Adoption of VietGAP and Distribution Channel Selection: A Study of Vegetable Production Farmers in Vietnam

ベトナムの野菜生産農家における VietGAP の採用と流通チャネルの選択に関する研究

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ABSTRACT

This research is situated within the context of Vietnamese agriculture, which continues to serve as a fundamental pillar of the national economy contributing approximately 14% to GDP and employing between 35–40% of the national labor force. In particular, the fruit and vegetable sector has become increasingly significant from both economic and social perspectives, owing to its high added value, capacity to meet modern consumer demands, and growing demand for safe, healthy produce. However, this potential is accompanied by substantial challenges related to quality assurance, food safety, and the sustainability of supply chains in an increasingly competitive environment. In response to these urgencies, the Vietnamese government has implemented the VietGAP certification system as a policy instrument designed to improve product quality, ensure compliance with international safety standards, and protect public health and ecological systems. VietGAP serves not only to expand export opportunities and enhance the value of agricultural goods, but also to support farmers by reducing production costs through the adoption of efficient production practices. This aligns with the global vision articulated in the United Nations' Sustainable Development Goals (SDGs), particularly those pertaining to the development of safe and sustainable food systems.

Nevertheless, despite the potential benefits of VietGAP, its implementation among smallholder farms remains fraught with obstacles, resulting in unstable and unsustainable outcomes. Previous research has primarily concentrated on macro-level barriers such as land fragmentation, limited access to credit, low technical capacity, and misaligned policy support. Meanwhile, evidence at the micro-level especially regarding factors that influence farmers' decisions around market partnerships and actual compliance behavior remains severely deficient. Notably, important determinants such as farming experience, landholding size, technology adoption, income levels, education, and household labor structure though crucial

for understanding production behavior and collaboration have not been systematically analyzed through quantitative frameworks within the context of the VietGAP vegetable supply chain in Vietnam's Southern Central Highlands. Furthermore, the pervasive misuse of agricultural chemicals, particularly pesticides, continues to pose serious risks both to food safety and public health. One troubling consequence is the phenomenon of "selective compliance," where farmers adhere only to the most accessible and low-cost standards, while avoiding those that are more complex or demanding longer-term investments. This research gap at the farm-household level where critical production decisions are made therefore represents a major barrier to effective policy design and VietGAP implementation.

Against this backdrop, the dissertation aims to fulfill two distinct research objectives that complement both empirical relevance and theoretical contribution. First, it seeks to elucidate the factors influencing farmers' choice of market partners (either companies or collector) within the VietGAP vegetable supply chain, thereby providing quantitative evidence to inform supportive policies that optimize decision-making, mitigate risks, and enhance economic performance. Second, it investigates the compliance behaviors of smallholder VietGAP vegetable producers with respect to specific certification criteria, identifying micro-level barriers and suggesting targeted interventions to bridge the gap between standards and on the ground practices.

The study employs a quantitative methodological framework. For the first objective, the study was carried out in Quang Thanh Commune (Quang Dien District, Thua Thien Hue Province), where over 370 households cultivate VietGAP vegetables on a total of 32.5 hectares. Data were collected from 91 households using a structured questionnaire. Compliance with the 12 key VietGAP criteria was measured using a 5-point Likert scale. Descriptive analysis (means, standard deviations, percentage distributions) was performed using Excel to assess compliance trends and identify notable areas of weakness.

For the second objective, the survey was conducted in Lac Lam Commune, Don Duong District, Lam Dong Province, a key VietGAP vegetable-growing region in Vietnam's Southern Central Highlands. A total of 161 VietGAP producing households were surveyed via random sampling in two rounds (September 2023 and September 2024). A binary logistic regression model was used to analyze the relationship between socio-economic factors and the decision to choose a collector (coded as 1) or a company (coded as 0) as the market partner. Explanatory variables included farm size, educational attainment, income, number of family laborers, production experience, and level of technological adoption. Marginal effects analysis was conducted to determine the strength of each variable's influence.

The results indicate that partner choice is significantly influenced by intrinsic farmer characteristics: households with lower education (primary level), larger family labor availability, higher income from VietGAP production, longer cultivation experience, and no high-tech adoption tended to favor middlemen valued for their flexibility, longstanding trust-based relationships, and favorable negotiating terms compared to rigid and inflexible company agreements. Conversely, farmers with higher educational attainment (secondary level or vocational training) and high-tech investments for example, greenhouses, automated irrigation, and humidity control systems were more inclined to partner with companies to obtain technical support and stable market access. However, even among tech-adopting farmers, many still maintain middleman partnerships due to transactional flexibility. Interestingly, larger-scale farms showed a marginally negative effect on middleman preference, suggesting greater negotiating power and capability to meet quality expectations to access corporate buyers.

Regarding VietGAP compliance, the findings reveal a stark divide in adherence across criteria. Standards that are observable, legally mandated, or frequently inspected such as approved pesticide use (US21–US27), non-contaminated production zones (EV2, EV4), hygienic irrigation water (WAI16), and post-harvest sanitation (HA28, HA32, HA39) showed

high average compliance scores, typically above 4.2. In comparison, standards requiring highly technical infrastructure or organizational systems such as microbial control (HA33–HA38), internal audit procedures (IN50–IN51), and grievance mechanisms (CO52–CO53) registered very low average compliance, ranging from 1.00 to 1.23. The key barriers included insufficient infrastructure, limited technical knowledge, and an absence of clear economic incentives. Particularly, criteria HA34–HA38 which require certified post-harvest facilities were almost entirely neglected by most respondents.

In summary, this research provides significant empirical evidence that VietGAP implementation among smallholder producers faces substantial structural and behavioral challenges. The findings underscore the need for supportive policies grounded in the realities of agricultural production such as technical training, awareness-building, technology and infrastructure facilitation, and promotion of effective cooperative marketing models to enhance the sustainability and efficacy of VietGAP in the field.

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CONTENT OF TABLE

LIST OF TABLE

LIST OF FIGURE

ABBREVIATIONS

ASEAN GAP	Association of Southeast Asian Nations Good Agricultural Practices
CAGR	Compound Annual Growth Rate
EUREPGAP	Euro-Retailer Produce Working Group Good Agricultural Practices
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GLOBAL GAP	Global Good Agricultural Practice
GRDP	Gross Regional Domestic Product
IPM	Integrated Pest Management
MAFF	The Ministry of Agriculture, Forestry and Fisheries
MARD	Ministry of Agriculture and Rural Development
NCAE	National Center for Agricultural Extension
QGAP	Quality Good Agricultural Practices
SC	Supply Chains
SDGs	Sustainable Development Goals
TCT	Transaction Cost Theory
TCVN	Vietnam Standards
Viet GAHP	Vietnamese Good Animal Husbandry Practices
VietGAP	Vietnamese Good Agricultural Practice

CHAPTER 1: INTRODUCTION

1.1.Background to the research

Agriculture constitutes a cornerstone of Vietnam's national development strategy, playing a critical role not only in economic growth but also in rural livelihoods and food security. As of 2023, the agricultural sector accounts for a substantial share of the country's Gross Domestic Product (GDP), while simultaneously providing employment for a significant proportion of the national labor force and ensuring food availability for millions of citizens (GSO, 2023). Within this broad sector, the production of vegetables and fresh fruits has emerged as an increasingly vital sub-sector, driven by shifting dietary preferences, urbanization, and a growing awareness among consumers of the health benefits associated with fresh, minimally processed, and safe food. The expanding domestic and export demand for these products highlights their dual economic and nutritional significance in contemporary food systems.

Nevertheless, the vegetable production sub-sector in Vietnam is currently facing a constellation of persistent and systemic challenges that threaten its long-term sustainability. Chief among these is the widespread and often indiscriminate use of agrochemicals particularly synthetic pesticides as a means of pest and disease control (Hoi et al., 2016; Schreinemachers et al., 2020). While such practices may offer short-term gains in yield or quality, they have been shown to impose profound negative externalities, including heightened health risks for both producers and consumers, environmental degradation, and a loss of agroecological resilience. Empirical evidence has linked the overapplication of pesticides with the contamination of soil and water bodies, disruptions to beneficial insect populations, and elevated levels of chemical residues in agricultural products (Pawan Kumar et al., 2023; Wu & Chen, 2004a). These issues are particularly alarming in the context of food safety governance, as they erode consumer trust, undermine public health initiatives, and threaten the reputation of Vietnamese agricultural products in global markets.

In light of these multifaceted threats, there is a growing consensus among scholars and policymakers that the Vietnamese agricultural system must transition toward safer, more sustainable, and ethically responsible production models (Dahab et al., 2017; Mostafalou & Abdollahi, 2013). This imperative is reinforced by the evolving expectations of domestic consumers, who increasingly demand food that is not only high in quality but also verifiably safe, traceable, and produced in environmentally sound ways (Dao et al., 2019). These preferences reflect broader global trends toward sustainable consumption and have exerted substantial pressure on producers to adopt more rigorous production standards, such as third-party certifications and national quality assurance protocols (Chen et al., 2019; Eskola et al., 2020; Simoglou & Roditakis, 2022).

In response to these pressures and in pursuit of long-term sectoral competitiveness, Vietnam introduced its own national certification framework Vietnamese Good Agricultural Practices (VietGAP) in 2008. Modeled on internationally recognized GAP principles but adapted to domestic conditions, VietGAP aims to elevate the quality and safety of agricultural commodities, protect the health of both consumers and producers, promote environmentally sound practices, and enhance the overall value and marketability of Vietnamese produce, particularly in the context of regional integration and global trade (MARD, 2008). The VietGAP framework encompasses 12 comprehensive groups of criteria, including provisions for soil management, water quality, pest control, record-keeping, traceability, and post-harvest handling. Policy reforms such as Decision No. 2998/QD-BNN-TT and the adoption of national standard TCVN 11892-1:2017 have sought to simplify the certification process and reduce compliance burdens, especially for smallholder farmers (MARD, 2014).

Despite these institutional efforts, the actual uptake of VietGAP certification among vegetable producers remains modest, particularly among small-scale farmers who make up the backbone of Vietnam's horticultural sector. A growing body of empirical research has documented a variety of

structural and operational constraints that inhibit widespread adoption. These include highly fragmented landholdings, limited access to affordable credit, insufficient technical capacity, and the lack of consistent government support mechanisms (H. Hoang, 2018; Lippe & Grote, 2017; Ngo et al., 2019). Moreover, while numerous studies have examined individual factors influencing GAP and VietGAP adoption, most have done so through narrow analytical lenses, either technical or socio-economic, often overlooking the interactive and multidimensional nature of the 12 VietGAP criteria. There is a notable absence of systems-level analyses that explore how these criteria function as an integrated compliance framework, especially under local constraints such as harsh climate conditions, mountainous terrain, and the small scale of household production units.

Compounding these adoption barriers is a second, equally consequential challenge: farmers' decisions regarding the marketing and distribution of their VietGAP-certified produce. This choice is not merely logistical; it is inherently strategic, shaping farm-level profitability, financial stability, and the long-term sustainability of compliance practices. Formal enterprises offer attractive incentives such as price stability and technical support through long-term contracts, yet often impose stringent entry requirements such as minimum production volumes, infrastructure standards, and extended payment terms that smallholders may struggle to meet (Tran Quoc & Do Van, 2013). In contrast, informal traders and aggregators provide immediate payments and reduced logistical demands, but the lack of contractual obligations leads to unstable incomes and undermines supply chain traceability and planning (Samli & El-Ansary, 2007; Tran Quoc & Do Van, 2013). Although the importance of supply chain partner selection has been acknowledged in the agricultural marketing literature, there remains limited empirical understanding of how micro-level variables such as farm size, labor structure, income levels, education, technology use, and production experience influence these decisions within the context of certified vegetable value chains.

In summary, Vietnam's vegetable sector is contending with two closely interrelated and deeply embedded challenges: (1) How to encourage and facilitate smallholder farmers to fully comply with VietGAP standards under local production conditions; and (2) how to support these farmers in making informed, resource-appropriate choices regarding their marketing channels to ensure both economic viability and supply chain sustainability. This paper seeks to address these dual challenges through a comprehensive analysis of VietGAP compliance and marketing partner selection among certified vegetable producers in two representative production areas Thua Thien Hue and Lam Dong provinces. By employing a multi-method research design and integrating technical, socio-economic, and institutional perspectives, the study contributes to closing a critical empirical gap in the literature. Moreover, the findings offer actionable insights for policymakers, extension agencies, and agribusiness actors aiming to strengthen the resilience, inclusiveness, and environmental performance of certified vegetable supply chains in Vietnam.

1.2. Literature Review

1.2.1. Factor driving the adoption of VietGAP standards in vegetable production

The development of Good Agricultural Practices (GAP) standards globally has been recognized as an important tool to ensure food safety, promote sustainable production, and enhance the competitiveness of the agricultural sector in the context of globalization (Amekawa, 2009). Following this trend, Vietnam has built a VietGAP standard system consisting of 12 groups of criteria, inheriting international GAP principles but adjusted to suit domestic production conditions . Studies on GAP adoption in developing countries show that farmers' decisions are influenced by many factors such as individual characteristics, production scale and conditions, as well as access to technical support and markets (Annor et al., 2016; Kersting & Wollni, 2012; Lippe & Grote, 2017; Muriithi et al., 2011). However, most of the existing studies have only considered each factor individually, without a systematic view of the entire VietGAP standards

framework as a multidimensional integrated structure where standards can interact with each other, influencing the overall adoption decision.

Considering each specific standard, many studies have provided empirical evidence on the role and influence of each factor. Standards for selecting production areas should take into account the risk of pollution and environmental conditions (Pham Van Hong et al., 2021), while standards for varieties are considered a prerequisite to ensure productivity and quality (G. H. Hoang, 2020). Regarding soil management, (Pretty, 2008) emphasized the importance of appropriate farming techniques to increase resource efficiency, while studies by Rigby & Cáceres, (2001) showed that organic fertilizers can improve soil structure and fertility. Similarly, effective irrigation water management is considered a key factor in controlling food safety risks (Pham Van Hong et al., 2021).

Standards for integrated pest management (IPM) have also attracted much attention, especially in the context of pressure to reduce the use of chemical pesticides. Studies by (Feder & Umali, 1993; Ghadim & Pannell, 1999) all agree that IPM contributes to balancing production efficiency and environmental protection. In addition, strict compliance with regulations on the use of pesticides is a prerequisite to ensure safety for producers and consumers (Ali, 2016). At the post-harvest stage, studies have shown that timely harvesting and application of advanced preservation techniques help extend shelf life, preserve quality and enhance added value of the product (Ali, 2016; Kader, 2005; Mittal, 2007). At the same time, the working conditions of agricultural workers, including safety, also play an important role in maintaining a sustainable production system (Sarkar, 2022).

An indispensable component of the VietGAP system is traceability. Many recent studies have confirmed that an effective recording and traceability system not only ensures transparency in the value chain but also contributes to building consumer trust (Tran et al., 2022). However, research also shows that Vietnamese consumers lack knowledge or are unfamiliar with traceability tools

such as QR codes, which reduces the communication effectiveness and attractiveness of certified products (My et al., 2017; Suhandoko et al., 2021).

In addition, institutional factors such as internal inspection mechanisms, complaint handling procedures, and the stringency of the certification system also significantly affect farmer compliance. According to Decision 84/2008/QD-BNN (MARD, 2008). VietGAP establishments are required to conduct periodic internal inspections, and research by Kalfagianni & Fuchs, (2012) shows that an effective complaint mechanism not only enhances transparency but also strengthens the relationship between businesses and consumers. However, the VietGAP certification system – although adapted from GlobalGAP is still considered to have a lower stringency, to suit the actual production conditions of Vietnam (Nabeshima et al., 2015).

Although previous studies on GAP and GlobalGAP have provided important theoretical foundations and empirical evidence for each standard, especially in terms of technical aspects and production impacts, most have not approached the system as an integrated structure of many interacting elements. For VietGAP a system adapted to the specific conditions of Vietnam existing studies have only focused on specific standards, lacking an overall assessment of the inter-sectoral and inter-standard relationships. This is particularly evident in the Hue city area, where the harsh climate, fragmented terrain, and small-scale household production make the synchronous application of the 12 VietGAP standards challenging. Therefore, there is still a significant gap in understanding the overall level of application and the factors influencing the decision to fully comply with the VietGAP system. This study aims to fill that gap by taking an integrated approach, assessing the application level of VietGAP standards in the Hue City area, thereby proposing policy solutions suitable to the specific production conditions of this area.

1.2.2. Trends in selecting sales partners in the VietGAP vegetable supply chain

Research Background

The extent and nature of supply chain (SC) can be influenced by contextual factors such as product characteristics, industry type, and social context (Matopoulos, Vlachopoulou, Manthou, & Manos, 2007; Singh & Power, 2009). It is important to note that, according to Turnbull et al., (1993) weaker parties in cooperative arrangements do not necessarily achieve better outcomes than their opponents. As mentioned earlier, smallholders in vegetable supply chains are negatively affected by power imbalances and resource constraints.

In the context of Vietnam, the majority of farmers in vegetable supply chains are smallholders, who only undertake primary production transactions. After the end of the centrally planned economy in 1990, farming in Vietnam returned to the family farming model after a long period of being managed by government-led cooperatives, which limited their ability to cooperate with other enterprises. Today, farmers due to a rapidly aging population, lack of access to technology, and limited marketing training, still largely rely on negotiating with collectors on price, quantity, and payment methods. In many cases, they suffer losses when selling their products due to poor quality or oversupply (Huong et al., 2013; Pham, Crase, Burton, & Cooper, 2019).

In addition, farmers often focus on short-term profits from growing vegetables that were once highly profitable, without paying attention to market requirements. It is this focus on short-term financial benefits that prevents them from investing in long-term and sustainable development. As a result, they fall into a vicious cycle focusing only on small, short-term benefits, making the vegetable supply chain unsustainable and consumers do not receive enough products to meet their development requirements (Johnson, Weinberger, & Wu, 2008; Williamson, 1996).

Compare and Contrast Contract (Company/Enterprise) and Non-Contract (Collector) Supply Chains

Although vegetable supply chains (SC) in Vietnam have existed for a long time, only in recent years have they become more diverse with many new linkages forming at the source. This open up more options for farmers when participating in different vegetable SC.

To better understand which SC farmer choose, we can rely on Transaction Cost Theory (TCT). The idea of transaction costs was originally proposed by Coase, (1937) when studying the nature of businesses. According to TCT when choosing partners in the vegetable SC, farmers often prioritize partners that help minimize transaction costs. Transaction costs include many types, of which Williamson, (1996) clearly identified four main types of transaction costs: costs of searching for information about partners, costs of negotiating and signing contracts, costs of monitoring contract implementation, and costs of handling possible disputes.

In the vegetable SC, farmers often have to consider transaction costs with key stakeholders such as cooperatives, collectors, wholesalers, retailers and end consumers. In general, farmers have two main options when it comes to cooperation (Figure 1). The first option is with collectors (non-contract) and with companies/enterprises (contract). Each of these options involves a chain of activities from vegetable production to distribution, aiming to quickly respond to market demand.

Supply Chain 1 (SC1) (Direct Sale Through "Non-Contractual" Collectors)

According to Rábade & Alfaro, (2006) SC 1 represents the traditional approach in agriculture. In this model, collectors actively come to the farmers to buy agricultural products and distribute them to wholesalers. Farmers often choose this form because it is familiar and does not require high-quality assurance. However, because there is no binding contract, farmers are passive in negotiating prices and are completely dependent on the collectors' bid prices. Wang et al., (2014a) pointed out that, although the government encourages agricultural production contracts, the rate of signed contracts is still very low. The main reasons are the small scale of production of farmers, the perishability of products, high transaction costs, and weak bargaining power. This puts farmers at a disadvantage, vulnerable to price pressure and unable to access more profitable markets (Ebata & Hernandez, 2017; Negi, Birthal, Roy, & Khan, 2018) also emphasise that the imbalance of bargaining power puts farmers at a heavy economic disadvantage. Collectors often take advantage

of farmers' dependence to offer the lowest possible price, leading to oversupply and destabilising the market.

Thus, most product lines must pass through the hands of collectors before reaching the next buyer. To sell their goods, each collector will have at least one group of wholesalers and one group of retailers (buyers). They rely on each other to protect their commercial interests. After receiving goods from farmers, collectors will sell the products to wholesalers. Then, wholesalers will sell to retailers, and finally retailers will bring the products to consumers. Each commune will have a number of local collectors responsible for handling the output market for farmers in their area. Therefore, farmers and collectors have had a close relationship with each other for a long time.

Supply Chain 2 (SC2) (Direct Sale Through Companies/Enterprises "Paper Contract")

In contrast to SC1. SC2 is a model in which farmers sign contracts directly with companies/enterprises before production, which is also consistent with the research of (Gramzow et al., 2018; Pham et al., 2019). This contract includes agreements on quantity, quality, price, and delivery time (Wuepper & Sauer, 2016). This form appears due to the increasing demand of consumers for quality, safe, and sourced agricultural products. Companies/enterprises have realised the importance of quality control from the production stage and building cooperative relationships with farmers. This supply chain will have an agreement and formal terms between the two parties. The contract will detail the type, quantity, and delivery time of VietGAP vegetables, as well as the rules and requirements to be followed so that both parties can fully fulfil their responsibilities. After harvesting, the company/enterprise will proactively come to purchase directly from the farmer's farm and put them into initial processing and export to countries with which the company has trade agreements (such as Japan, Europe, etc.). To be exported, VietGAP vegetables need to meet some additional conditions set by the company in addition to VietGAP standards. Vegetables that meet both the company's standards and VietGAP will be allowed to be exported. According to the contract, VietGAP vegetables will be destroyed and consumed

domestically if they do not meet the standards. Each form has its advantages and disadvantages. Choosing which form is appropriate depends on many factors.

1.2.3. Supply chain of fresh agricultural products.

Tan & Shaw, (1998) describe the supply chain as an interconnected network of business entities involved in the production of raw materials, their conversion into intermediate or finished goods, and the final delivery of these goods to consumers through a distribution framework. In a similar vein, Plazibat, Ćejvanović, and Vasiljević (2016) define the supply chain as a collection of organizations responsible for moving goods from the point of origin to the end-user.

The supply chain for fresh foods has attracted significant scholarly interest in both developed and developing coutries. Lemanowicz and Krukowski (2009) provided a comparative study of fruit supply chains in Poland, Spain, Greece, and the Netherlands. Their research found that all four countries share a common structure involving nurseries, growers, intermediaries (e.g., cooperatives), processors, wholesalers, retailers, and final consumers. The key differences among them lie primarily in the level of concentration at different stages within the supply chain.

In Germany, Hart et al., (2007) found that the fruit and vegetable supply chain includes a diverse set of participants and multiple distribution pathways. One notable trend is the rising influence of retail chains, which appears to be diminishing the role of traditional wholesale markets.

Negi et al., (2018) examined India's fruit and vegetable supply chain and argued that it suffers from significant inefficiencies, leading to substantial losses and reduced income for stakeholders along the chain. Zakaria & Rahim, (2014) studied the fruit supply chain in Malaysia, identifying producers, intermediaries such as collectors and wholesalers, retailers, and consumers as the main actors. They also noted that the supply chains of independent farmers are largely similar to those of contract-based farmers.

Several studies have concentrated on supermarket food supply chains. For instance, (Perera et al., 2011) investigated supermarket vegetable supply chains in Sri Lanka to determine whether the

growth of supermarkets has led to alternative distribution models compared to traditional channels. They analyzed three types of supermarket chains based on scale: (i) small chains with 1–2 outlets, (ii) medium-sized chains with 7–8 outlets, and (iii) large chains with up to 64 outlets. The findings suggested that only the largest supermarket chains were capable of establishing distinct alternative supply networks. Chin (2015) explored the role of supermarkets in Malaysia's food supply system, particularly through contract farming arrangements. The study concluded that while supermarkets play a dominant role, their interaction with small-scale farmers is often indirect and lacks close engagement.

Blandon (2006) assessed the level of participation of smallholder farmers in supermarket-driven supply chains for fresh fruits and vegetables. The study emphasized that collective action among farmers can reduce transaction costs and facilitate their entry into modern supply chains. However, the participation of small farmers remains limited, and there is still insufficient evidence to confirm that involvement in supermarket supply chains significantly improves their livelihoods

A comprehensive literature review on the supply chain of VietGAP (Vietnamese Good Agricultural Practices) vegetables in Vietnam is crucial for understanding current challenges and identifying potential improvements. Several studies have examined different aspects of the VietGAP vegetable supply chain, including production, certification, distribution, and market integration.

Nguyen et al. (2020) highlight that while VietGAP certification aims to ensure food safety and sustainable production, farmers often face barriers such as high compliance costs, limited technical support, and a lack of market incentives. These constraints result in low adoption rates and inconsistent application of VietGAP standards across regions.

Other research has focused on the structure and coordination of the supply chain. For example, Phan and Chambers (2019) emphasize that weak linkages between producers, cooperatives, and retailers hinder the efficient distribution of VietGAP-certified vegetables. The lack of trust and

transparency along the supply chain further reduces the competitiveness of certified products in domestic markets.

Furthermore, Nguyen and Tran (2021) note that consumers have limited awareness of VietGAP labeling and are often unwilling to pay premium prices, which discourages investment in the certified supply chain. The study also suggests that stronger governmental support and clearer policies are needed to enhance the traceability and credibility of VietGAP products.

Collectively, these studies underscore the fragmented nature of the VietGAP vegetable supply chain and the need for more integrated approaches. A well-functioning supply chain requires collaboration among stakeholders, effective policy enforcement, and consumer education (Le et al., 2018). Therefore, reviewing and synthesizing existing literature provides valuable insights into the systemic issues and potential strategies for strengthening the VietGAP vegetable supply chain in Vietnam.

1.3.Research objectives

Growing concerns about food safety, sustainable farming, and modernizing agricultural supply chains have made Good Agricultural Practices (GAP) - especially Vietnam's own VietGAP standards - a key focus in the country's agricultural policies and practices. VietGAP isn't just a technical guideline for improving product quality and food safety. It's increasingly seen as a tool that can reshape farming systems, strengthen market connections, and redefine relationships across the agricultural supply chain.

To address these challenges, this study focuses on four main goals:

The first, provide an overview of Vietnam's vegetable farming sector, including current VietGAP vegetable production, while reviewing VietGAP policies and implementation.

The second, assessing the level of farmers' compliance with the 12 VietGAP standard. By analyzing how each standard influences compliance, the study will highlight which factors matter most, helping policymakers prioritize effective support measures.

The third, Analyzing strategic factors influencing the choice between formal distribution partnerships (contracts with enterprises) and informal arrangements (transactions with collectors).

Finally, Develop practical policy recommendations to build stronger VietGAP vegetable supply chains, promote sustainable farming, improve cultivation methods, and enhance the market position of VietGAP-certified produce.

Why This Matters

This research clarifies how VietGAP adoption influences farmers' partner selection and supply chain dynamics. The findings will help design better farming networks, supporting sustainable agriculture while boosting the competitiveness and trust in Vietnam's certified safe vegetables.

1.4 Methodology

1.4.1. Study site

The study was conducted in two exemplary VietGAP vegetable-growing areas in Central Vietnam and the Central Highlands: Quang Thanh commune (Quang Dien district, Thua Thien Hue province) and Lac Lam commune (Don Duong district, Lam Dong province).

Quang Thanh commune was selected as a research site because it represents a typical VietGAP vegetable production area in Central Vietnam. With a total area of 32.5 hectares cultivated by 370 farming households, each household farms an average of just 0.1 hectares, reflecting the predominantly small-scale production characteristics. Despite this, the commune achieves outstanding economic results with an annual vegetable output of 1,625 tons, generating a production value of 21.94 billion VND (equivalent to 675 million VND/ha). The actual income from vegetable production reaches approximately 15.36 billion VND for farmers - nearly ten times higher than the district's average agricultural production value (72.3 million VND/ha). Remarkably, while the commune's cultivated area accounts for only about 10.9% of the district's total agricultural land, its crop production value reaches 69.46 billion VND, demonstrating exceptionally high land-use efficiency. This success stems partly from the application of VietGAP

standards for key vegetables like lettuce, bok choy, amaranth, fish mint, herbs, celery, malabar spinach, and centella, combined with effective policy support under Decision No. 01/2012/QD-TTg and local government initiatives including technical training, concentrated production zoning, input guarantees, and establishing stable distribution systems through supermarket and enterprise partnerships.

The research was also conducted in Lac Lam commune, Don Duong district, Lam Dong province - one of Vietnam's largest vegetable-growing regions benefiting from year-round cool climate conditions at altitudes between 300-1,500 meters above sea level. Here, the study randomly interviewed 161 VietGAP vegetable farming households from local government-provided lists. Data collection occurred in two phases: September 2023 (100 households) and September 2024 (61 households) to ensure data representativeness, stability, and to track changes in farmers' distribution channel selection decisions. The questionnaire comprised two main sections: (1) Household socioeconomic characteristics; and (2) Factors influencing VietGAP vegetable sales partner selection.

The selection of these two research sites - with their distinct production scales, natural conditions, and organizational approaches - provides comprehensive insights into the success factors of VietGAP vegetable models in Vietnam. This comparative analysis yields valuable lessons for scaling up safe vegetable production models nationwide.

1.4.2. Data collection and data analysis

This study applied a quantitative research approach to investigate both compliance with VietGAP standards and the determinants influencing farmers' choice of sales partners. Data were gathered from 91 households engaged in certified VietGAP vegetable production in Quang Thanh commune and 161 households in Lac Lam commune, selected at random from the two commune’s official list to ensure the sample's representativeness.

A structured questionnaire was used as the primary data collection tool, consisting of two main sections. The first section focused on the current status of farmers' compliance with 12 core components of VietGAP standards, including: production area assessment, seed selection, soil management, use of fertilizers and additives, irrigation practices, chemical usage, harvesting and post-harvest handling, waste management, labor practices, record-keeping and traceability, internal inspection, and complaints handling. Farmers were asked to rate their level of compliance for each component on a 5-point Likert scale, ranging from 1 (not compliance at all) to 5 (fully compliance). The second section collected demographic and socioeconomic data such as age, education, income, farming experience, and farm size.

Before the main survey, the questionnaire was pre-tested with 15 farmers and evaluated by a panel of experts, including agricultural officers and commune extension workers, to ensure clarity and validity. Additional data collection methods included in-depth interviews with local officials and a group discussion to enrich the quantitative findings.

To analyze the collected data, two separate analytical approaches were employed. Descriptive statistics such as means, standard deviations, and percentages were calculated using Microsoft Excel to assess VietGAP compliance levels.

In parallel, a binary logistic regression model was used to explore factors influencing farmers' decisions when selecting sales partners either companies or collectors. This model enabled the prediction of farmers' choices based on independent variables such as income, education, experience, farm size, and the use of high technology in production. The analysis was conducted using STATA 17 software.

The logistic regression was expressed in its standard logit form, where the log-odds of choosing a collector (coded as 1) over a company (coded as 0) were modeled as a function of the independent variables. Marginal effects were also calculated to estimate the degree of influence each factor had on the probability of choosing a specific partner. To ensure the robustness of the regression results, diagnostic tests such as the variance inflation factor (VIF) for multicollinearity and the Hosmer-Lemeshow test for goodness of fit were conducted.

After assessing variable correlations, some highly correlated variables, such as farmers' age, were excluded from the final model to avoid multicollinearity and improve model precision. Only independent variables with statistically significant and interpretable effects were retained in the final analysis, as detailed in Table 10.

This comprehensive methodological approach provides not only a clear picture of VietGAP implementation but also valuable insights into the economic behaviors of farmers, thereby supporting future policy recommendations for sustainable agricultural development in the region.

1.5.The structure of the thesis

This dissertation is structured in accordance with the standard monographic format commonly adopted in empirical agricultural and rural development research. It comprises seven chapters, including this introductory chapter, each designed to progressively build a coherent narrative and analytical framework. The content and focus of the subsequent chapters are outlined as follows.

Chapter Two presents a contextual overview that establishes the foundational background for the research. It provides a comprehensive examination of Vietnam’s agricultural sector, including its structural characteristics, the organization of agri-food supply chains, and the evolution of Good Agricultural Practices (GAP) within the country, with particular emphasis on the national VietGAP certification program. This contextualization is not only essential for interpreting the empirical result, but also underscores the rationale and urgency for investigating the implementation of VietGAP in vegetable production systems.

Chapter Three details the research methodology employed throughout the study. It outlines the selection of two representative case study regions Thua Thien Hue in Central Vietnam and Lam Dong in the SouthCentral Highlands both of which exemplify distinctive patterns of vegetable cultivation and supply chain integration under the VietGAP standard. The chapter elaborates on the sampling strategy, primary data collection procedures (including structured household surveys), and the quantitative analytical techniques compliance, such as mean, standard deviations.

Chapter Four focuses on assessing the level of compliance with VietGAP standards among small-scale vegetable farming households in Central Vietnam. Following the introduction, this chapter presents the empirical dataset and outlines the research design, highlighting the socio-economic and production characteristics of the surveyed households. It then provides an in-depth analysis of the key criteria where non-compliance remains prevalent. The chapter concludes with a synthesis of the main findings, offering critical insights into farm-level adherence to VietGAP requirements.

Chapter Five shifts the analytical lens to farmers' marketing strategies, specifically their decisions regarding the choice of downstream supply chain partners. The analysis contrasts two dominant marketing channels: formal enterprises with contractual arrangements and informal collectors without fixed agreements. After outlining the research context and conceptual framework, the chapter applies a binary logit model to quantitatively assess how household and farm-level variables affect partner selection. The findings are then used to inform policy-oriented conclusions on improving supply chain governance and market access for certified producers.

Chapter Six This chapter synthesizes the main findings and connects them to existing theories and literature, drawing broader implications. It highlights the interdependence between VietGAP compliance, institutional support, and farmers' market strategies factors that together shape the sustainability and inclusiveness of certified vegetable supply chains in Vietnam. The study demonstrates that successful standard compliance necessitates not only technical capacity but also

robust institutional support and access to markets. Fragmented support or limited market access can hinder smallholder participation, even when technical standards are met. The chapter concludes by summarizing key insights, noting methodological limitations, and suggesting future research on the long-term impacts of standard adoption and inclusive market integration for smallholders.

CHAPTER 2: OVERVIEW OF VIETGAP STANDARDS VEGETABLES IN VIET NAM

In recent years, the demand for safe and high-quality agricultural products has been rising in both domestic and international markets. To meet this demand, Vietnam has adopted and promoted the application of Good Agricultural Practices (GAP), particularly VietGAP, as a standardized framework to enhance food safety, environmental sustainability, and farmers' economic well-being.

This chapter provides a comprehensive overview of VietGAP vegetable production in Vietnam. It begins with an analysis of the current status, trends, and economic structure of vegetable farming, especially in key regions applying VietGAP standards. The chapter then explores the development and implementation of GAP standards, including the evolution of international benchmarks such as EurepGAP and GlobalGAP, and how VietGAP has been localized to suit Vietnam's agricultural context.

Furthermore, the chapter examines the policies that support VietGAP implementation, the structure of Vietnam's food marketing system, and the fresh produce supply chain. Finally, it discusses how VietGAP has been enforced and integrated into farming practices, laying the groundwork for understanding farmers' behavior and decision-making processes in choosing partners within the VietGAP vegetable supply chain an issue central to the research focus of this thesis.

2.1. Vegetable production in Viet Nam

2.1.1. Status of vegetable production

The vegetable industry plays an important role in the entire agricultural sector of Vietnam. With a tropical and subtropical humid climate, Vietnam has favorable conditions for the production of fresh vegetables all year round. Vegetable production in Vietnam can be divided into three types according to the season: winter crop (November-March); summer crop (April-October) and year-round vegetables. The winter crop is more diverse than the summer crop, growing root vegetables,

fruit vegetables and leafy vegetables. There are about 80 species of vegetables grown in Vietnam. They are divided into several groups (i) Leafy vegetables; (ii) Fruit vegetables; (iii) Root vegetables and root vegetables; (iv) Other vegetables.

In recent years, especially since 2021, the vegetable production area has grown rapidly (see Figure 1). From 2019 to 2023, vegetable production in Vietnam recorded a steady growth trend in both harvested area and yield, reflecting the expansion of scale and improvement in cultivation efficiency in the vegetable growing industry. Specifically, the harvested area increased from 993,920 ha in 2019 to 1,052,460 ha in 2023, corresponding to a compound annual growth rate (CAGR) of about 1.43%. This increase shows the continuous efforts to meet domestic consumption demand and expand export markets. At the same time, yield also recorded a slight improvement, from 16.79 tons/ha in 2019 to 17.35 tons/ha in 2023, with a CAGR of about 0.82%. The slower growth rate of productivity compared to area shows that vegetable production growth is still mainly based on expanding cultivated area, while the potential for improving production efficiency through technical improvements and agricultural management still has much room. Vegetable production is estimated to increase from about 1.67 million tons in 2019 to 1.83 million tons in 2023, confirming the positive development trend of the industry during this period.

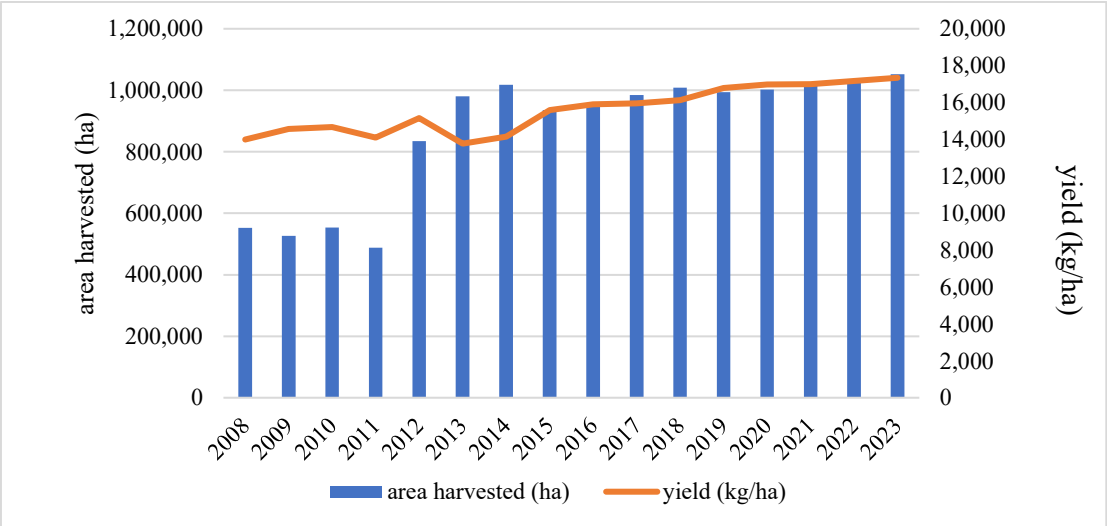

Figure 1. Trends in vegetable harvested area and yield, 2008-2023
(Source: FAOSTAT, 2023)

2.1.2 Major export markets

According to statistics from the General Department of Customs, China is Vietnam's largest agricultural export market, accounting for 65.5% of total turnover. The following markets include the United States (4.5%), South Korea (4.0%), Japan (3.2%), Thailand (2.8%) and the Netherlands (2.6%). Taiwan accounts for 2.5%, Australia 1.5%, UAE 1.0% and Russia 0.9%. The group of "Other markets" accounts for a total of 11.5%. The data shows a high concentration in one market and a low proportion in the remaining markets.

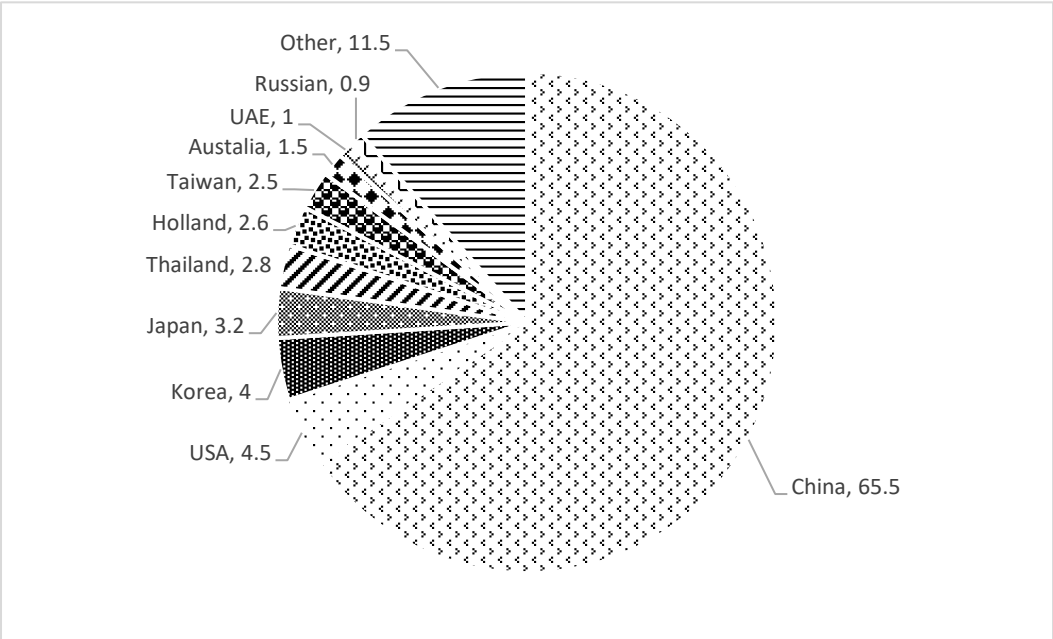

Figure 2: Vietnam's fruit and vegetable export market in 2023

Source: General Department of Customs, 2023

2.1.3. Trend in the area of farmland crtified under VietGAP

VietGAP Certification in Vietnamese Agriculture: Remarkable Growth in Just 7 Years:

The data from the Ministry of Agriculture and Rural Development (2023) highlights an impressive expansion of VietGAP-certified farming areas. From 2015 to 2022, both the certified farmland and the number of qualifying facilities grew exponentially, reflecting a significant shift in Vietnam’s agricultural practices.

Initial Phase (2015–2017): From Humble Beginnings to Rapid Growth

In 2015, VietGAP was still a niche standard, with only 3,200 hectares and 735 certified facilities. Yet, within just two years, the certified area surged nearly sixfold (18,200 ha), while the number of approved facilities doubled (1,406 units). This boom was driven by government policies promoting clean agriculture and rising domestic and international demand for safe produce.

Acceleration Phase (2018): A Dramatic Leap Forward

2018 marked a turning point—VietGAP farmland skyrocketed 4.5 times (81,500 ha) compared to 2017, far outpacing the growth in certified facilities (just 35%). This indicates a shift from small-scale farming to large-scale production zones, particularly for key crops like rice, vegetables, and fruit trees.

Consolidation Phase (2022): VietGAP as the New Standard

By 2022, VietGAP certification covered 463,000 hectares and 6,211 facilities, cementing its role as a baseline requirement for Vietnamese agricultural exports. Notably, farmland expansion (5.7x in four years) outpaced facility growth (3.3x), proving that centralized, large-scale farming models now dominate.

Despite rapid growth, VietGAP-certified land still accounts for only about 4% of Vietnam's total farmland (General Statistics Office, 2022). The real test lies in extending this model to smallholder farmers, who remain hesitant due to costs and certification hurdles.

Table 1: Development situation of area and number of VietGAP certified cultivation facilities by year

Years	VietGAP area (ha)	Number of VietGAP certified growing facilities (Unit)
2015	3.200	735
2017	18.200	1.406
2018	81.500	1.900
2022	463.000	6.211

Source: Report by the Department of Agricultural, Forestry and Fishery Product Quality Management belong to the Ministry of Agriculture and Rural Development, 2023

2.1.4. Agricultural economic structure between two key VietGAP vegetable regions

The 2023 Statistical Yearbook provides an overview of the trend of changes in agricultural land area and the contribution of the agriculture, forestry and fishery sector to GRDP in the two provinces of Thua Thien Hue and Lam Dong in the period 2019–2023.

In Thua Thien Hue, the agricultural land area decreased slightly from 68.6 thousand hectares in 2019 to 67.8 thousand hectares in 2023. At the same time, the proportion of the agriculture, forestry and fishery sector in the GRDP structure also decreased from 11.3% to 10.7%, reflecting the trend of decreasing relative role of this sector in the provincial economy.

In contrast, Lam Dong has a much larger agricultural land area, remaining stable at around 369.5 thousand hectares from 2019 to 2021, before decreasing slightly to 328 thousand hectares in 2023. Despite the decreasing area, the proportion of GRDP of the agricultural, forestry and fishery sector in Lam Dong remains high, ranging from 36% to 38.7%, and reaching 37.4% in 2023. This shows the clear importance of the agricultural sector in the local economic structure.

Comparing the two provinces, Lam Dong has a superior agricultural scale, both in terms of cultivated area and contribution to GRDP. This is the basis for assessing the potential for applying and expanding the VietGAP vegetable production model in Lam Dong is higher than in Hue, where the agricultural sector has a smaller scale and role in the economy.

Table 2: Agricultural Land and Sectoral GRDP (%) in Lam Dong and Thua Thien Hue

	Item	2019	2020	2021	2022	2023
Hue	Agricultural land (thous.ha)	68.6	68.3	68.2	68.1	67.8
	Structure of GRDP at current prices (%)	11.3	11.7	11.5	10.8	10.7
Lam	Agricultural land (thous.ha)	369.5	369.5	369.5	368.2	328
Dong	Structure of GRDP at current prices (%)	36	38.1	38.7	37.1	37.4

Note: GRDP structure of agriculture, forestry and fishery

Source: Statistical Yearbook, 2023

2.2. Development and implementation of VietGAP standards.

This section presents the development of Good Agricultural Practices (GAP) standards globally, along with the formation and application of VietGAP standards in Vietnam. The application of GAP aims to ensure food safety, improve the quality of agricultural products, protect the environment and contribute to sustainable agricultural development.

2.2.1. Evolution of Good Agricultural Practices (GAP), EurepGAP, and GlobalGAP

The concept of "Good Agricultural Practice" is defined by the Food and Agriculture Organization of the United Nations (FAO, 2022) as the process of applying existing knowledge in a reasonable manner to meet the requirements of environmental protection, economic efficiency and social development in agricultural production and post-harvest, with the ultimate goal of creating safe products for consumers' health, including both food and non-food products.

Initially, GAP was initiated and implemented by a group of retailers in Europe with the goal of standardizing quality and ensuring food safety throughout the European Union. In 1997, the European Retailer Fresh Produce Working Group developed a set of standards called EurepGAP. The standards reflect a concerted effort to respond to growing consumer concerns about food safety while meeting increasingly stringent European regulatory requirements (Asfaw et al., 2010; Tallontire et al., 2014). Since then, EurepGAP has rapidly become a widely accepted standard in the European food retail market. In 2007, to reflect its expansion beyond Europe, EurepGAP was renamed GlobalGAP. This name change marks an important step in the evolution of the standard from a regional standard system to a global benchmark for safe agricultural production. Currently, GlobalGAP is recognized as an international private standard, used by many countries, especially those exporting agricultural products to developed markets such as the EU, Japan or North America(Annor et al., 2016; Herzfeld et al., 2011; Lemeilleur, 2013).

In parallel with the development of GlobalGAP, many governments have also developed their own national GAP standards, based on the general principles of GlobalGAP but adjusted to suit

local conditions. These standards are often called public GAP to distinguish them from private GAPs such as GlobalGAP - which are operated by private organizations or international retail associations. Some typical examples of public GAP include Q-GAP in Thailand (Amekawa, 2009; Krause et al., 2016; Lippe & Grote, 2017), PhilGAP in the Philippines (Banzon, Mojica & Cielo, 2013), MyGAP in Malaysia (Amekawa et al., 2017) and VietGAP in Vietnam (Nicetic et al., 2010). In general, public GAP standards have lower technical requirements and strictness than GlobalGAP. For example, Q-GAP in Thailand allows some flexibility in the certification and control process compared to the strict requirements of GlobalGAP (Wongprawmas & Canavari, 2014.). However, many products certified under public GAP such as Q-GAP or PhilGAP are still exported to foreign markets. However, in some cases such as in Vietnam, agricultural products meeting VietGAP standards are mainly consumed domestically because they do not meet all the requirements from major export markets.

To promote the application of public GAP, governments often offer many support mechanisms to encourage farmers to participate. These forms of support can include: free training on GAP production techniques, direct advice from experts, partial or full support for certification costs, provision of production inputs (seeds, fertilizers, biological pesticides) at preferential prices, and even commitments to purchase at higher prices than the market (Nicetic et al., 2010; Wongprawmas & Canavari, 2015).

In contrast, private GAP standards such as GlobalGAP do not have direct support mechanisms from the state but rely mainly on market dynamics. Specifically, farmers and businesses who want to access large, high-value export markets must fully meet the technical requirements set by the organization that owns the standard. Compliance with GlobalGAP often requires large investment costs and strict control processes, which increases the pressure on small producers. In private GAP programs, certification is carried out by independent, reputable, and internationally recognized certification companies (Lemeilleur, 2013). Meanwhile, public GAP systems are often directly

managed and supervised by the government. For example, the Q-GAP program in Thailand is operated and certified by government agencies (Wongprawmas & Canavari, n.d.). In Vietnam, the central government is responsible for designating qualified organizations to carry out VietGAP certification. These organizations can be state agencies or private entitie, however the majority are still public sector agencies.

2.2.2. Introduction and implementation of VietGAP in Vietnam.

VietGAP short for "Vietnamese Good Agricultural Practices" was developed based on the GlobalGAP standards framework and was officially introduced in 2008 for agricultural producers in Vietnam (Nicetic et al., 2010). This set of standards includes principles, regulations and procedures to guide farmers in producing, harvesting and processing agricultural products in a way that ensures food safety, traceability and environmental protection (MARD, 2008c). According to the Ministry of Agriculture and Rural Development (MARD, 2008c, p. 2), VietGAP was issued with the following objectives: to enhance the responsibility of individuals and organizations in food safety production and management; to create favorable conditions for organizations and individuals to be recognized for their capacity to ensure food safety according to VietGAP standards; to ensure transparency and traceability, as well as to recall products when necessary; improve the quality of agricultural products and economic efficiency in fruit and vegetable production in Vietnam.

To support the implementation of VietGAP as well as promote the transformation of agriculture towards marketization, the Vietnamese government has applied a series of major policies and strategies. One of the important strategies is to develop a master plan for the development of agricultural production and consumption until 2020, with a vision to 2030, stated in Decree No. 210/ND-CP issued on December 19, 2013. Accordingly, the Ministry of Agriculture and Rural Development will organize the implementation of a comprehensive, modern, large-scale, sustainable agricultural production system with high productivity and competitiveness, while

taking advantage of comparative advantages, applying advanced science and technology, ensuring food security and meeting the increasingly diverse needs of the domestic and export markets.

In addition, Decision No. 899/QD-TTg dated June 10, 2013 on restructuring the agricultural sector was also implemented to increase added value and sustainable development. The objectives of this plan are: maintaining growth in the agricultural sector; improving efficiency and competitiveness through productivity, quality and added value; increasingly meeting the needs and tastes of domestic consumers. The Vietnamese Government has also issued many legal documents to support traceability and minimize environmental impacts. In particular, Circular No. 74/2011/TT-BNNPTNT dated October 31, 2011 issued by the Ministry of Agriculture and Rural Development has detailed regulations on traceability, recall and handling of unsafe agricultural and forestry products. At the central level, the main responsibility lies with the National Agro-Forestry-Fisheries Quality Assurance Department this unit will coordinate with relevant organizations to inspect and handle warned products. At the provincial level, this work is carried out by the Sub-Department of Agro-Forestry-Fisheries Quality Assurance or a unit assigned by the Department of Agriculture and Rural Development. VietGAP for fruits and vegetables includes 12 main criteria according to MARD (2008). Specifically:

1. Evaluation and selection of production areas
2. Varieties and rootstocks
3. Soil and substrate management
4. Fertilizers and additives
5. Water for irrigation
6. Chemicals (including inorganic fertilizers and pesticides)
7. Harvesting and post-harvest handling
8. Waste management and treatment
9. Labor safety

10. Recording, archiving, traceability and product recall

11. Internal inspection

12. Complaints and complaint resolution

The Ministry of Agriculture and Rural Development has issued many legal documents guiding localities in implementing VietGAP. For example, Decision No. 379/QD-BNN dated January 28, 2008 promulgated the VietGAP process applicable to the production of safe vegetables, fruits and tea (MARD, 2008a). Article 3 of this decision stipulates the responsibilities of relevant units in organizing implementation.

In addition, the Government has also issued other decisions related to the management, certification and consumption of VietGAP products to support producers and related parties such as retailers. Typically, Decision No. 99/QD-BNN dated October 15, 2008 regulates the production and trading of safe vegetables, fruits and tea; and Circular No. 48/2012/TT-BNNPTNT dated December 21, 2012 on the process of certifying agricultural products meeting VietGAP standards.

Organizations such as the National Center for Agricultural Extension (NCAE), in coordination with the Department of Crop Production and local Departments of Agriculture, have organized 5-7 days training courses for provincial/district level agricultural extension officers. At the same time, they also organized practical demonstration models in localities to help farmers access and apply the VietGAP process (MARD, 2013). At the commune level, local officials, in collaboration with scientists from agricultural universities, commune authorities and cooperatives, organize soil and water quality testing before implementing VietGAP production.

As of 2014, although there are no official statistics on the number of farmers applying VietGAP, data from the Department of Crop Production shows that there are about 7,557 hectares of vegetables, 11,027 hectares of fruit trees, 7,554 hectares of rice, 5,644 hectares of tea and 124 hectares of coffee produced according to VietGAP standards. However, this area still accounts for a relatively small proportion compared to the total area of each type of crop: only about 0.08% for

vegetables, 1.35% for fruits, 0.01% for rice, 4.19% for tea and 0.02% for coffee. This shows that the application of VietGAP is still modest, especially in the study area.

2.2.3. Key drivers for adopting GAP programs.

The adoption of Public GAP certification schemes in developing countries is driven by a number of factors, including clear practical benefits for farmers. One of the main drivers for many farmers to choose Public GAP over private standards such as GlobalGAP is that the inspection, monitoring and evaluation systems in Public GAP are often simpler and less rigorous. For example, in Japan, the Ministry of Agriculture, Forestry and Fisheries (MAFF) has implemented "Basic GAP" as a model of good production practices without requiring formal certification. Despite the lack of documentation confirming compliance, farmers have accepted the scheme because of its flexible approach and the possibility of self-assessment. This has helped the model spread rapidly, although Japan has since moved to develop the private certification system JapanGAP to meet the higher demand for transparency and verification. In addition, government financial support has played an important role in increasing access to public GAP programs. In Vietnam, the cost of VietGAP certification for a citrus farm is only about one-third of the cost of GlobalGAP, thanks to government subsidies. Thailand and the Philippines have adopted a similar approach, with the government providing certification services free of charge or at a significant discount to encourage farmers to join QGAP and PhilGAP. Although there are still skepticism from the private sector about the reliability of government-supported quality systems, easy access and low costs have helped to expand the reach of public GAP standards in agricultural production.

Another notable factor is that public GAPs establish minimum production standards that farmers can achieve under real-world conditions. These standards not only provide a basic technical framework but also help improve production efficiency. (Ha, 2014) showed that farmers applying VietGAP in growing Chinese cabbage achieved higher yields while the cost of fertilizers and pesticides was lower than the traditional farming model. Srisopaporn et al. (2015) also

recorded similar results when households growing rice under QGAP in Thailand significantly improved in pest management and reasonable fertilizer use, thereby the products were highly appreciated by the market for their safety. In addition, some studies suggest that the public GAP program also acts as a stepping stone to more stringent international standards such as GlobalGAP. Typically, in Vietnam, many contents of VietGAP especially criteria related to food safety and chemical control - have approached international standards. However, VietGAP is still limited in aspects such as environmental protection and labor rights, making it unable to completely replace the role of international certifications in agricultural exports. Public GAP systems in Thailand (QGAP) and Malaysia (MyGAP) are also built on the GlobalGAP framework, and are classified into levels of compliance from basic to comprehensive, helping farmers gradually improve their production capacity.

In addition, non-governmental organizations (NGOs) and local government units (LGUs) play an important role in supporting farmers to access public GAP, especially for smallholders or group farmers. A typical example is in the Philippines, the achievement of PhilGAP certification of some Cardava banana growers is mainly driven by technical and financial support from these organizations. Meanwhile, for Cavendish bananas a key export commodity the driving force comes from foreign market requirements and a quality-oriented corporate culture.

In short, the popularity of public GAP programs comes not only from economic benefits but also from their suitability to the current production capacity of many farmers. Factors such as moderate technical requirements, flexible monitoring systems and government support make these programs effective tools in improving agricultural product quality and moving towards sustainable development.

2.3. VietGAP Policy Development Process Over Time

2.3.1. Legal framework for implementing VietGAP

The VietGAP (Vietnamese Good Agricultural Practices) standards are applied across three main agricultural sectors: crop production, livestock, and aquaculture. Specifically:

VietGAP Standards for Crop Production

The content of the VietGAP standards for crop production is specified in the National Standard TCVN 11892-1:2017. These standards are developed based on the principles and frameworks of ASEAN GAP, EUREPGAP/GLOBALG.A.P, and FRESHCARE. The crop production component of VietGAP aims to facilitate the integration of Vietnamese agricultural products into regional and global markets, particularly within ASEAN, and to promote sustainable agricultural practices.

VietGAP Standards for Livestock Production

The VietGAP standards for livestock, abbreviated as VietGAHP (Vietnamese Good Animal Husbandry Practices), are defined in Decision No. 4653/QĐ-BNN-CN dated November 10, 2015, issued by the Ministry of Agriculture and Rural Development. This decision includes eight detailed practice guidelines for different types of animal husbandry:

VietGAHP for poultry (chickens)

VietGAHP for waterfowl (ducks and muscovy ducks)

VietGAHP for beef cattle

VietGAHP for dairy cattle

VietGAHP for meat goats

VietGAHP for dairy goats

VietGAHP for honeybee farming

These guidelines establish standardized procedures for ensuring hygiene, animal welfare, feed safety, and traceability throughout the livestock production process.

VietGAP Standards for Aquaculture

The aquaculture component of VietGAP is detailed through several official documents:

Decision No. 3824/QĐ-BNN-TCTS dated September 6, 2014, which promulgates the national code of good aquaculture practices in Vietnam;

Decision No. 4835/QĐ-BNN-TCTS dated November 24, 2015, which provides specific guidance on applying VietGAP to whiteleg shrimp (P. vannamei) and black tiger shrimp (P. monodon);

Decision No. 1233/QĐ-BNN-TCTS dated April 11, 2016, which offers guidance for implementing VietGAP in the production of commercial tilapia (Oreochromis spp.).

Table 3: Legal documents related to VietGAP

Field	Number/Name of Document/name of decision, circular	Date of Issuance	Policy Content Related to VietGAP
1.Crop production			
	Decision No. 379	January 28, 2008	Promulgation of Good Agricultural Practices (GAP) for the safe production of fresh vegetables and fruits.
	Decision No. 1121/QĐ-BNN-KHCN	April 14, 2008	Decision on the issuance of Good Agricultural Practices (GAP) for the safe production of fresh tea buds
	Decision No. 84/2008/QĐ-BNN	July 28, 2008	Promulgation of the Certification Regulation for Good Agricultural Practices (VietGAP) applied to the safe production of vegetables, fruits, and tea.
	Decision No. 2998/QĐ-BNN-TT	November 9, 2010	Issuance of Good Agricultural Practices (VietGAP) for rice production.
	Decision No. 2999/QĐ-BNN-TT	November 9, 2010	Issuance of Good Agricultural Practices (VietGAP) for coffee production.
	Decision No. 2802 (Ministry of Science and Technology)	October 17, 2017	Publication of National Standard TCVN 11892-1:2017 – Good Agricultural Practices (VietGAP) – Part 1: Crop Production.
2.Livestock			

	Decision No. 1579/QĐ-BNN-KHCN	June 30, 2005	Issuance of Good Animal Husbandry Practices (GAHP) for safe dairy cattle farming.
	Decision No. 1504/QĐ-BNN-KHCN	May 15, 2008	Issuance of Good Animal Husbandry Practices (GAHP) for safe poultry farming.
	Decision No. 1506/QĐ-BNN-KHCN	May 15, 2008	Issuance of Good Animal Husbandry Practices (GAHP) for safe pig farming.
	Decision No. 1580/QĐ-BNN-KHCN	May 26, 2008	Issuance of Good Animal Husbandry Practices (GAHP) for safe beekeeping.
	Decision No. 1947/QĐ-BNN-CN	August 23, 2011	Issuance of Good Animal Husbandry Practices (GAHP) for safe household pig farming
	Decision No. 1948/QĐ-BNN-CN	August 23, 2011	Issuance of Good Animal Husbandry Practices (GAHP) for safe household chicken farming.
	Decision No. 4653/QĐ-BNN-CN	November 10, 2015	Issuance of General Guidelines for Good Animal Husbandry Practices (VietGAHP).
	Decision No. 2509/QĐ-BNN-CN	June 22, 2016	Decision on the promulgation of certification regulations and VietGAHP for safe pig and chicken farming in smallholder households.
3.Aquaculture			
	Decision No. 1503/QĐ-BNN-TCTS	July 5, 2011	Issuance of Good Aquaculture Practices (VietGAP) applicable in Vietnam.
	Decision No. 3824/QĐ-BNN-TCTS	September 6, 2014	Issuance of Vietnamese Good Aquaculture Practices (VietGAP) guidelines.
	Decision No. 4835/QĐ-BNN-TCTS (replacing Decision No. 1503)	November 24, 2015	Guidelines for implementing VietGAP in commercial farming of whiteleg shrimp (P. vannamei) and black tiger shrimp (P. monodon).
4.General Supporting and Related Policies			

	Decision No. 01/2012/QĐ-TTg by the Prime Minister	January 9, 2012	Policies supporting the implementation of Good Agricultural Practices (GAP) in agriculture, forestry, and fisheries.
	Circular No. 53/2012/TT-BNNPTNT	October 26, 2012	Issuance of the list of agricultural and aquatic products eligible for support under Decision No. 01/2012/QĐ-TTg.
	Joint Circular No. 42/2013/TTLT-BNNPTNT-BTC-BKHĐT	October 16, 2013	Implementation guidelines for Decision No. 01/2012/QĐ-TTg on policies supporting the application of Good Agricultural Practices in agriculture, forestry, and fisheries.
	Circular No. 06/2018/TT-BNNPTNT	June 21, 2018	Amendments to Circular No. 48/2012/TT-BNNPTNT dated September 26, 2012 by the Ministry of Agriculture and Rural Development on certification of products from aquaculture, crop, and livestock production in conformity with Good Agricultural Practices.

2.3.2. The Policy Development Process of VietGAP Over Time

Based on the historical issuance of relevant decisions, the development of VietGAP policy can be categorized into three main phases:

Phase 1: Initial Stage and Establishment of Technical Foundations (2005–2011)

The policy process began with the development and promulgation of technical "Procedures" (VietGAP) or "Regulations" for key agricultural commodities in Vietnam across crop production (e.g., vegetables, fruits, tea, rice, coffee), animal husbandry (e.g., dairy cattle, poultry, pigs, bees, household pig/chicken farming), and aquaculture. These technical documents, for the first time, clearly defined the required standards and practices for safe agricultural production.

In parallel with the technical frameworks, the policy also established a certification mechanism. A prominent example is Decision No. 84/2008/QĐ-BNN, which outlines a comprehensive certification scheme for the safe production of vegetables, fruits, and tea under VietGAP. This document stipulates evaluation procedures (e.g., document reviews, field inspections), specific assessment criteria (e.g., livestock waste management, risk assessment related to fertilizers), and documentation requirements. This reflects an early recognition of the importance of third-party verification (certification) in building consumer and market trust.

Phase 2: Promotion of Application and Policy Refinement (2012–2016)

Following the formulation of initial technical standards and certification mechanisms, the policy focus shifted to promoting practical implementation. Decision No. 01/2012/QĐ-TTg issued by the Prime Minister exemplifies this shift, representing governmental commitment to VietGAP through financial and technical support measures.

During this phase, technical and administrative regulations were reviewed, updated, and refined to better align with practical conditions and specific target groups. For instance, the VietGAP regulation for aquaculture was re-issued in 2014 (Decision No. 3824/QĐ-BNN-TCTS), replacing the earlier Decision No. 1503/QĐ-BNN-TCTS. In 2015, a more detailed guideline for shrimp farming was released (Decision No. 4835/QĐ-BNN-TCTS). Similarly, updated regulations regarding household livestock farming and its certification were issued in 2016 (e.g., Decision No. 2509/QĐ-BNN-CN). These adjustments indicate a policy learning process and a commitment to continuous improvement based on implementation experience.

Phase 3: Standardization and Systematization (2017–present)

VietGAP has gradually been elevated to the level of national standards (TCVN). A major milestone was the publication of TCVN 11892-1:2017 for crop production, formally integrating VietGAP into the national standard system, thereby enhancing its legal status and credibility.

Concurrently, certification-related regulations have continued to evolve—for example, Circular No. 06/2018/TT-BNNPTNT, which amended earlier provisions on product certification in line with Good Agricultural Practices.

In summary, the evolution of VietGAP policy has been documented through a series of legal decisions that trace a clear trajectory—from the initial definition of sector and commodity specific technical practices, to the establishment of certification systems, the introduction of support measures for wider adoption, and finally the standardization and regular updating of technical and management guidelines. These policy instruments have primarily been issued by the Ministry of Agriculture and Rural Development (MARD), either independently or in coordination with other ministries, underscoring the Ministry's leading role in the state management of this domain.

2.4. Enforcement and practical application of VietGAP in farming systems.

VietGAP was developed based on the GlobalGAP program and introduced in Vietnam in 2008 to support domestic agricultural producers to meet international food safety and quality standards (Nicetic et al., 2010). This program includes regulations, procedures and processes to guide farmers in the production, harvesting and processing of agricultural products, ensuring requirements on food safety, product quality, traceability and environmental protection (MARD, 2008c).

The main objective of implementing VietGAP in Vietnam is to enhance the responsibility of individuals and organizations in food safety management, facilitate the approval of products meeting VietGAP standards, ensure transparency and traceability of products, and improve the quality and economic efficiency of fruit and vegetable production (MARD, 2008c).

To support the implementation of VietGAP, the Vietnamese Government has issued many policies and plans for agricultural development. For example, Decree No. 210/ND-CP dated December 19, 2013, regulating the development of agricultural production and consumption until 2020, with a vision to 2030, aims to build a modern, sustainable and large-scale agricultural

production system, focusing on promoting comparative advantages, applying new science and technology, ensuring national food security and improving resource efficiency (MARD, 2013). In addition, Decision No. 899/QD-TTg dated June 10, 2013 of the Prime Minister on restructuring the agricultural sector towards increasing added value and sustainable development was also issued, with the goal of maintaining growth in the agricultural sector, improving efficiency and competitiveness through improving productivity, quality and added value of products (MARD, 2013).

To ensure effective implementation of VietGAP, the Ministry of Agriculture and Rural Development (MARD) has issued many detailed guidance documents. For example, Circular No. 74/TT-BNNPTNT dated October 31, 2011 regulates the traceability, recall and handling of unsafe agricultural products and food, which clearly stipulates the responsibilities of competent agencies in inspecting, monitoring and handling violations related to food safety (MARD, 2011).

Table 4: Number of VietGAP registered farms and businesses

Crop production		**Livestock**		**Aquaculture**	
Category	Number of registered	Category	Number of registered	Category	Number of registered
Rice	20	Chicken	5	Pangasius	3
Fruit	530	Cow	2	Shrimp	10
Coffee	5	Pig	6		
Tea	137				
Vegetable	517				

Source: VietGAP website

The implementation and application of VietGAP in Vietnam's agricultural system is clearly reflected in the distribution of the number of registered farms and enterprises by sector. According to data from the VietGAP website, crop cultivation facilities dominate in terms of the number of registrations, while the livestock and aquaculture sectors remain low. This shows that the

orientation and effectiveness of the implementation of current VietGAP policies are still uneven among sectors.

In the crop cultivation sector, fruits and vegetables have the highest registration rates, with 530 and 517 establishments, respectively. These are two groups of agricultural products with high consumption and strict requirements on food safety, especially in the context of consumers increasingly concerned about health and product quality. Tea is also an agricultural product with a significant number of registrations (137 establishments), reflecting the demand for export and the requirement to comply with standards in the supply chain. In contrast, products such as rice and coffee – although they are key export commodities – have very limited registrations (20 and 5 establishments), showing that the application of VietGAP in mass production areas still faces many obstacles, possibly due to certification costs, small scale and limited awareness of farmers (MARD, 2008c; Department of Crop Production, 2015).

In contrast to the crop sector, the implementation of VietGAP in the livestock sector is very limited. There are only 13 registered establishments in total, of which 6 are pig farms, 5 are chicken farms and 2 are cow farms. This fact raises questions about the effectiveness of support policies in this sector. Due to the characteristics of small-scale production, lack of biosafety control processes and weak antibiotic management, many livestock households have difficulty meeting the strict criteria of VietGAP. The lack of technical and financial support from local agencies is also a major obstacle to the expansion of the program in the livestock sector (USDA, 2017; MARD, 2013).

The aquaculture sector also shows a modest level of implementation, with only 13 registered facilities, of which 10 are shrimp farms and 3 are pangasius farms. These are two types of seafood that play a strategic role in export, however, most businesses in this sector still prioritize using international standards such as GlobalGAP, ASC or BAP instead of switching to VietGAP. This shows part of the challenge of VietGAP in competing and creating trust with international markets.

Although the State has issued many documents such as Circular 74/2011/TT-BNNPTNT to support traceability and handling of unsafe food, the level of access and application at the grassroots level is still limited (MARD, 2011).

An overview from Table 3 shows that although VietGAP has been implemented for more than a decade, implementation at the grassroots level still depends heavily on local capacity, the level of policy support, and the specific characteristics of each sector. Specific figures show initial success in the crop sector, but at the same time, there is a need for clearer and more synchronous intervention policies in the remaining sectors. There is a need for more technical assistance programs, training, reduced certification costs, and extensive communication to ensure the comprehensive and sustainable development of VietGAP in all agricultural sectors.

2.5. Differences and Challenges in the Development of VietGAP Vegetable Production in Vietnam

2.5.1. The Extent of VietGAP Vegetable Production Adoption in Vietnam

Vegetable production in accordance with VietGAP standards in Vietnam has witnessed a significant increase in recent years, as evidenced by the growing number of certified farms and the expanding cultivation area. According to the Ministry of Agriculture and Rural Development, by 2024, approximately 322,497 hectares of crops nationwide were certified under VietGAP—an increase of over 105,000 hectares compared to 2023. Among these, vegetables account for more than 10% of the area, equivalent to around 32,000 hectares, and this number continues to grow steadily each year (IASVN, 2024). Additionally, more than 10,000 agricultural production facilities across the country have received VietGAP certification, demonstrating the increasing interest and adoption of good agricultural practices among farmers.

Many localities have proactively developed VietGAP vegetable production models, with notable examples including Hanoi, Son La, Lam Dong, and Tien Giang. In Hanoi, specialized vegetable farming areas such as Phuc Tho, Dan Phuong, and Chuong My have applied VietGAP

standards on about 224 hectares (Communist Party of Vietnam, 2018). In Son La province, nearly 2,230 hectares of crops are cultivated under VietGAP and GlobalGAP standards, with 99 certified facilities (IASVN, 2024). Lam Dong province is one of the leading localities, with over 7,560 hectares of vegetables, flowers, and fruits following GAP standards, many of which are exported to demanding markets such as Japan and the EU (VCCI News, 2024). Value chain-based production-consumption linkages are being strongly promoted in this province, contributing to market stability and increased farmer income.

The application of VietGAP not only improves the quality and safety of vegetable products but also helps farmers access high-standard markets. Many cooperatives have reported yield increases of 10–15% after switching to VietGAP production, along with significant reductions in pesticide and fertilizer costs. Additionally, some models have started building branding and traceability systems, which enhance product value and expand distribution channels.

However, despite these positive trends, the scaling-up of VietGAP vegetable models still faces several obstacles. Common issues include high certification costs, short certification periods (only two years), lack of post-certification support mechanisms, and unstable consumption markets. Moreover, in many areas, linkages between farmers and enterprises remain weak, resulting in production that is not aligned with market demand.

Nevertheless, the increasing area and number of VietGAP-certified facilities reflect growing awareness and demand for safe production. With comprehensive support from state policies, enhanced enterprise roles in distribution and certification services, and widespread consumer education, VietGAP vegetable production is expected to develop even more strongly in the coming years.

2.5.2. Differences Between VietGAP Vegetable Certification and Other VietGAP Product Certifications in Vietnam

VietGAP (Vietnamese Good Agricultural Practices) certification is applied across various agricultural production sectors, including crop cultivation (vegetables and fruits), animal husbandry, and aquaculture. Although all sectors follow general principles of food safety, traceability, and environmental protection, each has specific requirements tailored to its production characteristics.

-Standards and Control Focus

VietGAP for vegetables focuses on controlling pesticide residues and heavy metals in soil and irrigation water. The production process must ensure proper pesticide application, pre-harvest intervals, and full production log recording.

In contrast, VietGAP for livestock emphasizes feed management, veterinary drug usage, and housing conditions. Farms must strictly follow antibiotic regulations, ensure appropriate withdrawal periods before selling animals, and properly handle livestock waste to prevent environmental pollution.

For aquaculture, VietGAP requirements center on water quality management, disease control, and limiting the use of chemicals and antibiotics. Farmers must regularly monitor environmental indicators such as pH and dissolved oxygen, and use safe, non-banned feed.

-Evaluation and Certification Process

The VietGAP certification process for all three sectors includes evaluating production conditions, checking recordkeeping, and collecting samples for analysis. However, the specific evaluation criteria differ.

For vegetables, certifying bodies thoroughly test soil, irrigation water, and product samples to detect chemical residues. For livestock, assessments focus on feed sources, veterinary drug usage history, and waste management systems. In aquaculture, water, feed, and farmed product samples are analyzed to ensure the absence of antibiotics and hazardous chemicals.

-Market Value and Consumption

VietGAP-certified vegetables and fruits are generally favored in domestic supermarkets and clean food stores, meeting increasing consumer demand for safe produce. Meanwhile, VietGAP-certified livestock and aquaculture products have a competitive advantage in export markets, especially in strict regulatory regions such as the EU, Japan, and South Korea, where there are stringent requirements regarding antibiotic residues and banned substances.

Although they fall under the same VietGAP framework, each sector—crop cultivation, livestock, and aquaculture—has distinct requirements suited to its production specifics. Applying VietGAP not only improves product quality and consumer safety but also opens up export opportunities and enhances the international value of Vietnamese agricultural products.

2.5.3. Challenges Facing VietGAP Vegetable Agriculture Amidst Production Expansion

Despite the expanding area of VietGAP-compliant vegetable cultivation, this sector continues to face various challenges that impact its efficiency and sustainability. The main challenges include:

-High Production Costs, Low Price Competitiveness

Implementing VietGAP requires significant initial investments in high-quality seeds, organic fertilizers, biological pesticides, as well as modern irrigation systems and greenhouses. However, product prices often do not match production costs, as many consumers are not yet willing to pay a premium for VietGAP vegetables over conventional produce.

-Difficulty in Controlling Input Quality

A major challenge is the insufficient regulation of seed and fertilizer safety, which increases the risk of contamination or unwanted chemical residues. In addition, irrigation water in many production areas remains at risk of pollution due to surrounding industrial and residential activities.

-Weak Value Chain Linkages and Traceability Issues

Most farmers still operate on a small scale with limited coordination with purchasing enterprises, resulting in unstable market access. Furthermore, electronic traceability systems are not yet widely adopted, making it difficult for consumers to verify product information.

-Lack of Awareness and Compliance Among Farmers

Many producers still lack a thorough understanding of VietGAP processes, leading to inconsistent application and reduced product quality. Traditional habits of using chemical fertilizers and pesticides persist and are difficult to change in the short term.

-Limitations in Management and Oversight

The current inspection and supervision system is not robust enough to ensure that all products labeled VietGAP genuinely meet the standards. Cases of counterfeit or fraudulent VietGAP certifications still occur, causing consumer mistrust and damaging the reputation of the entire certification system.

Despite its strong development potential, VietGAP vegetable production still faces numerous challenges in terms of cost, input quality, market access, and regulatory enforcement. For sustainable development, joint efforts from the government, businesses, and consumers are essential in improving product quality and strengthening trust in VietGAP-certified produce.

CHAPTER 3: GENERAL METHDOLOGY

This chapter describes in detail the research area, data collection methods and data analysis techniques applied in the studies in the two research areas of Thua Thien Hue and Lam Dong.

3.1. Research area

The research was conducted in two different areas in Vietnam, focusing on vegetable production activities according to VietGAP standards.

The first research area is Quang Thanh commune, Quang Dien district, Thua Thien Hue province, Vietnam. This area is identified as an outstanding VietGAP certified vegetable production area, with economic efficiency and scale exceeding the average of the district and the region. In 2022, the commune had 32.5 hectares of VietGAP vegetables grown by 370 farming households, with an average cultivation scale of only about 0.1 ha, showing that this is an area with a concentration of small-scale farmers. The value of VietGAP vegetable production here reached 675 million VND/hectare, with a total value of 21.94 billion VND, bringing about a real income for farmers of about 15.36 billion VND, nearly ten times higher than the average agricultural value of Quang Dien district. The success of the VietGAP model in Quang Thanh is supported by policies of the Government and local authorities, including technical training, planning of concentrated production areas, ensuring inputs and establishing a stable distribution system. The selection of Quang Thanh as a research site is important because it represents a pioneering model of VietGAP application, providing empirical data to analyze the factors that determine initial success. Although Quang Thanh is an exception in terms of technical support and markets in Quang Dien district, its agricultural production structure is still typical for Thua Thien Hue and Quang Dien district.

The second research area was conducted in Lam Dong province, a province in the SouthCentral Highlands region of Vietnam. Lam Dong has an altitude of 300 to 1,500 meters above sea level and a temperate climate all year round, which is very favorable for growing crops, especially

vegetables and fruits, and is one of the largest vegetable producing areas in the country7. The main data collection site was Lac Lam commune, Don Duong district. This area is famous for its strengths in vegetable and fruit production, contributing significantly to both domestic and export markets. However, farmers here still face many difficulties in maintaining stable prices and lack of close links with consumption partners, leading to unstable income and affecting long-term sustainable development.

The selection of these two research sites allows to explore different aspects of VietGAP application and farmers' business decisions in the specific context of each region in Vietnam

3.2. Data collection

Both studies applied quantitative methods to collect data from VietGAP vegetable farming households.

3.2.1. Sampling method

In the study in Thua Thien Hue, data were collected from 91 households producing safe vegetables according to VietGAP standards, randomly selected from the official list of Quang Thanh commune. The sample size (n = 91) was assessed to meet the criteria for mean value, standard deviation.

In the study in Lam Dong, a survey was conducted with 161 VietGAP vegetable growing households randomly interviewed according to the list provided by Lac Lam commune. The interviews were divided into two rounds, one in September 2023 (100 households) and one in September 2024 (61 households). Dividing the interviews into two rounds not only helps to increase the accuracy, representativeness and stability of the research results but also helps to better understand the factors affecting the decision to choose a consumption partner of VietGAP vegetable growing farmers at different stages.

3.2.2. Data collection tools

The main data in both studies were collected through the use of structured questionnaires.

In Thua Thien Hue, the questionnaire consisted of two parts. The first section assessed 12 factors related to VietGAP requirements, including: (1) assessment and selection of production areas, (2) varieties, (3) soil management, (4) fertilizers and additives, (5) irrigation water, (6) use of chemicals, (7) harvesting and post-harvest handling, (8) waste management and disposal, (9) workers, (10) recording, record keeping, traceability and product recall, (11) internal inspection, and (12) complaints and complaint handling. The level of application of these factors was assessed using a 5-point Likert scale, ranging from 1 = Not at all compliant; 5 = Fully compliant. The second section of the questionnaire collected demographic and socioeconomic data of the participants. The questionnaire was pre-tested with 15 farmers and reviewed for face and content validity by an expert panel consisting of Quang Thanh commune extension officers and Quang Dien district agricultural officers. In addition, additional data were collected through in-depth interviews with commune and village officials and focus group discussions.

In Lam Dong, the questionnaire was divided into two parts. The first part collected information on the socio-economic and demographic characteristics of VietGAP vegetable growing households. The second part focused on factors related to the decision to choose a consumption partner of VietGAP vegetable growing farmers. Although not describing specific items in detail as in the study in Thua Thien Hue, this study also included variables related to farm size, education level, family labor, income, production experience, and the application of high technology such as net houses/greenhouses, drip irrigation, humidity control, automatic fertilization, and ventilation nets. In addition to quantitative data from the questionnaire, this study also added quotes from farmer interviews to further clarify the reasons behind their decisions.

3.3. Data analysis

The collected data were analyzed using appropriate statistical methods.

In Thua Thien Hue, this study employed a quantitative approach to assess VietGAP compliance and identify factors influencing farmers' choice of sales partners in Quang Thanh commune. Data

were collected from 91 randomly selected households engaged in certified VietGAP vegetable production, ensuring sample representativeness. A structured questionnaire served as the primary tool, comprising two sections. The first evaluated compliance with 12 core VietGAP components ranging from land and seed management to post-harvest handling and traceability using a 5-point Likert scale. The second section gathered demographic and socioeconomic data, including age, education, income, experience, and farm size. The questionnaire was pre-tested with 15 farmers and reviewed by local agricultural experts for clarity and validity. Supplementary methods included interviews with local officials and a group discussion. Descriptive statistics (means, standard deviations, and percentages) were calculated using Microsoft Excel to analyze VietGAP compliance.

In Lam Dong, data were analyzed using STATA 17 software. The study used a binary logistic regression model to analyze factors affecting the decision to choose a consumption partner of VietGAP vegetable farmers.... The dependent variable is the choice of consumption partner (1 if choosing a trader, 0 if choosing a company). Independent variables include demographic factors, production conditions and high technology application. Independent variables with high correlation (e.g., farmer age) were removed to avoid noise and reduce the accuracy of the model. The study also calculated marginal effects to measure the degree of change in the probability of choosing a partner when the independent variable changes. To test the accuracy and validity of the model, statistical tests were used, including multicollinearity testing through VIF (< 10), testing the suitability of the Hosmer-Lemeshow model (p-value > 0.05), and classification accuracy of the model.

The data analysis methods applied in both studies are popular quantitative statistical techniques and are suitable for identifying factors affecting farmers' decisions and behaviors related to the application of production standards (study 1) and the choice of consumption partners (study 2) in

the VietGAP vegetable supply chain. The tests were performed to ensure the reliability and validity of the built models.

CHAPTER 4: THE GAP BETWEEN STANDARDS AND PRACTICE: A STUDY ON VIETGAP COMPLIANCE AMONG SMALLHOLDER FARMERS IN CENTRAL VIETNAM

4.1.Introduction

The overuse of agricultural chemicals, particularly pesticides, in vegetable production across Southeast Asia has emerged as a critical challenge to public health and ecological integrity (Nicetic et al., 2010). This rampant misuse not only exacerbates public health risks but also inflicts severe environmental damage, underscoring the urgent need to transition toward safer, more sustainable, and responsible farming practices (Dahab et al., 2017; Mostafalou & Abdollahi, 2013). While agrochemicals play a pivotal role in pest management, their indiscriminate application poses significant ecological risks, including biodiversity loss and contamination of soil, water, and air (Pawan Kumar et al., 2023; Wu & Chen, 2004b). Equally concerning is the bioaccumulation of chemical residues in food crops, which directly compromises consumer health and exacerbates food safety concerns, thereby imposing substantial pressure on agricultural producers (Chen et al., 2019; Eskola et al., 2020; Simoglou & Roditakis, 2022). Given these multifaceted risks, the shift to sustainable and safe agricultural production models has become an imperative in contemporary agri-food systems. Growing consumer awareness of food safety issues has driven significant demand for safer food production systems, particularly in the context of rapidly expanding agricultural production (Dao et al., 2019). Modern consumption trends reflect an increasing preference for high-quality, traceable food products, with chemical-free and certified agricultural goods becoming a priority for consumers. This shift has compelled producers to adopt stricter production standards, especially for export-oriented products (Boccaletti & Nardella, 2000; Kashif et al., 2020). To address these challenges, Vietnam introduced the VietGAP (Vietnamese Good Agricultural Practices) standard in 2008 under Decision No. 379/QD-BNN-KHCN, aiming to enhance agricultural quality and strengthen consumer trust (MARD, 2008). This marked a critical

step in implementing VietGAP nationwide, particularly in the fruit and vegetable sector. Subsequent reforms, such as Decision No. 2998/QD-BNN-TT, simplified certification criteria to improve farmer compliance (MARD, 2014). Further refinements were introduced with the adoption of TCVN 11892-1:2017 (VietGAP for Crop Production) under Decision No. 2802/QD-BKHCN replacing the original VietGAP framework (MARD, 2014). These policy enhancements demonstrate Vietnam's commitment to aligning with global agricultural standards to promote environmental sustainability and strengthen its agricultural products' competitiveness in regional and international markets. The government's resolve to enhance the value-added potential of Vietnamese agricultural products and establish a distinctive global brand remains evident.

While VietGAP implementation demonstrates clear benefits, including improved labor productivity (Huong et al., 2013; Lapar et al., 2017; Truc & Thuc, 2022) and higher farmer profits (Vu et al., 2016), vegetable production under this standard has failed to achieve sustainable growth in recent years. Multiple constraining factors contribute to this stagnation, including volatile market demand and limited farmer understanding of VietGAP requirements (Ngo et al., 2019). The agricultural sector faces significant structural barriers to VietGAP adoption, particularly land fragmentation and capital constraints (H. Hoang, 2018). These challenges are compounded by inconsistent policy implementation and inadequate governmental support, resulting in uneven and often suboptimal outcomes (Lippe & Grote, 2017; Ngo et al., 2019). Despite numerous policy interventions, the lack of coordinated support mechanisms across government levels and between stakeholders, including farmers, cooperatives, and enterprises, continues to undermine program effectiveness (Swinnen, 2015). Further institutional challenges included: Limited managerial capacity within farmer organizations. Insufficient collaboration among value chain actors. Weak coordination between farmers, cooperatives, and regulatory agencies (Bingen & Munyankusi, 2002). These findings underscore the critical need for organizational improvements and capacity building to achieve sustainable agricultural production (Silici et al., 2021). Specifically, enhanced

farmer-enterprise partnerships could strengthen agricultural value chains from production to market (Nguyen & Jolly, 2020). Simultaneously, training programs for local extension officers are essential to ensure consistent policy implementation (Shiferaw et al., 2016).

A notable exception in the implementation of VietGAP exists in Quang Thanh commune (Quang Dien district), where comprehensive technical and market support has contributed to the successful certification of 32.5 hectares of vegetable farming, involving more than 300 smallholder households. However, it is important to emphasize that the agricultural production structure of Quang Thanh is not an outlier but rather representative of the typical farming model found throughout Quang Dien district and Thua Thien Hue province. Therefore, analyzing the factors influencing compliance with and dissemination of VietGAP in this local context offers practical implications for the broader nationwide expansion of the standard.

Previous studies (G. H. Hoang, 2020; Lippe & Grote, 2017; Vu et al., 2016) have identified four systemic barriers to VietGAP implementation: (1) fragmented and small-scale landholdings, (2) limited access to credit, (3) low levels of technical knowledge among farmers, and (4) inconsistent and unstable policy support mechanisms. Nevertheless, most existing research remains focused on macro-level analyses, while empirical evidence at the micro level—particularly at the community and household levels—remains scarce. This gap is especially pronounced in the vegetable production sector, which requires stringent food safety standards yet is disproportionately affected by structural constraints inherent to smallholder farming systems.

Although a growing body of literature has examined GAP, GlobalGAP, and VietGAP, there remains a lack of systematic assessment regarding actual compliance with the twelve specific criteria outlined in the VietGAP standard. This research gap presents not only a scholarly limitation but also a challenge for policy formulation and adjustment, particularly as Vietnam advances its green agriculture agenda. The promotion of standards such as VietGAP currently

plays a central role in national strategies to enhance the competitiveness of agricultural exports and ensure food safety for both domestic consumption and international markets.

In this context, the present study seeks to address the existing research gap through two primary objectives: (1) To investigate the characteristics of small-scale vegetable farms that comply with VietGAP standards;(2) To examine the current and degree of compliance with VietGAP requirements in local vegetable production.

Through this approach, the study aims not only to inform the optimization of local policy interventions but also to provide empirical evidence to address a global challenge: achieving a balance between food safety requirements and the preservation of smallholder livelihoods—an increasingly urgent issue in developing economies (FAO, 2022). The findings from this research are expected to contribute to bridging the gap between standards and practice, thereby enhancing the effectiveness of VietGAP implementation in Thua Thien Hue in particular, and in Vietnam more broadly.

4.2. Methodology

4.2.1. Study site

This study was conducted in Quang Thanh commune, an administrative unit of Quang Dien district, Hue City, Vietnam (see Figure 1). Quang Thanh stands out as a prominent VietGAP-certified vegetable production area, with economic efficiency and scale far exceeding the district and regional averages. In 2023, the commune had 32.5 hectares of VietGAP vegetables cultivated by 370 farming households. The average vegetable cultivation scale of VietGAP vegetable farmers is only about 0.1 ha. This VietGAP vegetable production area is consisted of small-scale vegetable farmers. The vegetable output reached 1,625 tons, generating an average production value of 675 million VND per hectare and a total production value of 21.94 billion VND for the vegetable-growing area. Farmers' actual income from vegetable production amounted to approximately 15.36 billion VND as report socio-economic Quang Thanh Commune (2023). Compared to the

average agricultural output value in Quang Dien district which was only 72.3 million VND per hectare the income from vegetable production in Quang Thanh was nearly ten times higher. This clearly demonstrates the superior economic efficiency of this model. Moreover, while the commune's cultivated area accounted for only about 10.9% of the district's total (1,092 ha vs. 10,002.7 ha), its crop production value reached 69.46 billion VND, indicating exceptionally high arable land efficiency as report socio-economic (Quang Dien, 2022). Notably, the VietGAP vegetable model in Quang Thanh has been systematically implemented, focusing on crops such as lettuce, bok choy, amaranth, fish mint, herb, celery, malabar spinach. These not only meet the demand for safe food but also gradually expand supply chains for both local and interprovincial markets.

Furthermore, Quang Thanh's commune success in implementing VietGAP stems from support policies enacted under the Prime Minister's Decision No. 01/2012/QD-TTg (MARD, 2013) as well as support from local authorities including: VietGAP technical training for farmers, zoning of concentrated production areas, guaranteed agricultural inputs, and establishment of a stable distribution system through partnerships with supermarkets and enterprises. These measures have not only accelerated VietGAP adoption but also enhanced farmer incomes, particularly through the high-efficiency concentrated vegetable farming model (2 ha) (Quang Thanh Commune, 2023). The selection of Quang Thanh as the research site holds significant relevance as it represents a pioneering VietGAP application model that provides empirical data to analyze key determinants of early-stage success.

4.2.2. Data collection and data analysis

This study employs a quantitative methodology, utilizing data collected from 91 households producing vegetables under VietGAP certification, which were randomly selected from the official list of Quang Thanh commune, ensuring sample representativeness. A structured questionnaire, comprising two sections, was developed to collect data. The first section study in current status of

compliance with vegetable production according to VietGAP standards: (1) evaluation and selection of production areas, (2) seeds, (3) land management, (4) fertilizers and additives, (5) water for irrigation, (6) use of chemical, (7) harvest and post-harvest handling, (8) waste management and treatment, (9) workers, (10) recording, record-keeping, traceability and product recall, (11) internal check, and (12) complaint and complaints handling (MARD, 2020). These 12 parameters were selected for the study as they represent the core factors currently being applied by Quang Thanh farmers in VietGAP-compliant vegetable production.

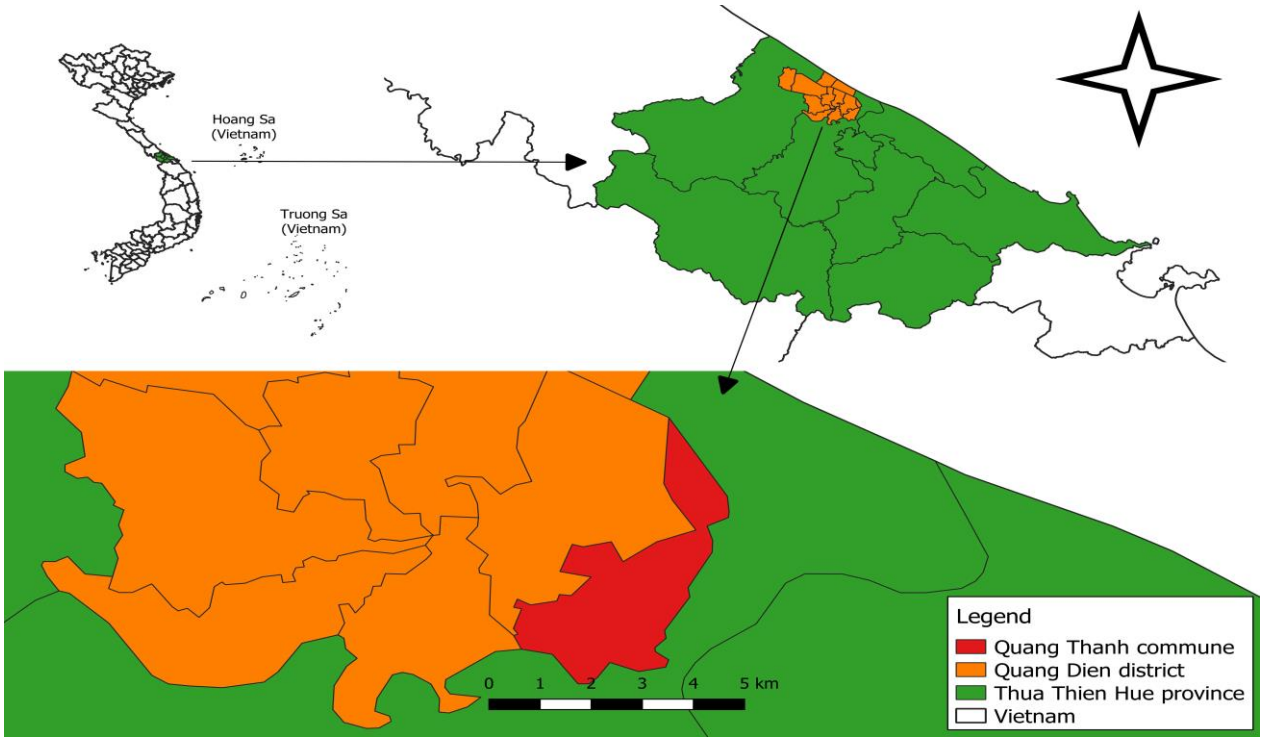

Figure 3: Map of the study sites (Hue city)

Note: The interview commune is red in the map. The study sites were Quang Thanh commune, Quang Dien district, Thua Thien Hue province.

The degree to which these elements were incorporated into VietGAP practices was evaluated using a 5-point Likert scale, where 1=Not at all compliant, 2= Occasionally compliant, 3= Moderately compliant, 4= Frequently compliant, and 5= Fully compliant. Gathering demographic and socioeconomic data from participants was the main goal of the study's second section. 15 farmers participated in a pretest of the questionnaire, and a panel of experts, including Quang

Thanh commune extension workers and agricultural officers from Quang Dien district who closely collaborate with farmers to implement VietGAP standards, examined it for face and content validity. In-depth interviews with commune and village officials, household surveys, and a single group discussion were used to gather data for the study. Microsoft Excel was used to analyse the data, and means, standard deviations, and percentages were used.

This methodological approach guarantees a strong and thorough analysis, giving useful information about the compliance with VietGAP and practical suggestions for making farming more sustainable in Quang Thanh commune.

Table 5: Coding of 12 groups of vegetable production standards according to VietGAP guidelines

Order	Scales	Encode
1. Evaluation and selection of production areas		**EV**
1	Is the vegetable production area consistent with the state and local planning?	EV1
2	Planting vegetables far from the hospital area, the area with industrial waste?	EV2
3	Is the vegetable growing area contaminated with dirt, chemicals, heavy metals, industrial waste, etc.?	EV3
4	Has the vegetable growing area been assessed for the risk of chemical, biological or physical contamination, which may cause product contamination?	EV4
2. Seeds		**SE**
5	Is there a complete record of treatment measures for self-produced varieties?	SE5
6	In the case of having to buy, is there a complete record of the origin of the variety?	SE6
3. Land management		**LA**
7	Has annual analysis and assessment of potential chemical, biological and physical hazards in the soil and substrate of the production area been conducted that could contaminate the product?	LA7
8	Are there measures to prevent soil erosion and degradation?	LA8
9	Does livestock grazing cause soil and water pollution in the production area?	LA9
10	If there is livestock grazing, have measures taken to ensure that it does not contaminate the environment and products?	LA10
4. Fertilizers and additives		**FE**
11	Has the risk of chemical, biological, or physical contamination been assessed to contaminate the product from the use of fertilizers and additives?	FE11
12	Only use fertilizers on the list of permitted business in Vietnam, right?	FE12
13	Only treated organic fertilizers are used and are there complete records of these fertilizers?	FE13
14	Are tools, mixing and storage of fertilizers and additives always maintained and kept clean to reduce the risk of contamination?	FE14
15	Have you recorded and documented the purchase and use of fertilizers and additives?	FE15
5. Water for irrigation		**WAI**
16	Is the quality of water used for irrigation and post-harvest water used for fruit and vegetable production up to current standards?	WAI16
17	Have chemical and biological risk assessments of water sources been recorded?	WAI17
6. Use of chemicals		**US**
18	Has the employer or organization been trained in chemicals and how to use chemicals?	US18
19	Is integrated pest management (IPM) and integrated crop management (ICM) used?	US19
20	Are purchased chemicals, pesticides and biological drugs on the list of permitted use?	US20
21	Do you buy chemicals, pesticides and biological drugs from shops with business licenses?	US21
22	Are chemicals used according to label directions?	US22
23	Is there a log and record of the use and handling of chemicals?	US23
24	Is the storage, arrangement, preservation, use and handling of chemicals done exactly as Vietgap instructed?	US24
25	Are chemical warehouses regularly inspected to remove expired or banned chemicals	US25
26	When replacing the packaging, does the container have the full name of the chemical and instructions for use like the original packaging and container?	US26
27	Is the destruction of chemicals and packaging carried out in accordance with state regulations?	US27

Source: MARD, 2017

Table 5: Coding of 12 groups of vegetable production standards according to VietGAP guidelines

Order	Scales	Encode
7. Harvest and post-harvest handling		**HA**
28	Is the harvest of the product correct for the quarantine period?	HA28
29	Are the equipment for harvesting, preliminarily processing and preserving products clean, safe and appropriate?	HA29
30	Is it practice not to have direct contact with the soil?	HA30
31	Are areas for preliminary processing, packaging and product storage isolated from chemical warehouses, storage yards or other supplies?	HA31
32	Is clean water used to wash produce after harvest?	HA32
33	Is the quality of water used after harvest consistent with regulations?	HA33
34	Does the use of chemicals to treat post-harvest products comply with regulations on safe use of chemicals?	HA34
35	Are safety and hygiene conditions strictly observed in the pre-processing area?	HA35
36	Are livestock and poultry isolated from the preliminary processing area?	HA36
37	Have measures been taken to prevent species of organisms inside and outside the pre-processing and packing areas?	HA37
38	Is the product properly processed, graded and packaged to ensure it does not cause contamination?	HA38
39	Are the tools for post-harvest, preliminary processing and product preservation guaranteed to be clean, safe and appropriate?	HA39
8. Waste management and treatment		**WAT**
40	Is wastewater and garbage collected and treated in accordance with regulations to minimize the risk of contaminating workers and products?	WAT40
9. Workers		**WO**
41	Do workers working in production areas have personal records?	WO41
42	Is the employee within the working age as prescribed by law?	WO42
43	Have employees been trained on chemical use, occupational safety and adequate labor protection equipment?	WO43
44	Are you fully equipped with drugs, medical equipment and first aid instructions for chemical poisoning?	WO44
45	Is there a warning sign for the new production area to be sprayed?	WO45
10. Recording, record keeping, traceability and product recall		**RE**
46	Have you kept a full log of harvesting and selling products?	RE46
47	Are there internal audits, recordings and record keeping?	RE47
48	Is the time of sale, the name and address of the buyer recorded, and records kept for each batch of product each time it is shipped?	RE48
49	When a product is found to be contaminated or at risk of contamination, is it isolated and distributed, and informed to consumers?	RE49
11. Internal check		**IN**
50	Has an internal audit been conducted at least once a year?	IN50
51	Have you entered the assessment/internal inspection board yet?	IN51
12. Complaints and complaints handling		**CO**
52	Does the producer have a complaint form available at the request of the customer?	CO52
53	Has the household ever complained to a higher level? (if yes: content of complaint, time of complaint?	CO53

Source: MARD, 2017

4.3. Results

4.3.1.Characteristics of households of VietGAP vegetable growers in the study site.

The survey reveals key socioeconomic characteristics of households engaged in VietGAP-compliant vegetable production in Quang Thanh commune (Table 2). The majority of producers are older workers, with an average age of 60.8 years, many of whom continue working despite reaching retirement age[1].

Although they possess considerable experience in VietGAP vegetable production 41.8% with 4–7 years and 37.4% with 8–11 years of practice their educational attainment remains low, with 90% having not completed high school. Economically, income from VietGAP vegetable production is predominantly concentrated in the range of 21 to 40 million VND per year (51.6%). The average annual income for households engaged in VietGAP vegetable farming is 17.1 million VND, a relatively modest figure that underscores the financial challenges faced by these farmers, particularly small-scale manufacturers. (Gneiting & Sonenshine, 2018).

A significant challenge in adopting VietGAP standards is the fragmentation of land and labor shortages. The area allocated to VietGAP vegetable production per household is relatively small, ranging from 40m² to 1,500m², with an average of 608.35m². This aligns with previous studies by (G. H. Hoang, 2020; Pedroso et al., 2017), which highlight the diverse characteristics of Vietnamese farmers, most of whom operate on a small scale. The average household size is 4.48 members, with a maximum of 9 and a minimum of 1. The number of dependents in a household significantly influences the adoption of VietGAP vegetable production, as it directly impacts household income and expenditure. On average, each household has 2.40 agricultural workers, primarily consisting of spouses. Few households have children involved in agricultural production, as most are either pursuing education or working in urban areas.

1 Article 4 of Decree 135/2020/ND-CP stipulates the retirement age under normal working conditions. Accordingly, the retirement age of employees under normal working conditions according to Clause 2, Article 169 of the Labour Code is specifically stipulated as follows: From January 1, 2021, the retirement age of employees under normal working conditions is 60 years and 3 months for male employees and 55 years and 4 months for female employees. Link: https://lsvn.vn/tuoi-nghi-huu-hien-nay-duoc-quy-dinh-ra-sao-a151911.html

These findings highlight the socioeconomic constraints faced by Quang Thanh commune farmers, including limited land resources, an aging workforce, and low educational attainment. Despite their extensive experience but the modest income levels and small-scale operations pose significant barriers to the broader adoption and scalability of VietGAP standards.

Table 6: Main characteristics of the surveyed farmers

Characteristic		Frequency (N)	Percent (%)	Minimum	Maximum	Mean
Age (year)	41- 60 years old	48	52.7	42	88	60.88
	61- 80 years old	37	40.7			
	over 80 years old	6	6.6			
VietGAP vegetable growing experience (year)	0-3 year	18	19.8	2	12	6.51
	4-7 year	38	41.8			
	8-11 year	34	37.4			
	12-15 year	1	1.1			
Education level	Primary school	40	44.0	0	12	5.99
	Junior high school	42	46.2			
	High school	9	9.9			
VietGAP vegetable income (million VND/year)[2]	0-20 million	19	20.9	2	85	17.10
	21-40 million	47	51.6			
	41-60 million	16	17.6			
	61-80 million	8	8.8			
	81-99 million	1	1.1			
Farm size (m2)	0-500 m2	52	57.1	40	1500	608.35
	501-1000 m2	32	35.2			
	1001-1500 m2	7	7.7			
Production labor (people)	0-2 people	62	68.1	1	6	2.40
	3-4 people	23	25.3			
	5-6 people	6	6.6			
The size of the family (people)	0-2 people	11	12.1	1	9	4.48
	3-4 people	36	39.6			
	5-6 people	41	45.1			
	7-9 people	3	3.3			

Note: [2]VND is Vietnamese dong. About 23.000 VND = 1 USD (Exchange rate in 2024, December 26th).
Source: Data acquired from the formal survey.

4.3.2. The Current Status of Farmers' Compliance with VietGAP Standards group

The VietGAP framework comprises 12 distinct standards that collectively shape a holistic approach to safe and sustainable agricultural production. While each standard addresses a specific aspect of the production process, their interconnectivity forms a coherent system of management and quality control. To enable a more structured and insightful analysis, these standards are categorized into three functional groups based on their thematic focus and operational objectives: (1) Production Management and Cultivation Conditions, which encompass input controls and field

practices; (2) Post-Harvest and Environmental Management, which concern product handling and environmental sustainability; (3) System and Organizational Management, which reflect internal audits and mechanisms for continuous enhancement. This grouping approach not only streamlines the analytical framework but also aligns with the practical structure of VietGAP implementation.

Group 1: Production management and farming conditions (EV, SE, LA, FE, WAI, US)

The implementation of Group 1 criteria in the VietGAP standard set ranging from production area assessment to the management of seeds, soil, water, and chemicals reveals an uneven yet functionally interconnected compliance landscape. These criteria do not operate in isolation but function as an integrated value chain, where deficiencies in initial stages can directly impact output control efficacy and food safety levels.

The chain begins with production area evaluation (EV), which demonstrates moderately high compliance. Criteria such as selecting production sites far from hospitals or industrial waste sources (mean = 3.44, SD = 0.872 – EV2; mean = 3.47, SD = 0.923 – EV4) are relatively well implemented, reflecting a foundational awareness of environmental concerns. However, quantitative assessment requirements, such as determining heavy metal contamination and chemical residues (mean = 3.37, SD = 0.95 – EV3), exhibit significantly lower compliance. This highlights a common issue among small-scale farmers: while awareness may exist, technical and financial capacities remain limited (Nguyen & Jolly, 2020).

Deficiencies in production area assessment are closely linked to compliance levels in seed management (SE), which has the lowest mean scores in the entire chain (mean = 3.38, SD = 0.8 – SE5; mean = 3.22, SD = 0.854 – SE6). Notably, farmers tend to maintain better records for self-produced seeds (SE5) compared to externally sourced ones (SE6), indicating a major gap in input traceability a critical concern when production areas have not been thoroughly assessed for contamination risks. (Duc Truong et al., 2022) previously reported that over 35% of vegetable

products failing VietGAP input seed standards were due to unclear traceability information from commercial seeds.

When both production areas and seeds are inadequately controlled, land management (LA) becomes a decisive factor in ensuring farming stability. However, survey results reveal a clear disparity between short-term and long-term benefit-driven criteria. For instance, erosion and land degradation prevention (mean = 3.59, SD = 0.882 – LA8) is better implemented due to its direct impact on productivity. In contrast, annual soil contamination risk assessment (mean = 3.07, SD = 0.892 – LA7) is often neglected because of high technical and cost requirements. FAO (2020) analysis noted that soil assessment costs in developing countries may account for 8–10% of total production expenses, leading farmers to overlook preventive measures despite their long-term strategic importance.

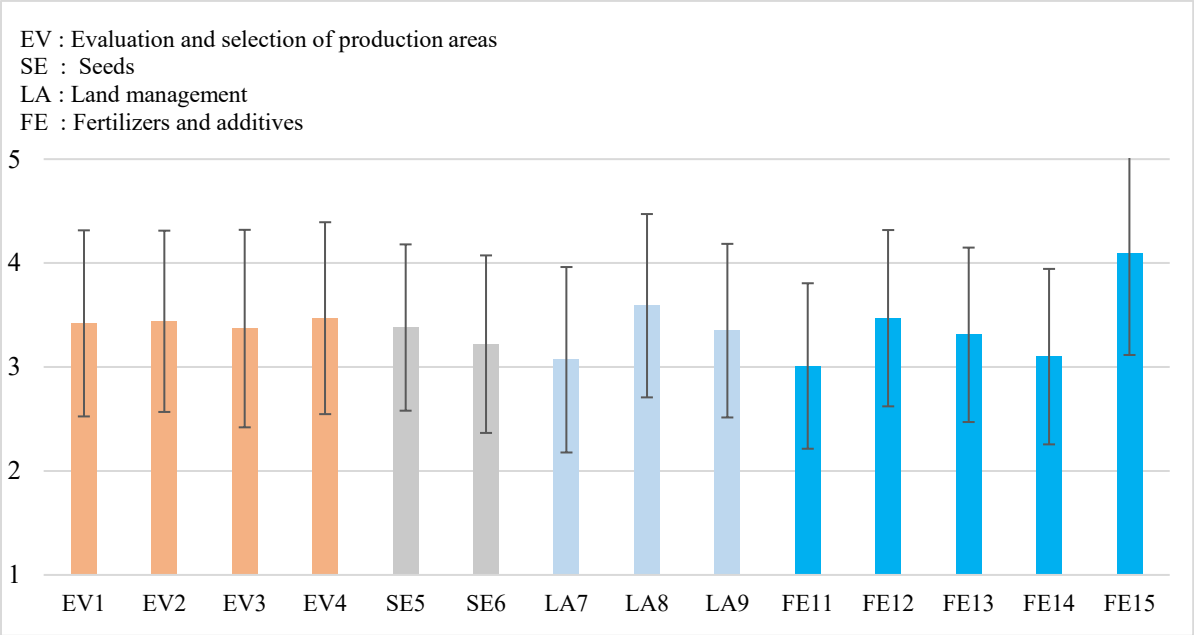

Figure 4: Compliance levels with soil, seed, and fertilizer management standards

Irrigation water (WAI) an input factor equally critical as soil and seeds continues to exhibit polarized compliance levels. The use of quality assured water scored relatively well (mean = 3.66, SD = 0.897 – WAI16), indicating farmers' awareness of the link between clean water and productivity. However, water source risk assessment and record-keeping remain underprioritized

(mean = 3.27, SD = 0.87 – WAI17), a particularly hazardous gap amid declining surface and groundwater quality. According to Nguyen & Huynh (2022), only about 15% of Vietnam's production zones have periodic water quality monitoring systems, while over 40% face contamination risks.

The cumulative deficiencies in input criteria from EV, SE, and LA to WAI pose significant challenges for the final yet critical food safety control: chemical use (US). Paradoxically, this category demonstrates the highest compliance levels in the entire study. Specifically, farmers strictly adhere to regulations such as purchasing chemicals from licensed sources (mean = 4.58, SD = 0.967 – US21), following label instructions (mean = 4.71, SD = 0.91 – US22), and notably, proper disposal of chemical waste (mean = 5.00, SD = 0 – US27). This underscores the decisive role of legal enforceability and surprise inspections in compliance (G. H. Hoang, 2020) (Nguyen & Do, 2023). Conversely, criteria requiring technical expertise or lacking stringent oversight exhibit lower adherence.

The contrast between high compliance in US and moderate-to-low compliance in EV, SE, LA, and WAI highlights a paradox in VietGAP implementation: measurable, legally binding, and easily audited practices are prioritized, while preventive, long-term investments are neglected. Consequently, this fosters a form of "superficial compliance" where the system appears standard-compliant yet harbors latent risks accumulated from poorly monitored input stages."

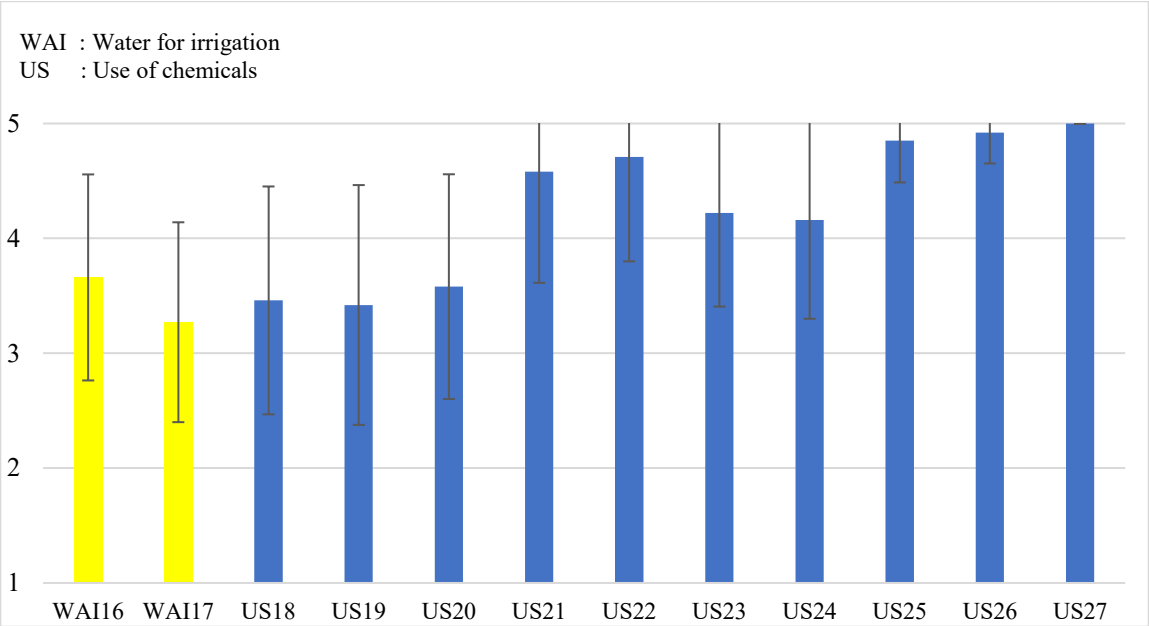

Figure 5: Compliance levels with water and chemical management standards

Group 2: Post-harvest and environment (HA, WAT)

The second group of VietGAP standards encompassing post-harvest handling (HA) and waste management (WAT) criteria serves as a critical nexus between production completion and market distribution. Unlike input-related criteria (e.g., production zones, seeds, soil, and water), these requirements directly influence product quality, safety, and consumer perception. Consequently, compliance levels here are pivotal in sustaining market trust in certified safe vegetables.

In Quang Thanh commune, farmers' adherence to post-harvest handling (HA) criteria reveals a stark bifurcation. The first cluster demonstrates moderate-to-high compliance, reflecting partial adoption of good practices. For instance, pre-harvest intervals (mean = 3.44, SD = 0.859 - HA28) were reasonably observed, aligning with residue mitigation protocols, while harvesting and processing tools met safety standards (mean = 3.62, SD = 0.8 - HA29). Measures like preventing direct soil contact (mean = 3.44, SD = 0.703 - HA30) and isolating packaging areas from chemical storage (mean = 3.52, SD = 0.835 - HA31) were moderately implemented. Notably, using clean water for post-harvest washing (mean = 4.68, SD = 0.594 - HA32) showed stringent compliance,

underscoring farmers' awareness of food hygiene, consistent with national trends (Pham Van Hong et al., 2021).

Conversely, a second cluster exhibited near-total non-compliance, exposing critical post-harvest vulnerabilities. Water quality monitoring was largely neglected (mean = 2.66, SD = 1.593 - HA33), highlighting a gap between awareness and practice. The sole exception was tool sanitation (mean = 4.67, SD = 0.473 - HA39), suggesting farmers prioritize visible, inspection-ready measures over technically demanding ones (e.g., microbiological or environmental controls). This aligns with Zita Sebesvari et al (2012)**,** which identified inadequate post-harvest infrastructure particularly for microbial testing and water quality as a key barrier among smallholders.

The study reveals an extremely low level of compliance with post-harvest safety criteria (HA34 to HA38), with an average score of just 1.00 (SD = 0.000), indicating near-total non-compliance. These criteria pertain to essential practices such as chemical use, hygiene conditions in processing areas, exclusion of animals and pests, and proper packaging. The main reasons for this non-compliance include: (1) Lack of technical knowledge and infrastructure: These criteria require specialized skills and adequate facilities, which most smallholder farmers are unable to meet. (2) Preference for simple, visible measures: Farmers tend to comply with practices that are easy to implement and visibly verifiable, while neglecting more complex and costly requirements. (3) Serious risks to food safety: Inadequate control of the post-harvest stage increases the risk of contamination, undermining the credibility and value of the VietGAP certification. These findings highlight a significant gap between standards and practice, calling for targeted technical support and infrastructure investment to improve compliance levels.

Waste management (WAT) compliance was equally concerning. The sole criterion WAT40 ("Are wastewater and solid waste collected/treated to mitigate contamination risks?") scored suboptimally (mean = 3.03, SD = 0.809), reflecting systemic neglect in agro-waste handling (e.g., pesticide packaging, organic debris). (Faqeerzada et al., 2018; Pokhrel, 2020; Rajapaksha et al.,

2021)Nga. T. Do et al (2025) corroborates this, noting >60% of Central Vietnamese small holders discharge waste untreated due to lacking on-site systems.

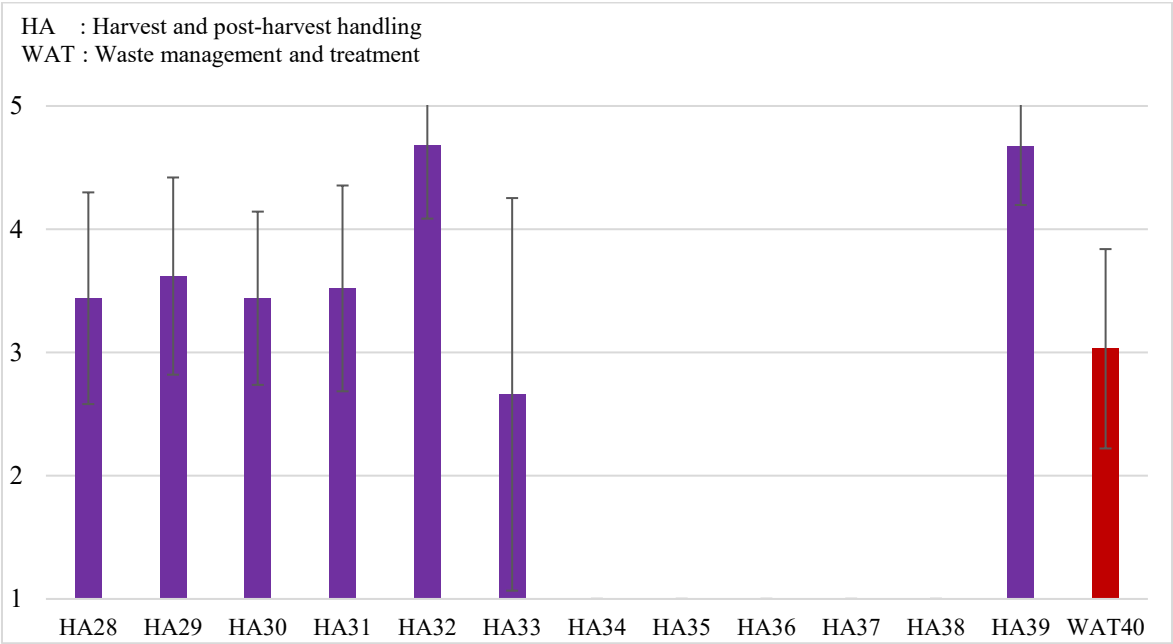

Figure 6: Compliance Levels with harvest and waste management standards.

Group 3: System and Organizational Management (WO, RE, IN, CO)

The third component of VietGAP standards encompassing labor management (WO), record-keeping and traceability (RE), internal inspection (IN), and complaint resolution (CO) constitutes the operational backbone of certified agricultural production. Unlike technical criteria focusing on soil, water, or post-harvest handling, this group evaluates organizational capabilities, reflecting producers' professionalism, managerial competence, and supply chain transparency from farm to market. Consequently, compliance levels here directly influence VietGAP certification outcomes and market confidence.

Survey data from Quang Thanh reveal moderate adherence to basic administrative requirements. Key labor management practices maintaining worker records (mean = 3.36, SD = 0.768 – WO41) and verifying legal working ages (mean = 3.42, SD = 0.746 – WO42) demonstrate foundational compliance. Similarly, provisions for chemical first-aid kits (mean = 3.44, SD = 0.819 – WO44)

and posted warnings in recently sprayed areas (mean = 3.38, SD = 0.84 – WO45) indicate nascent attention to occupational safety.

However, performance declines markedly for advanced organizational demands. Chemical safety training and provision of protective equipment (mean = 3.27, SD = 0.731 – WO43) show significant gaps, mirroring weaknesses in traceability systems. While harvest/sales documentation (mean = 3.57, SD = 0.845 – RE46) and transaction records (mean = 3.64, SD = 0.901 – RE48) suggest progress in product transparency, internal audit maintenance (mean = 3.00, SD = 1.065 – RE47) remains inconsistent. Notably, most farms respond adequately to contamination incidents through product isolation and customer notifications (mean = 3.64, SD = 0.901 – RE49), which is consistent with the findings reported by (Thai et al., 2017).

The compliance rates for internal inspection (IN50–IN51) and complaint handling (CO52–CO53) criteria are alarmingly low, with mean scores close to the minimum, indicating near-total non-compliance in practice. Specifically, the criteria of conducting annual internal inspections (IN50, mean = 1.10) and participation in internal audit committees (IN51, mean = 1.07), as well as the availability of standardized complaint forms (CO52, mean = 1.23) and actual submission of complaints to higher authorities (CO53, mean = 1.23), are rarely observed among surveyed households. These non-compliance criteria are attributed to three main factors. First, the lack of organizational and managerial capacity severely limits the ability of smallholder farmers to implement the foundational operational systems required by VietGAP. These criteria are not peripheral; rather, they represent the backbone of certified agricultural production systems, aimed at ensuring professionalism, transparency, and accountability within in compliance with vegetable production according to VietGAP. Second, the complexity and resource demands of these requirements such as formal internal audits and functioning grievance mechanisms often exceed the technical and financial capabilities of small-scale producers in Vietnam. As noted by Techane & Girma (2023) the absence of adequate internal systems is a systemic constraint, not merely a

localized issue. Third, and perhaps most critically, these criteria offer no immediate or visible economic returns for farmers. Unlike more tangible criteria such as chemical use or hygiene practices, which are easily inspected and tied to market access, internal management systems are perceived as bureaucratic, costly, and offering little benefit without external support. The cumulative effect of these barriers reflects a broader phenomenon of "selective compliance," wherein farmers prioritize easily verifiable, low-cost actions over more complex but essential institutional practices, undermining the holistic integrity of VietGAP certification.

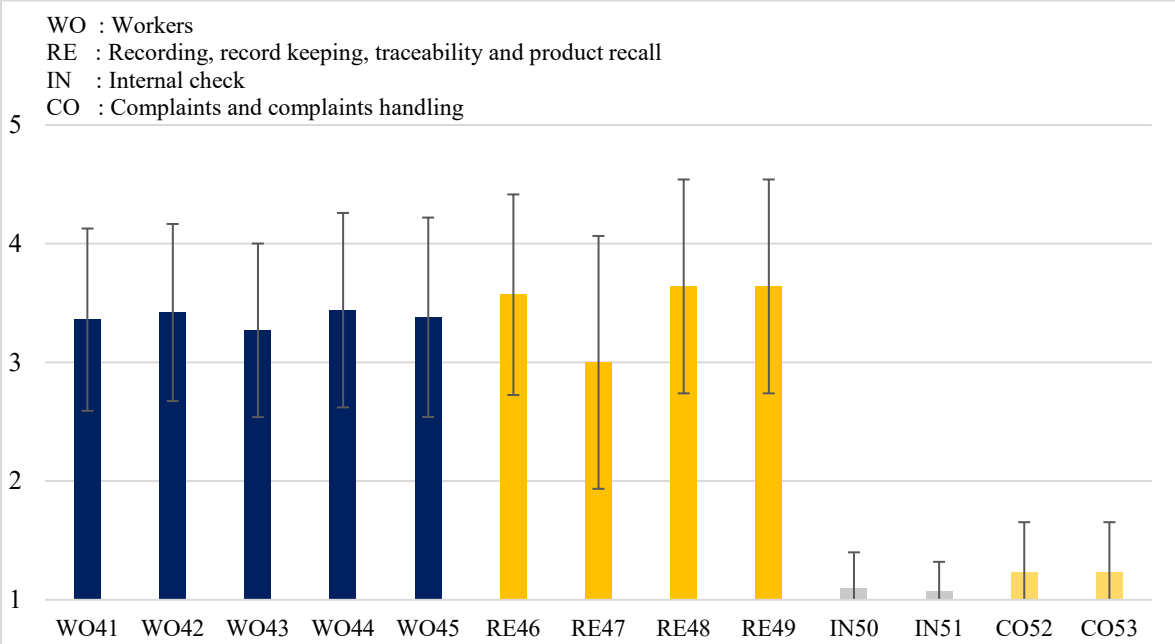

Figure 7: Compliance levels workers, recording, internal check, complaints standards.

4.4. Conclusion and Discussion

The survey conducted in Quang Thanh commune reveals a clear disparity in the level of compliance with VietGAP standards, largely shaped by the perceived clarity and practical enforceability of each criterion. Farmers tend to comply more consistently with standards that are legally mandated, easily observable, or subject to frequent external inspection. This is particularly evident in the criteria related to pesticide use (US21–US27), where regulatory requirements are explicit and routine inspections are common. These findings align with prior studies (Faqeerzada

et al., 2018; Pokhrel, 2020; Rajapaksha et al., 2021), underscoring the pivotal role of clearly verifiable standards in maintaining the quality and safety of agricultural products.

Similarly, standards that are visually assessable or closely tied to everyday farming practices such as selecting non-contaminated production areas (EV2, EV4), using clean irrigation water (WAI16), and ensuring basic post-harvest hygiene like washing produce and cleaning tools (HA28, HA32, HA39) also exhibit higher levels of compliance. These practices are generally low-cost, require limited technical expertise, and produce immediate, visible benefits. As supported by earlier research (Aung & Chang, 2014; Dabbene et al., 2014; Jayasooriya & Aheeyar, 2016; Timprasert et al., 2014), such criteria are often aligned with existing farmer habits and are reinforced by legal or market-based incentives, encouraging greater adherence.

In contrast, compliance is notably poor for standards that demand long-term investment, specialized technical knowledge, or structured organizational systems. These include microbiological control and certified post-harvest facilities (HA33–HA38), as well as internal management processes such as self-inspections (IN50–IN51) and grievance mechanisms (CO52–CO53). These requirements are complex, costly, and frequently exceed the operational and financial capacities of smallholder farmers particularly in the absence of external support or institutional capacity building by Techane & Girma (2023)

This uneven pattern of compliance reveals a substantial gap between the idealized design of VietGAP as a comprehensive quality assurance system and the practical realities of small-scale agricultural production. While visible, low-cost, and easily enforced standards are often fulfilled, more systemic elements especially those related to risk prevention, environmental sustainability, and supply chain governance are frequently neglected. This suggests a phenomenon of "selective compliance" or even “formalistic implementation,” wherein farmers adhere primarily to what is simple and immediately beneficial, while omitting more complex but equally critical aspects of the standard.

Therefore, promoting effective VietGAP implementation in the context of smallholder farming in Vietnam requires a more adaptive and supportive policy approach. Legal enforcement alone is insufficient. Meaningful compliance must be supported by targeted interventions to build technical capacity, provide appropriate financial incentives, and invest in accessible post-harvest infrastructure. Without such measures, VietGAP is likely to remain fragmented and superficial in its application, limiting its potential to improve food safety, sustainability, and the international competitiveness of Vietnamese agricultural products.

4.6. Study limitations

This study employs a case study methodology conducted in Quang Thanh commune, Quang Dien district, Thua Thien Hue province - a representative area for VietGAP vegetable production in Central Vietnam. Due to the unique socioeconomic conditions and farming systems in this locality, the findings may not be fully generalizable to other regions of Vietnam with differing economic, social, and agricultural conditions. Furthermore, the research scope is specifically limited to VietGAP standard compliance with vegetable production. While this approach proved effective for our data structure, it may represent a potential limitation regarding factor extraction methods. These limitations, however, do not diminish the study's contribution but rather highlight valuable directions for future research

4.7. Future research directions

To gain a more comprehensive understanding of VietGAP compliance in vegetable production, future research should expand its geographic scope to include other regions of Vietnam. This broader approach would enhance the generalizability of current findings, which are presently limited to a single commune. Furthermore, more in-depth studies are needed on the criteria that exhibit consistently low levels of compliance, particularly in the areas of harvest and post-harvest handling specifically, internal check (IN) and complaints and complaints handling (CO). Such

research should aim to identify the specific barriers and challenges that farmers face in adhering to these standards.

CHAPTER 5: COMPANY OR COLLECTOR: WHO DO FARMERS TEND TO CHOOSE AS THEIR SALES PARTNERS IN THE VIETGAP VEGETABLE SUPPLY CHAIN

5.1. Introduction

Vietnam's agricultural sector has long played a key role in the national economy, not only contributing about 14% to the gross domestic product (GDP) but also employing 35–40% of the country's workforce (GSO, 2023). The agricultural sector not only promotes economic growth but also creates jobs, helps reduce poverty, and ensures food security while improving nutritional quality for the people. In particular, the fruit and vegetable industry is increasingly dominating the market with higher value, meeting the increasing consumption needs of the people. This comes from the increased awareness of the health benefits of fruits and vegetables, especially in the context of consumers increasingly interested in healthy diets (Huong, Everaarts, Neeteson, & Struik, 2013). However, the fruit and vegetable industry is still facing many difficulties, especially in maintaining product quality, food safety, and supply chain sustainability in the context of fierce market competition (Pérez Mesa & Galdeano-Gómez, 2015).

To cope with these challenges, the Vietnamese government has implemented many policies to not only expand the market for fruits and vegetables but also promote growth in production scale and ensure product quality, thereby supporting sustainable development for the agricultural sector. The United Nations Sustainable Development Goals (SDGs) have also emphasised the importance of the vegetable industry in building sustainable food systems and ensuring global food security (Yang, Pham, Yang, Sun, & Tran, 2022).

The Vietnamese agricultural sector has implemented the application of the VietGAP certification system (Good Agricultural Practices in Vietnam) to improve the quality of fruits and vegetables, ensuring compliance with international requirements on food safety, environmental protection, and public health (Ha, 2014; Hoang, 2020; MARD, 2014). VietGAP certification not

only helps increase product value but also opens up greater export opportunities and helps farmers reduce production costs (Kim, Duong, Nguyen, & Nguyen, 2022; Ngo, Vu, Liu, Moritaka, & Fukuda, 2019). However, the implementation of VietGAP requires farmers to have high production techniques and sustainable links in the supply chain. Rural areas, especially the Southern Central Highlands, stand out with their strengths in fruit and vegetable production and make important contributions to both the domestic and export markets (Tran Quoc & Do Van, 2013). However, farmers here still face many difficulties in maintaining stable prices and lack of close links with consumption partners, leading to unstable income and affecting long-term sustainable development (Tran Quoc & Do Van, 2013).

In agricultural production and consumption, choosing a consumption partner is one of the important decisions farmers face. This decision not only directly affects short-term income but also profoundly impacts the financial stability and sustainable development of the production model. In the context of the VietGAP vegetable supply chain, farmers face the choice between cooperating with companies that have the financial capacity and long-term commitment or choosing collectors that can provide immediate benefits but lack stability in the relationship. Companies often have the advantage of providing long-term contracts and stable prices, helping farmers minimize price risks and ensure more stable income. However, to cooperate with these companies, farmers need to have a large production scale, a convenient location, and the ability to transport products to the partner's warehouse. At the same time, companies often apply delayed payment terms, which can cause financial difficulties for farmers, especially in the context of their need for working capital to maintain production activities (Tran Quoc & Do Van, 2013). In contrast, cooperation with collectors offers some obvious advantages, such as quick payment and helping farmers save on transportation costs. However, cooperation with collectors also comes with significant risks as a lack of long-term commitment can lead to unstable farmers' incomes and a limited ability to build a sustainable supply chain (Samli & El-Ansary, 2007; Tran Quoc &

Do Van, 2013). Fluctuations in the relationship between farmers and collectors can reduce the sustainability of the entire agricultural supply chain.

In the context of the VietGAP vegetable supply chain, where agricultural products must comply with strict food safety standards, choosing a consumption partner is an important decision that farmers face. This decision not only directly affects income but also profoundly impacts the financial stability and sustainable development of the VietGAP vegetable production supply chain. Although there have been some previous studies that have mentioned the choice between companies and collectors, these studies have not fully analyzed factors such as production experience, the scale of cultivated area, ability to apply advanced technology, education level, income, and family labor status that can directly affect farmers' ability to cooperate with consumption partners or not. In particular, how are farmers in the Southern Central Highlands, Vietnam, currently choosing consumption partners? Do they tend to choose companies or collectors to optimize benefits and minimize risks?

The gap in current research shows the absence of an in-depth analysis of these factors in the VietGAP vegetable supply chain, which limits the ability to understand the motivations and determinants of farmers' choice of consumption partners. Therefore, this study aims to clarify the factors affecting farmers' decisions to choose consumption partners in the VietGAP vegetable supply chain. The study will analyze the factors that motivate farmers to cooperate with companies or collectors and clarify the factors that influence these decisions in the specific context of the VietGAP vegetable supply chain. From there, it is possible to provide specific information and recommendations, helping farmers make more effective cooperation decisions, optimise benefits, and minimize risks in the product consumption process, thereby promoting the sustainable development of the VietGAP vegetable supply chain.

5.2. Methodology

The study was conducted in Lam Dong province. A province located in the SouthCentral Highlands of Vietnam with an altitude of 300 to 1,500 metres above sea level (see Figure 2). Lam Dong is characterised by a temperate climate, cool all year round, very suitable for growing crops, especially vegetables and fruits, and is one of the largest vegetable producing regions in the country (Ngo et al., 2019). Lac Lam commune, Don Duong district, was chosen as the primary data collection site. To collect data, we randomly interviewed 161 households growing VietGAP vegetables according to the list provided by Lac Lam commune. Of which, 100 households were interviewed in September 2023 and the remaining 61 households were interviewed in September 2024. We divided the interviews into two rounds, which not only helped increase the accuracy, representativeness, and stability of the research results but also helped us better understand the factors affecting the decision to choose a sales partner of VietGAP vegetable farmers in different stages. The data collected through the questionnaire was divided into two parts: The first part collected information on the socio-economic and demographic characteristics of VietGAP vegetable farmers; the second part focused on factors related to the choice of sales partners of VietGAP vegetable farmers.

We used a binary logistic regression model to study the factors affecting farmers' decisions to choose a sales partner. This model allows us to predict the likelihood of choosing a sales partner based on independent factors such as income, experience, education level, farm size, and high-technology application in producing other VietGAP vegetables. Data analysis was performed using STATA 17 software. Logistic regression models are especially useful in binary choice studies, where the dependent variable has only two values (in this case, “company” or “collector”) (Digal & Placencia, 2019; Okon & Idiong, 2016; Xie, Zhao, Pawlak, & Gao, 2015). The logistic regression model will help identify factors that have a statistically significant relationship with

farmers' choice of sales partners. Specifically, the logit model is represented in the standard function form as follows.

$$Logit = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X5 + \ldots\ldots\cdots + \beta nXn +$$

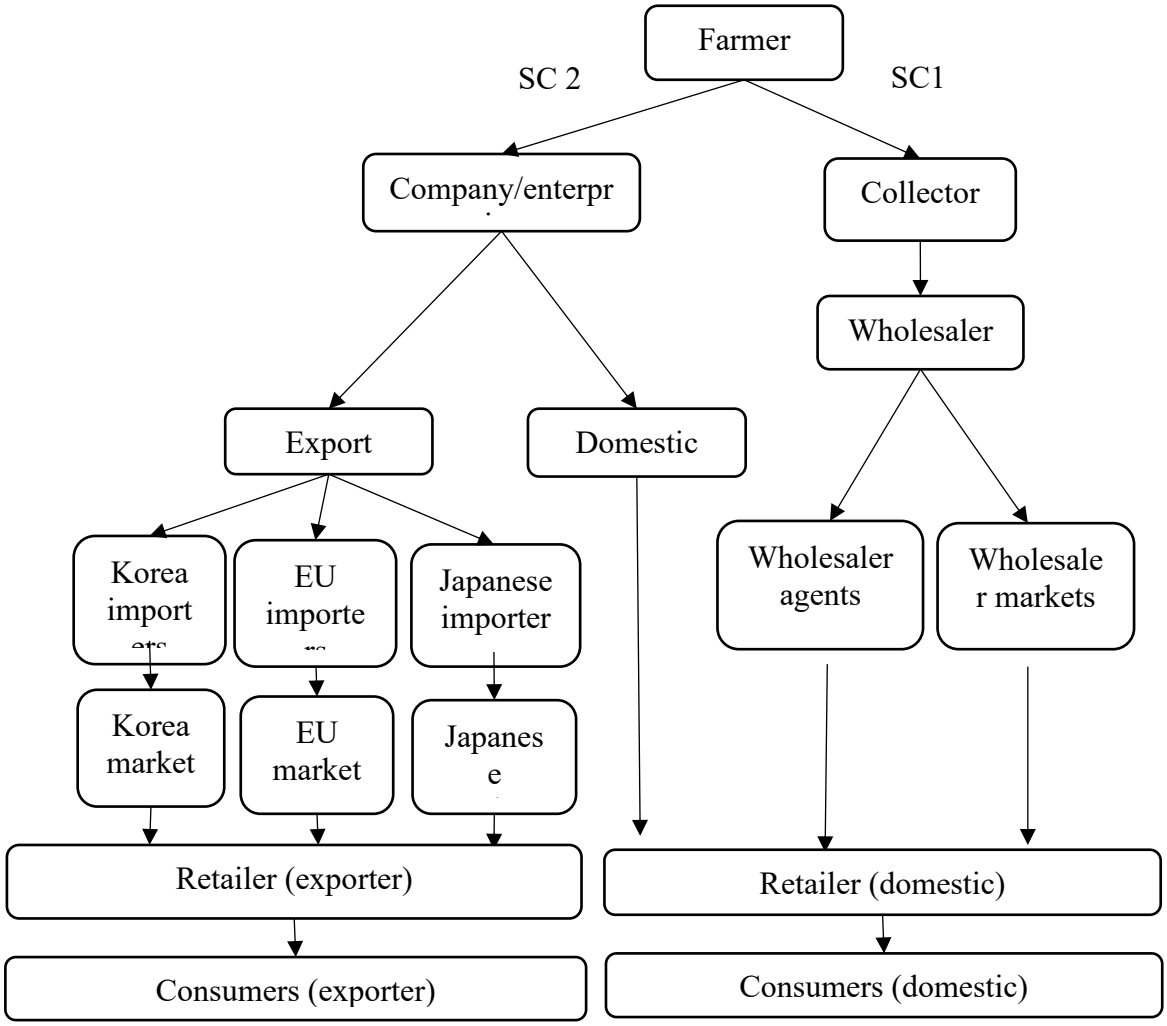

Figure 8. The supply chain of VietGAP vegetables in Don Duong district

Source: Stakeholder interviews

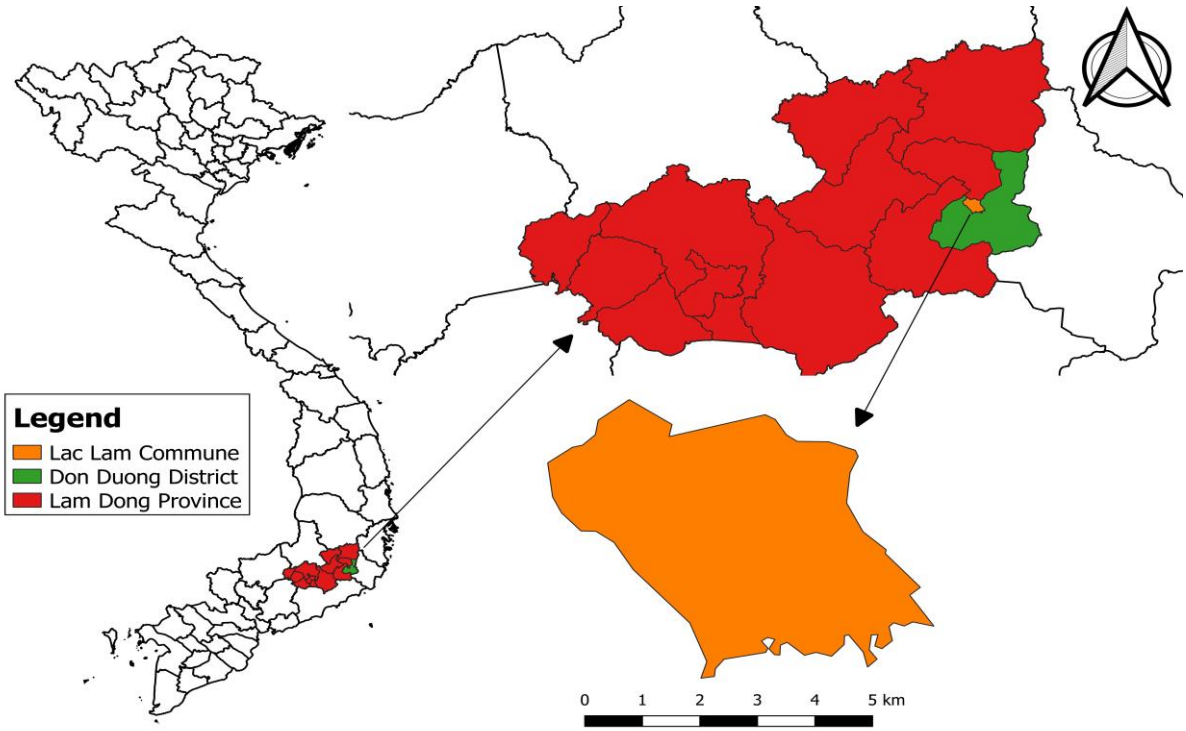

Figure 9. Map of the study site (Lam Dong province)

Where β are parameters, X are independent variables, and Logit is the logarithm of the odds ratio between the probability of the event occurring (choosing the collector as the sales partner) and the event not occurring (choosing the company as the sales partner). The higher the odds ratio, the greater the probability of choosing the collector.

$$Logit = Log\ Pi\ 1 - Pi$$

Where Pi is the probability of the dependent variable taking the value 1 and Pi/1-Pi is the odds ratio. The higher the odds ratio, the higher the probability of the dependent variable taking the value 1. In the model applied here, the dependent variable is the farmer's choice of sale partners; the collector is represented by 1, and the company is represented by 0.

In addition to the logit model analysis, we also calculated marginal effects to measure the extent to which the probability of choosing a sale partner changes when the independent factors change. Marginal effects provide additional information about the degree of influence of each factor, while regression coefficients only show the direction of change without clarifying the extent of change (Serebrennikov, Thorne, Kallas, & McCarthy, 2020). In addition, to check the accuracy and

reasonableness of the model, we use a number of statistical tests, including testing for multicollinearity through the variance inflation factor (VIF) and testing the model's fit through the Hosmer-Lemeshow test. These tests help ensure that the regression model does not suffer from problems with accuracy or bias in the estimates. During the analysis, we also considered factors that may influence the decision to choose a sales partner, including age, education level, income, farm size, experience, and several other factors (Knowler & Bradshaw, 2007; Lesch & Wachenheim, 2014; Priya & Singh, 2024). However, after checking the correlation between variables, we decided to remove highly correlated variables due to the high correlation between some variables, such as the age of the farmer, to avoid confounding and reducing the accuracy of the model. The final results only used independent variables that had a clear and statistically significant relationship with the decision to choose a sales partner of VietGAP vegetable farmers as presented in Table 10.

5.3. Results and discussion

This section begins by describing the characteristics of VietGAP vegetable farmers based on a household survey and interviews with 161 households. We then describe the differences between farmers who sell VietGAP vegetables to companies and farmers who sell VietGAP vegetables to collectors using logit regression. Finally, we present the results of an econometric analysis of the determinants of farmers' choice of sales partners.

5.3.1. Descriptive Statistics

The analysis of data from Table 12 reveals clear distinctions between two groups of farmers producing VietGAP vegetables. Those selling VietGAP vegetables to the company and those selling VietGAP vegetables to collectors. Farmers who sell VietGAP vegetables to companies tend to have higher levels of education, with 36% having completed high school. This educational advantage enables them to access information more easily, apply new technical knowledge, and comply with the production requirements set by companies. Higher education levels also play a

crucial role in enhancing their ability to negotiate contracts with company partners and improve the efficiency of adopting high technologies (Best, 2009; Laxmi & Mishra, 2007; Xie et al., 2015). However, this group has less experience in VietGAP vegetable production (3.7 years) and a lower average monthly income (25.2 million VND/person/month) compared to farmers selling to collectors.

Table 7. Variables and description of variables used in logistic regression.

Variables	Description of variables	Source
Dependent variable		
Farmer's choice of sale partnes	= 1 if the farmer is sell VietGAP vegetable of collector; = 0 company	
Independent variables		
Farm size	Total VietGAP vegetable area measured in square meter.	Kafle (2011); Laxmi and Mishra (2007); Maertens (2006) and Suwanmaneepong, Kullachai, and Fakkhong (2017)
Education level	Education level (1-primary school, 2-junior high school, 3-senior high school, 4-intermediate and 5-over intermediate)	Best (2009); Laxmi and Mishra (2007) and Xie et al. (2015)
Family labour	Number of family members involved in grow VietGAP vegetable	Abdulai, Monnin, and Gerber (2008)
Income	Monthly household income from VietGAP vegetable (Million VND)	Chichongue, Pelser, Tol, du Preez, and Ceronio (2020); Laosutsan, Shivakoti, and Soni (2019); Pongthong, Masahiro, and Kenji (2014) and Porter and Phillips-Howard (1997)
Experience	Years of VietGAP vegetable farming experience of the farmer	Laosutsan et al. (2019) and Suwanmaneepong et al. (2017)
Greenhouse/Nethouse	1 if farmer applies; 0 otherwise	Abdel-Ghany and Al-Helal (2020) and Romacho, Castilla, and Soriano (2006)
Drip irrigation	1 if farmer applies; 0 otherwise	Berman, Jonides, and Kaplan (2008) and David and Otsuka (1994)
Adjust fertilizer	1 if farmer applies; 0 otherwise	Arinloye et al. (2015) and Feder, Just, and Zilberman (1985)
Automatic humidity, light, temperature	1 if farmer applies; 0 otherwise	Arinloye et al. (2015) and Feder et al. (1985).
Ventilation mesh	1 if farmer applies; 0 otherwise	Arinloye et al. (2015) and Feder et al. (1985)

In contrast, farmers selling VietGAP vegetables to collectors have more years of experience (5.7 years), higher income (22.8 million VND/person/month), and rely more on family labor (3.2

people). However, the adoption rate of high technologies in VietGAP vegetable production is lower in this group, as seen in the limited use of greenhouses/net houses (8%), drip irrigation systems (63%), humidity control (25%), and ventilation mesh (29%). Meanwhile, farmers selling VietGAP vegetables to companies show significantly higher adoption rates of high technologies, such as greenhouses/net houses (52.46%), drip irrigation (48.45%), humidity control (37.89%), and ventilation mesh (33.54%).

In summary, this difference shows that each group of farmers has its advantages in accessing the market and organizing VietGAP vegetable production

5.3.2. Estimating Parameters on Making Decisions on Choosing Sales Partners of VietGAP Vegetable Farmers using the Logit Model

Table 13 presents the results of estimating the logistic regression model to analyse the factors affecting the decision to choose a sales partner of VietGAP vegetable producers in the Southern Central Highlands, Vietnam. The dependent variable in the model is the choice between a company or a collector as a sales partner. The independent variables include demographic factors, production conditions, and factors related to the application of high technology. The results show that several factors have a clear and statistically significant influence on the decision to choose a sales partner for producers. The research results show that farm size has a negative coefficient and a p-value of 0.015, indicating that households with larger farm sizes tend to reduce the possibility of choosing a sales partner as a company, which means that farmers with larger farm sizes tend to choose collectors to sell their products. A farmer who sells VietGAP vegetables to collectors described.

Table 8. Characteristics of vegetable production households according to VietGAP.

Variable	Criteria	Frequency (Company)	Frequency (Collector)	Total frequency
Farmsize	m2[1]	9065	8150	8496
Education	Primary school	20 (32.79)2	16 (16)	36 (22.36)
	Junior high school	27 (44.26)	24 (24)	51 (31.68)
	Senior high school	8 (13.11)	36 (36)	44 (27.33)
	Intermediate	4 (6.56)	16 (16)	20 (12.42)
	Over intermediate	2 (3.28)	8 (8)	10 (6.21)
Family labor	People	2.1	3.2	2.8
Income	Million VND/Person/Month3	25.2	22.8	48
Experience	Years	3.7	5.7	4.9
Greenhouse/Nethouse	No	29 (47.54)	92 (92)	121 (75.16)
	Yes	32 (52.46)	8 (8)	40 (24.84)
Drip irrigation	No	46 (75.41)	37 (37)	83 (51.55)
	Yes	15 (24.59)	63 (63)	78 (48.45)
Adjust humidity	No	25 (40.98)	75 (75)	100 (62.11)
	Yes	36 (59.02)	25 (25)	61 (37.89)
Automatic fertilizer	No	45 (73.77)	84 (84)	129 (80.12)
	Yes	16 (26.23)	16 (16)	32 (19.88)
Ventilation mesh	No	36 (59.02)	71 (71)	107 (66.46)
	Yes	25 (40.98)	29 (29)	54 (33.54)
Note:	1 one ha equals 10000m2 (ha is the typical unit of measurement for land area in Vietnam; one "ha" is equivalent to 10000 m2), 2Figures in parentheses are the percentage, 3Vietnamese Dong (VND). About 24.248VND = 1USD (Exchange rate: 09.2024).			
Source:	Author's surveyed data.			

"The reason I decided to sell VietGAP vegetables to collectors instead of to the company is because we have built a sustainable business relationship over many years. This trust has helped our transactions run smoothly and transparently. Moreover, collectors have a deep understanding of the local market thanks to more than 10 years of experience in the industry, along with a large

network of partners, which makes it easy for them to consume all of my products. What is more important is the flexibility in price negotiations. Compared to the company, collectors can quickly adjust prices and cooperation conditions to suit the market situation, bringing us initiative and convenience. This flexibility is an important factor that helps us feel secure and satisfied in the long-term cooperation process."

These findings are consistent with the studies of (Feder et al., 1985; Kafle, 2011; Laxmi & Mishra, 2007; Maertens, 2006; Suwanmaneepong et al., 2017). However, in another study by (Maertens, 2006) it was found that farmers with large farm sizes will sell products to the company because large farm size is one of the advantages for farmers to easily cooperate.

The regression results indicate that households with a senior high school with a large coefficient (6.298977) and p-value of 0.001 have a higher level of education and are significantly more likely to choose collectors sales partners. The marginal effect of 0.3201 indicates that each unit increase in education level increases the odds of choosing company sales partners by up to 32%. This was further stated by a VietGAP vegetable farmer in Lac Thanh village.

"I want to cooperate with companies to sell VietGAP vegetables because I know that when signing a contract with them, I will receive comprehensive technical support, from choosing plant varieties to monitoring production processes. The company can provide knowledge and tools to optimize productivity and product quality. However, I realize that to work with the company, I need to be able to negotiate and handle problems that arise during the transaction process. I feel I do not have enough knowledge and experience and do not have enough skills to solve problems effectively. Therefore, in the current situation, choosing a collector as a sales partner would be more suitable for my abilities and conditions."

Similarly, the variables family labor, income, and experience are also positive and statistically significant at the 1 level. Specifically, family labor has a coefficient of 2.08752, with a marginal effect of 0.0948, indicating that each unit increase in family labor increases the odds of choosing

colletors sales partners by about 9.5%. The positive and significant effects of family labour are similar to the findings reported by (Abdulai et al., 2008; Chichongue et al., 2020; Laosutsan et al., 2019). However, surveys by (Porter & Phillips-Howard✠, 1997) demonstrate that most farmers who sell products to the company under contracts earn high incomes. These factors suggest that farmers are more likely to choose a corporate sales partner if they have high income, experience. This is further demonstrated by the sharing of a farmer selling VietGAP vegetables in Hai Hung village.

"I know that many farmers will find it attractive to sell VietGAP vegetables to collectors because they often pay higher prices than the company. However, I want to choose to cooperate with the company because I believe that this is an opportunity to receive specialized technical support and stable consumption of output products. I am the only main labourer in my family, so having the company's support in technical guidance and ensuring quality standards is essential to improve production efficiency. However, to fulfil the contract with the company, we need to meet many strict requirements from the company, such as ensuring enough human resources, having experience in producing VietGAP vegetables, and the family's economic situation must be stable to maintain production activities."

In contrast, factors related to technology and production methods have negative coefficients. They are statistically significant at 1% or 5%, indicating that these factors reduce the likelihood of choosing collectors over companies as partners to consume VietGAP vegetables. Specifically, the use of greenhouses/net houses, humidity control, automatic fertilization, and ventilation nets all negatively impact the selection of collectors. This shows that farmers who apply high technology tend to maintain company relationships. The logit regression results show that greenhouses/net houses have a coefficient of -3.35865 and a p-value of 0.004 indicating that the application of greenhouses reduces the likelihood of farmers choosing collectors as sales partners. The marginal effect of this variable is -0.1525, meaning that farmers using greenhouses have a lower probability of choosing collectors by about 15.25%. Other factors such as adjusted humidity, automatic

fertilizer, and ventilation mesh also have a similar negative impact on collector selection. This study is consistent with the findings reported by (Abdel-Ghany & Al-Helal, 2020; Arinloye et al., 2015; Feder et al., 1985; I.Romacho et al., 2006)

Table 9. Logistic regression estimation for farmers' decision to choose sales partners.

Variable	Coefficients	Std.error	p-value	dy/dx	Significant	VIF
Farmsize	-0.00026	0.000105	0.015	-0.0000116	**	3.14
Junior high school	0.344345	1.090591	0.752	0.0183596	NS	2.27
Senior high school	6.298977	1.881218	0.001	0.3201115	***	2.23
Intermediate	3.057803	1.465758	0.037	0.1622353	**	1.53
Over intermediate	3.797575	3.181902	0.233	0.1985415	NS	1.42
Family labour	2.08752	0.63107	0.001	0.0948061	***	7.86
Income	0.063762	0.024567	0.009	0.0028958	***	9.86
Experience	0.853547	0.320477	0.008	0.0387644	***	6.53
Greenhouse/Nethouse	-3.35865	1.179127	0.004	-0.1525353	***	1.45
Drip irrigation	1.455872	0.818941	0.075	0.0661194	*	2.41
Adjust humidity	-3.11607	1.173788	0.008	-0.1415183	***	1.85
Automatic fertilizer	-3.87597	1.485187	0.009	-0.1760297	***	1.37
Ventilation mesh	-2.54625	1.156293	0.028	-0.1156394	**	1.64
Constant	-9.29258	2.565211	0.000	-	***	-
Number of observations	161					
LR chi2	165.71					
Prob > chi2	0.0000					
Pseudo R2	0.7756					
Log - likelihood	-106.82578					
Corrected classfied	91.93%					
Hosmer - Lemeshow goodness of fit (p-value)	0.9866					

Note: *, **, *** indicate significance at 10%, 5% and 1% levels respectively, NS: not statistically significant

Source: Author's surveyed data.

Nevertheless, some farmers who use high-tech express a preference for maintaining relationships with collectors as their primary partners for selling VietGAP vegetables rather than collaborating with companies. This preference highlights the strategic reliance of small-scale technology-driven farmers on local collectors as key intermediaries in the supply chain. During an interview conducted in Quynh Chau Dong village, a VietGAP vegetable farmer elaborated on this dynamic, emphasizing the perceived reliability and flexibility of working with collectors compared to formal corporate arrangements.

"Although we apply high technology in VietGAP vegetable production to achieve high productivity, reduce labor, and increase income, we tend to choose collectors as sales partners instead of companies. The reason is that companies often offer prices lower than the market and lack price flexibility after signing the contract. On the contrary, collectors are willing to pay high prices or equivalent to the market, without a binding contract, and only need verbal agreements. Therefore, choosing collectors helps us optimize income and maintain business flexibility.".

In addition, the variables junior high school, over intermediate, and drip irrigation were not statistically significant (p-value > 0.05), indicating that these factors do not play an important role in the decision to choose a sales partner of farmers in the study area. This study is consistent with the findings of (Berman et al., 2008; David & Otsuka, 1994). This may indicate that factors such as junior high school education and adoption of drip irrigation techniques do not strongly influence the choice of sales partners. This logistic regression model has a good fit with LR chi2 = 165.71 and Pseudo R2 = 0.7756, indicating that the model explains about 77.56% of the variation in the decision to choose a sales partner of farmers. Furthermore, the model achieved a classification accuracy of up to 91.93%, indicating a very high predictive ability. The Hosmer–Lemeshow test results (p-value = 0.9866) indicated that the model had a very good fit to the data, with no problems in risk prediction accuracy (Midi et al., 2010). This supports the application of the model in practice. Furthermore, the Variance Inflation Factor (VIF) values of all variables were less than

10, indicating that there was no serious multicollinearity among the independent variables in the model, ensuring the stability and reliability of the estimates.

5.4. Conclusion and implication

This study elucidates the factors influencing the decision-making process of VietGAP-certified vegetable farmers in the SouthCentral Highlands region when selecting their distribution partners. The findings not only provide a comprehensive perspective on the interplay between demographic characteristics, production conditions, and the adoption of high technologies but also contribute significantly to the development of sustainable agricultural supply chains, particularly for VietGAP-certified vegetables.

Key factors such as farm size, educational attainment, income, family labor involvement, and experience in VietGAP vegetable production were identified as significantly influencing farmers' choice of distribution partners. Farmers with lower educational levels (primary education), higher family labor participation in VietGAP vegetable production, higher income from VietGAP farming, extensive experience, and limited adoption of high technologies tend to prefer collectors as their primary distribution partners. In contrast, farmers with higher educational levels (high school or vocational training), who adopt high technologies such as greenhouses, humidity control systems, automated fertilization systems, and ventilation nets, are more inclined to partner with companies for the distribution of their VietGAP-certified vegetables.

The study also revealed that farmers adopting high technologies are more likely to choose companies over collectors as their distribution partners. Meanwhile, farmers with extensive experience in VietGAP vegetable production tend to maintain long-term relationships with collectors due to the flexibility and fewer constraints compared to working with companies. On the other hand, farmers with less experience in VietGAP production and those who adopt high technologies are more likely to partner with companies. However, some farmers who engage with

companies still express a desire to maintain relationships with collectors, as they seek flexibility in selling their produce and the potential for higher prices.

Additionally, the logistic regression model indicated that farm size has a negative, albeit minor, influence on the likelihood of farmers choosing collectors as their distribution partners. Farmers with larger farms often produce VietGAP vegetables in greater quantities and are better positioned to negotiate favourable terms directly with companies. Conversely, farmers with smaller farms tend to rely on collectors for the aggregation and distribution of their produce. These findings suggest that farmers strategically select their distribution partners based on their household resources, particularly agricultural experience, family labor, technological adoption, and income. This implies that the choice of distribution partner is a strategic decision shaped by the farmers' specific circumstances. Furthermore, it highlights that farmer perceive little difference in the advantages offered by companies versus collectors as business partners.

The study underscores the need for tailored policy interventions that align with the practical needs of farmers. Additionally, it emphasizes the critical role of training programs and agricultural extension services in enhancing farmers' production skills and their understanding of high technologies. Local authorities should actively promote supportive policies, reduce cost and skill-related barriers, and create favorable conditions for farmers to optimize their partnership decisions. This study not only deepens the understanding of the factors influencing farmers' choice of distribution partners but also provides a scientific foundation for policymakers to promote sustainable agriculture in Vietnam. The findings will serve as a basis for stakeholders, including policymakers, businesses, and farmers, to make informed decisions that enhance the efficiency and sustainability of the VietGAP vegetable supply chain in the future.

CHAPTER 6: CONCLUSION AND DISCUSSION

6.1. Introduction

Vietnam's agricultural sector has long played a key role in the national economy, contributing about 14% to the Gross Domestic Product (GDP) and employing 35–40% of the country's workforce by 2023. This sector not only promotes economic growth, creates jobs, reduces poverty but also ensures food security and improves nutritional quality for the people. In particular, the fruit and vegetable industry is increasingly asserting its position in the market with higher value, meeting the increasing consumer demand of the people, especially the trend of interest in healthy diets and health benefits from fruits and vegetables. However, the Vietnamese fruit and vegetable industry still faces many significant challenges, especially in maintaining product quality, ensuring food safety and sustainability of the supply chain in the context of fierce competition in the market. The overuse of agricultural chemicals, especially pesticides, in vegetable production in Southeast Asia has become a serious problem that threatens public health and ecosystem integrity. This widespread overuse not only exacerbates public health risks but also causes severe environmental damage, highlighting the urgent need to transition to safer, more sustainable, and more responsible farming practices. The accumulation of chemical residues in food crops directly affects consumer health and exacerbates food safety concerns.

Recognizing these multidimensional risks, the transition to safe and sustainable agricultural production models has become an urgent requirement in modern agrifood systems. Increasing consumer demand for safe food production systems has driven a significant increase in demand for safer food products, especially in the context of rapidly expanding agricultural production. Modern consumer trends reflect a growing preference for high-quality, traceable food products, with certified, chemical-free agricultural products becoming a consumer priority. This shift has forced producers to adopt more stringent production standards, especially for export-oriented products.

To address these challenges, Vietnam introduced the VietGAP (Vietnamese Good Agricultural Practices) standard in 2008. The aim is to improve the quality of agricultural products and increase consumer confidence2. This was an important step in the nationwide implementation of VietGAP, especially in the fruit and vegetable sector. Further reforms have been introduced to simplify certification criteria to improve farmer compliance. These policy improvements demonstrate Vietnam's commitment to harmonizing with global agricultural standards to promote environmental sustainability and enhance the competitiveness of Vietnamese agricultural products in regional and international markets. The government's determination to enhance the value-added potential of Vietnamese agricultural products and build a distinctive global brand remains clear.

However, the implementation of VietGAP requires farmers to have high production techniques and sustainable links in the supply chain. Although VietGAP helps increase product value, open up export opportunities and help farmers reduce production costs, rural areas, especially in the SouthCentral Coast and Central Highlands, still face many difficulties in maintaining stable prices and lack of close links with consumption partners, leading to unstable incomes and affecting long-term sustainable development.

In this context, studies conducted in specific locations such as Quang Thanh commune, Thua Thien Hue province and the SouthCentral region of Vietnam become important. Quang Thanh is an outstanding VietGAP certified vegetable production area, with economic efficiency far exceeding the district and regional average. However, the agricultural context of Quang Thanh is still typical of Thua Thien Hue province and Quang Dien district. This suggests that identifying factors affecting the application of VietGAP and problems in the supply chain here can contribute to identifying problems and solutions for the dissemination of VietGAP throughout Vietnam. Similarly, the SouthCentral region has strengths in fruit and vegetable production, but farmers still face difficulties in linking consumption.

Previous studies have identified a number of systemic barriers to VietGAP implementation, such as land fragmentation, limited access to capital, limited technical knowledge of farmers, and unstable policy support mechanisms. However, current studies lack empirical evidence at the micro and local level on the determinants of VietGAP compliance. Specifically, there is still a research gap on the impact of the 12 VietGAP standards. In addition, although there have been some studies on farmers' choice of consumption partners, there has not been a full analysis of factors such as production experience, scale of cultivated area, ability to apply high technology, education level, income, and family labor status that may directly affect farmers' ability to cooperate with consumption partners. Therefore, this study aims to fill this gap by: (1) To examine the current and degree of compliance with VietGAP requirements in local vegetable production. (2) Clarifying the factors influencing the decision to choose a consumption partner (company or collector) of VietGAP vegetable farmers in the SouthCentral region. Through analyzing these factors, the studies contribute to optimizing policies at the local level and addressing the global challenge of balancing food safety requirements with maintaining livelihoods for small-scale farmers, a pressing issue in developing economies such as Vietnam.

6.2. Key conclusions to the research question

In-depth research on the VietGAP vegetable supply chain in Vietnam has shed light on two core challenges that are often overlooked in discussions on sustainable agricultural development.

First, farmers’ decisions regarding market partners within the VietGAP framework cannot be simply understood as short-term economic choices. Rather, these decisions represent complex strategic considerations shaped by the interplay of economic, social, and technological factors. Farmers are continuously compelled to weigh two opposing forces: on one hand, the stability in output, pricing, and technical support offered by supplying companies; and on the other hand, the flexibility, fewer contractual constraints, and more competitive prices provided by traditional traders. This trade-off not only reflects the multidimensional nature of production behavior but

also underscores the adaptive agency of farmers in the face of institutional underdevelopment and market uncertainty.

Second, the implementation of VietGAP standards at the household level reveals a significant gap between normative design and actual practice, highlighting the phenomenon of "selective compliance" a form of strategic adaptation adopted by farmers under conditions of limited resources and capabilities. Criteria that are easy to apply, easily observable, clearly beneficial, or linked to legal enforcement are more likely to be prioritized. In contrast, standards requiring long-term investment, advanced technical knowledge, or complex organizational processes tend to be neglected, implemented superficially, or completely disregarded. This dynamic not only illustrates the stratification in compliance capacities across different farming households but also questions the practicality of uniformly applying a high-level technical standard in a rural context marked by heterogeneous resources and knowledge.

Overall, these two findings offer a deeper and more comprehensive understanding of the operational realities within the VietGAP vegetable supply chain. They expose both the systemic structural barriers and the complex trade-offs that farmers must navigate as they attempt to integrate into sustainable agricultural models. At the same time, they underscore the urgent need for intervention policies that go beyond technical prescriptions to incorporate adaptability, flexibility, and multidimensional support aimed at assisting farmers' strategic decision-making and bridging the gap between ideal standards and actual implementation capacity. Understanding these dynamics and constraints is foundational to building agricultural value chains that are not only economically efficient, but also socially feasible and environmentally sustainable.

6.3. Discussion

This study offers a comprehensive analysis of the factors shaping farmers' decision-making processes in selecting market partners and complying with VietGAP standards, thereby shedding light on the systemic drivers and barriers that underpin the development of sustainable agricultural

supply chains in Vietnam. The two key findings namely, the trade-offs in partner selection and the phenomenon of "selective compliance" are not isolated observations but are intricately interrelated. Together, they reflect the depth of farmers' strategic adaptation in a transitioning agricultural landscape characterized by institutional fragmentation and volatile markets.

First, the choice of market partners among VietGAP farmers is best understood as a complex strategic calculus, rather than a simple economic decision aimed at maximizing short-term gains. Quantitative analysis reveals that this choice is significantly influenced by household demographics, resource endowments, technological adoption, and expectations of market stability. Specifically, farmers with lower educational attainment, larger household labor availability, higher income from VietGAP cultivation, and limited technological investment tend to prefer traditional traders. These traders are valued for their flexibility in pricing negotiations, minimal contractual constraints, and long-standing trade relationships built on trust. Notably, logistic regression results indicate that larger farm size correlates with a higher likelihood of choosing traders, contradicting conventional assumptions (e.g., Maertens, 2006) that larger scale confers an advantage in accessing formal company partnerships. This finding raises questions about the universal applicability of existing theoretical models and suggests that, in certain contexts, farm size may serve as leverage to strengthen informal trade ties rather than to pursue more rigid, corporate contracts.

Conversely, farmers with higher levels of education and greater investment in advanced production technologies such as greenhouses, automated irrigation systems, and climate control mechanisms are more inclined to collaborate with companies. These farmers seek technical support, traceability, and stable market access, even if such arrangements require compliance with stringent standards and entail delayed payments. However, it is important to note that even among this group, many farmers continue to maintain relationships with traders. This dual-channel strategy enables them to diversify risk, maximize income, and preserve business flexibility in the

face of fluctuating prices or unpredictable policy shifts by corporate buyers. Such behavior underscores that partner selection is neither static nor linear; rather, it is shaped by an interplay between short- and long-term interests, practical feasibility and strategic aspiration, internal capacities and external institutional conditions all of which are embedded in the specific production context of each farming household.

Second, the study highlights a significant gap between the idealized technical structure of the VietGAP standard and its actual implementation at the farm level. This discrepancy manifests through a prevalent pattern of "selective compliance" a strategic adaptation adopted by farmers operating under constrained resources. Farmers tend to comply with standards that are easier to implement, more observable, and offer clear, immediate benefits such as the use of clean irrigation water, basic post-harvest sanitation practices, and the use of approved pesticides. These practices are often reinforced by legal sanctions and routine inspections, creating a stronger incentive for adherence. In contrast, standards that demand long-term investment, technical expertise, or complex organizational processes such as microbial management, certified post-harvest facilities, internal auditing procedures, or grievance mechanisms are often superficially implemented or completely neglected.

This phenomenon reflects not only limitations in farmers' technical and financial capacities but also the impracticality of a standardized, one-size-fits-all approach to certification in a rural landscape marked by land fragmentation, unequal access to resources, and uneven levels of technological absorption. The widespread application of high-level technical standards without commensurate institutional support exacerbates inequality in compliance capacity and risks eroding farmers' trust in certification programs, which often require long-term commitments with uncertain or delayed returns.

By connecting the two aforementioned findings, it becomes clear that farmers' choice of market partners and their level of VietGAP compliance are not merely parallel dynamics but mutually

reinforcing elements within a volatile value chain system. Choosing collectors who offer flexibility and fewer regulatory demands can lower the perceived need for strict adherence to complex standards. On the other hand, partnerships with companies, while requiring higher levels of compliance, can promote investment in technology and standardized production processes. Yet even in such cases, inconsistencies in corporate procurement policies, uncompetitive pricing, and delayed payments lead many farmers to maintain informal trade channels as a complementary outlet, balancing economic gains with operational flexibility. This further illustrates the non-linear, multifaceted, and deeply adaptive nature of farmer behavior an aspect that sustainable agricultural policy design must carefully consider.

In light of these insights, it is evident that building sustainable agricultural value chains cannot rely solely on the enforcement of technical standards or the formalization of farmer–firm linkages. Instead, there is a critical need for policy interventions that are adaptive, multidimensional, and context-sensitive policies that not only support farmers' technical capacity but also enable them to make informed strategic decisions within their specific socio-economic environments. Only by correctly diagnosing and appropriately addressing the underlying drivers and constraints of farmer behavior can Vietnam's transition toward sustainable agriculture become meaningful, effective, and equitable.

6.4. Practical implication

The findings from these two studies offer critical insights for the design and recalibration of policies, business strategies, and production practices among stakeholders in the VietGAP vegetable supply chain in Vietnam particularly in the context of sustainable agriculture, which is increasingly constrained by multi-layered institutional, technical, and social barriers.

First and foremost, for policymakers, a fundamental shift is required from top-down administrative management to adaptive, multidimensional policy interventions that recognize and respond to the heterogeneous capacities, production conditions, and levels of compliance readiness

across different farmer groups. Policy design can no longer rely on uniform approaches, but must instead be tailored to the specific characteristics of farming households ranging from educational background, production scale, and farming experience to the degree of technological adoption in order to generate viable, context-sensitive transition pathways. Furthermore, greater investment in agricultural extension systems particularly in the form of specialized training programs on clean production techniques, advanced technologies, and value chain management is essential for enhancing farmers' endogenous capabilities. Such efforts should not merely aim for minimum VietGAP compliance, but more importantly, prepare farmers to transition toward professional and sustainable agricultural practices in the long term.

In addition, financial support policies including preferential credit, technical subsidies, and public investment in post-harvest infrastructure such as standardized processing centers, cold storage facilities, and traceability systems should be prioritized to address structural financial and technical bottlenecks. Simultaneously, capacity building for farmer cooperatives and producer groups must become a central pillar in strengthening internal governance, improving monitoring systems, and establishing credible self-auditing and grievance mechanisms areas that currently remain among the weakest links in the implementation of VietGAP standards.

For the business sector including both agricultural companies and middlemen the findings highlight an urgent need to reconsider their engagement strategies and partnership models with farmers. Companies must develop a more nuanced understanding of the trade-offs farmers face, particularly the pressures of short-term income and operational flexibility, and accordingly design commercial contracts that strike a more balanced alignment between technical requirements and economic benefits. Building more flexible cooperation models regarding pricing schemes, payment terms, and procurement frequency while simultaneously maintaining technical support and market guarantees, will be key to increasing trust and encouraging farmer participation. On the other hand, traders who currently dominate transaction practices in many localities must make

a concerted effort to formalize their roles in the supply chain. This can be achieved by strengthening their capacity in quality control, enhancing transparency in procurement processes, and assuming partial responsibility for food safety assurance. Such an approach would not only improve the reputation of traders within the system but also contribute meaningfully to the broader goal of increasing the reliability and sustainability of the entire value chain.

Finally, farmers themselves must reframe their perceptions and behaviors in light of the ongoing transformation of agriculture toward greater technical integration, quality standardization, and global competitiveness. Full compliance with VietGAP standards should not be perceived merely as an externally imposed obligation, but rather as a long-term strategic investment in enhancing commercial value, product reputation, and access to high-end markets. Farmers must take initiative in seeking learning opportunities, participating in technical training programs, and actively collaborating with intermediary organizations to strengthen both production and managerial capacities. Only when all actors share responsibility, adjust their expectations, and act in coordination can the VietGAP vegetable supply chain in Vietnam develop along a path that is sustainable, equitable, and resilient in the face of growing challenges stemming from market volatility, climate change, and the intensifying demands of global standards.

6.5. Research limitation

Although the two studies have made significant contributions and provided valuable insights into the VietGAP vegetable supply chain in Vietnam, several limitations must be acknowledged and considered in the interpretation of the results as well as in guiding future research directions.

Firstly, the geographical scope and sample size represent fundamental constraints. The study on the selection of marketing partners was conducted in Lam Dong Province, specifically in Lac Lam Commune, Don Duong District, while the study on VietGAP compliance was carried out in Quang Thanh Commune, Thua Thien Hue Province. Although these locations are representative of key VietGAP vegetable production areas, their representativeness may be limited due to the

diverse socio-economic, cultural, and climatic conditions that vary widely across Vietnam's agricultural regions. Moreover, the relatively small sample sizes 161 households in the partner selection study and 91 households in the compliance study—reduce the generalizability of the findings to the broader population of VietGAP vegetable farmers nationwide, especially considering the heterogeneity and fragmentation of Vietnam's small-scale agricultural system.

Secondly, in terms of methodology, both studies primarily employed quantitative methods such as logistic regression and Likert scale measurements. While these approaches are advantageous for analyzing variable relationships and predicting behavior, they are limited in capturing complex factors, psychological nuances, underlying motivations, or intangible socio-cultural influences affecting farmers' decisions. The exclusion of certain highly correlated variables, for instance farmers' age, although a technically sound approach to avoid multicollinearity, may have omitted potentially important influences related to experience, perception, and openness to innovation.

Thirdly, although both studies focus on the VietGAP vegetable supply chain, they are presented and analyzed separately without an in-depth or quantitative examination of the reciprocal relationship between partner selection and the degree of VietGAP compliance—especially the phenomenon of "selective compliance," which is critical for a comprehensive understanding of the drivers and barriers within the value chain.

Finally, both studies adopt a cross-sectional design, offering a snapshot at specific points in time (September 2023 and 2024 for the respective datasets), without investigating temporal dynamics. In reality, farmers' decisions and VietGAP compliance levels may fluctuate significantly under the influence of external factors such as market volatility, policy changes, competitive pressures, and environmental conditions. These variables call for longitudinal or mixed method approaches to more fully and accurately capture the dynamic evolution of the VietGAP supply chain within the context of sustainable agriculture in Vietnam.

6.6. Future research

To address the limitations of the current research and simultaneously broaden the comprehensive understanding of the VietGAP vegetable supply chain in Vietnam, future research directions should focus on several key areas.

First, expanding the research scope and diversifying methodological approaches are prerequisites for enhancing representativeness and analytical depth. Specifically, studies need to be conducted across a wider geographical range, encompassing diverse ecological zones and varying socio-economic conditions nationwide, to verify and compare the generalizability of findings related to marketing partner selection and the degree of VietGAP compliance. At the same time, integrating traditional quantitative methods with in-depth qualitative approaches such as interviews, case studies, and focus group discussions will facilitate exploration of subjective and cultural drivers, beliefs, and barriers that quantitative data alone cannot fully capture. This is particularly essential to explain phenomena such as why some farmers, despite applying advanced technologies, still prioritize traders as marketing partners due to their flexibility and distinct benefits.

Furthermore, future research should focus on analyzing the interrelationships among the constituent elements of the supply chain, especially the impact of partner types on the level of VietGAP compliance. It is necessary to clarify whether companies are capable of promoting strict adherence to complex standards, while more flexible traders may enable the occurrence of "selective compliance." A comprehensive analysis of the value chain—from inputs through production to marketing along with the roles of intermediaries and coordination mechanisms, will provide a fuller picture of the factors influencing sustainability and food safety within the VietGAP vegetable supply chain.

Additionally, longitudinal studies are needed to observe changes over time in farmers' partner selection behaviors and compliance levels, thereby identifying trends, adaptive mechanisms, and

long-term impacts. Concurrently, evaluating the practical effectiveness of support policies including technical training programs, credit assistance, and infrastructure investment in narrowing the gap between ideal standards and actual practices will offer scientific grounds for policy adjustment and improvement, while addressing structural barriers such as land fragmentation and workforce aging.

Finally, future research should extend to exploring emerging factors increasingly influencing the supply chain, such as the role of information technology, e-commerce platforms, and innovative cooperation models like smart contract farming in transforming partner selection and VietGAP compliance. Moreover, deeper analysis of consumer awareness and market pressures for full compliance particularly regarding less frequently implemented standards will help clarify the incentives and obstacles to sustainable development of the VietGAP vegetable supply chain in Vietnam.

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APPENDIX

Figure 10: VietGAP vegetable garden of farmers in Lac Lam commune, Don Duong district, Lam Dong province

Ventilation mesh

Drip irrigation

Automatic fertilizer

Adjust humidity

Figure 11: Some images of high-tech machinery in vegetable production according to VietGAP