

Value Chain Mapping of Carrots: The Case of Negros Oriental, Philippines

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Abstract — Carrot production and postharvest operations are mostly done manually contributing to high production costs. Farmers expressed the need to mechanize planting and harvesting in order to improve efficiency. Each actor in the value chain plays a vital role in the proper functioning of the chain. Farmers are responsible for cultivating and harvesting the carrots, ensuring the initial quality of the produce. Traders, wholesalers, and retailers then handle the carrots' distribution, marketing, and disposal making them available to consumers and other end-users. The problems faced by the industry are related to environment and economics. Lack of continuous water supply and pest outbreaks can significantly affect crop productivity. On the economic side, farmers grapple with high input costs, such as fertilizers, pesticides, and labor. The fluctuating prices of these inputs can strain farmers' financial resources, making it challenging to sustain their operations. Furthermore, market prices for carrots can be volatile, influenced by factors such as supply and demand dynamics, high transportation costs, and competition from other regions. These economic problems can lead to reduced profitability of farmers which often results to decreased supply.

Keywords— carrots, value chain analysis, postharvest handling system, postharvest losses.

I. INTRODUCTION

Carrot (*Daucus carota* L.) is an important vegetable in the Philippines. It is known for its high vitamin A content. It is usually cooked with other vegetables such as cabbage, cauliflower, and baby corn. It can be eaten raw or cooked and served as attractive garnishes and appetizers in the form of sticks and curls. Carrots can be juiced, baked into cakes, or made into jam or wine. In 2023, The total area planted to carrots in the Philippines was 4,822.49 hectares with a total production of 59,979.07 MT. The top three producing provinces of carrots are Benguet, Mountain Province, and Negros Oriental (psa.gov.ph).

The High Value Crops Development Program (HVCDP) is a key initiative by the Department of Agriculture (DA) in the Philippines. Its objective is to ensure food security, reduce poverty and promote sustainable growth. The program focuses on producing, processing, and marketing. By doing so, HVCDP seeks to increase farmers' income, create livelihood opportunities, and contribute to the overall agricultural development of the country (High Value Crops Development Program).

To enhance global competitiveness, the Philippines prioritize the cultivation of high-value crops and accelerate the development of its agro-industry. The Department of Agriculture has identified carrots as one of the important high

value crops. However, the development of economic activities related to this crop is often hindered by inappropriate interventions and technologies. Researchers lack sufficient knowledge about the types of interventions or technologies that need to be developed and program planners do not have concrete information on the kind of support they should provide to farmers and other stakeholders.

This study intends to generate information on carrot value chain to serve as guide in identifying the appropriate interventions to improve the industry. Specifically, it aimed to: 1) determine the production and postharvest handling system of carrots; 2) describe the market chain and actors involved in the commodity chain; and 3) identify challenges facing the industry.

II. METHODOLOGY

The research framework of the study

Figure 1 presents the research framework based on the concept of value chain analysis (ASIADHRA, 2008). The study identified the various actors in the value chain specifying their roles in every activity in the crop's chain from production to postharvest activities, the flow of commodity from farm to market, problems, and challenges within the carrot industry. To gather the information, the study utilized a multi-method approach. Primary data were established through focus group discussion (FGD), personal interviews, key informant interviews (KII), and consultation workshops. The survey respondents included farmers, traders and other stakeholders. Secondary data were gathered from government publications, websites, books, journal articles, and internal records were reviewed to validate the research findings. These methods provided a comprehensive understanding of the carrot value chain, ensuring the inclusion of diverse perspectives and accuracy of data.

Farmer respondents were randomly selected and invited by the Office of the Municipal Agriculturist and barangay officials to participate in the interviews. The farmers were organized into groups of 5-6 respondents in order to facilitate a structured discussion. During these group sessions, a facilitator used a guided questionnaire to gather detailed information from the farmers. One staff member was specifically assigned to record the information provided. If any responses were unclear or ambiguous, further validation was sought through key informant interviews with agricultural technicians to ensure the accuracy and reliability of the data

collected. In addition to the group interviews with farmers, individual interviews were also carried out to gain a broader perspective on the carrot value chain. These one-on-one sessions included farmers, traders, local government staff, and other stakeholders involved in the carrot industry. This comprehensive approach ensured that diverse viewpoints were considered and that the data collected covered all aspects of the value chain, providing a holistic understanding of the industry dynamics. The findings of this study provide insights into carrot production and post-harvest handling, the marketing chain, the participants in the commodity chain and the challenges facing the industry.

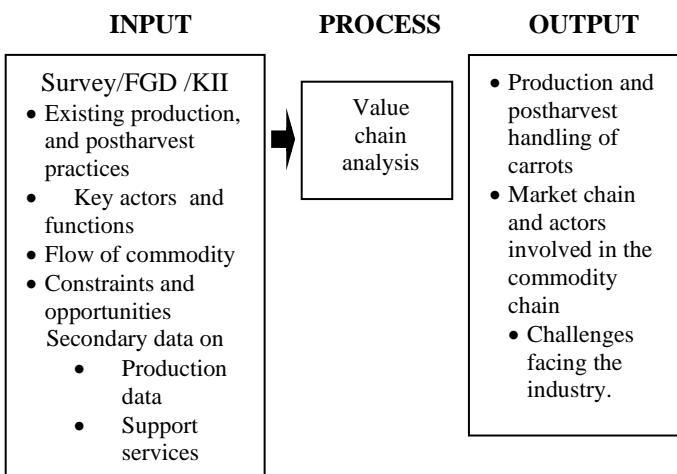


Figure 1. Research framework of the study

Methods of Analysis

The study employed descriptive analysis and used the Statistical Package for the Social Sciences (SPSS) in the processing and analysis of data.

III. RESULTS AND DISCUSSION

3.1 Description of Study Areas

Negros Oriental is located in the Central Visayas region and its capital is Dumaguete. Major crops grown are palay, corn, sugarcane, coconut, banana, and cassava. Vegetables grown are tomatoes, broccoli, cauliflower, carrots, and pechay. The major growing areas of carrots in the province are Canlaon City, Siaton, and Guihulngan City.

Canlaon City is situated on the eastern side of Mt. Canlaon in the province of Negros Oriental. Commonly grown crops include rice, cut flowers, and various crops like potatoes, cauliflower, broccoli, carrots, ginger, and spring onions (<http://canlaonciv.gov.ph>). Guihulngan is a coastal component city in the province of Negros Oriental. It is an agricultural economy and the main industries are the production of sugar cane, copra, corn, rice soybeans, tobacco, and carrots (<https://www.philatlas.com/visayas/r07/negros-oriental/guihulngan.html>). Siaton is a coastal municipality in the province of Negros Oriental. The natives produce a great number of food crops which includes rice (the main farm product), corn cassava, coconuts, sweet potatoes, mangoes, carrots blackberries, and siriguelas (<https://www.philatlas.com/visayas/r07>).

3.2 Farmer and Farm Profile

Most of the farmers interviewed were between 47 and 59 years old. Respondents were evenly distributed, with 50.6 percent women and 49.4 percent men. Around 59 percent and 14.2 percent had attained elementary and high school education respectively. In addition, 2.4 percent had a college degree while 8.4 percent were college students.

Majority of the farmers in Negros Oriental were dependent on farming as their major source of income. Other sources of livelihood were employment, vegetable trading, and sari-sari stores. Carrot production in Negros Oriental is relatively new compared to other major producing areas like Benguet and Davao del Sur. Large majority of the farmers have less than 10 years of experience in carrot farming and own the land they till while others were tenants and renting the land. In terms of hectarage, most of the farmers in Negros Oriental owned .01-3.00 hectares and the area planted for carrots is about 0.46 hectare or 4,600 square meters on the average.

3.3 Postproduction and Postharvest practices

Production practices

The production practices cover land preparation, crop establishment, irrigation, planting, fertilization, weeding, and application of chemicals:

Land preparation. Land preparation is done by deep plowing, harrowing, and then leveling the soil. Carrots require well-pulverized soil to allow better root penetration. After land preparation, furrows or canals are usually constructed around the area for drainage purposes.

Crop establishment. A hectare of carrots would require 6 to 8 kg seeds. The seeds are distributed uniformly in furrows and covered with fine soil of about two (2) cm thick. The emergence of seeds will take about two (2) weeks from sowing.

Irrigation. The carrot is watered after planting, twice to three times a week. Sprinkler is used by most farmers to maintain the water requirement of carrots. Frequent irrigation is required up to the vegetative stage. With regards to the source of water for their farm, farmers were dependent on rain as their source of water and only a few have access to communal irrigation.

Planting. Seeds are broadcasted to the soil and aligned per soil bed. Typically, a hectare of land requires 6 to 8 kilograms of seeds. Varieties of carrots planted were Terracotta and Takiis, New Kuroda. Their choices of varieties were dependent on yield, shape, and size. Planting season is dependent on the type of climate prevalent in the area. Negros Oriental has two types of climate namely: Type I and Type II. Type I climate has two pronounced seasons, dry from November to April and wet from May to October in parts of the province. Type II climate has no dry season with maximum rain from December to February. Minimum rainfall is from March to May for the northern part of the province. Farmers plant carrots throughout the year but most of the farmers plant carrots in January, June, and October due to the favorable weather conditions for carrot production. The planting of carrots is distributed throughout the year.

Fertilizer application. Fertilizers are applied to farms to increase soil fertility and availability of nutrients needed by the crop to attain good yield. Application of fertilizers varies from 2 to 5 times for the whole cropping season, depending on soil fertility and farm budget.

Weeding. The majority of farmers use herbicides to eliminate weeds in the production area. Manual weeding on their carrot farms is also done 1 to 4 times for the whole season.

Application of chemicals. Chemicals are used in the fields to prevent and control weed growth as well as insect and disease infestations. Other than manual removal of weeds, farmers (98.6%) applied herbicide to prevent and or eliminate the weeds.

Postproduction practices

The postproduction practices comprised of harvesting, hauling, cleaning, and packaging:

Harvesting

Carrots are harvested between 5:00 a.m. to 8:00 a.m. There are three major indicators used by farmers when to harvest. These are maturity, size, and market price. The majority of farmers used maturity index as an indicator of the time of harvest which is 100 to 120 days after planting. Carrots are individually pulled by bare hands while others use sticks to dig the soil and carrots are being uprooted.

Hauling. Harvested carrots are placed in wooden crates or clean sacks. It is immediately delivered to the trading post or market. The most common mode of transporting the produce from the farm to the market is using jeepneys or trucks. The hauling vehicle is parked beside the farm for easy hauling.

Cleaning. Cleaning of carrots involves thorough process to ensure they are free from dirt and ready for packaging. First, the carrots are soaked in a plastic drum filled with water, which helps to loosen any soil clinging to their surfaces. After soaking, they are carefully brushed to remove any remaining soil. Once cleaned, the carrots are air-dried to eliminate excess moisture. Finally, they are placed in transparent plastic packaging. In some areas of Negros Oriental, leaf pruning is practiced. This practice involves removing the leafy tops of the carrots, which not only enhances their appearance but also extends their shelf life.

Packaging. Most of the carrots are carefully packed in polyethylene plastic bags or sacks which protect during transportation.

Hauling to final market: Normally hauling is carried out by traders to the final market by truck.

3.4 Value chain mapping

The carrot value chain encompasses the various segments or functions in which different types of actors are involved, spanning from the provision of inputs to the marketing of produce (Figure 2). At the initial stage, farmers cultivate the carrots, leveraging inputs to produce quality crops. Input suppliers play a critical role by providing essential materials such as seeds, fertilizers, and pesticides. The harvested carrots are then sold to traders, who facilitate the movement of produce from the farms to broader markets. Wholesalers and retailers are the subsequent actors, responsible for distributing

the carrots to end consumers, ensuring that the produce reaches local markets and other retail outlets.

In addition to these primary actors, several enablers support and facilitate the efficiency and effectiveness of the carrot value chain. The Department of Agriculture plays a pivotal role by implementing policies, providing technical assistance, and ensuring compliance with agricultural standards. Local government units (LGUs) offer additional support through infrastructure development, regulatory oversight, and local market facilitation. Trucking services are also crucial enablers, providing the necessary logistics to transport the produce from farms to markets, ensuring timely delivery and maintaining the quality of the carrots throughout the supply chain.

3.5. Key actors and functions:

The roles of the different market chain actors are vital in the development of the carrot industry. Hereunder are their respective functions and activities:

Farmers. They are engaged in carrot production, postharvest management, and marketing of crops. They provide funds for the purchase of seed, fertilizer and pesticides, care, and maintenance of the crop. Assume responsibility for the cost of harvesting, sorting, hauling, and delivery to market. Farmers are supported by: 1) financiers/informal lenders; 2) local government units that provide seeds, training, and extension support; 3) the Department of Agriculture that provides irrigation facilities and training; and 4) input suppliers that provide seeds and set up demo farms.

Input Suppliers. Agricultural supply stores are the main source of farm inputs. They supply seeds, fertilizers, pesticides, and plastic mulch. Some of the input suppliers are seed companies, agri-input suppliers, traders, and farmers' associations. Department of Agriculture and local government also provide free seeds to the farmers.

Financers. They provide inputs and cash to the farmers. They buy the produce or negotiate with wholesalers. They are supported by traders and banks for their working capital.

Agent/Middlemen. Agents/Middlemen source carrots from farmers and negotiate with traders for their purchase. Traders provide them with incentives for facilitating the transactions.

Traders. They sometimes provide financial support to farmers. They engage in buying and selling carrots; rent bodegas/stalls, purchase carrots from farmers and pay for: the hauling of carrots.

Wholesaler. Purchase large quantities of carrots from farmers or through an agent and provincial traders. Purchased carrots are sold to processors or retailers. Payment of carrots is done either in cash or online payment. They hire laborers to sort and wash carrots every day or when necessary.

Retailers: Sell carrots directly to consumers through various outlets such as supermarkets, grocery stores, and farmers' markets. They rent stalls in local markets.

Service providers: Ensure the carrots move efficiently from farms to markets. They provide trucking services.

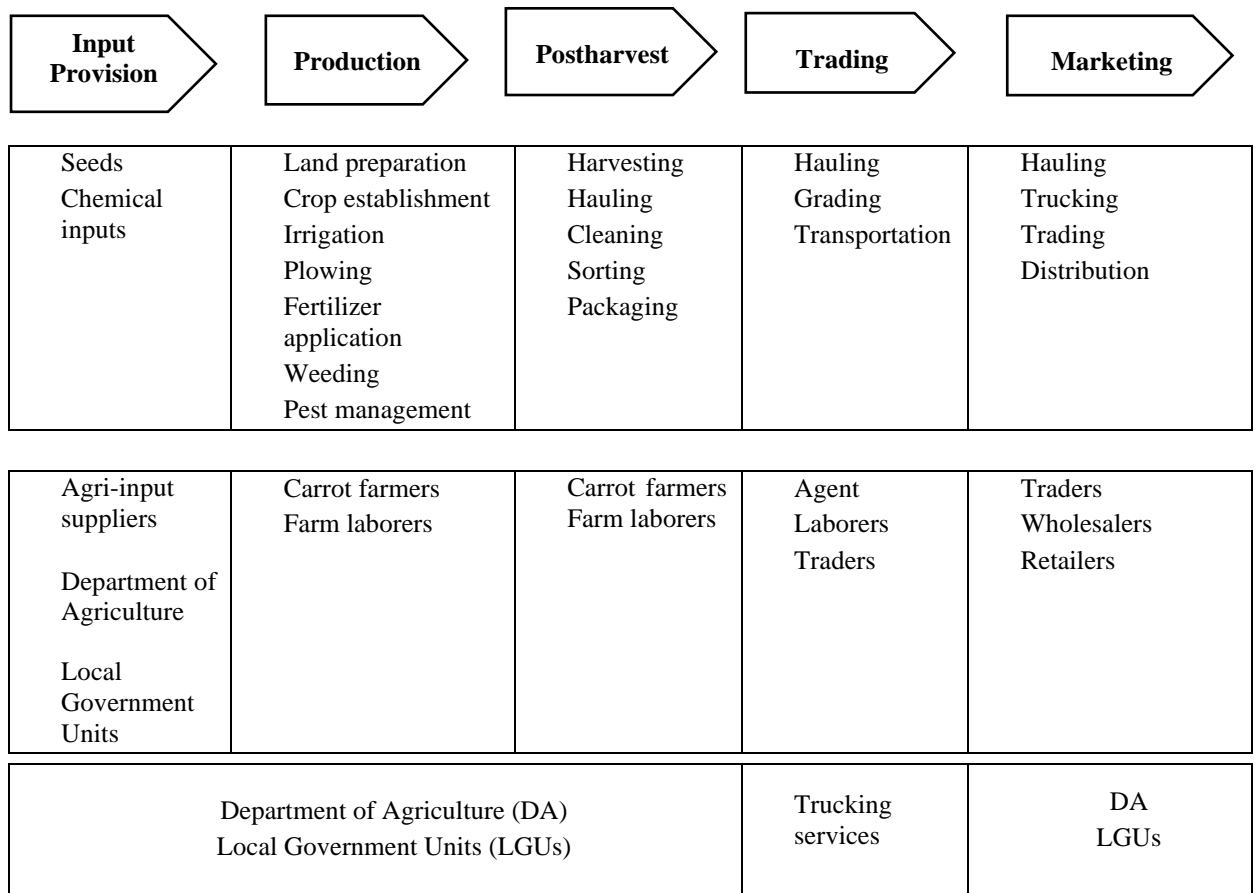


Figure 2. Value chain mapping

Source: KII with carrot farmers, Negros Oriental 2020

3.6 Flow of Carrots from Farm to Market

The flow of carrots from farm to market in three (3) major producing areas in Negros Oriental are presented:

Canlaon, Negros Oriental

There are two trading centers of vegetables in Canlaon City, namely: Uptown Market Canlaon and Malusog Trading Post. Five (5) major players are involved in marketing carrots namely: 1) farmers; 2) traders; 3) wholesalers; 4) retailers and 5) institutional buyers. These traders are based either in the province or neighboring areas. They negotiate with agents who are familiar with the areas and farmers planting carrots. They act as intermediaries who buy and sell carrots. Traders interact with farmers, wholesalers, and retailers. Marketing transaction usually starts early in the morning at 5:00 a.m. and ends at 4:00 p.m. Carrots purchased are placed in plastic bags or carton boxes to protect the carrot from bruising and transported using wing van trucks to Bacolod and cargo ships to Iloilo and Cebu.

Farmers dispose their produce to local markets, Uptown Market, and Malusog Trading Post wherein major trading of carrots is carried out. As shown in Figure 3, traders and wholesalers purchased 80 percent of carrots produced in Canlaon City and transported them to Bacolod (40%), Iloilo (40%), and Cebu (20%). Wholesalers sell carrots to institutional buyers and retailers in various areas where they

distribute the carrots. The remaining 20 percent of the local production was retained in the local markets. Buyers of these carrots include schools, universities, restaurants, hospitals, fast food chains, and households.

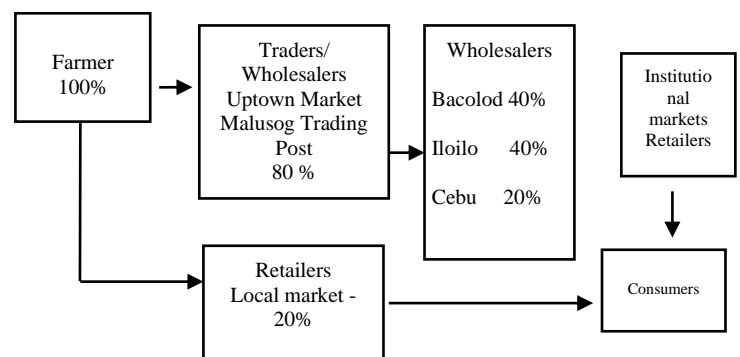


Figure 3. The flow of carrots from farm to market, Canlaon City, Negros Oriental (2019)

Sources: FGD and KII among carrot farmers and other traders

Siaton, Negros Oriental

Most of the carrots produced in Siaton are traded in the public market. It serves as a trading center for vegetables in the municipality. Wholesalers shipped 80 percent of purchased carrots to Dumaguete City, Negros Oriental and Cebu.

Dumaguete is the capital city of Negros Oriental and serves as a significant market for carrots. It has a vibrant business sector with numerous establishments ranging from local shops and markets to modern shopping centers and restaurants. It is home to several prestigious universities and leading healthcare institutions. Cebu is an urbanized city in the Central Visayas region and is also a major buyer of carrots. The remaining 20 percent of the carrots are retained in the trading post or local market for the local population (Figure 4).

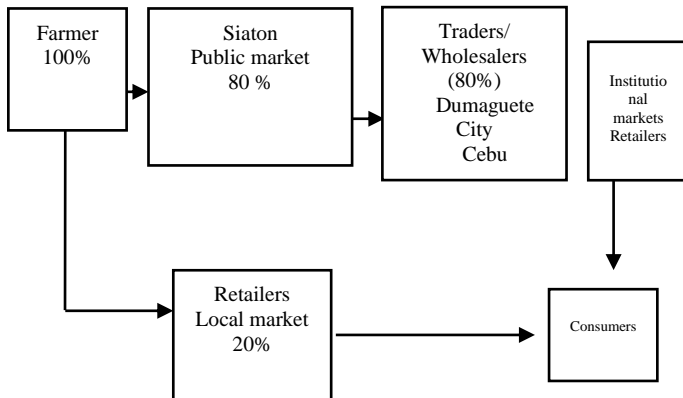


Figure 4. The flow of carrots from farm to market, Siaton Negros Oriental (2019)

Sources: FGD and KII among carrot farmers and other traders

Guihulngan, Negros Oriental - Market Flow

Most of the carrots produced in Guihulngan are traded in the public market (Figure 5) where major trading of crops occurs. Traders purchase carrots from farmers through an agent. Wholesalers provide incentives to traders for negotiating with the farmers. About 80 percent of the produce within Guihulngan is transported to different places: Dumaguete (40%), Canlaon (30%), La Libertad (15%), and Jimalalud (15%). The remaining 20 percent of the municipality's production is retained in the local market or with retailers in the trading post.

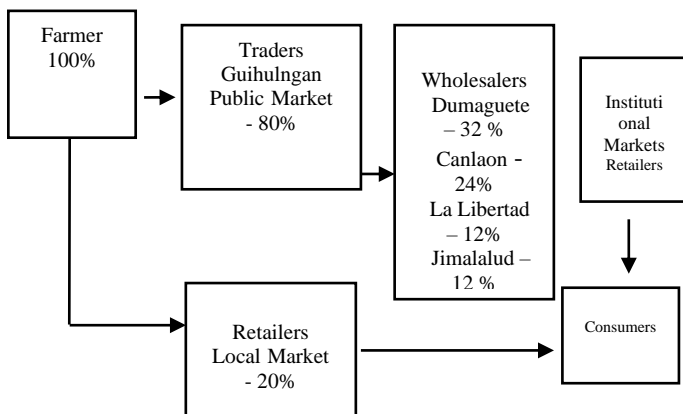


Figure 5. The flow of carrots from farm to market, Siaton Negros Oriental (2019)

Sources: FGD and KII among carrot farmers and other traders

3.7 Problems of the industry

The carrot industry is faced with challenges. These are postharvest losses due to compression damage, bruises, puncture, high incidence of pests and diseases, water availability short shelf-life of carrots, continuous increases in the cost of inputs, and low buying prices, especially during peak season. In some areas, they have always experienced a shortage of water supply that causes delays in planting.

During peak season harvest, the price of carrots is low. Some farmers expressed their need to have cold chain facilities where they can store carrots to wait for better prices. Other farmers suggested that the government can put up processing plants for carrots where the farmers can sell their carrots. This can help reduce postharvest losses and provide additional income to our farmers.

IV. CONCLUSION

Carrot production and postharvest operations are predominantly carried out manually in the study areas. This labor-intensive process requires significant human effort when growing and harvesting crops. Farmers have noted that these manual operations, particularly planting and harvesting, account for a substantial portion of their total production costs, estimated at around 20-30 percent. This high labor cost, coupled with the physical demands of the work, has provided impetus in the introduction of mechanization technologies as a means to enhance efficiency and reduce production costs. Mechanizing the labor intensive carrot farming operations could significantly alleviate the burden on farmers and improve overall productivity. Mechanized systems for planting and harvesting can streamline operations, minimizing the time and labor required for these tasks. This not only reduces the operational losses associated with manual labor but also potentially lowers production costs. By adopting mechanical methods, farmers can optimize their resources, decrease their reliance on manual labor, and potentially improve the quality and consistency of their crop yields.

Each actor in the value chain system has an important role to play. Farmers produce carrots for the food requirement of the burgeoning population, ensuring a steady supply of this essential vegetable. Traders then take on the responsibility of distribution of these carrots to various intermediaries, who ultimately deliver the product to the final consumers. This interconnected system relies on the seamless cooperation of all parties involved to function effectively. Without the active participation of each actor, the value chain would face significant disruptions as indicated by inefficiencies.

The carrot industry faces several significant challenges, including postharvest losses, high incidence of pests and diseases, low farm gate prices, and a lack of storage facilities and processing centers. Addressing these multifaceted issues requires a collaborative effort among various government and private agencies. Governmental bodies can play a crucial role by providing subsidies and technical assistance to farmers, helping them adopt better pest management practices and improve crop yields. The government and private sectors can invest in storage facilities and processing centers. These facilities can help reduce postharvest losses and add value to the produce, improving farmers' incomes. Collaboration

between research institutions, agricultural extension services, and financial organizations can also drive innovation and provide farmers with the resources they need to tackle these challenges effectively.

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