approved on 10 September 2020. Institutionally, the AAI Cargo Logistics and Allied Services Company Limited (AAICLAS) was set up as a wholly-owned subsidiary of the Airports Authority of India (AAI) in 2016 for business development of air cargo, logistics and allied services at various airports. Airports, including cargo terminals, and cold chain facilities and warehouses, have been included in the harmonized list of Infrastructure for fiscal support. Cold storage facilities are available at 28 airports operated by AAICLAS, besides at every JV airport. The Varanasi cold chain facility has been augmented to a 5 MT capacity for Agri and pharma perishables. The joint venture airports have also been periodically upgrading their capacity. Notably, the world's largest and uniquely segregated Cold Facility for Agri and pharma products was launched at Mumbai Airport on 19 February 2020.

Methodology

Study Area

It is geographically situated in the North part of the state; it lies between North latitudes 17°10 and 17°45 and between East longitudes 76° and 77°. This district is the second biggest district (Area wise) in the state, covering 8.49 per cent of the area and 5.9 per cent population. It shares its boundary in the East with the Medak and Mehabubnagar Districts of Andhra Pradesh, West with the Vijaypur district of Karnataka state and Solapur district of Maharashtra state, and North boundary with Bidar districts of Karnataka state, and Osamanabad district of Maharashtra state. South with Yadgir district of Karnataka state consists of seven taluka, namely Afzalpur, Aland, Chincholi, Chitapur, Gulbarga, Jewargi, Sedam and 10 sub-urban areas. The geographical area of the district is 10954 Square Kilometers (SQ KM), the Population density is 234 and the total population is 2566326 (Census 2011). The projected population for 2022 is 3080566. The Gross District Domestic Product of Kalaburagi at current prices (2018-19) is 3176440 and constant prices (Base year 2011-12) is 2215676 (Kalaburagi – Statistical Report, 2020).

Sample Selection

Multistage and Random sampling is used to select the samples. The study uses a structured schedule to collect data. Field study locations were selected from North-east Karnataka, i.e., the Kalyana- Karnataka (HK) region of Karnataka. This region is chosen because this is the most backward region of Karnataka. A resolution to make special provisions for the Hyderabad-Karnataka Region was passed by the Legislative Assembly and Legislative Council of Karnataka in March 2012. The resolution aims to establish an institutional mechanism to develop the region and promote inclusive growth. In the first stage, the district of Kalaburagi is selected. In Kalaburagi, there 11 Taluka. In the second stage of the 11 Taluka, one Taluka is set, i.e., Aland, because Aland is the biggest based on VA Circle (47), Hoblies (5), Grama Panchayats (42) and total villages (120 inhabited + 1 uninhabited). In the third stage, two panchayats are selected, i.e., Kadaganchi and Patton. The two villages, i.e., Kadaganchi and Patton, are selected in the fourth stage. The sample for the study is the household farmer who directly sells Onions soon after harvesting and the farmers who store their products to sell later. The crop Onion under the

ISBN: 978-93-83302-57-4

vegetables is determined based on the area and production and importance of the produce in Aland.

Materials and Method

The sources of the secondary data are the Directorate of Economics and Statistics, Department of Agriculture and Horticulture, Government of Karnataka, and India; Various issues of Statistical Handbook, Karnataka; National Horticulture Board; various issues of Economic Survey…etc. Secondary data were mainly on the area, production, and productivity of the crops in India, Karnataka and the study area.

Data from the field study was collected about the infrastructural facilities in the village, general family background, and land use patterns. Information related to the broad family background includes the family size, caste, occupation, age, and educational status of the family members. The information related to the mode of transportation, system and duration of storage, packaging, marketing, losses during post-harvest operations…etc. was collected. Further, the schedule is included information on quantity purchased, mode of transport, storage and purchase and portion marketed…etc. The data was collected in August and September 2022. The reference period for the field study is 2021.

Methods

The PHL losses are estimated by tabular, percentage, and averages. The losses due to the lack of inefficient logistics services are shown as a percentage share of all the factors contributing to the PHLs. Calculation of the monetary value of post-harvest losses **(Monetary value of weight loss plus the economic value of quality loss) is** done by the following formula -

A = Quantity traded x % weight loss / 100 x P_1 (P_1 = Price without quality loss)

B = Quantity traded x % sold at price P_2 / 100 x ($P_1 - P_2$) (P_2 = Price after quality loss)

Total loss = A + B

Discussion

A. Status of Agriculture in Kalaburagi

Kalburagi district is a predominantly agrarian district rainfed agriculture is the primary occupation of the majority population except for a few cement industries, the district trailing in industrialization. Hence people are forced to bank upon agriculture for their livelihood. Per records of the 2011 census, 20.26 per cent of the total working population of the district are cultivators and 38.2 per cent are agricultural Laborers. The Net Sown Area (NSA)[3] of the district is 1156.7 ('000 Hectares), the Area sown more than once is 268.9 ('000 Hectares), Gross Cropped Area (GCA) is 1425.6 ('000 Hectares) and the cropping intensity is 123.2 per cent. 35 per cent of the soil is deep black clayey soils and 34 per cent is shallow mixed black clayey and loamy soils. The major crops of the region are Paddy, Jowar, Bajra, Maize, Ragi, Vegetables, and other Horticultural crops…etc. Water is a scarce input & it is intended to store every raindrop in sites

[3] **Net Sown Area:** The physical area of land on which crops are sown and harvested.

ISBN: 978-93-83302-57-4

in the profile. And collect inevitable runoff in water roosting structures & recycle the same to crops under distress conditions by adopting conservation irrigation methods, i.e., by using sprinkler/ drip irrigation units. These units are supplied to farmers on subsidy. Agriculture land & the topsoil are significantly limited input endowed by nature. The land holding profile of the farmers is given below in the table-

Table 1: MARGINAL AGRICULTURAL LAND HOLDER (Below 1 hectare)
(Unit: Area = Hectare)
Panel (a)

SL. No	Regions	Numbers	Area	Percentage to the Total Land Holders
1	Aland	14241	8816.54	22.876
2	Kalaburagi	106374	60698.77	25.222
SMALL AGRICULTURAL LAND HOLDERS (1-2 Hectares) Panel (b)				
SL. No	**Region**	**Numbers**	**Area**	**Percentage to the Total Land Holders**
1	Aland	23820	34954.4	38.26
2	Kalaburagi	154013	223449.21	36.52
MEDIUM AGRICULTURAL LAND HOLDERS (4-10 Hectares) Panel (c)				
SL. No.	**Region**	**Numbers**	**Area**	**Percentage to the Total Land Holders**
1	Aland	6976	40419.88	11.21
2	Kalaburagi	43871	250641.58	10.4
LARGE AGRICULTURAL LAND HOLDERS (More than 10 Hectares) Panel (d)				
Sl. No.	**Region**	**Numbers**	**Area**	**Percentage to the Total Land Holders**
1	Aland	985	13497.31	1.58
2	Kalaburagi	5681	78423.83	1.35
Source: District at a Glance – Kalburgi – Statistical Report – FY 2020-21				

The area in the district of Kalaburagi in 2020 under the marginal landholders, small landholders medium landholders and large landholders are 223449.21 hectares, 223449.21hectares, 250641.58 hectares and 78423.83 hectares respectively. The cold storage facilities for horticulture crops in Kalaburagi district in 2019-20 is 2 and the capacity is 9799 Tones. Both cold storage facilities are available in Gulbarga, Kalaburagi.

ISBN: 978-93-83302-57-4

B. Area, Production of Horticulture in Karnataka - Kalaburagi

India is known as the fruit and vegetable basket of the world. It is the second largest producer of overall fruits and vegetable production in the world, after China. As per National Horticulture Database (Second Advance Estimates) published by National Horticulture Board, during 2020-21, India produced 102.48 Million Metric Tonnes (MMT) of fruits and 200.45 MMT of vegetables. The area under cultivation of fruits stood at 9.6 Million Hectares (MH), while vegetables were cultivated at 10.86 MH. According to Food and Agriculture Organization (FAO, 2020), India is the largest producer of Ginger and Okra among vegetables and ranks second in the production of Potatoes, Onions, Cauliflowers, Brinjal, Cabbages…etc. Amongst fruits, the country ranks first in the production of Bananas, i.e., 26.29 per cent, Papayas, i.e., 43.26 per cent and Mangoes (including Mangosteens and Guavas), i.e., 45.14 per cent (APEDA, 2022). Revenue in the Vegetable segment amounts to US $ 87.81 Billion in 2022.

India can become a significant exporter of horticulture produce if it reduces its high delivery costs and improves weak standards and assessment mechanisms at home. A new World Bank report, ''From Competition At Home to Competing Abroad: A Case Study of India's horticulture,'' examines the paradox that while India is a large, low-cost agricultural producer, its share in global agriculture exports is minuscule. India produces nearly 11 per cent of all the world's vegetables and 15 per cent of all fruits, yet its share in global exports of vegetables is only 1.7 per cent and in fruits a meager 0.5 per cent.

The market is expected to grow annually by 8.72 per cent (CAGR 2022-2027). In global comparison, most revenue is generated in China (US$131.50bn in 2022). Concerning total population figures, per-person revenues of US $ 62.43 will be developed in 2022. In the Vegetable segment, volume is expected to amount to 125,044.7 Million Kilograms by 2027. The Vegetable segment is expected to show a volume growth of 6.3 per cent in 2023. The average volume per person in the Vegetable segment is expected to amount to 70.8 KG in 2022. The Vegetable segment contains fresh, frozen, and processed vegetables. The Fresh Vegetable segment includes the following subsegments: Tomatoes, Potatoes, Leafy Vegetables, Cabbage Vegetables, Onions, Root Vegetables & Mushrooms, and Other Fresh Vegetables such as Pumpkins, Eggplants, Zucchinis, Cucumbers, Paprikas, Bamboo Shots, Legumes, and other vegetables. The Processed Vegetable segment covers dried and canned as well as frozen vegetables.

Most of the onion produced in India comes from Maharashtra, Gujarat, Uttar Pradesh and Karnataka. However, onion is also grown in Orissa, Tamil Nadu, Madhya Pradesh, Andhra Pradesh and Bihar. Karnataka state accounted for 20 per cent area and 13 per cent total output of onion in the country. In Karnataka, north Karnataka accounts for the bulk of the total onion production and Hubli and Belgaum are the biggest onion markets. The onion produced in North Karnataka is distributed throughout the country. The bulk of the onion exported from India also originates from North Karnataka. Though there is great potential for the state of Karnataka in the cultivation of onion crops, formers often incur losses due to low prices, lack of market outlets, and other infrastructure and services in the marketing system. In Domestic Onion marketing following four important marketing channels have been identified -

ISBN: 978-93-83302-57-4

Channel I: Producer-seller ---- Village merchant ----Wholesaler ----Retailer----Consumer
Channel II: Producer----seller----Commission agent ----Wholesaler ---- Retailer---- Consumer
Channel III: Producer-seller----Commission agent-cum-Wholesaler - Retailer ---- Consumer
Channel IV: Producer-seller---- Consumer

However, Marketing channel IV is not famous among onion growers, as only 2 to 5 per cent of them market their products through this channel. The village merchant plays a significant role in moving the product from the village to the market, mainly smaller lots of produce by the farmers. Therefore, considering the role of village merchants, especially in handling small lots of small and marginal vegetable growers, it is essential to encourage the village merchants to link production centers with the wholesale markets of vegetables. It is also essential to bring the transactions under regulation to a proper licensing system. Alternatively, farmer's markets may be developed in line with Ryath Bazar/Apni mandi to get the farmers in direct transactions with the consumers to benefit both producers and consumers.

Table 2: Horticultural Area in Karnataka State during 2020-21
Unit: Area = Hectare

SL. No.	Item	Regions	
		Kalaburagi	Karnataka
1	Geographical Area	1094120	19050068
2	Cultivable Area	956325	12845986
3	Net Area Sown	889797	11453300
4	Area under Horticultural Crops	24812	2620535
5	Percentage of Area under Horticultural Crops to Geographical Area	2.27	13.76
6	Percentage of Horticultural Cropped Area to Cultivable Area	2.59	20.40
7	Percentage of Horticultural Cropped Area to Net Area Sown	2.79	22.88

Source: Department of Horticulture, Government of Karnataka, 2022

Table 2 shows that the geographical area of Kalaburagi in 2020 is 1094120 hectares. The Area under Horticultural Crops is 24812 hectares i.e., 2.27 per cent. The cultivable area in Kalaburagi is 956325 hectares out of 2.59 per cent is covered in Kalaburagi. And Net Sown Area in Kalaburagi is 889797 hectares. The percentage of NAS covered in Kalaburagi is 2.79 per cent.

ISBN: 978-93-83302-57-4

Table 3: Total Area, Production, Yield and Value of Horticultural Crops in Karnataka State - 2020-21					
Unit: Area =Hectares; Production = Million Tonnes; Yield = M.Tons / Hectare; Value = Rs. in Lakhs					
Panel (a)					
Sl. No.	**Regions**	**Area**	**Production**	**Yield**	**Value**
1	Kalaburagi	24812	439403	17.71	109290
2	Karnataka	2620535	24150226	9.22	6626280
Total Area, Production, and Value of Vegetable Crops in Karnataka State - 2020-21					
Panel (b)					
Sl. No.	Regions	Area	Production	Value	
1	Kalaburagi	14353	254181	54334	
2	Karnataka	521183	10884759	1511903	
Area, Production, Yield and Value of Onion in Karnataka State – 2020-21					
Panel (c)					
Sl. No	Regions	Area	Production	Value	
1	Kalaburagi	5284	102961	20592	
2	Karnataka	247942	4417725	600062	
Source: Department of Horticulture, Government of Karnataka, 2022					

Table 3 shows the production of the horticulture crops in Kalaburagi is 439403 million tonnes which is worth 109290 lakh. The contribution of Vegetables to the total production of horticulture is 254181 million tonnes which are worth 54334 lakh. Whereas the contribution of Onion production is 102961 million tonnes and worth 20592 lakh.

C. Post–Harvest Losses of Vegetable

Despite the remarkable progress made in increasing food production at the global level, approximately half of the population in the Third World does not have access to adequate food supplies. There are many reasons for this, one of which is food losses occurring in the post-harvest and marketing system. Evidence suggests that these losses tend to be highest in those countries where the need for food is most significant. Both quantitative and qualitative food losses of extremely variable magnitude occur at all stages in the post-harvest system (FAO)**.** The post-harvest losses reduce the availability of fruits and increase per unit cost of production & marketing. This affects the producers (reduction in share in consumer's price) & consumers (reduced availability & higher prices). The vegetables are transported to different markets by road for quicker delivery, using CFB & wooden boxes as packaging material. The unscientific post-harvest management, lack of storage facilities & poor handling of vegetables result in substantial losses during the transit to the various markets. The vegetables wasted in transit from orchards to consumers represent a significant loss. The quantum of loss is governed by factors like perishable nature, method of harvesting & packaging, transportation…etc. Onion being a vegetable crop; the postharvest losses are significant in terms of quantity & economic value.

Karnataka's soil, climate, water and other resources are congenial for horticulture development. The importance given to the cultivation of horticulture in the state has led to an

increase in production. Of the total production of horticulture produce, 30 to 35 per cent of the crop is being lost due to post-harvest losses. Karnataka Horticulture Federation was

Results

The major marketing channel of Onion in Kalaburagi can be categorized as under

Channel I: Producer (seller) ---- Village merchant ----Wholesaler ----Retailer----Consumer
Channel II: Producer (seller) ----Commission agent ----Wholesaler ---- Retailer---- Consumer
Channel III: Producer (seller) ----Commission agent-cum-Wholesaler - Retailer ---- Consumer

However, the major marketing channel of Onion in the selected villages is different. As per the information from the field study, the major marketing channel of Onion is under-

Channel I: Producer (seller)----Wholesaler ----Retailer----Consumer
Channel II: Producer (seller) ----Commission agent-cum-Wholesaler - Retailer ---- Consumer

Table 4: Details of the Items
Unit: Land =Acre; Output = Q; Price = Rs.

SL. No.	Land	Crop	Output	Storage	Sale After Storage	Price per Quintal	Sale Before Storage	Price per Quintal
1	1	Onion	120	100	83.85	20	17.55	15

Source: Author's Field Study, 2022

The farmers cultivate Onions two times annually. To avoid loss due to rain and weather the farmers sell Onions during rainy seasons soon after harvesting the crop. The farmers store Onion in summer to earn more money from the selling of the crop.

Table 5: Post-harvest Losses Per Acre of Land
Unit: Quantity = Q

Particulars	Quantity	Percentage
Output	120	100
Loss in the field	2.4	2
Loss During Transportation and Packaging	0.150	0.1
Loss During Storage	16	13.4
Sale after storage	83.85	69.87
Sale before storage	17.55	14.63

Source: Author's Field Study, 2022

The storage of the crop for a better price leads to weight loss. Table 4 and 5 states that this weight loss is due to the lack of proper storage facilities in the region. The study shows that the output of Onion per acre is 120 quintals. On average farmers store 100 quintals of Onion for a better price. The price of Onion before storage is Rs. 15 whereas the price after storage is Rs. 20. The loss in the field after harvesting is an average of 2.4 quintals i.e., 2 per cent per acre. The transportation and packing loss average 15 kg per acre. The weight loss due to the storage is 16

ISBN: 978-93-83302-57-4

quintals i.e., 13 per cent per acre of land. In Onion cultivation, there is only quantitative loss i.e., in terms of quality and no quality loss. The monetary loss of Onions is around Rs. 40,000 per acre of land. The logistics loss of the farmer is around Rs. 34,000. This can be understood as follows – after harvest, the loss due to the lack of inefficient logistics is compared to other factors.

Outlook and Conclusion

The looming global problem of food scarcity is worsened by the persistent increase in the population, with no corresponding increase in agricultural yield. This has, over the years, become a primary focus of most Governments to provide enough food for its teeming population with an optimum value chain. There is a need for greater attention to Post-harvest Losses (PHLs) in addressing the world's food challenges. Mitigation of PHL will lead to the minimization of food loss throughout the supply chain and hence lead to the development of the economy. In the era of modern technologies and changing world trade environment, is evident to increase in per hectare yield of horticulture produce. In this context, it is necessary to establish infrastructures for post-harvest management and market facilities for horticulture crops. It is essential to develop marketing facilities and provide remunerative prices for the horticulture produce than just production technology.

References

Hodges, R. J., Buzby, J. C., & Bennett, B. (2011). Postharvest losses and waste in developed and less developed countries: Opportunities to improve resource use. Journal of Agricultural Science, 149(S1), 37–45. https://doi.org/10.1017/S0021859610000936

Sharma, G. & Singh, S. P. (2011). Economic Analysis of Post-harvest Losses in Marketing of Vegetables in Uttarakhand. Agricultural Economics Review, 24, 309-315. https://www.researchgate.net/publication/227365154

Parfitt, J., Barthel, M., & MacNaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1554), 3065–3081. https://doi.org/10.1098/rstb.2010.0126

Food losses and waste in the context of sustainable food systems (2014). A report by The High-Level Panel of Experts on Food Security and Nutrition. www.fao.org/cfs/cfs-hope

Kafa, N., & Jaegler, A. (2021). Food losses and waste quantification in supply chains: a systematic literature review. British Food Journal. Emerald Group Holdings Ltd. https://doi.org/10.1108/BFJ-09-2020-0879.

The state of food Security and Nutrition in the World, 2021 - Food - the United Nations

https://www.fao.org/state-of-food-security-nutrition

Saxena, N. C. (2018). Hunger, Undernutrition and Food Security in India. Poverty, Chronic Poverty and Poverty Dynamics. https://www.indiafoodbanking.org/hunger.

ISBN: 978-93-83302-57-4