



PRODUCTION AND SUPPLY CHAIN OF SAFE VEGETABLES IN HUONG TRA TOWN, THUA THIEN HUE PROVINCE

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Abstract: On the basis of descriptive statistical methods, the authors describe the supply chain of safe vegetables in Huong Tra Town. The primary data were collected from the survey of six households providing vegetable production in the region. 40 households growing safe vegetables (20 households per ward), 40 households growing vegetables normally (20 households per ward), 10 traders purchasing processed products to provide safe vegetables for supermarkets, 5 retailers, and 10 consumers are involved in the study. The results show that Huong Tra Town is one of the main areas for growing vegetables in Thua Thien Hue province, which mainly provides safe vegetables for Hue City and neighbouring provinces. Safe vegetable products are mainly supplied for the markets in the province, especially supermarkets, restaurants, hotels and clean vegetable shops in Huong Tra Town and Hue City. In this supply chain, safe vegetable households play an important role when creating the greatest added-value. However, their real income is low due to facing the highest risks. Other actors in this supply chain receive higher benefits and facing lower risks than the producers. Households' income depends mainly on the price and weather conditions.

Keywords: safe vegetables, supply chain, Huong Tra Town

1 Introduction

Vegetables are an indispensable food for consumers, and they provide vitamins, minerals, micronutrients, fiber, etc., help to eliminate cholesterol toxins from the body and prevent constipation. Some spice vegetables can be used to treat diseases thanks to essential oils and plant antibiotics in them [2]. Recently, the vegetable area has had significant changes, especially safe vegetables production has been applied by many countries in the world. In 2012, the vegetable area reached 54,593,391 hectares worldwide. The first position belongs to Asia with 39,608,251 hectares, accounting for 72.55% of the world. China accounts for 42.26% of the world and 58.25% of Asia. In 2012, the vegetable yield was about 1,036,631 million tons worldwide. Asia has the largest vegetable output with 790,733 tons, accounting for 76.3%. China accounts for 52.05% of the globe and 68.2% of the Asian vegetable yield. India is the second largest vegetable producer in the world, accounting for 9.68% of global vegetable production and 12.7% of Asian vegetable production [10].

In recent years, the demand for green vegetables in the cities, urban areas, and the crowded population has increased. In order to provide a large quantity of vegetables, many

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growth-stimulating chemicals have been used to respond to the requirements. From this, many problems in production, harvesting, processing, preservation, and consumption of green vegetables have occurred. The vegetable production uses many unclear sources of chemicals which harm the producers, consumers, and ecological environment. Many poisoned cases occur by eating antibiotic residues in food or vegetables. Many epidemics are spread due to using raw vegetables which are contaminated with toxic. They have caused great harm to human health, economy, society, and environment.

Statistics show that in 2012, the Food Safety Department recorded 167 cases of food poisoning with 5,500 cases and 34 deaths. In 2013, there were about 5,300 cases of food poisoning [8]. According to the Food Safety Department, Ministry of Health, until October 2018, Vietnam had 91 cases of food poisoning, making more than 2,710 people poisoning. Among them, there are 15 deaths due to alcohol and mushrooms poisoning. Regarding the inspection and sanctioning, the functional agencies have checked and sanctioned 99 companies with a total amount of nearly 6 billion VND. In addition, hundreds of special licenses related to advertising food products are revoked [9].

To prevent this problem, the state as well as other domestic and foreign organizations has supported the producers in processing and consuming safe vegetables according to the VietGAP standards.

Huong Tra Town is located in the north of Hue Citadel. According to the socio-economic development plan of Huong Tra Town towards 2020, the area for planting vegetables and beans is estimated about 1,300–1,400 ha with the vegetable zone mainly in Huong Chu, Huong An, and Huong Xuan wards. This vegetable zone is certified to be eligible according to the VietGAP standards in 2010 for safe vegetable production and trading by the Department of Agriculture and Rural Development of Thua Thien Hue province. The vegetables such as cabbages, green onions, bunching onions, salads, Chinese onions, herbs, and red amaranth are cultivated to satisfy the consumers' demand, reasonable economic structure transition, and sustainable development. Like other safe vegetable zones in Vietnam, Huong An and Huong Chu wards in Huong Tra Town have been facing many risks and challenges such as fragmented and spontaneous production with a simple supply chain, unsustainability, small competitiveness, and risk.

Therefore, the local authorities and actors involved in the supply chain need to produce and supply safe vegetables in Huong Tra Town and make the production sustainable. They also have to strengthen the linkage among the factors of the supply chain, increase the competitiveness and consumption of safe vegetables and satisfy the safe vegetable demand, especially for Hue City – a tourism city of the country. This paper analyzes and evaluates the current situation of safe vegetable production and supply chain in Huong Tra Town. Besides, it

suggests solutions for expanding the production, developing the safe vegetable supply chain in this town. The authors choose Huong An and Huong Chu wards as the study sites because they are certified as a centralized area of safe vegetables.

2 Theoretical basis, objectives, scope of study and research method

Theoretical basis

Safe vegetables are fresh vegetable products (including all types of leafy vegetables, stems, tubers, flowers, fruits, nuts, and food mushrooms). They are produced, harvested, processed, packaged and preserved according to technical regulations to ensure that the residues of harmful microorganisms and chemicals are maintained under the maximum permitted limits [1].

Vietnamese Practicing Good Agricultural Production (VietGAP) is a standard system for fresh vegetables and fruits. It regulates the principles, orders, and procedures to guide the organizations and individuals in the collection and preliminary processing. These regulations help to improve product quality, ensure the safety, social welfare and the health of producers and consumers. They also help to protect the environment and enable product traceability [1].

The supply chain includes all direct or indirect businesses in responding to customers' demand, demonstrating the movement of materials from the original supplier to the final customer.

The term "*supply chain management – SCM*" was first used by Oliver and Weber in 1982: Materials management flows across organizational borders. . Supply chain management is the coordination and management of a complex network of activities involved in delivering a finished product to the end-user or customer. It is a vital business function and the process includes sourcing raw materials and parts, manufacturing and assembling products, storage, order entry and tracking, distribution through the various channels and finally delivery to the customer [16].

A simple supply chain includes input suppliers, assembly manufacturers, distribution centers, retailers, and customers. SCM considers every facility that has an impact on cost as well as on making the product to conform the customers' requirements. The objective of SCM is to ensure the efficiency and cost-effectiveness across the entire system.

There have been many studies worldwide on safe vegetable supply chains. The results show that the safe vegetable supply chain is quite long and has many agents. In India, for example, wholesale is prominent when the intermediary agents make the transport process long, which increases 10–12% of the cost and affects the quality of fruit and vegetable products in the study site. This is because of the lack of infrastructure, transportation facilities, and cold

storage. Moreover, the government does not have clear policies and guidelines for producing and consuming clean vegetables [6].

Research reveals that the vegetable supply chain faces big challenges in Chinese supermarkets. The delivery cost is very high when providing a large quantity of fresh vegetables and fruits on time [11].

Negi and Anand identify the factors affecting the fruit and vegetable supply chain in India. The main factors are infrastructure, processing, and increasing value, finance and information. Some challenges are identified as the lack of infrastructure equipment, low processing, and value. In addition, there are other limitations such as farmers' low income, inefficient supply chains, large quantities of intermediaries/fragments in the supply chains, and poor quality and safety standards. When they overcome these problems, they will bring the benefit to farmers, state governments, transport, and processing food units by reducing losses and waste, increasing the farmers' exchange rates, and providing jobs for local people [12].

Tran Thi Ba from Can Tho University indicates that in a safe vegetable supply chain in the Mekong Delta, farmers distribute a large quantity of vegetables to other actors in the supply chain and play an important role. To strictly implement the regulations on safe vegetable production, they must assure the output because of high investment costs such as net houses and fertilizers. There are not specialized shops for selling safe vegetable products like in Ho Chi Minh City, or farmers cannot sell their vegetables outside the Delta as Da Lat can. This makes it impossible to produce safe vegetables in large quantities. The consumption is mainly for regional supermarkets (Metro, Coopmart, Citimart) or the local agricultural industry. So, the efficiency of this supply chain is very low [5].

Nguyen Duc Chinh found that safe vegetable only responds for 8.6% of demand in Hanoi in 2008. The safe vegetable supply chain is established spontaneously with little effectiveness, lacking the contribution of factors; each factor only pursues his or her own goals without considering the benefits of the whole chain and the interests of end consumers. As a result, the chain operates inefficiently without considering end consumer's demand [13].

The annual area of vegetables and fruits in Thua Thien Hue province is up to 4,144–4,500 ha, mainly distributed in the coastal sandy areas with high groundwater circuits and fertile soil. This area establishes the food belts for cities such as Huong Tra – Quang Dien, and Huong Thuy. However, the vegetable structure is poor, comprising mainly leafy vegetables (spinach, sweet vegetables, salads, vegetables, chrysanthemum, and spicy vegetables) [14].

Research method

The study analyses secondary data and primary data from two wards. Primary data were collected from a survey of 6 households providing the input for vegetable production in this region. 40 households are growing safe vegetables belonging to 2 wards (20 households per ward), 40 households are growing normal vegetables (20 households per ward). 10 traders purchase and process the products to supply safe vegetables for supermarkets. 5 retailers and 10 consumers are also in the supply chain.

The methods of disaggregation, descriptive statistics, comparison, economic accounting, supply chain analysis, and value chain of safe vegetables are used for analysis.

The research applied the statistical descriptive method to describe the safe vegetable supply chain in Huong Tra Town. On the basis of the supply chain aspects, the stakeholders of the safe vegetable supply chain know their function, share the benefit as well as the difficulties and expectations.

3 Findings and discussion

3.1 Current situation of vegetables and safe vegetable production in Huong Tra Town

Green vegetables, in general, safe vegetables, in particular, are quite suitable to grow on alluvial areas and alluvial soils along small and large rivers in Huong Tra Town. Food crops and green vegetables are considered as a major crop when they have large markets, not only in Huong Tra Town, Hue City, but also in nearby areas such as Da Nang and Quang Nam province. According to the statistics of Huong Tra Town, the vegetable area increases sharply every year and reached 700 hectares in 2017. Huong An and Huong Chu wards have 128 hectares with 521 households growing vegetables.

The concentrated villages, according to VietGAP standards, are Bon Pho, Co Buu (Huong An ward), An Do, Phu O, La Chu and Que Chu (Huong Chu ward). In these two wards, the vegetable area has increased rapidly in recent years, from 110 hectares in 2015 to 128 hectares in 2017, an increase of 18 hectares. The annual vegetable production is about 3.3 thousand tons, in which safe vegetables are about 620 tons, accounting for 18,8% [4].

In 2010, the Department of Agriculture and Rural Development in Thua Thien Hue province provided the certification for 5 organizations. They are eligible for safe vegetable production and trading according to the VietGAP standards. Huong An and Huong Chu wards cultivate many types of vegetables such as cabbages, green onions, bunching onions, salads, Chinese onions, herbs, and red amaranth. However, the safe vegetable area in two wards has been modest.

In 2015, with the transformation of plants structure, local authorities and farmers concentrated on developing a vegetable-growing area which brings high economic efficiency. Thus, the vegetable area in the two wards has increased significantly in the last 3 years. Currently, the ward policy focuses on growing safe vegetables and management according to VietGAP standards. However, the safe vegetables and fruits products according to VietGAP following Decision No. 379/QD/BNN-KHCN (January 28, 2008) of Minister of Agriculture and Rural Development have been facing many difficulties with certification and publication. Farmers and locality do not have any solutions to this problem.

Vegetables are diverse, including cabbages, green onions, bunching onions, salads, Chinese onions, herbs, red amaranth, bitter melons, Japanese-green, and other seasoning vegetables. Safe vegetables are mainly grown in this area such as green cabbages, white cabbages, salads, amaranths, sweet potatoes, sprouts, watercress, calabash, onions, and chilis.

3.2 Supply chain of safe vegetables in Huong Tra Town

After studying the safe vegetable supply chain in Huong Tra Town, we can see that the number of households and area for planting safe vegetables is small. However, the supply chain is quite complicated in this area. Vegetable households have many different consumption channels.

Firstly, about 12.5% of safe vegetable production is directly distributed to markets, restaurants, etc. by farmers (Figure 1). This is the simplest consumption channel without any intermediaries. The advantage of this channel is that the vegetables are always fresh and cheap. However, this channel is only applicable to small-scale households with low vegetable production.

Secondly, about 82,5% of safe vegetable production is collected and sold by collectors and retailers in the area (Figure 1). Currently, there are 57 people specializing in buying safe vegetables from households and distributing to markets, supermarkets, and restaurants in Huong Tra Town and Hue City (about 70% of products). 30% of the remaining is selected carefully to redistribute to big traders in Da Nang and Quang Nam province. On average, a collector buys 20–30 kg of vegetables/day. Their customers buy vegetables for daily consumption with a small quantity, approximately 1 to 2 kg. The advantage of this channel is that the intermediary specializes in retailing, consuming a large quantity of safe vegetables with high quality. The reason could be that the supply chain has few factors and the time for transportation is short. Nevertheless, there is a big difference in price between producers and consumers. In addition, the retailers buy vegetable from various sources and therefore the quality of vegetables is unequal. The relationship between the factors is not strong. When there is a fluctuation in the price or consuming market, this relationship is broken and the producers lose their benefit.

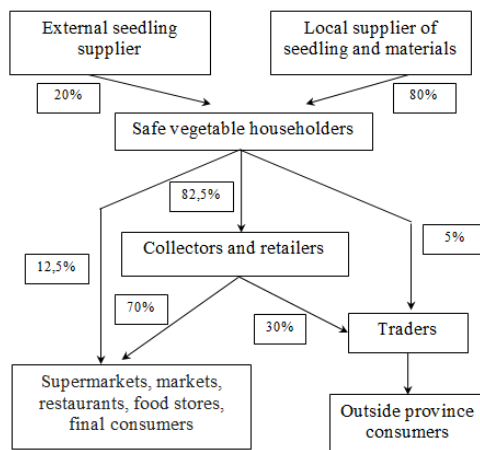


Figure 1. Supply chain of safe vegetables in Huong Tra Town, Thua Thien Hue province

Households directly consume about 5% of safe vegetables (Figure 1). At the moment, approximately 25 traders frequently buy vegetables in the wards. The advantage of this channel is that the traders always buy a huge quantity of vegetables. However, they require excellent quality and only buy certain types of vegetables. This type of supply is suitable for big-scale households with vegetables as their main crops. Hence, the households have disadvantages concerning price and transaction. Vegetables from households are collected by traders and consumed in big markets in Quang Nam and Da Nang.

In general, the supply chain of safe vegetables in Huong Tra Town is quite simple, including input suppliers (seed, fertilizers, tarpaulins, plastic bags, etc.), technical supporters (Agricultural Extension Center, Plantation and Plant Protection Department), collectors, retailers, traders, supermarkets, and end consumers (restaurants, families, and individuals). The relationship between factors in the chain is temporary, and the information exchanged among factors is limited.

3.3 Added value in the supply chain of safe vegetables

In order to see the process of creating a product's value, this research only focuses on analyzing two main products: mustard greens and salads. Two vegetables are planted by most of the households and distributed through channel 2 (Vegetable households – collectors – retailers – supermarkets, markets – restaurants, and end consumers). The data are collected and analyzed in Table 1 and 2.

Table 1. Added value of factors in the supply chain of safe mustard greens for the collectors and retailers in Huong Tra Town in 2017

Calculated for 1 kg of mustard greens

No.	Actors	Cost			Income			Marginal revenue	
		Intermediate cost (dong)	Cost-added (dong)	Percent (%)	Revenue (dong)	Income (dong)	Percent (%)	Marginal revenue (dong)	Percent (%)
1	Vegetable households	906.3	906.3	79.7	7,218.7	6,312.4	44.3	7,218.7	46.9
2	Collectors, retailers	7,218.7	231.5	20.3	15,146.0	7,927.3	55.7	8,158.8	53.1
Total		–	1,137.8	100	–	14,239.7	100	15,377.5	100

Source: Collected data

Table 1 shows the mustard greens in channel 2 (Vegetable households – Collectors, retailers – Supermarkets, markets, restaurants, and consumers). This supply chain consists of 2 main actors: Vegetable households and Collectors, retailers. Although households growing mustard greens spend 79.7% of the intermediate costs (except the labor), their income is only 44.3%. In contrast, retailers only spend 20.3% of the costs, but they get 55.7% of the income, reaching 7.9 thousand VND/kg. If the family labor is taken into account, the cost of households is large and the income is very small. In this case, we do not consider the risks concerning the production, markets and other factors to which vegetable households are exposed. These results show that, in this channel, the retailers have a better income than the households.

Table 2. Added value of factors in the supply chain of safe salads for the collectors and retailers in Huong Tra Town in 2017

Calculated for 1 kg of salad

No.	Actors	Cost			Income			Marginal revenue	
		Intermediate cost (dong)	Cost-added (dong)	Percent (%)	Revenue (dong)	Income (dong)	Percent (%)	Marginal revenue (dong)	Percent (%)
1	Vegetable households	1,442.5	1,442.5	73.6	8,358.0	6,915.5	49.96	8,358.0	52.9
2	Collectors, retailers	8,358.0	516.1	26.4	15,283.8	6,925.8	50.04	7,441.9	47.1
Total		–	1,958.6	100	–	13,841.3	100	15,799.9	100

Source: Collected data

Similar to mustard greens, for salads, the intermediate factors are the collectors and retailers, and their cost is 26.4%, but their income accounts for 50.04%. Regardless of consumption channels, vegetable households create the greatest value in the chain. However, it

is necessary to look at the nature and time of product value creation. Production households need the longest time (30–40 days) to produce and obtain products. In the production process, they are often affected by pest, weather conditions, and price fluctuations in the production. Therefore, they suffer the most risk of this supply chain. With a short participation time, trading activities only take place during the day, and they are less risky in terms of the market price. In 2016 and 2017, the prices of safe vegetables in the Thua Thien Hue market fluctuate greatly, especially in the rainy season. During this time, vegetable households suffered from much damage caused by floods. Most of the vegetable areas were flooded and the vegetable production plummeted. If the price is high, vegetable producers still suffer from big losses.

After considering the process of creating the value of distribution channels in the supply chain of safe vegetables in Huong Tra Town, we can see that the producers of safe vegetables create value-added and receive the largest profit. The shorter the supply chain of safe vegetables is, the easier for the vegetable households to control the quality of vegetables and directly contact with consumers. However, this vegetable supply chain takes a lot of effort and time, but the efficiency is low. With a long supply chain, vegetable households cultivate vegetables, and the intermediate factors specialize in collecting and distributing. The quantity of vegetables consumed will be high, resulting in higher profits of vegetable households. In addition to the risk of market price, households of safe vegetables also suffer from other risks such as bad weather (55% of respondents believe that bad weather highly affects vegetable production).

3.4 Solutions for enhancing the safe vegetables supply chain in Huong Tra Town

In order to improve the economic efficiency for safe vegetable production and complete the supply chain in Huong Tra Town, the study proposes some solutions as follows:

- Local authorities at all levels should have policies on planning and developing the growing areas in the two wards. The organizations need to identify the areas for planting safe vegetables, specifically to sign the commitment to plant safe vegetables according to VietGAP standards. This commitment includes transferring the application of seed technology, supporting the technical cultivation methods, building and completing the safe vegetable production according to VietGAP standards for each type of vegetable, enhancing product quality management in harvesting, preliminary processing, storage and transportation, and improving the quality of products for the market.

- Local authorities need to provide legal support for vegetable households to sign vegetable consumption contracts at clean vegetable business establishments. A reasonable policy to call for investment concerning the construction of workshops, machinery, post-harvest technology, product collection, processing, packaging and packaging facilities to ensure

product quality is necessary. To increase the product value before supplying to market is also essential. Local authorities should act as a focal point to guide vegetable households to sign supply contracts with collective restaurants, industrial parks, primary schools, semi-boarding and educational institutions in the locality, and households.

– Building the product brand, propagating and promoting the images of safe vegetable in Huong Tra Town are also necessary. The construction of safe vegetable brand should clearly identify the geographical indication of the growing area with its own name and symbol and should not use rampant geographical brand at the ward level causing difficulties in controlling and protecting brand households. At the same time, the brand of the ward will cause suspicion among consumers. The prestige and reliability of the brand for consumers are low, resulting in the difficult consumption of safe vegetables.

– The authorities should promote the management of safe vegetable production in Huong Tra Town. In order to implement these contents, local authorities need to promote training and certification of safe vegetable production and trading according to VietGAP, Good Production Practices (GMPs), Hazard Control and Critical Control System (HACCP), etc. for farmers. Information on safe vegetable production and trading establishments in the ward, combined with propaganda and dissemination of the state regulations on food hygiene and safety should be provided regularly. It is also necessary to ensure the quality of safe vegetable products, create prestige and gradually locate safe vegetable products of the locality, gradually occupy the market, stabilize prices, enhance the value of safe vegetable products through factors, and gradually improve local safe vegetable supply chains.

4 Conclusion

Safe vegetables according to VietGAP standards are planned and developed by Huong Tra district to respond to the local demand and the reconstruction of economic and sustainable development. Natural conditions and resources in the locality are perfectly suitable to produce safe vegetables according to VietGAP standards. However, the scale of safe vegetable production is still quite modest. The number of households participating in the production is small and they are not certified by the competent organizations according to VietGAP standards. The safe vegetable products from the locality are mainly supplied to the local markets, especially supermarkets, restaurants, hotels, and fresh vegetable shops in Hue City. The consumption channel of safe vegetable products has few intermediate factors, mainly collectors, retailers, and traders. The linkage of the supply chain is based on the familial relationships.

In the supply chain of safe vegetable products, households play an important role, creating the greatest value-added but the actual income is low and facing many risks. Other

actors gain much higher benefits than the producers while their risks are lower. The income of the producers depends much on price and climate conditions.

In order to improve the efficiency of the safe vegetable supply chain, it is necessary to implement solutions such as planning and identifying safe vegetable areas, defining areas and households for growing safe vegetables, specifically to sign a commitment to grow vegetables according to VietGAP safe vegetable production. The local authorities should provide legal support for safe vegetable households to sign product consumption contracts and construct facilities, workshops, machinery and equipment for processing, packaging, storage, and transportation. The households should register at the National Agro-Forestry-Fisheries Quality Assurance Department – Branch 2. They also need to have VietGAP certificates of safe vegetables, build and protect the safe vegetable brand and promote the state management for safe vegetable production in Huong Tra Town, Thua Thien Hue province.

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