

Explorations #1

The Vegetable Industry in Tropical Asia: *Vietnam*

An Overview of Production and Trade

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About *Explorations*

AVRDC – The World Vegetable Center’s *Explorations* series seeks to inform discourse on the convergence of science, technology, and practice in vegetable breeding, production, and marketing. Envisioned as a catalyst for enterprise and research, the series enables diverse communities to explore expertise, ideas, and common frameworks.

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AVRDC Publication: 08-712
ISBN 92-9058-169-7

Editor: Maureen Mecozzi
Cover design: Oliver Hanschke
Map: Vanna Liu

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Suggested citation

Johnson, G.I., Weinberger, K., Wu, M.H. 2008. The Vegetable Industry in Tropical Asia: An overview of production and trade, with a focus on Thailand, Indonesia, the Philippines, Vietnam, and India [CD-ROM]. Shanhua, Taiwan: AVRDC – The World Vegetable Center. 56 pp. (Explorations series; no. 1).

Acknowledgements

The advice and counsel of colleagues in Vietnam is acknowledged:

Dr. Nguyen Van Bo, President, Vietnamese Academy of Agricultural Sciences (VAAS); Dr. Vu Manh Hai, Deputy Director VAAS; A/Prof Dr. Nguyen Van Tuat, Director Food Crops Research Institute (FCRI); Dr. Chu Doan Thanh, Head, Department of Postharvest Technology, Fruits and Vegetable Research Institute (FAVRI); Mr. Nguyen Trong Mai, Chief of Vegetable and Spices Division, FAVRI; Dr. Pham Thi Kim Thu, Hanoi Seeds Company; Dr. Paule Moustier, CIRAD-Malica; Dr. Dominic Smith, Agrifood Consulting; Dao The Anh, Center for Agrarian Reform Research and Development CASRAD; Ministry of Trade personnel; Metro supermarkets; Australian Trade Commissioner, Patrick Stringer; the Vietnam Women's Union; Dr. Ngo Quang Vinh, Institute of Agricultural Science HCMC; Dr. Le Van To, NATPHC; Dr. Nguyen Minh Chau SFRE; Mr. Nguyen Duy Duc, the Southern Sub-Institute of Agriculture Engineering for Post Harvest Technology.

Advice from Dr. T.K. Lim, ACIAR, is also acknowledged.

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1 Summary

This report examines the role of the vegetable industry as a key asset for productivity improvement, export market development, income generation, and livelihood improvement in Vietnam.

1.1 Key statistics for Vietnam

Statistics gathered from FAOSTAT (2007); GSO (2007); UNFPA (2007); Wiesmann (2006).

Land area:	331,688 km ²
Latitude:	8° 30' - 23° 22' N
Longitude:	102° 10' E - 109° 30' E
Climate:	Tropical and humid. Prone to hurricanes and flooding in delta areas with cooler northern areas and highlands.
Population:	86.4 million
Global Poverty Index:	198-32.2% > 1992-25.9% > 1997-24.5% > 2003-18.4% (Wiesmann, 2006)
Refrigerator ownership:	16.4% (GSO, 2007)
Child mortality:	M/F/1000 (2000): 42
Production:	8.1 million tonnes
Area:	721,396 ha (FAOSTAT, 2007)
Per capita availability:	230 to 307 g/day (2000-2004)
Main crops:	(area) dry chilies, brassicas, tomato, cucumber, watermelon and onion/garlic. (volume) brassicas, tomato, cucumber,

watermelon, onion/garlic and dry chilies¹ (FAOSTAT, 2007; VRD, 2007).

Exports: Main exports: tomato, carrot, onion, baby corn, fresh legumes, cabbage, and Chinese cabbage. Total: 275,860 tonnes of fresh and processed vegetables worth US\$ 74 million (FAOSTAT, 2007)

Imports: Total 190,870 tonnes (fresh/processed) worth US\$ 45.8 million (FAOSTAT, 2007)

¹ Local sources indicate that main crops may also include water spinach, amaranth, squash, chayote and mustard greens (Rau Hoa Qua Viet Nam, 2006) but accurate data is not available.

1.2 Industry issues

<p><i>Enhancing production and marketing</i></p>	<ul style="list-style-type: none"> • Achieving productivity gains and cost-containment while seeking market-focused opportunities through niche markets, and expanding exploitation of germplasm diversity (indigenous vegetables) and value-adding. • Developing capabilities of farmers for Good Agricultural Practice (GAP) implementation, and the GAP training and auditing capabilities of researchers and extension personnel • Enhancing cross-institution and private/public collaboration in R&D to reduce duplication and improve the efficiency and productivity of investments.
<p><i>Expanding trade and value adding</i></p>	<ul style="list-style-type: none"> • Ensuring trade development is market-focused and undertaken in partnership with exporters and processors. • Revamping agricultural education and training systems, and the skills base and remuneration of current personnel, to improve capabilities and incentives for delivery of enhanced outcomes.
<p><i>Benefiting farmers, traders, and consumers</i></p>	<ul style="list-style-type: none"> • Modernizing the wholesale sector to improve efficiencies and reduce losses while strengthening partnerships with traders. • Focusing policy and regulatory frameworks to facilitate industry modernization and increase investment and capacity building. • Strengthening capabilities of poor farmers to capitalize on opportunities, to use sustainable production systems, and to meet the delivery and quality requirements of supermarkets, export markets, and processors.
<p><i>Assuring quality and increasing consumption</i></p>	<ul style="list-style-type: none"> • Enhancing support for, and building customer confidence in, safe vegetable production and marketing systems. • Improving water quality management and waste disposal to reduce the risks of pre- and postharvest contamination. • Developing strategies and policy initiatives that minimize the risks or alleviate marginalization of poor farmers and traditional retailers as the industry modernizes.

1.3 Recommendations for development

Marketing and economics

- Agricultural statistic collection and analysis needs urgent attention; data is often incomplete or inconsistent.
- Policy and regulatory framework revision should continue to enhance the enabling environment for liberalization of the agricultural markets, including fruits and vegetables.
- It is critical that the government continue efforts to meet commitments under the Sanitary and Phytosanitary agreement (SPS) of WTO to enable development of export markets and to more closely regulate imports.
- Market analysis (local and export), price reporting (wholesale), and capacity building should continue to be strengthened.

Industry development

- Build credibility of certification systems for safe vegetable production with domestic and export markets by strengthening technology application, farmer training, and regulatory enforcement.
- Enable industry modernization by promoting R&D and the adoption of improved cultivars and optimal production and postharvest technologies.
- Facilitate the expansion of the supermarket sector and the development of supply arrangements that are mutually acceptable and beneficial to farmers, traders, and consumers.

Systems and technology

- Public sector breeding should focus on OP rather than hybrid seed and enhancement of plant variety rights protection and seed marketing regulation.
- Strengthen farming systems and sustainability approaches to production.
- Land reform processes need to be accompanied by reforms of the credit sector to facilitate investment and modernization.
- Foster upgrading of the processing sector through private sector investment with government in assisting with financial incentives and promoting grower cooperatives.

Collaboration and engagement

- Strengthen industry associations and working arrangements.
- Continue revitalization of public sector R&D and reduce pressure to “grow their own funds.”

2 Introduction

Extending from 8° 30' N to 23° 22' N, and 102° 10' E to 109° 30' E, Vietnam is the second most populous country in Southeast Asia and the 13th largest in the world. Sandwiched between the Annamite mountain chain (2500 km long), and the South China Sea, Vietnam is bordered by China, Laos, and Cambodia (Reddy, 2005; Wikipedia, 2007a). The country has 86.4 million out of the 570.2 million people in Southeast Asia², and a predicted population growth rate of 1.3% /year between 2005 and 2010; 27% of the population lives in urban areas (UNFPA, 2007).

Vietnam has 59 provinces and five administratively separate cities grouped within eight regions (northwest, northeast, Red River Delta (RRD), north-central coast, south-central coast, central highland, southeast, and Mekong River Delta (MRD). Provincial administration is further divided into districts and municipalities. The capital is Hanoi, and Ho Chi Minh City is the most populous city.

The climate is tropical and humid, but conditions vary considerably due to the long spread of the country from north to south and the range of topography. The greatest temperature variations are in northern and highland areas. The seasons are summer (hot season), the wet season with a monsoon from the northeast, and the (mostly dry) cool season (November to February) (Wikipedia, 2007a).

Vietnam has a long history. In 938, after a millennium of Chinese rule, it emerged as a nation-state. The country was colonized by the French in the 19th century and convulsed by political turbulence and war from 1945 until unification as the Socialist Republic of Vietnam in 1976. In 1986, the government began implementing free-market reforms (Đổi Mới = *Renovation*), which encouraged private ownership of farms and business, deregulation, and foreign investment. Modern Vietnam is a densely settled powerhouse of agriculture and industry, and one of the fastest-growing economies in the world. Gross domestic product (GDP) grew about 7.5% from 1996 to 2006, and an estimated 8.2% in 2007, with growth of 8.5% predicted for 2008 (Wikipedia, 2007a; ADB, 2007b).

Economic growth has been strong and broad-based. Along with well-targeted poverty reduction initiatives by the government, agriculture has contributed significantly to development. The Global Hunger Index for Vietnam declined

² ASEAN countries + Timor Leste (UNFPA, 2007).

from 32.2% in 1981, to 25.9% in 1992, then to 22.5% in 1997, and to 18.4% in 2003 (Wiesmann, 2006).

Under the *Socio-Economic Development Plan 2006-2010*, the government hopes to eliminate hunger and reduce poverty incidence to 10% of the population by 2010 (MPI, 2006). Vietnam's change from a centrally planned to a market-based economic system has involved market liberalization, property rights recognition and opening up to trade and investment. The private sector has been a key element of development, accounting for > 50% GDP in 2006 (ADB, 2007b).

2.1 Significance of the vegetable industry in Vietnam

Vietnam consists of mountainous and hilly areas, with just 20% of the 331,688 km² as flat lands, and 42% as forests. The delta regions of the Red (3,000 km²) and Mekong Rivers (40,000 km²) are the main agricultural areas, with another 16% of arable lands in highlands to the north of Hanoi and Ho Chin Minh City (Wikipedia, 2007a). The climatic variation from north to south, and in the northern and southern highlands, provides a range of agri-ecological environments for temperate (northern lowlands in cool months, highlands all year), and tropical (northern lowlands in summer, central and southern all year) vegetable production, depending on rice cropping needs and wet/dry season water availability.

Most rural households grow vegetables. In 1998³, about 85% of rural households grew fruit and vegetables, but cultivation was more common among northern than southern households. Water spinach (kangkong), leafy greens and banana were most frequently grown; on average, households grew 3.4 categories of fruit and vegetables (IFPRI, 2002).

Vegetable production and the wild harvesting of herbs and vegetables are traditional practices, with the latter saving labor, time, and land (Ogle et al., 2001a; 2001b). Production is for self-sufficiency (poor households) or commercial objectives, with the latter divided into peri-urban intensive cultivation supplying urban markets, and rural cropping in rotation with rice or other crops to supply regions, processors, and export (VRD, 2007).

Vegetable production has been more widespread in the north, but more commercial in the south (where farms are larger) (IFPRI, 2002 - citing 1998 data). Cultivation of fruit and vegetables by poor farmers was higher (70%) than

³ Increases were most substantial in the central regions and the southeast. Ninety-six percent of households in northern uplands already grew fruit and vegetables in 1993, with levels remaining stable from 1993-1998 in the deltas (IFPRI, 2002).

the richest category of farmer (59%), perhaps due to poor households having greater ability to supply the labor needed for vegetables. Most production was sold (63%), with the poorest households selling at least half, and more farmers from the south (91% for fruit and vegetables in Mekong Delta) than the north (46% for fruit and vegetables in northern uplands) selling a portion of production. Marketed-share ranged from 91% from Mekong Delta farms (86% in southeast farms), to 50% from northern uplands farms (54% from Red River Delta). Commercialization of production was increasing (IFPRI, 2002).

With improvements in farm productivity and increasing income from other sources, between 1993 and 2004, farmers increasingly sold a larger proportion of farm vegetable production compared to the proportion consumed at home (Table 1) (M4P, 2006b).

Table 1. Vegetable use data for Vietnam: Share (%) of selected vegetables sold rather than consumed at home

	1993	1998	2002	2004
Brassica vegetables	17.4	56.0	68.9	71.4
Other leafy greens	14.2	61.3	65.5	70.9
Tomatoes	28.3	96.2	78.6	79.8
Water spinach	6.0	14.4	57.6	58.4
Fresh legumes	16.0	38.3	69.1	70.7
Herbs and spices	45.0	6.0	(na)	24.6
Other vegetables tubers and fruit ⁴	18.6	44.8	(na)	22.4

Source: M4P (2006b)

Farms are small and fragmented (Hung et al., 2007). Most (95% = > 9 million) are under 2 ha, and average size is < 0.5 ha (Nagayets, 2005). In the RRD, average farm size is around 0.25 hectares. This land is comprised of, on average, 8-10 noncontiguous plots of land, some of which are only 200 –500 m² in size (Hung et al., 2007). It should be noted that a larger cooperative unit of farm (*trang trai*) is also recognized (Phan, 2006). In 2001, there were more than 61,000 agricultural, forestry and aquatic organizations registered as “farms” (*trang trai*) in Vietnam, employing more than 370,000 people, and with an average size for annual crop farms of 6.2 ha (2001 GSO data) (Phan, 2006).

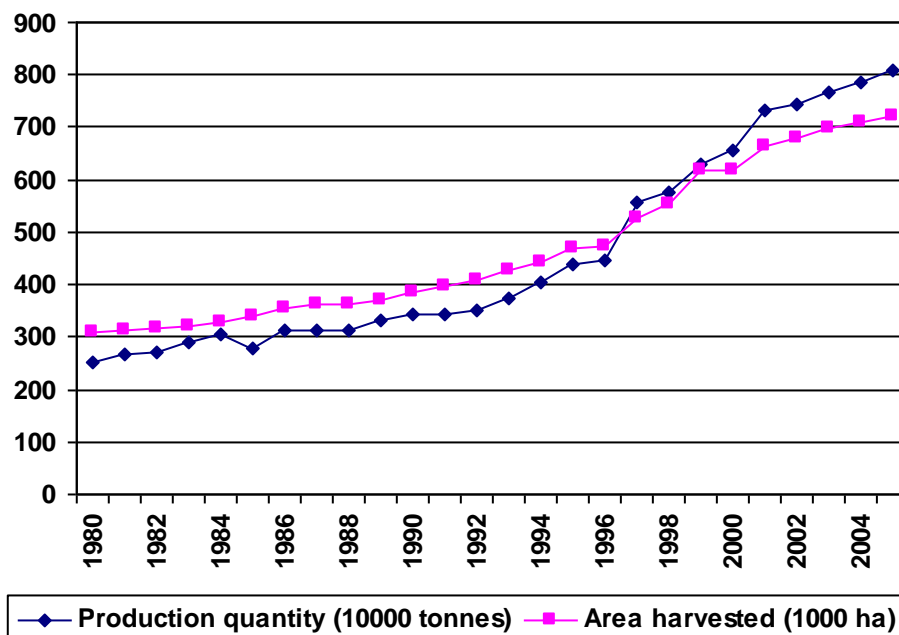
Within a decade of many farmers commencing fruit and vegetable production in 1990, almost three-fourths of household income by more specialized “commercial” growers was coming from fruit and vegetables, but income from postharvest processing was small (3.5%), and weather, market price, and volume of trade affected profitability. Only minor amounts of production were kept for home consumption⁵ or processing (2%) (IFPRI, 2002).

In the 1990’s, the area planted with “vegetables and beans” grew at 5% per year—twice the growth rate for food crops, but lower than the growth rate for industrial crops, and accounted for only 5% of total cropping area (IFPRI, 2002). Between 1995-2005, annual vegetable production increases averaged 9.3% compared to 4.5% for the agriculture sector (VRD, 2007), with hybrid uptake reaching 60% and new varieties of cauliflower, sweet pepper (capsicum), red cabbage, baby corn, and baby cucumber being adopted.

⁴ (not including potato or sweet potato)

⁵ It should be noted that if men are interviewed about use of farm produce use, they are often unaware of what is used for home consumption.

The vegetable production area increased 38% between 2000 and 2005 (from 426,000 to 624,000 ha⁶ = 6% agricultural area), with average yields reaching 14.8 t/ha⁵ (VRD, 2007). Total production was 9.2 million tonnes⁵ worth about US\$ 900 million, and accounting for 9% of agricultural GDP (VRD, 2007). In 2006, vegetable production rose 6.4% over 2005 production, despite the fact that 100,000 ha of vegetables were destroyed by three typhoons that affected the central, southeast, and Mekong regions (GSO, 2007). General trends in vegetable production (tonnes) are shown in Figure 1.

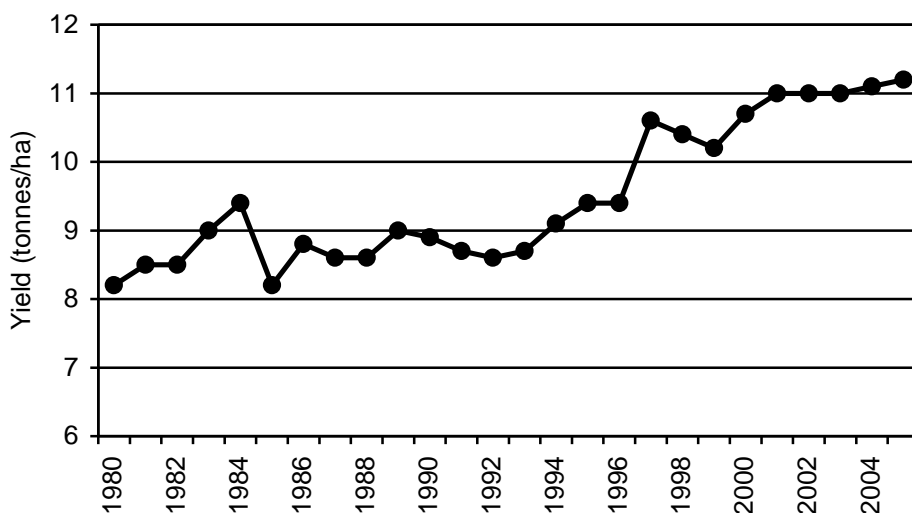


Source: FAOSTAT (2007)

Figure 1. Trends in vegetable production and area for Vietnam, 1980-2005

Production and area harvested increased fairly steadily from 1980-2005, with production volume increasing most sharply between 1997 and 2001 (Table 2, Figure 1). Mean yield rose from 8.6 t/ha in 1992 to 11.0 t/ha in 2001, and then plateaued between 2001 and 2005 (Figure 2) (FAOSTAT, 2007).

⁶ These figures (VRD, 2007) are higher than those of FAOSTAT (2007) .



Source: FAOSTAT (2007)

Figure 2. Yield fluctuation in vegetable production (tonnes/ha) in Vietnam, 1980 to 2005

Table 2. Population, area, production, and export/import volume and value for vegetables in Vietnam 1995-2005

	1995	1997	1999	2001	2003	2005	Growth rate (1995-2005) (%)
Population ('000)	73,329	75,740	77,964	80,255	82,639	85,028	1.5
Area harvested ('000 ha)	468	525	617	663	698	721	4.8
Production volume ('000 t)	4,399	5,559	6,279	7,319	7,678	8,072	6.5
Export Volume (tonnes)							
<i>Fresh</i>	9,330	15,920	44,320	52,110	82,910	201,330	29.6
<i>Processed</i>	14,450	35,790	31,670	43,160	54,660	74,530	11.9
Export Value (US\$ 1000)							
<i>Fresh</i>	2,686	1,932	8,190	5,366	10,823	23,749	22.5
<i>Processed</i>	13,640	26,867	23,357	27,958	34,640	50,238	9.1
Import Volume (tonnes)							
<i>Fresh</i>	4,560	6,310	14,600	13,500	153,660	160,190	48.6
<i>Processed</i>	9,350	1,670	1,740	8,860	24,300	30,680	32.3
Import Value (US\$ 1000)							
<i>Fresh</i>	1,786	1,178	2,822	2,484	28,730	29,600	40.1
<i>Processed</i>	4,507	1,318	2,341	4,912	11,018	16,245	24.8

Note: Ginger included in trade data, but not area or production data.

Source: FAOSTAT (2007) (last accessed October 2007).

Trade

While exports have risen slowly, imports have risen dramatically, displacing and outcompeting local production of some crops (Table 2).

The Government of Vietnam aims to double gross domestic product (GDP) between 2000 and 2010, and recognizes this has to go hand-in-hand with environmental protection for sustainable development (ADB, 2004). The vegetable industry has the potential to contribute significantly to this goal, but greater adoption of advanced technologies will be needed to increase production and exports (VRD, 2007).

Vegetable production is a critical component of subsistence systems in more remote and impoverished communities, and a key industry in specialized peri-urban areas; it occurs in rotation with rice and other crops in the main farming zones (Red River Delta, Mekong Delta, Central) (IFPRI, 2002).

Currently, the vegetable industry mainly supplies the domestic market. Average per capita vegetable availability rose to 240 g/day for 2004 and 234 g/day for 2005, including 2.5 g/day of dry chili (FAOSTAT). Others (Ogle et al., 2000; 2003) have reported vegetable consumption levels in surveyed communities of 274 g/day in the Mekong, and 268 g/day in the Central Highlands. Some reports suggest consumption has risen to 307 g/day (2004), which is double the ASEAN average of 156 g/day (Moustier and Danso, 2006; VRD, 2007). Intake may still be inadequate or unbalanced in some areas and community sectors (Ogle et al., 2001a; 2001b).

Moustier and Danso (2006) defined four types of urban production: (1) subsistence home intra-urban farmers (intra- and peri-urban areas) (2) family-type commercial farmers (intra- and peri-urban areas) (3) urban and peri-urban agricultural entrepreneurs (intra- and peri-urban areas) and (4) multi-cropping peri-urban farmers (peri-urban areas). Noting that the expenditure of public resources in supporting these types of agriculture had been questioned by some, Moustier and Danso (2006) make a strong case for supporting the sector, especially in a population dense/land-poor country like Vietnam. They indicated that agriculture provided more than half of the income for family-type commercial farmers in peri-urban Hanoi along with commerce and craft work in municipalities such as Trung Trac (Lecostey and Malvezin, 2001).

Most peri-urban production units are < 1000 m² /household. Specialized peri-urban production accounts for 46% of total area and 45% of production total volume for vegetables, while commodity/commercial production in the deltas and plains account for 54% of area and 55% of production, supplying export,

processing, and regional needs. Southern Vietnam accounts for 53% of total production (VRD, 2007).

Export and processing are relatively undeveloped compared to domestic marketing, and exports are mainly to lower-end markets in China. Although Vietnam aims to grow and expand export volume and value, the current large supply for the domestic market ensures vegetables remain plentiful and affordable for the Vietnamese poor.

2.2 Vegetable demand

As Yeomans (2007) notes: “Fragrant, herbaceous, and built around subtle flavors and contrasting textures, Vietnamese food has a character all of its own.” Vietnamese cuisine is known for its diverse use of fresh and wild harvested herbs (mint, basil, coriander, Vietnamese mint⁷, *Erygium*, and fennel), vegetables, and fish, soy, or hoisin sauces, with Chinese and French influences. A typical meal includes rice (in individual bowls) and communal dishes of meat or fish (steamed or roasted), stir-fried vegetables, a clear broth or soup with vegetables and meat (pork, beef, chicken) or seafood (fish, shrimp), and a dipping sauce—often fish sauce with chili and cucumber. Rice noodles, and raw vegetables and other ingredients rolled in rice wrappers, are a common option. Meal preparation often requires less heat, reflecting the water-based lifestyle of the deltas. Perhaps the best-known dish is phở—a clear broth with rice noodles, beef or other meat, and fresh herbs, typically taken as breakfast. There is also a tradition of Buddhist vegetarian food (Trinh et al., 2003; Wikipedia, 2007b).

Vietnamese cuisine can also be divided into northern style, featuring more traditional, specific uses of spices and ingredients; southern style, with more Chinese influence; and central style, the former “royal food” of Hue, with many small dishes and distinct spiciness (Wikipedia, 2007b).

Domestic demand and government planning targets are the key drivers of production. Although vegetables are an integral part of the Vietnamese diet, and food the priority expenditure, rice continues to be the single most important item in household food budgets. Its share in food spending, however, has declined from 20.5% in 1993, to 16.7% in 2004 (M4P, 2006b).

In general, urban consumers spend less than half the amount on rice, and more than twice the amount on outside eating than rural consumers, but for both

⁷ There are some reports that suggest that Vietnamese mint (*Polygonium*) may be anti-mutagenic (Nakahara et al., 2002).

groups, less than 5% of total food expenditure is on vegetables (2004 survey⁸) (M4P, 2006b). In rural areas, wild harvested vegetables are a significant component of the diet (Trinh et al., 2003). These reduce the need for producing or buying produce, and are probably under-assessed in statistic collection. A challenge for the vegetable industry and the retail sector is to increase their share of the food-consumption dong.

Income is a key limiting factor in food expenditure. “Food poverty” (insufficient resources to assure adequate food intake) and general poverty are much higher in rural than in urban areas, and are highest in the northwest and central highlands. Food poverty is low in the main rice/vegetable production areas (Red River Delta and Mekong Delta) when compared to the national average and the levels in the northeast, northwest, north-central coast and central highlands in particular (Table 3) (M4P, 2006b).

Freshness is an important attribute of food for the Vietnamese, especially for vegetables, which are usually purchased daily (average 13 purchases/week for poor households) from a nearby outlet or harvested from home production to guarantee freshness and safety (Figuié, 2004; Figuié et al., 2006). This means constant supplies and quick turnover in markets.

Table 3. Poverty incidence (%) among the population of Vietnam as “food poverty” and “general poverty” (2004) VHLSS

	Food Poverty	General Poverty
All Vietnam	7.4	19.5
Urban	0.8	3.6
Rural	9.7	25.0
Regions		
Red River Delta	2.3	12.1
Northeast	11.4	29.4
Northwest	34.8	58.6
North Central Coast	13.6	31.9
South Central Coast	8.1	19.0
Central Highlands	18.8	33.1
Southeast	1.5	5.4
Mekong Delta	4.0	15.9

Source: M4P (2006b)

The modern retail sector, with requirements for higher quality and delivery standards (and perhaps longer shelf-life), is likely to increase as a key driver of demand.

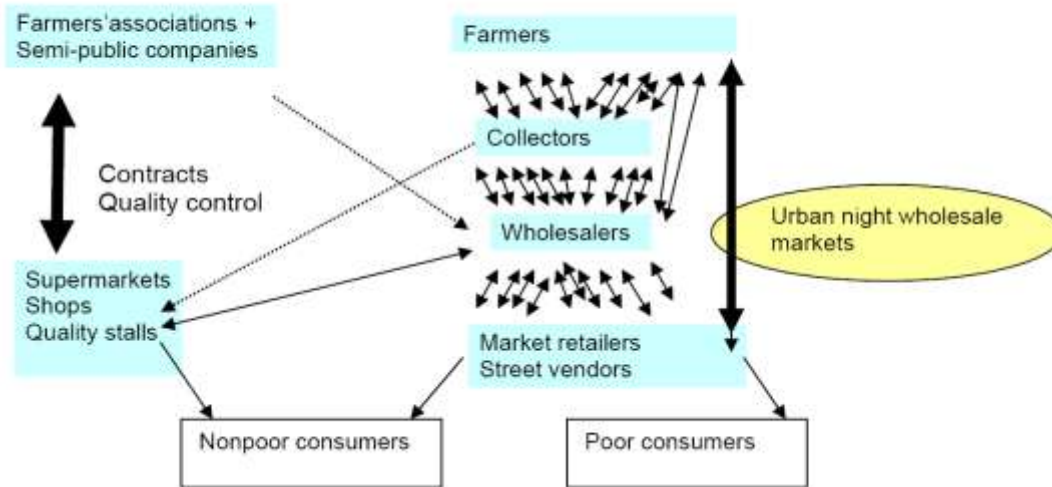
⁸ The Viet Nam Living Standards Survey (VHLSS), 2004

While exports and processing are relatively small compared to the domestic market for fresh produce, the government intends that they will increase in importance as drivers of demand. Increasingly, however, imports of some vegetable types and preferences for imported product (at least seasonally) by wholesalers and retailers may serve to dampen domestic production demand and price.

3 The vegetable supply chain

3.1 Industry status

Sectoral involvement in traditional and modern supply chains are shown in Figure 3 (Moustier et al., 2005).



Source: After Moustier et al. (2005).

Figure 3. Vegetable supply chains in Vietnam: Traditional chain and modern chains

The transformation of agriculture from subsistence to commercial and export-orientated agriculture was made a policy objective of the government under Decision 80 in 2002 (Decision 80/2002/QD-TTg). The policy aimed to increase the use of contracts to improve procurement and efficiency, and to promote technology innovation in agriculture, but use of contracts is still low (less than 30%) and focused on processing crops (Dang et al., 2005; M4P, 2006a)⁹. IFPRI (2002) also provides a summary of the factors and circumstances when

⁹ Reneging on contracts by processors (payment) and farmers (delivery or paying for inputs) is common. Contracts between traders and processors are more common than with farmers, but coordination with farmers is limited, and the system tends to favor only large-scale farmers (southeast and Mekong). Contract farming could improve smallholder welfare, but these farmers are often excluded. To be successful, improvements are needed: Decision 80 must be revised to provide more flexibility; farmer cooperation/coordination needs to be improved; and more attention should be given to education and training in the public and private sectors to increase awareness of contractual obligations and develop workable enforcement mechanisms. A value-chain approach would help the industry to progress (M4P, 2006a).

contracting may be a reasonable option, and cautions against overemphasis by government on contracts that may adversely affect productivity and efficiency.

3.2 Production sector

About 80 different species are grown in the vegetable sector, with 30 main species accounting for 80% of production (Trinh et al., 2003; VRD, 2007) (Appendix 1) In subsistence production systems, vegetable gardens and wild harvest provide significant food supplies, nutrition, and income (Ogle et al., 2001a; 2001b; Trinh et al., 2003). Incomes have increased substantially compared to traditional subsistence production through adoption of new varieties (e.g. tomato by 20-25% in Nan Dinh province, hybrid cucumber by 100% in Nam Ha province), modern technologies (Hanoi, Bac Ninh, Vinh Phuc provinces), and safe vegetable production (SUSPER¹⁰ project).

Principle vegetables in the north are water spinach (dry-land, wet-land, floating, red and green types), amaranth (main export vegetable, especially in Lam Dong Province), squash (cultivated all year, main crop December to March, second crop September to October, common in all regions and processed for export), chayote (*choko*, as shoots and fruit) in northern provinces and mountain regions, crucifers (north and western plateau areas, with two crops: the early crop in August, the main crop October to December, harvested January to March) (Rau Hoa Qua Viet Nam, 2006).

However, the focus for industry development (and availability of statistics), is on tomato, chili, cucumber, watermelon, bitter melon, pea, French bean, yard-long bean, the brassicas, and alliums, with attention to productivity improvement, processing, and storage (VRD, 2007). Comprehensive data for vegetable production and areas are not readily available in Vietnam due to inadequate statistics collection; the data from FAOSTAT groups a large number under “vegetables other” (Table 4).

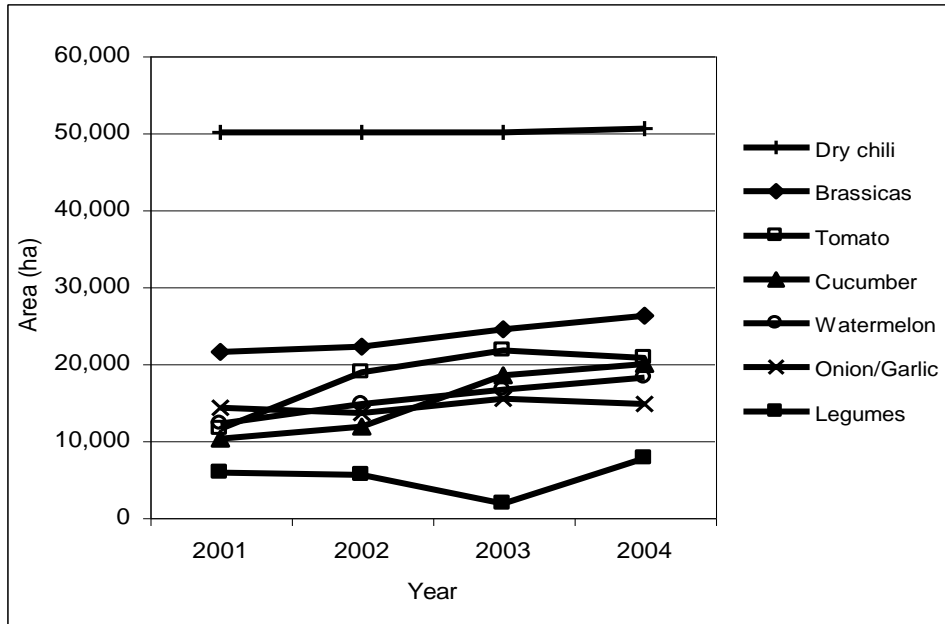
¹⁰ Sustainable Development of Peri-urban Agriculture in South-East Asia Project, Kingdom of Cambodia, Lao PDR, Vietnam RS (SUSPER) managed in collaboration between the World Vegetable Center (AVRDC) and CIRAD. (<http://www.avrdc.org/susper/index.htm>)

Table 4. Vegetable production in Vietnam ('000 tonnes) 2000-2005

	2000	2001	2002	2003	2004	2005
Cabbage and other brassicas	400.0	453.9	499.2	606.2	650.0	700.0
Cauliflower and broccoli	27.5	26.5	26.5	26.5	27.6	28.2
Chilies and peppers, dry	76.5	77.0	77.0	77.0	79.5	81.0
Mushrooms	20.5	16.0	16.0	16.0	17.4	18.3
Vegetables – Other, incl. okra	5,632.1	6,277.9	6,235.3	6,326.3	6,450.0	6,600.0
Watermelons	200.0	244.7	372.3	401.2	410.0	420.0
Onions, incl. shallots	210.0	222.8	223.0	225.0	225.0	225.0
Total	6,566.6	7,318.8	7,449.3	7,678.2	7,859.5	8,072.5

Source: FAOSTAT (2007)

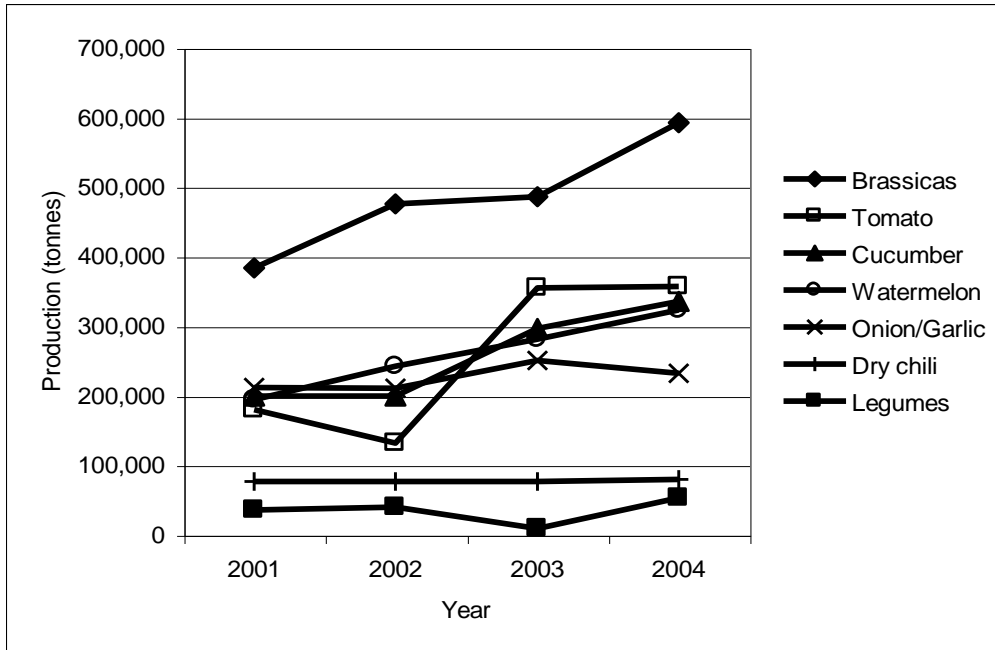
Production and area harvested 2001-2004 for some of the focus crops are shown in Figure 4 and Figure 5.



Source: Dry chilies from FAOSTAT (2007); others from VRD (2007)

Figure 4. Area harvested (ha) of focus vegetables (excluding potato) in Vietnam, 2001-2004

Production areas harvested for brassicas, cucumbers, and watermelon steadily increased 2001-2004. Tomatoes increased, then declined due to excessive rain affecting production in 2004, while onion/garlic production growth has been slow.



Source: Dry chilies from FAOSTAT (2007); others from VRD (2007)

Figure 5. Production (tonnes) of focus vegetables (excluding potato) in Vietnam, 2001-2004

Between 2001 and 2004, production volumes for brassicas, cucumber (2001-2004), and watermelon increased steadily, while chili has been unchanged 2001-2004. Tomato plateaued from 2003-2004; increases in onion/garlic and legume production have been slower. Production and productivity by region is shown in Table 5. Production is highest in the deltas, but yields were highest in the western plateau and the deltas (Table 5) (Rau Hoa Qua Viet Nam, 2006).

Table 5. Production area, productivity and yield of vegetables in Vietnam according to regions

Region	Production area (1000 ha)		Yield (tonnes/ha)		Production (1000 tonnes)	
	1999	2005	1999	2005	1999	2005
Red River delta	126.7	158.6	15.7	17.99	1988.9	2852.8
Northern midland	60.7	91.1	10.51	11.06	637.8	1008.0
Northern central	52.7	68.5	8.12	9.78	427.8	670.2
Central coastal	30.9	44	10.9	14.01	336.7	616.4
Western plateau	25.1	49	17.75	20.17	445.6	988.2
Southeast provinces	64.2	59.6	9.42	12.95	604.9	772.1
Mekong River delta	99.3	164.3	13.6	16.63	1350.5	2732.6
Vietnam	459.6	635.1	12.6	15.18	5792.2	9640.3

Source: Rau Hoa Qua Viet Nam (2006).

Production sectors, analyzed by region and types of urban/peri-urban production are described in Table 6.

Table 6. Production sectors and key issues in Vietnam's vegetable industry

Production sector	Trends and issues
<p><i>Subsistence Production.</i> In 1997, home gardens, ponds and husbandry provided 30% of Vietnam's total agricultural production (Trinh, 1998). One of the constants within the Vietnamese agricultural system has been the high cultural significance associated with home gardens (Trinh et al., 2003). In this context, home gardens (<i>vuon nha</i>) encompass the subsistence production systems in rural and remote areas, with varying emphasis on vegetables/gardens, ponds, livestock, and trees/shrubs. During periods of conflict, home gardens have been an important source of subsistence, with perhaps more focus on staples. Trinh et al. (2003) define 4 types of home garden: with fruit trees (south); with pond and covered livestock areas (Red River delta and central); with vegetables (Red River Delta and Central); and with forest trees (mountainous/ethnic communities). With time, the proportion of home garden production is declining especially in delta and highland areas with good market access, but the system will remain important in more remote communities and as a subset of peri-urban production.</p> <p><i>Urban and peri-urban production.</i> As land is lost due to urban encroachment around Hanoi and HCMC, intensive production in peri-urban areas is extending out into the Red River Delta and Mekong areas, with > 80 (15 major) vegetable types, intensive land-use (3-4 harvests/year) and high input use (fertilizers, chemicals). Protected, greenhouse, and hydroponic/organic/safe vegetable production systems are emerging to tap specialized markets. NGOs working with poor farmers and disadvantaged population segments assist production. There is some use of high-technology systems (Rau Hoa Qua Viet Nam, 2006).</p>	
<p>Types of urban and peri-urban production (Moustier and Danso, 2006)</p>	
<p><i>Subsistence home intra-urban farmers</i> (intra-urban and peri-urban areas)</p>	<p>Usually urban residents grow crops around their homes or on vacant plots for subsistence purposes, with production seasonal and outputs for home use to supplement market purchases with occasional sale, home-processing, or barter of surpluses. In multi-generational families, the elderly can be the main ones engaged in production, and vegetables are</p>

	of good quality, lower cost, and more consistent supply than purchased food.
<i>Family-type commercial farmers</i> (intra-urban and peri-urban areas)	Common characteristics include irrigation, use of organic matter, bed cultivation, and small areas (< 1ha) with intensive use and high capital pressure on land. Cropping changes with improvement in capital access from short-cycle quick return (leafy vegetables) to riskier and longer-cycle (temperate vegetables, ornamentals). Input use and marketing strategies change, and men become more involved. Cultivation may move with the season (e.g to the riverbank/bed in the dry season). In urban areas, domestic labor is usually adequate, while in larger peri-urban areas, labor may be hired and domestic.
<i>Urban and peri-urban agricultural entrepreneurs</i> (intra-urban and peri-urban areas)	Entrepreneurial production differs from family production in scale and the use of paid labor. Urban entrepreneurs (government officers, businessmen, expatriates using income from other sources) provide more capital and technology and partly mechanize operations, and pay labor to do the work.
<i>Multi-cropping peri-urban farmers</i> (peri-urban areas)	This group is similar to rural (delta) producers, except they are located in urban areas and thus closer to markets, and subject to the disadvantages (land costs, urban pollution) and advantages (income from other sources, access to cheap labor) of city farming. They may also be more specialized, or use intensive modern technologies (screenhouses, hydroponics), with production under threat from urbanization (land resumption, cost, government inspection, consumer protests about the use of pesticide sprays.)
Production Regions (2005 data - Rau Hoa Qua Viet Nam, 2006)	
Northern regions	<p>Peri-urban areas around Hanoi: 8100 ha producing 150,800 t (2005) (= 3,000 ha x 2.7 crops/year), high yields (18.6 t/ha). Leafy vegetables (mustard greens, water spinach, cabbage, amaranth) are 70-80% of cropping, using traditional practices (high safety risk). Moving to safer systems (20-25% of area), mainly in outer districts (Dong Anh, Gia Lam, Thanh Tri), to supply 15-20% of area's production.</p> <p>Intensive systems include 16 ha in Tu Liem, 30 ha in Nam Hong, 15 ha in Kim Son. Around Hanoi, 37 cooperatives (Dong Anh, Soc Son, Tu Liem) are certified for safe vegetable production (RAI = production control, with trademark, bar code, and specified production/consumption system).</p> <p>Specialized areas around Nam Sach, Bin Giang and Kim Thanh districts of Hai Doung produce carrots, water spinach and garlic. Cucumber production for processing is specialized in Phu Ly, Ha Nam (400-500 ha), and other processing vegetables are grown around Nam Dinh, Bac Giang, Thanh Hoa (840 ha = 274 ha cucumber, 300 ha chili, 125 ha sweet corn, 45 ha tomato = yielding > 6000 t)</p> <p>In Thai Binh Province, export commodities are produced in Quynh Phu District (onion, garlic, chili, baby potato) and Thai Thuy District (cucumber, baby corn). Production of German and Dutch baby tomatoes, Taiwanese, Korean, and Japanese chilis varieties are expanding.</p>

	Bamboo var. Dien Truc is produced in infertile foothill soils of Dan Phuong district of Ha Tay for bamboo shoots (8,000-11,000 dong/kg) and handicrafts.
Central Region	Quyh Luu District of Nghe An is an important production area. Quynh Luong Commune in the district has established a website to promote its products. In 2005 they exported 600 t fresh vegetables (tomato, cabbage, spice-vegetables, beans, onion) to the Netherlands, compared to 100 t in 2004.
Southern Regions IAS (2007) indicated in 1998 average farm size for vegetables around HCMC was 5,260 m ² .	<p>Around Ho Chi Minh City: 1663 ha of safe vegetables (30,000 t/yr) are produced. A high-technology area in Cu Chi District (1000 ha) is using hydroponics, nutrient film technologies for vegetables.</p> <p>Mushrooms are produced in Vinh Long Province. 20 communes are using 634.5 ha for straw mushroom production. Edible mushrooms are also produced in Tan Phuoc of Tien Giang Province (500 ha).</p> <p>Regional production is focused in Tien Giang – 30,000 ha produce 450,000 t. Safe vegetable production areas are in Than Cuu Nghia, Long An, Phuoc Thanh, Tan Hiep, Long Binh Dien, Binh Phan, Binh Phuc Nhat, Binh Nhi, Long Vinh, My Phong, Tan My Chanh and Long Hung communes</p> <p>Temperate vegetables are produced in Lam Dong (27,315 ha in 2005 produced 67,700 t (cabbage, cauliflower 55-60%, potatoes and carrots 10-12%, and fruit, vegetables, tomatoes, and peas). There are > 600 ha of safe vegetable production with net houses, etc.</p>

In future years, it is anticipated that there will be a need for more diversification of vegetable types produced in peri-urban areas to cater for broadening customer and supermarket interests (VRD, 2007). The commodity-vegetable regions more distant from cities mainly produce crops in winter-spring (November-March), between the two rice crops or rice/maize seasons, when vegetable yield and quality is optimal because of favorable climate and soil conditions and there is a competitive advantage over ASEAN and Chinese production (VRD, 2007). Vegetable production for export is concentrated in the Red River Delta and Lam Dong Province (Don Duong, Duc Trong) and focuses on brassicas, Solanaceae, cucurbits, and legumes (VRD, 2007).

For the vegetable sector, strengths include climatic advantages, year-round production of a diverse array of products, experienced farmers, and high returns. Opportunities include the growing domestic demand for vegetables, and in near-export markets, reductions in export taxes (after 2006), policies favoring investment in R&D, and the rise of supermarkets. Weaknesses include small production unit size, which limits scope for use of some modern technologies;

inadequate R&D facilities; below world average yields (currently about 87% of world average); increased safety risks in peri-urban and industrial areas; and underdeveloped supply chains. Threats include the dominance of foreign seed companies eroding the base of traditional germplasm and reliance on traditional practices that may reduce productivity compared with improved modern methods (VRD, 2007).

3.3 Inputs, finance, and utilities

In general, production infrastructure is adequate (80% with irrigation and drainage, and safe transport on roads and rivers) especially in the Red River and Mekong River delta areas (VRD, 2007). Vietnam has been promoting a “*Three Decreases and Three Increases*” Program¹¹ to reduce direct seeding, excessive pesticide use, and excessive nitrogen fertilizer use, and to increase productivity, quality, and economic returns (MARD, 2006).

Inputs and supply chain logistics

Affordability of inputs for poorer farmers is a concern for Vietnamese authorities, as this reduces critical use of some inputs such as hybrid seed, improved pest control, and balanced fertilization for yield improvement. (VRD, 2007).

Seed

Research in Vietnam has mostly focused on open pollinated varieties, with basic R&D for new varieties undertaken in other countries by seed companies. Currently about 50% of the production area uses seed distributed by foreign companies (VRD, 2007).

IFPRI (2002) estimated that about one-third of vegetable growers purchased seed in any year, and suggested that attention to improved seed use and access would boost productivity. Uptake has increased since then.

Fertilizers

While Vietnam once depended on fertilizer imports (formerly urea came from Ukraine, Russia, the Middle East, and now from China), production capabilities are increasing while usage rates are declining. Demand for urea has fallen from 1.5-2.7 million t in 2002 to est. 1.7 million t in 2006-2007, possibly due to cost.

¹¹ Under Directive No 24/2006/CT-BNN, 07 April 2006, Minister of Agriculture and Rural Development.

Petro Vietnam Fertilizer and Chemicals Company (PVFCC) operates Vietnam's only fertilizer factory¹² in Ba Ria-Vung Tau. The plant's urea production and the fertilizer it imports meet 40 percent of Vietnam's domestic demand. Other facilities will come on line within three years—and Vietnam will need to develop export markets or face oversupply (Reuters, 2007; VietNamNet Bridge, 2007). Although the increased local production of nitrogenous fertilizers may reduce fertilizer costs for farmers, it may also encourage overuse and increase nutrient loads in runoff.

In general, Vietnamese farmers overuse nitrogen and underuse phosphorus, which reduces yields and profits (Nguyen et al., 1999). IFPRI (2002) noted that the Vietnamese Living Standards Survey (VLSS 1998) estimates of fertilizer use for fruit and vegetables (47%) and pesticides (22%) were lower than the Ministry of Agriculture and Rural Development (MARD) estimates, but suggested the latter may have meant “commercial growers.” IAS (2007) indicated that average usage rates around HCMC were urea at 353 kg/ha, diammonium phosphate at 257 kg/ha, superphosphate at 441 kg/ha and ammonium sulphate at 291 kg/ha. Leers (2001) suggested recommendations for vegetable fertilization in Vietnam.

The decline in “per hectare” fertilizer use from 2002-2007 (Reuters, 2007) may also reflect more targeted application, a partial switch to biofertilizers (Barrett and Marsh, 2001; Kennedy, 2007), and the recycling of by-products, wastes, and water (RURBIFARM, 2006). Interest in organic fertilizers is traditional, and has increased in recent years as fertilizer prices have risen and the market for organic produce has grown. However, McLaughlin (2007) cautioned farmers also need to be aware that contaminants may be present in inputs such as fertilizers, manures, composts and pesticides, and in recycled city waste and some soil replacement materials, and that intensive use of fertilizers and manures in peri-urban agriculture can lead to the accumulation of cadmium in crops.

Agricultural chemicals

Before 1990, government companies imported and distributed pesticides, and national use was 13,000 to 15,000 t/year (all purposes), with a subsidy of 20-30% of price. Since 1990, pesticide distribution has been in response to commercial demand, with government regulation only of registration, trade, formulation, manufacture, sale, and use permits. In 1991, pesticide use doubled compared to 1990, and use increased tenfold between 1991 and 1998 (insecticide x 7, fungicide x 8 and weedicide x 41) (Nguyen, 2001). One study in northern

¹² The Phu My Fertilizer Plant uses natural gas as feeding stock for Ammonia and Urea production (<http://www.petrovietnam.com.vn/Modules/PVWebBrowser.asp>).

Vietnam found that only 30-40% pesticides were distributed through government organizations and cooperatives (Nguyen, 2001).

In response to rising concerns about excessive use of pesticides on vegetables, there has been a strong focus on “safe” vegetable production by researchers in Vietnam since 1997 (Truong, 2001), and increased promotion of integrated pest management (IPM) and resistant cultivars (Moustier and Danso, 2006). Pesticide residues in vegetable are a key concern of domestic and export markets (ADB, 2007a). In response to public concerns about vegetable safety, a “safe” vegetable program was launched in 1995, with technical support to eight cooperatives for information dissemination on safe practices, especially in relation to water and input use, and distribution through “safe” vegetable outlets (Tran, 2006b). Since 1995, the scheme has grown considerably to become a significant portion of production (Table 6).

IAS (2007) surveys of 100 farmers in the HCMC area (with an average farm size of 5260 m²), found that completely chemical-free cultivation was not attractive to farmers because pests and diseases were not controlled. Two-thirds of those surveyed had received training in IPM, and they found the training on effective use of pesticides most useful (and fertilizer management least useful), with 61% reporting that after training, they reduced pesticide use and used less toxic, cheaper pesticides. The IAS (2007) findings suggest that even if farmers are not ready to adopt more sophisticated aspects of IPM (such as pest scouting, etc.), the program increases farmer awareness and reduces pesticide use.

Farm machinery

Because of the small size of production units, there are few opportunities for mechanization. In the Red River Delta, some mechanization of soil cultivation is occurring (MARD, 2005). Across all agriculture, the government aims to mechanize 88% of tilling work, 55% of farm produce drying, and 10-15% of rice transplanting by 2010 (MPI, 2006).

Irrigation and water

As a densely populated country with high rainfall, frequent flooding (especially in the Mekong River delta), and pollution risks associated with rapid industrialization, Vietnam must find sustainable ways to manage water. The *Law on Water Resources* aims to balance community, environmental, and agricultural needs and to protect water quality (ADB, 2004).

In 2005, only 30% of the population had access to clean water (50% urban). Wastewater treatment was a major problem, with most cities and provinces having no treatment systems. This is a major concern for vegetable production,

particularly in peri-urban areas. The government aims to ensure access to clean water for all urban and 85% of rural users by 2010, with all urban wastewater and solid waste being safely handled and disposed of (IEICI, 2007). The plans will require an investment of US\$ 7.6 billion (IEICI, 2007), but will go a long way towards reducing pre- and postharvest contamination risks on fresh vegetables.

Labor

Labor employment in agriculture, forestry and fisheries continues to fall, to 55.7% of the population in 2006 from 57.2% in 2005; unemployment in 2006 was at 4.4% (GSO, 2007). The *Socio-Economic Development Plan 2006-2010* has a target of agriculture providing 50% of employment by 2010 (MPI, 2006).

Family labor is most common in vegetable production, with male and female labor contributing equally to fruit and vegetables¹³, and temporary labor (> 50% women) hired by about one-quarter of producers and accounting for about half of total labor inputs (IFPRI, 2002). Family labor is preferred, as hired labor erodes profits, but the situation is changing (See Table 6). The Vietnam Women's Union is a key group for mobilizing and involving women, and provides access to new knowledge and skills (Barrett and Marsh, 2001).

IAS (2007) (1998 data) indicated farmer estimates of their labor requirements for vegetable production in HCMC area: irrigation–35 days, harvesting–20 days, fertilizer application–9 days, pesticide application–7.4 days, weeding–6.4 days, trellising–6 days, field inspection–5 days, transplanting–5 days, postharvest–3.6 days, and plowing–2 days. (IAS (2007) does not state whether this is per crop, ha, or annum.

The wholesale sector is also a significant employer. On average, traders employed 47 workers, mostly seasonal hired labor and a small number of family members (IFPRI, 2002).

Genova et al. (2006) also provide assessments of labor inputs at farm, trader, and retail levels based on surveys from northern Vietnam.

Good Agricultural Practice (GAP), EurepGAP (2007) and quality certification

National and provincial governments are committed to the development of GAP and quality certification mechanisms, particularly in relation to export crops. Phan et al. (2005) have reviewed the development of GAP certification systems in Vietnam, and identified the differences and deficiencies between the existing

¹³ The findings of IFPRI (2002) conflict with Tran Thi and Le (2000), who considered that women dominated the labor sector in the vegetable industry, contributing 76% of personnel.

GAP and EurepGAP. GAP in Vietnam focuses on site selection, land use, water use, fertilizer use, and pest/pesticide control. However enforcement has been ineffective due to inadequate resources and poor inter-agency coordination (Phan et al., 2005).

Vietnam is involved in collaborations to develop EurepGAP compliance for dragon fruit (Phan et al., 2005) and for the development of ASEAN GAP standards (Ledger et al., 2006). While EurepGAP compliance will be critical for European market access, a working group from Malaysia, Philippines, Singapore, and Thailand has developed a generic ASEAN GAP suitable for the region. The ASEAN GAP focuses on food safety, especially chemical usage and microbial contamination issues (Ledger et al., 2006; APHNeT, 2007).

Postharvest technology

Currently, postharvest technologies are inadequate and losses are high. Postharvest processing of vegetables on-farm is limited to washing and drying, although for example, three-quarters of tomato growers also ripen fruit before sale. Most farmers are aware of quality and grading standards¹⁴ (91%), and base their production and postharvest management on the standards (IFPRI, 2002). In 1998, traders' use of postharvest technologies was limited to bagging (86%), grading (62%), and sorting (43%) of produce. Use of cool-stores was rare (< 3%, but higher in large and export trader groups), despite the fact that most traders (84%) had storage facilities (IFPRI, 2002).

Under the *Socio-Economic Development Plan 2006-2010*, there is a target of reducing postharvest losses from an estimated 24% to 10%; if achieved, this will represent a significant saving in land and input use. Currently Vietnamese customers purchase vegetables almost daily (Moustier et al., 2005) but losses between farmer and market are very high due to trimming, heat exposure, rough handling and transport, and unrefrigerated display.

As lifestyle and shopping patterns change, supply chains improve, and supermarket patronage and refrigerator ownership increase, less frequent and larger quantity purchases may become the norm. The switch to supermarkets (and more efficient supply chains) and refrigerator use will provide better conditions for vegetable storage, and could contribute significantly to meeting

¹⁴ Farmers considered size, shape, and color of vegetables as most important, with smell, texture, and flavor unimportant. Fifty-seven per cent of farmers indicated some postharvest problems, but losses were low (1.4%). Major postharvest problems were transport (27%), handling (17%), and inability to sell (17%) (IFPRI, 2002).

loss reduction targets. However, considerable investment and capacity building will be needed to meet the goal.

Logistics

Logistics and infrastructure are critical, but logistic mapping and “soft” infrastructure need most attention (IFPRI, 2002).

Typically the most perishable leafy vegetables are produced in peri-urban areas close to markets, while more durable/transportable products are produced in more distant regions. The traditional supply chain involves many hands, and delays can occur due to traffic congestion and unofficial levies on roads. In the south, river transport provides better access to the city, but produce still has to be moved across the city by road. Transport is the major operating cost (60% - IFPRI, 2002) for traders, and 39% experienced major problems (poor access to road, rail, and docks; delays; long routes; underloading; inefficient transport) as well as damage and spoilage (IFPRI, 2002). Police actions such as random roadside checks and fines (30% traders) and interprovince movement restrictions (14%) also impeded marketing (IFPRI, 2002).

Table 7 provides comparisons of market accessibility for different regions in terms of road, public transport, and market frequency (M4P, 2006b).

Table 7. Market accessibility across regions in 2002 compared to average for Vietnam, based on road, public transport, and market frequency rankings*. Higher rankings indicate greater accessibility.

	Roads	Public Transport	Daily Market	Periodic Market	Σ Score
Vietnam	0.90	0.54	0.96	0.36	2.76
Red River Delta	0.97	0.43	0.98	0.53	2.91
Northeast	0.92	0.40	0.90	0.50	2.72
Northwest	0.78	0.40	0.97	0.50	2.65
North Central Coast	0.93	0.44	0.97	0.50	2.84
South Central Coast	0.94	1.08	0.98	0.30	3.30
Central Highland	0.92	0.38	0.92	0.29	2.51
Southeast	0.99	1.07	0.99	0.11	3.16
Mekong River Delta	0.75	0.49	0.96	0.18	2.38

* (i) Road Index = [1- (km to nearest road/10)] X [1- (months with impassable roads/10)] ; (ii) Public transport index = [1-(km to nearest train, bus or water transport/50)] X daily frequency /10 (divide by 10 to allow sum of factors); (iii) Daily market index = [1- (distance to nearest daily market/72)]; (iv) Periodic market index = [1- (distance to nearest periodic market/50)] (adapted after M4P, 2006b); Σ Score = sum of 4 rankings (i) to (iv).

Market accessibility varies with location across Vietnam (Table 7). Access in terms of proximity to a road or public transport, or a daily or a periodic market is poorest in the Central Highlands, and highest for the south central coast (Table 7). Accessibility from the Mekong River Delta is lower than that of the Red River Delta (based on mean score), and for access Ho Chi Minh City markets, access is compounded by the need for road transport to take ferries across some rivers.

Ethnic groups in remote areas are marginally disadvantaged in market accessibility compared to the national average. By contrast, on average poor households and non-poor households have similar levels of market accessibility (M4P, 2006b).

Financial and utility services

The Medium Plan 2006-2010 aims to have 35 telephones/100 population by 2010 (MPI, 2006). The increasing penetration of mobile phones has improved collector-trader-wholesaler-retailer links, and increasingly farmers and cooperatives are also connected.

Financial services

In the late 1990s, about one-quarter of producers used credit (IFPRI, 2002), mostly from the Agricultural Bank, and it was sufficient for their needs. Fruit growers were more likely to have higher levels of borrowing than vegetable or fruit and vegetable growers. Those who did not use credit indicated it was due to problems dealing with the bank (IFPRI, 2002).

Traders, however, were more likely to use formal-sector credit (36% - IFPRI, 2002). Most used family sources for start-up capital and/or formal-sector loans. About two-thirds did not have outstanding loans, implying they were self-financed (IFPRI, 2002).

About half of processors surveyed in 1998 had loans, and most borrowed from the Agricultural Bank, family or friends, or commercial banks, with the non-bank sources not requiring collateral. Smaller processors were more in need of collateral (IFPRI, 2002).

As in other countries, land title/ownership affects farmers' access to finance. Marsh et al. (2007) and Hung et al. (2007) provide some analysis of policy issues in relation to land and finance.

Value-adding, food processing, and processed sectors

Before 1999, Vietnam's fruit and vegetable processing capacity consisted of 12 large processing plants and 48 workshops, with a total capacity of 150,000 tonnes a year. This had increased to 290,000 t capacity by 2003, with foreign investment also increasing. In 2004, the industry involved 25 state-owned enterprises, 129 private companies, and 10,000 farmers. In addition, a number of micro, small and medium enterprises (MSME) were involved in processing in some provinces, and about 5-7% total fruit and vegetable production was being processed (Tran, 2006b).

Most MSME processing involves private enterprises operating seasonally and using family labor, with relatively little outside labor. Operations are generally basic (drying, salting, canning, and only one or two vegetables or fruit), and only a few are diversified enough to operate year-round. In 1998, only 15% used contracts with suppliers; most processors were too small, or prices too variable (IFPRI, 2002).

Most processed product goes to supermarkets, exporters, or buyers overseas. Knowledge of overseas market needs by processors is low. Only a minority export directly; most used exporters or agents (IFPRI, 2002).

Quality management by processors often focuses on equipment and processing facility hygiene. Only 15% of processors (mainly large and medium firms) had quality certification (IFPRI, 2002). Most processors have storage facilities, and losses were low (0.5% loss in quality, 1.5% loss in volume), but only 3% used cold storage. Losses were most commonly due to excessive humidity (in the north) or transport problems (in the south), but processors were doing little to address the causes other than to repair leaks (14%) and holes (11%) (IFPRI, 2002).

Quality, consistency, food safety, product diversification, ensuring a favorable environment for investment, and industry stability are key challenges for the sector. An action plan to improve the safety and quality standards of produce, increase the number of SMEs in the sector, and enhance the capacity of relevant government agencies is currently being funded by the ADB (ADB, 2007a).

Marketing fresh produce: wholesale and retail sectors

An overriding feature of the Vietnamese supply chain for vegetables is its complexity. Women dominate marketing—especially retailing, while farming and collecting involve more men (Genova et al., 2006).

Most produce is sold by farmers to assemblers (collectors) and wholesalers (80%), with less sold to processors, exporters or retailers, who generally become involved later (IFPRI, 2002). Traders buy from farmers in spot-market transactions (57% direct from farmer, 37% from assemblers or other traders), or under contract (12%). Domestic traders mostly sold to processors (52%) while exporters sold directly to foreign customers (88%) (IFPRI, 2002). Genova et al. (2006) found similar results in 2005 surveys of chili trading—89% of farmer production was sold to collectors, and the rest to wholesalers, wet market vendors and possibly processors. Processors obtained 68% of their chilies from collectors and 21% from wholesalers (Genova et al., 2006).

A minority (16% in 1998) of surveyed fruit and vegetables farmers had contracts, mostly for pineapple or cucumber (80%), that were mainly with state enterprises (72%) and producer co-ops (21%). The most common features of contracts were specification of variety required, time of harvest, and a guarantee to purchase, and relations were relatively stable. Farmers indicated “buyer reluctance” was a main reason for not having contracts, and traders indicated “price uncertainty” was the main reason for not using them (IFPRI, 2002).

In Hanoi, 40% of wholesale market sellers are producers (and 100% of water spinach sellers are producers). Farmers haul 100-200 kg vegetables a day on bicycle or motorbike (together = “bike”) into the wholesale markets. Short-distance transport in peri-urban areas is on foot or bike, while produce from China and Dalat comes by truck. For rural vegetable supplies, there is wholesaler or collector involvement in > 70% transactions (Moustier and Danso, 2006). Profit margins in Hanoi ranged from 30% for leafy vegetables, to 35% for cabbage, and 75% for tomato in 1998 (Moustier and Danso, 2006 quoting HAU, 1998 findings), and were 45-50% for cabbage in 2002 (Moustier and Danso, 2006). In 1998, gross returns of an average trader (north and south) was VND 7.5 billion, with VND 5.6 billion in purchases, while exporters had higher revenues (VND 25 billion) (IFPRI, 2002).

Wholesale

Marketing: Currently, there is a melding between the wholesale and retail sectors in Vietnam, particularly between the wholesale and the wet markets and the informal markets. In 2004, there were about 8300 markets (almost double the 1993 level), with 700 classed as supermarkets, trade centers, self-service shops, and wholesale markets (VNS, 2004a).

The night wholesale markets (Hanoi, HCMC) are the key venues where producers or collectors sell their produce to wholesalers or retailers. The market modalities are complex; internal modes of organization do exist, but they

involve trust and regular transaction relationships. In Hanoi, the supermarkets have more specific supply chains (Moustier and Danso, 2006).

In a survey of retailers in the Hanoi area (Genova et al., 2006), supermarket turnover had the highest average turnover per outlet (US\$ 4.9 million), followed by processors (US\$ 0.7 million). Approximate mean turnover for other outlets were: grocery stores (US\$ 84,400), collectors (US\$ 30,000), wet market vendors (US\$ 11,500), and street vendors (US\$ 5,000) (Genova et al., 2006).

The government has recently developed a number of wholesale markets—for example, markets at Hai Boi, Xuan Dinh and Mai Dich in Hanoi—to give farmers better facilities and a more competitive environment, but they are barely being used because of less convenient locations and usage costs. Traders still favor the Van Noi Wholesale Vegetable Market in Dong Anh, built in 2002. This market was supposed to operate only in the evenings, but it is busy 24 hours a day, and civic authorities have had to consider expansion to reduce congestion (VNS, 2007a).

Traders: Vegetable traders vary in size and legal status (IFPRI, 2002), with small traders as unregistered private enterprises, and medium and large traders as registered private enterprises. Some large traders are provincial or central state-owned enterprises (IFPRI, 2002). Sales are typically spot transactions, small in volume, with occasional interactions and regular relationships, but without rigid commitments in priority, volume, or price; the spot transactions give good scope to adjust negotiations when more market price information is made available (Moustier and Danso, 2006).

Distribution centers: Supermarkets will increasingly bypass wholesale markets and source through purpose-built distribution centers and preferred suppliers. In Hanoi, supermarkets, stores, restaurants, and institutions source from co-ops (three main co-ops in 2003 that together have 30 ha for production), and have regular supply commitments and the technical capacity and certification (from the Department of Plant Protection since 2004) for “safe vegetable” production. The Dutch Government is providing funding to Metro through its parent company to establish a 1.2 ha distribution center, including cool-store, in Dalat to supply retail, wholesale, and export sectors; it will support 500 farmers. Facilities will include a pack-house and equipment, a lab, and three trucks. In addition, two mobile cold storage units will be used for sourcing tropical vegetables and a 1.5-ha greenhouse will be used to produce and supply virus-free seedlings to farmers. Training will also be provided in production of quality produce and GAP compliance, as well as supply chain operation and services (EVD, 2007).

Retail

Retail diversity: The retail sector is divided into mobile street vendor sales from baskets, bicycles, and motorbikes, moving around and calling at houses on a regular basis; informal street vending in stalls, from two baskets on a pole on the sidewalk, or by calling house-to-house; informal markets held in the open, not state-planned, some with permanent stalls, some spontaneous; formal markets planned by the state, with a management board and stalls, and rents plus taxes; shops less than 500 m², with walls and cover, often as family-run house-front shops or increasingly as chain convenience stores; and supermarkets having a diversified product range, more than 500 m² (or 250 m² for specialized shops), with self-service and services such as parking and security (Moustier et al., 2005).

Supermarkets: In 1995, there were 10 supermarkets and two shopping malls in Vietnam. In 2006, there were 140 supermarkets and 30 malls, with another 20 supermarkets and 35 malls in the pipeline (Ngoc, 2007). Supermarket growth is further summarized in Table 8. Under the Department of Trade definition of registered shops calling themselves supermarkets (usually > 200 m²), the number grew at 17% per year in HCMC between 1990 and 2004, and 14% per year in Hanoi between 2000 and 2004. Total retail sales were estimated at US\$ 20 billion, with just 10% through modern retail; the percentage is expected to increase to 30% by 2010. Ho Chi Minh City and Hanoi, where incomes are double that of the rest of the country, have 105 of the supermarkets between them, and local and foreign retailers are continuing to expand there and in regional centers (Moustier et al., 2005).

Table 8. Supermarket growth in Vietnam, plus source of data

	1990	1993	1995	2000	2001	2002	2004	2005	2006
Vietnam	0		10 (Ngoc, 2007)	49 (Moustier et al., 2005)	70			90 (ITPC, 2005a, 2005b)	140 (Ngoc, 2007)
Hanoi (Moustier et al., 2005)	0	3		25	32		43		
HCMC (Moustier et al., 2005)	0	0		24	38	46		71	

Two state-owned supermarket chains, *Intimex Hanoi* (owned by the Ministry of Trade), and *Saigon Coop Mart*, based respectively in Hanoi and HCMC, are accelerating plans to open elsewhere. *Intimex* will grow from 2 to 5 stores. *Saigon Coop* (whose retail sales in 2007 rose by 26% over the previous year) will double the number of outlets to 30 by 2007-08 in HCMC and surrounding provinces, with plans to develop wholesale centers to supply goods to retailers and supermarkets; it is also considering opening stores in the Hanoi region.

Three foreign chains Metro (Germany), Seiyu (Japan), and Bourbon (France) are also expanding. Metro, a mainly wholesale distributor targeting small retailers and restaurants, but increasingly seeing individual customers (Moustier et al., 2005), plans to open five outlets in Haihong, Danang, and Can Tho by 2008. Bourbon has three *Big C* supermarkets around HCMC and Hanoi, and plans to open three more in HCMC, Can Tho and Danang in 2008. Seiyu is hoping to obtain licenses to expand beyond Hanoi. The expansions have alerted both local retailers and the government to the need to review operations and policy; policy changes adopted in Thailand and Malaysia that limit foreign domination of the sector, but recognize the advantages in business practice foreign companies bring, have been scrutinized for possible adaptation.

Obtaining adequate trained staff for the supermarkets is a challenge (Ngoc, 2007; Thanh Nien, 2007). A supermarket association has been operating in Hanoi since 2005 to promote supermarkets and provide a focal point for interaction with government and industry (Moustier et al., 2005).

Farmer access to supermarkets: Currently, poor-farmer access to supermarkets is only indirect, through membership or contracts with farmers' associations. In 2005, ten farmers' associations were supplying supermarkets with a range of produce, including vegetables, and some had poor-farmer members (e.g. in peri-

urban HCMC). The ability of farmer cooperatives to supply supermarkets depends on the range of functions they provide, which reduces costs and improves product suitability compared to dealing with individual farmers: training (safe vegetables), input access, collective marketing, quality management, credit access, and public and NGO support. Supplying supermarkets can improve farmer incomes compared to traditional chains (e.g. baby tomato, no difference; 25% increase for Soc Son vegetables, 400% increase for water spinach in peri-urban HCMC). Farmers supplying supermarkets appreciate the more stable prices and quantities sold compared to traditional markets. Supplying produce through cooperative shops also can have the advantages (profit, throughput, marketing advantage) of supplying supermarkets, but with fewer demands on individual producers (Moustier et al., 2005).

Future trends: In general, vegetable sales through supermarkets lag behind growth of durable and packaged goods. While the supermarket sector is growing fast, traditional markets and street vendors predominate in fresh produce trading in Vietnam. In both Hanoi and Ho Chi Minh City, centralized food distribution has been favored by the government via wholesale and retail markets and private sector supermarkets, and the planned closing down of street vending and informal markets. This system is seen as the most practical for transport, food safety monitoring, regulation, and modernization, but will create unemployment problems and potentially reduce competition and customer choice in purchasing venue (Moustier et al., 2005). It will also increase demand for road and vehicle transport.

Figuié et al. (2006) noted from (2004) surveys that Hanoi supermarket prices were 40 to 160% higher than open air markets, but differences were lower in HCMC. They also suggested some poor people felt too ashamed of their shabby clothing to enter the supermarket (Figuié et al., 2006). The poor are especially vulnerable to any sudden changes, because food purchases represent 70% of their consumption, with urban poor producing only 4% of food at home (vs. 32% in rural areas). In Hanoi, > 60% of the poor had not shopped in supermarkets (33% in HCMC vs. 2% for non-poor), and only 2.7% used them regularly (38.5% in HCMC vs. 81.2% of non-poor) (2004 data), with most poor consumers opting for the informal market (95%). In HCMC, 62% choose formal markets. For the poor who do use supermarkets, it is not for vegetables (Moustier et al., 2005). The choice of shopping venue for the poor may not just be price, but also can be due to trust, relationship, and credit dependency (Moustier et al., 2005).

The situation will change as supermarkets expand and seek a greater share of the consumer VND. Already, however, supermarkets are beginning to be frequented by the poor, particularly in Ho Chi Minh City where supermarket market share is larger (Moustier et al., 2005).

In promoting modernization, consideration must be given to the needs of consumers. To ensure a smooth transition to modern retailing, Moustier et al. (2005) recommended transitional arrangements that initially maintain the diversity of retail trade, including tolerance of street vendors in defined areas.

Trade development

Reliable and detailed statistics on vegetable imports and exports are not readily available from Vietnamese agencies. The International Trade Centre (ITC, 2007) publishes import and export values (Table 9). FAOSTAT (2007) also lists trade data (import/export quantity and value). Countries of destination and tonnage figures are available from a range of publications.

Exports

Tran (2006b) noted that Vietnam exported fruit and vegetables to over 50 countries, but 2003 exports worth US \$153 million¹⁵ amounted to less than 7% of production, with major destinations China, Taiwan, Japan, Korea, and Russia¹⁶ (Tran, 2006b; VRD, 2007). Until 2006, export taxes ranged from 15-20%, but they since have been eliminated (VRD, 2007). The vegetable sector's competitive advantages are: delivering supplies during winter in northern areas and in China, and low prices. Quality, however, is not high (VRD, 2007).

Main exports include cucumber, tomato, carrot, onion, baby corn, fresh legumes, cabbage, and Chinese cabbage. The government has established wholesale markets near the Chinese border to help facilitate trade to China, with access through Yunnan, Guangxi, and Guangdong provinces (VRD, 2007). At present, Vietnam's fruit and vegetable exports to China via the Guangxi border are subject to taxation. China has eliminated taxes on vegetables imported from Thailand (under Free Trade Early Harvest) but eliminated the tariff preference between China and Vietnam in 2004, so Vietnam's vegetable trade with China has been doubly disadvantaged in recent years. Although of smaller volume, there is also a substantial trade of vegetables to Cambodia, which competes with

¹⁵ Which is considerably higher than the figure for just fresh vegetables (other than tubers) from ITC (Table 9).

¹⁶ Russia was a traditional market before the collapse of the Soviet Union, and although geographically distant, there are still trade and political ties.

and hampers the development of Cambodia's vegetable industry (Moustier and Danso, 2006; Tran, 2006a).

According to VNS (2007c) the low level of exports reflects planning insufficiencies, and small-sized production and planning deficiencies. Land policies have also been problematic, hampering development of high-tech production systems. A target of US\$ 600-700 million in exports has been set for 2010, rising to US\$ 1 billion by 2015 (VNS, 2007c; VNA, 2007). MARD has adjusted the national vegetable R&D program to focus more on improved technology to help achieve this; it will closely coordinate with the Ministry of Trade to boost exports and help farmers meet export standards.

Some progress already has been made, with farmers who have adopted advanced production and handling systems earning 400-500 million VND/ha (x 10 rice returns), but the models need to be adopted more widely. Attention will be given to promoting the models in northern mountain and midland provinces, in the Central Highland province of Lam Dong, HCMC, and some Mekong Delta provinces. Intensive production areas and trading centers that apply modern technologies are proposed to help meet the goals (VNA, 2007).

To grow exports in the highly competitive global environment, more than technology and government target-setting are needed. Vietnam has geographic, seasonal, and socio-political advantages for supplying mainland China, where quality/SPS standards are not as high as for other markets. Japan and Taiwan are other potential markets. There is considerable scope to boost trade, especially in supplying processed products and off-season fresh vegetables, while building quality and safety compliance capacity for other markets. Key issues to address are improving the supply consistency and reputation, and building investment/contract production for the higher-end fresh and processing markets. Already efforts seem to be paying off. In May 2007, exports of vegetables to China (mainly French bean, mushroom, fennel, lettuce, and baby corn) rose from 110 tonnes per week to 130 tonnes per week (ICARD, 2007).

Target markets for export expansion include: mainland China (cucumber, potato, legumes, bamboo shoots, tomato, mushroom, ginger, chili, saffron, garlic); Taiwan (pickled cucumber, cabbage, taro, mushroom, fresh legumes, ginger, chili, saffron, garlic, onion); Japan (cabbage, cucumber, potato, fresh legumes, bamboo shoots, tomato, mushroom, sweet corn, eggplant, ginger, chili, saffron) (VNA, 2007).

Table 9. Import and export volumes and value for fresh and processed vegetables by Vietnam 2000-2005 (including chili and ginger, but excluding potatoes).

	2000	2001	2002	2003	2004	2005
Export volume fresh (tonnes) (FAO)	23,040	52,110	87,870	82,910	101,350	201,330
Export volume processed (tonnes) (FAO)	39,380	43,160	48,410	54,660	66,930	74,530
Export volume Total (FAO)	62,420	95,270	136,280	137,570	168,280	275,860
Export value fresh ('000 US\$) (FAO)	2,479	5,366	8,082	10,823	10,972	23,749
Export value processed ('000 US\$) (FAO)	25,333	27,958	28,824	34,640	43,845	50,238
Export value Total ('000 US\$) (FAO)	27,812	33,324	36,907	45,464	54,817	73,986
Export value fresh ('000 US\$) (ITC)	3,516	10,338	13,088	16,155	16,954	35,919
Export value processed ('000 US\$) (ITC)	19,844	30,443	32,608	38,174	47,929	55,455
Export value Total ('000 US\$) (ITC)	23,360	40,781	45,696	54,329	64,883	91,374
Import volume fresh (tonnes) (FAO)	20,770	13,500	95,510	153,660	123,490	160,190
Import volume processed (tonnes) (FAO)	3,790	8,860	17,360	24,300	23,460	30,680
Import volume Total (tonnes) (FAO)	24,560	22,360	112,870	177,960	146,950	190,870
Import value fresh ('000 US\$) (FAO)	3,564	2,484	18,588	28,730	25,327	29,600
Import value processed ('000 US\$) (FAO)	3,388	4,912	7,695	11,018	12,575	16,245
Import value Total ('000 US\$) (FAO)	6,952	7,396	26,283	39,748	37,902	45,845
Import value fresh ('000 US\$) (ITC)	3,081	1,845	16,527	26,065	22,149	28,381
Import value processed ('000 US\$) (ITC)	2,439	3,707	6,008	9,048	9,931	14,035
Import value Total ('000 US\$) (ITC)	5,520	5,552	22,535	35,113	32,080	42,416

Note: Ginger is included under processed vegetables. The ITC trade data listed here was calculated from mirror figures based on partner data.

Sources: FAOSTAT (2007) (accessed 28/8/07); ITC: PC-TAS ITC/UNSD (2002; 2007).

Trade statistics for vegetables are shown in Table 9. The value of import values reported by FAOSTAT are higher than those reported by ITC, while reverse was true for export values in recent years. Detailed FAO data is attached as Appendixes 2 and 3. Export volumes grew significantly between 2000 and 2005 (FAOSTAT, 2007) but trade has been in high volume, low value product (mean 2005 US \$ 268/tonne).

While trade with China is important, the border is difficult to monitor and regulate. Competition among Vietnamese traders (and to a lesser extent Chinese traders) selling to buyers in China can erode profits (IFPRI, 2002). Elimination of tariffs will reduce smuggling and enhance the scope for quarantine monitoring.

A key role for the government is in trade promotion and facilitation. IFPRI (2002) cautioned that “central planning” to meet export targets (such as the 2010 export targets) could be risky, as it could slow the development of a dynamic trading sector that will have the resilience and innovative capacity to compete in increasingly competitive global markets. Further, an increased role for state-enterprises could be counterproductive; the experience of this approach in other countries has been poor (IFPRI, 2002).

Imports

Imports also grew significantly between 2000 and 2005 (average in 2005 @ US\$ 240/tonne), with costs/tonne of exports and imports similar (Table 9). FAOSTAT (2007) data indicates a significant increase in imports starting from 2002, and continuing to rise (Table 9). The ITC or PC-TAS data are lower than FAOSTAT, but also indicate the value of imports is increasing, although still substantially lower than exports.

City data: Moustier and Danso (2006) indicated the Long Dien Market (Hanoi) received 9,000 tonnes of imported vegetables from China in 2002, including tomato (3,500 t), cabbage (2,700 t), and carrots, Chinese cabbage, and mustards (2,800 t). Imports were concentrated in May-October and represented just 9% of the volume consumed in Hanoi (Moustier and Danso, 2006). Chinese producers cited marketing problems, finding customers, and low prices as key issues affecting the trade (but their tomatoes transported better than Vietnamese tomatoes), while Vietnamese producers mostly had problems with climate (Moustier and Danso, 2006).

In Ho Chi Minh City in 2006, imports had become more significant compared to the 2002 Hanoi survey (Moustier and Danso, 2006). An estimated 35% of total farm produce at the wholesale markets was imported, mostly from China, up from 20% in 2005. Wholesalers reported that imported produce was cheaper and of better quality, and traders made more profit, but there were concerns about contaminants and the need for the government to monitor and test regularly (VRD, 2007).

The trend indicates trader preferences for imported vegetables at least seasonally, and this will be a key issue for Vietnamese farmers to address (See Case Study 1).

3.4 Institutional framework and operational environment

Policy and regulatory agencies

Key framework policy issues for agriculture (and the vegetable sector) encompass Vietnam's commitment as a member of the Association of South East Asian Nations (ASEAN), the World Trade Organization (WTO) (since 2006), and the Asia Pacific Economic Co-operation Forum (since 1998) (APEC, 2007). Vietnam is signatory to various international and regional agreements (e.g Mekong River Commission), free trade agreements with ASEAN and ASEAN + China, with impacts felt in the vegetable sector in terms of sanitary and phytosanitary (SPS) issues, pesticide residue contamination and quality/safety standards, and export access. Vietnam has a trade agreement with the US, and through ASEAN, is looking to sign FTAs with China, Japan, South Korea, Australia, New Zealand, and the European Union (VNS, 2004b). Vietnam also enjoys a good traditional trading relationship with China.

The Government's *5 Year Socio-Economic Development Plan 2006-2010* is overseen by the Ministry of Planning and Investment (MPI), and has overarching goals of boosting economic growth through sustainable development; improving economic, social and cultural well-being; creating a strong foundation for industrialization and modernization; stabilizing political order and social security; and maintaining independence and security (MPI, 2006). Other agencies and departments with policy oversight relevant to the agriculture sector are listed in Table 10. Marsh et al. (2007) and Hung et al. (2007) reviewed aspects of policy in relation to title and taxes and made recommendations for improvement.

Table 10. Agencies with policy and regulatory responsibilities relevant to the vegetable sector in Vietnam.

[Ministry of Agriculture and Rural Development](#) (primary responsibility for agriculture and rural development)
[Ministry of Planning and Investment](#) (national planning, international development coordination)
[Ministry of Foreign Affairs](#) (market access negotiation)
[Ministry of Finance](#) (customs)
[Ministry of Trade](#) (trade promotion and negotiation)
[Ministry of Education and Training](#) (universities)

[Ministry of Health](#) (community health and nutrition)
[Ministry of Science and Technology](#) (science and technology for agriculture)
[Vietnam Chamber of Commerce and Industry](#)
[General Department of Customs](#) (English)
<http://www.customs.gov.vn/default.aspx?tabid=454>
[Directorate for Standards and Quality](#)

Source: <http://www.vietnambassay-usa.org/weblinks/>

Under the *2001-2005 Socio-Economic Development Plan*, Vietnam made considerable progress in poverty reduction. The main goals for the current plan are listed in Table 11, along with comments on how the vegetable sector can contribute to their realization (MPI, 2006)

Table 11. Goals of Vietnam's Socio-Economic Plan 2006-2010 and how enhancement of the vegetable sector could contribute to them

Socio-Economic Plan 2006-2010 Goals*	How can the vegetable sector contribute?
<p>Liberalizing labor and significantly boosting infrastructure and services</p>	<p>The vegetable sector provides more employment at farm and postharvest levels than the rice industry per hectare of production (Moustier et al., 2005).</p> <p>Improvement of infrastructure and services will help the vegetable industry to contain costs and improve efficiency, making it more competitive.</p>
<p>Strengthening development of the market economy and institutional frameworks</p>	<p>Through links to retail sector (supermarkets), processing and trade, the vegetable sector can be a key driver of market development and private sector engagement.</p>
<p>Accelerating economic integration and improving trade efficiency</p>	<p>Boosting the processing and export sectors of the vegetable industry, with attention to infrastructure and market access streamlining, can improve trade efficiencies. The vegetable industry also offers scope for improving livelihoods in remote and marginalized communities provided there are market links.</p>
<p>Developing science and technology, education and training for industrialization, modernization, and enhancing development of the knowledge economy</p>	<p>Enhanced attention to improvement of production and postharvest technologies in partnership between government and private sector R&D will improve productivity and safety, and reduce losses.</p>
<p>Strengthening the cultural and social foundations of society, enhancing community health and well-being, and promoting environmental protection</p>	<p>Greater consumption of vegetables is a key factor for improving nutrition in marginalized sectors of society, including poor rural and remote communities, and in reducing diet-related illnesses such as diabetes.</p> <p>Enhancement of cooperative marketing and industry associations in the vegetable sector will improve industry marketing power and policy dialogue.</p>
<p>Advancing social progress, equity, and gender equality, and enhancing employment, poverty alleviation, wealth creation, and social security frameworks</p>	<p>The vegetable industry offers scope to improve farm incomes and employment (especially for women). SME processing also offers scope for value adding, loss reduction, and employment.</p>

*Not verbatim; summary of main goals by G.I. Johnson

Within this framework, the overarching goals of the agriculture and rural development sector for 2006-2010 are to build a modern, efficient and sustainable production system; to enhance productivity, quality and competitiveness through application of advanced technologies to meet export market and consumer requirements; to establish a sound economic structure, appropriate management and socio-economic frameworks in rural areas; and to enhance employment security and incomes for rural communities to improve livelihoods, prosperity, equality, and democracy in rural society (ISG, 2005, 2006). The government has set a goal of increasing vegetable production to 11.7 million t worth US\$ 1.2 billion and 10% of agricultural GDP by 2010 (from 800,000 ha = 8% agricultural land), to meet domestic needs and an increased export turnover to 1.4 million tonnes for fresh and processing exports worth US\$ 690 million (VRD, 2007; VNA, 2007).

In 2007 Vietnam passed new laws on chemical safety and product quality (VNS, 2007b). If effectively implemented, these laws will enhance capabilities for reducing chemical contamination and assuring quality of exports and imports. Appendix 4 has additional information on Vietnamese laws relevant to the vegetable sector.

Research and development agencies

Stads and Nguyen (2006) provide a recent overview of research and development trends in Vietnam. Agricultural research and development is undertaken by three government/state enterprise agencies (Table 12), often in partnership with development agencies, nongovernmental organizations or the private sector. They are: MARD research institutes, including six institutes under the Vietnam Academy of Agricultural Sciences (VAAS) (FAVRI, IAS, Southern Fruit Research Institute (SOFRI), Cuu Long Rice Research Institute (CLRRI), the Institute of Electrics and Mechanics and Postharvest Technologies, the Plant Protection Research Institute, with a focus on breeding, cultural practices, postharvest technologies, marketing and economics; universities and colleges under the Ministry of Education and Training (MOET) (including Hanoi, Thai Nguyen, Hue, HCMC City agricultural universities, Cantho University, An Giang University, National Science University, and Hanoi National University, in teaching and research, with a focus on cultural practices, application of IPM, ICM, and off-season production; and entrepreneurs undertaking R&D including the Southern Seed Stock Company (SSSC), the Vietnam Seed Company (VSC), the East-West Seed Company, Nonghuu Company, Hanoi Agricultural Department and Investment Company, and the Haiphong Agricultural-Forestry Company operating in a close chain of

breeding, seed production, trading, distribution of seeds, and supply of improved technologies (VRD, 2007). Key future needs for R&D are breeding and seed technologies, especially pest and climate tolerance, cultural practices (IPM, ICM, GAP), and postharvest technologies (VRD, 2007).

Main crops with export and processing potential, including tomato, watermelon, legumes, and alliums, are priorities for R&D. There is a need for F1 hybrids of Solanaceae, cucurbits, and alliums. Improved production and postharvest technologies are needed, along with technologies for year-round production, and improvement of quality and safety (ISG, 2005, 2006; VRD, 2007).

Under the restructuring of the Ministry of Agriculture and Rural Development (MARD), the Fruit and Vegetable Research Institute (FAVRI, formerly the Research Institute for Fruit and Vegetables (RIFAV)) within the Vietnam Academy of Agricultural Science (VAAS) has major responsibility for R&D on vegetables. Other agencies have vegetable departments, including the Institute of Food and Foodstuffs, the Institute of Agricultural Sciences in the South (IAS), the Institute of Agricultural Electrics and Mechanics and Postharvest Technologies, and regional institutes of VAAS (VRD, 2007). About 100 scientists are involved in vegetable R&D. In addition, agricultural extension from central to local levels links R&D with farmers and traders. Seed companies (including Southern Seed Stock and East West Seeds) are involved in vegetable R&D (VRD, 2007).

Major support is provided by the World Vegetable Center (AVRDC) in training, germplasm exchange, and through cooperative projects with donor agencies of Australia, France, Switzerland, SIDA, Sweden, Germany, other European countries, the European Union, and the ADB. As well, ADDA (Denmark) and Rubyfarm (Belgium) in Hanoi, and Care (Sweden) in Dalat and Can Tho provide significant support (VRD, 2007).

Table 12. Institutions involved in vegetable sector research and development in Vietnam.

<p>MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)</p> <p>Ministry of Agriculture and Rural Development (primary responsibility for agriculture and rural development)</p> <p>http://210.245.64.232/en/</p> <p>Bureaus International Support Group MARD Planning and Projection Department Science and Technology Department International Cooperation Department Crop Production Department Plant Protection Department Cooperatives and Rural Development Department Informatics Center for Agriculture and Rural Development National Agriculture Extension Department</p> <p>Research Institutes Vietnam Academy of Agricultural Sciences (VAAS) Fruit and Vegetable Research Institute (FAVRI) Postharvest Technology Dept Institute of Policy and Strategy for Rural Development (IPSARD) Electric Mechanics for Agriculture and Postharvest Technology Institute of Agricultural Science of South Vietnam (IAS) Southern Fruit Research Institute</p> <p>.. and after 2008:</p> <p>Vietnam Agricultural Science Institute (VASI) Policies and Strategies for Rural Development Electric Mechanics for Agriculture and Postharvest Technology</p>	<p>DEPARTMENTS OF AGRICULTURAL AND RURAL DEVELOPMENT (Provincial)</p> <p>UNIVERSITIES</p> <p>Hanoi University of Technology Ho Chi Minh City University of Technology Ho Chi Minh City University of Natural Science Nonglam University</p> <p>OTHER MINISTRIES</p> <p>Ministry of Trade</p> <p>Trade Promotion Agency</p> <p>Ministry of Science and Technology National Institute for Science and Technology (policy and strategic issues)</p> <p>Vietnam Academy of Science and Technology</p> <p>Institute of Tropical Biology (Plant biology, ecology and bio-resources for development)</p>
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Vegetable R&D in Vietnam commenced in the 1960s, when the MARD institutes were first established, and since 1966, national level programs have framed research: KC08 (1996-2000), KC 06, KC 07 (2001-2005), and the domestic variety programs of MARD. Achievements include FI hybrid varieties

and hybrid seed production (tomato FM29, VT3, FM20, cucumber CV5, CV11, hot pepper HB9, HB14). Between 1996 and 2000, hybrid uptake was low, but it is now much higher, and other new technologies (hydroponics, net houses) have been adopted (VRD, 2007).

Extension

The vegetable industry is one of Vietnamese agriculture's most progressive in terms of application of new technologies, especially improved varieties and use of protected cultivation systems, because returns are quick compared to other industries (VRD, 2007). Factors that encourage uptake of improved practices and technologies include: use of demonstrations that show technological advances; ensuring the cost of the improvement is within the investment capacity of the farmer; ensuring the techniques are not too complicated; and focusing on outputs that can be consumed. In addition to the involvement of extension personnel, researchers need to guide and monitor implementation and entrepreneurs who can sell should be involved or linked to farmers. Markets for the produce are needed, and government policies should support uptake of the technologies (VRD, 2007).

In southern Vietnam in 1998, the vast majority (84% - IFPRI, 2002) had used extension services in the previous year (mostly Extension Services Dept.), and most (63%) rated them as 'fair' quality (21% as poor, 16% as good). Research centers were well regarded (59% - good), but state-owned processors and farmer co-ops were considered poor.

4 Achievements and Lessons Learned: Case Studies

In the last decade, vegetable production and marketing in Vietnam have been extensively studied (Trinh, 1998; Ogle, 2001; Ogle et al., 2000; 2001a; 2001b; 2003; IFPRI, 2002; Trinh et al., 2003; Moustier and Danso, 2006; Genova et al., 2006). Among the challenges for the Vietnam vegetable industry are: maintaining and improving productivity of smallholdings, including those in remote and impoverished communities; capitalizing on the opportunities of modern marketing and exports (IFPRI, 2002); assuring consumers that vegetables are safe, while adequately protecting crops against pests and diseases; and capitalizing on the wealth of biodiversity in vegetable cropping systems (Trinh et al., 2003). Lessons learned are illustrated by examples from two areas: home production systems incorporating indigenous vegetables, and urban marketing.

4.1 Indigenous vegetable conservation, collection, and evaluation

Lesson 1: Conservation of indigenous germplasm in situ provides the vegetable industry with food security and future commercial potential, and opportunities for remote communities to develop a marketing edge as consumer interest in exotic and unusual foods rise.

Vietnam has a rich diversity of indigenous¹⁷ vegetables that as both wild-harvested and cultivated crops have traditionally formed a significant component of rural diets (Trinh, 1998; Ogle, 2001; Ogle et al., 2000; 2001a; 2001b; Trinh et al., 2003). In Vietnam, there is also a strong interest and long history of the evaluation and use of plants for medicinal purposes¹⁸, and there is considerable interest by biopharmaceutical companies in indigenous germplasm as sources of bioactive compounds for pharmacological use (Reddy, 2005; VISTA, 2006).

Why indigenous vegetables? Trinh et al. (2003) found that home gardens of four surveyed districts in Vietnam had a high diversity of plant species, ranging from

¹⁷ Indigenous vegetables: species native to or originating in the region, excluding products of scientific breeding programs (Dayal, 2004).

¹⁸ According to the Pharmaceutical Institute, 3830 medicinal plant species have been recorded from Vietnam with 3,600 growing wild in forests and 106 threatened (VISTA, 2006).

23 species in the Central Midlands, 39 species in the northern mountains, 50 species in the southern lowlands, and 53 species in the Mekong Delta (including trees, shrubs, vegetables, herbs, spices, and ornamentals). Although communities were focusing more on income generation, commercialization of home garden products was not (at the time of the survey) reducing species diversity; in fact, the more highly commercialized southern sites had higher levels of diversity. On average, the gardens contributed to 29% of total household cash income, and of the surveyed districts where income was lowest, and use of gardens for “self-sufficiency/home consumption” highest (Central), gardens contributed 22% of average household cash income (Trinh et al., 2003).

Harvesting of wild vegetables is a significant source of nutrition in addition to garden cultivation, at least in some rural areas. In the Mekong Delta and the Central Highlands, a large variety of vegetables contribute to the micronutrient supply in diets, and only about half were cultivated, with wild food being an integral part of the farming and food systems (Ogle, 2001; Ogle et al., 2001a).

Implications: The traditional farming systems in Vietnam represent a significant source of biodiversity for use in germplasm conservation and improvement. Work is currently ongoing to collect and evaluate germplasm from traditional production and wild plant collection¹⁹ of Vietnam (Engle et al., 1999; Dayal, 2004). The extent and diversity of wild plant harvesting represent key contributions to household food security and nutrition. These contributions may not be adequately considered when agricultural productivity is being estimated. Detailed studies on consumption patterns (Ogle, 2001; Ogle et al., 2001a; 2001b) provide baseline information, which would allow predictive modeling of vegetable intakes in rural areas.

(ii) The promotion of production and wild harvesting of vegetables for home consumption, preservation, and marketing represents an opportunity for improving self-sufficiency and incomes in remote and impoverished communities, especially if supply chains for food and medicinal use are developed. The Vietnamese government has given high priority to promotion of production and marketing of indigenous vegetables, and to promoting the role of women (Lim et al., 2007). Diversification of production in peri-urban areas should also be encouraged. As urban populations increase, strategies may be

¹⁹ 10% of 4408 collected accessions have been evaluated, training and capacity building has been undertaken and 2779 accessions are now held by the World Vegetable Center and/or national repositories for long-term conservation. About 3500 accessions were characterized and regenerated, > 800 accessions field-evaluated, and 150 selected for further testing (Engle et al., 1999; Dayal, 2004).

needed to ensure that the dietary diversity of urban communities is enhanced to provide better nutrition and generate additional marketing opportunities.

Analysis: Industry modernization is critical for domestic and export market development, with attention needed in improving production efficiency, profit, quality, safety, and supply chain efficiency. The wide collection and evaluation of indigenous germplasm can provide both the national and global vegetable sectors with a marketing edge, and future commercial and food supply potential. Identification and use of plant traits for developing vegetable varieties with pest and disease resistance, enhanced nutritional value, or particular bioactive compounds or consumer appeal, can increase production efficiency and yields in the vegetable industry and encourage greater consumption and market diversification.

Other issues to consider are national resources for long-term conservation (perhaps cryogenic storage and tissue culture); extending and building on the World Vegetable Center database and making it available online in the manner of the *New World Fruits Database* (Biodiversity, 2007); developing strategies to ensure national rights to biopharmacological compounds extracted or synthesized from indigenous vegetables; and focusing R&D resources to develop the commercial potential and promote marketing of the most promising lines.

4.2 Market supply flows, relationships, and expectations

Lesson 2. Development of the vegetable sector and industry opportunities will benefit from analysis and understanding of market flows, relationships, and customer requirements.

The Vietnamese consume large volumes of vegetables, perhaps the highest per capita in tropical Asia. But as incomes and urbanization increase, and modern marketing (supermarkets, food services) dominate, consumers will increasingly demand high quality, safe, and convenient vegetables. For farmers to capitalize on these trends rather than having the growing markets supplied wholly through imports, the Vietnam industry needs to improve quality, safety, and consistency, and deliver produce to wholesalers and supermarkets at prices that are competitive with imports (Moustier and Danso, 2006; Genova et al., 2006; Mergenthaler et al., 2007a, 2007b).

Consumption is supply driven: Per capita consumption or availability levels for vegetables in Vietnam reported from surveys range from 230 to 300 g/person/day in 2000-2005, depending on the region or data source (Ogle et al., 2000; 2003; Moustier and Danso, 2006; VRD, 2007; FAOSTAT, 2007). In one study of Hanoi consumers, per capita vegetable consumption (2002) averaged

252 g/day and was rising, with leafy vegetables dominating (52% by weight), along with onions and tomatoes. In the rainy season, total consumption dropped (by 11% on average), and expenses increased by 6%, but declines in tuber or root vegetables, cabbage, and fruit-vegetable intakes were partly compensated by greater intake of leafy vegetables. In making purchase and consumption decisions, freshness and supply were important factors affecting consumer preferences (Moustier and Danso, 2006).

Implication: Consumers observe seasonal consumption patterns, and while there may be potential to increase consumption in the rainy season, this pattern may be culturally imbedded. Enhancing the supply of cabbages and fruit vegetables in the rainy season could be a marketing opportunity, but supplies would compete with other vegetable types that can be produced more readily at that time.

Sources of supply: Hanoi consumers mostly source vegetables from local retail markets (usually < 500 m away from their homes), often right on the same street. Most leafy vegetables (water spinach, brassicas, herbs, lettuce, and shallots, which have a short shelf-life) come from zones less than 30 km from the urban area (in Hanoi, >70% of leafy vegetables in 2002; 95-100% of lettuce from within a 20-km zone, most water spinach from within a 10-km zone). For less perishable vegetables like tomatoes and cabbages, supply was split between peri-urban and rural areas, and was affected by seasonal temperature and rainfall. Peri-urban areas had low product availability in the rainy season, and the mountainous areas of China, Dalat, and Sonla took over production and supply. In the cool season, 75% of Hanoi's tomato supply came from peri-urban areas (and prices were lowest), while 80% came from China in the hot season and 15% came from Dalat, despite being > 1000 km from Hanoi (Moustier and Danso, 2006 (2002 data); Genova et al., 2006 (2005 data)).

Implications: Remote communities need to focus on producing more durable products, or develop efficient transport and handling systems for perishable vegetables. Marketing opportunities exist for Vietnamese farmers to supply tomatoes in Hanoi during the hot season, provided they are competitive with those from China.

Tomato case study

The production and trade statistics for tomato are shown in Table 13. According to FAOSTAT (2007) statistics, production of tomatoes (2001-2004) was much higher than levels reported for imports of fresh and processed tomatoes.

Table 13. Tomato production and imports of fresh and processed produce (tonnes) in Vietnam 2000-2005 (where data is available)

	2000	2001	2002	2003	2004	2005
Production		179,755	132,178	354,846	357,210	
Imports (fresh)	100	-	0.00	5,650	4,750	10,760
Imports (tomato paste)	250	690	1,130	1,170	1,700	1,630
Imports (Peeled tomatoes)	40	20	1,150	1,380	30	60
Imports (tomato juice)	90	130	100	40	30	10
Total imports	480	840	2,380	8,240	1,760	12,460

Source: FAOSTAT (2007)

Analysis of tomato supply chain stakeholders: One of the areas supplying tomatoes to Hanoi is the Red River Delta (RRD). Farmers supplying tomatoes from three districts in the region, along with retailers and traders (about 50 in each group), were profiled in 2005 (Genova et al., 2006). The RRD farmers on average devoted about 1900 m² to vegetable production, and this represented 63% of their cultivated land. About half of the farmers and traders surveyed were involved in contracts for vegetable production, but less than 20% of retailers surveyed had quality assurance systems in place (among Hanoi retailers this was about a third higher). Supply chains were complex, and all groups ranked freshness as the most important quality trait; freedom from pesticide residues was also considered important.

Implications: Where farmers and traders are involved in contract arrangements, these could potentially be adapted to cover quality specifications, especially since freshness and freedom from pesticide residues were regarded as important.

High tomato loss levels affect competitiveness: Most farmers and traders reported postharvest losses (mainly disease), with losses highest at farmer and retailer level, and amounting to a median loss of about 14% of production. The key strategies proposed by farmers, traders, and retailers for loss reduction were: careful harvesting, cool storage, reducing damage during transport, and ensuring quick turnover at the retail level. Improvement of production was also regarded as an important opportunity for farmers to increase returns. Another finding was that most of the time between harvest and retail sale was taken up on the farm—

about 80% of the average time of 127 hours (about 6 days) (Genova et al., 2006)

Implications: Loss reduction and productivity improvement are key areas for improving profitability. Areas for focus include yield, harvesting, storage and transport, and reducing the time between harvest and retailing. The chance of implementing improvements is likely to be higher where cooperation between farmers, traders, and retailers is enhanced and there is more coordination of produce range and availability.

5 Conclusions

5.1 Policy and human resource issues

Vietnam is a densely populated country with a highly productive agricultural system. The predominant vegetable production areas are peri-urban intensive, rice-rotation in river deltas, and highlands mixed cropping, but subsistence production is also substantial among ethnic communities in remote areas and other disadvantaged groups. Access/title to land, small farm size, low education of farmers, poor adoption levels for modern technology, excessive chemical use, and market access difficulties for the poor are key challenges affecting vegetable productivity improvement.

Most of the population and the majority of poor people live in rural areas. Although industrialization is booming and agriculture's share of GDP is declining, the government at national and provincial levels is giving high priority to vegetable industry development to enhance marketing and profitability and to increase trade and value-adding as a means of improving living standards and community nutrition.

The emergence of supermarkets, and policy and financial incentives to encourage processing and exports, offer opportunities to enhance returns to farmers—especially if supply chains are streamlined, costs are contained, and losses reduced while adding value and improving quality and safety. Improvement of production in remote and highland areas will boost local food security and economic development, and enhance year-round supplies to those communities as well as to the cities and industry. A key challenge is to ensure progress is equitable in delivering benefits to poor farmers and small-scale traders, and that implementation strategies address their needs.

5.2 Industry issues

Safety of vegetables and price are foremost in the minds of Vietnamese consumers. The government is encouraging safe vegetable production systems, and has acknowledged the need for Good Agricultural Practice (GAP) and EurepGAP compliance, as well as intensive/reduced chemical management and protected cultivation. Priority is also being given to water quality and safe waste disposal to reduce the risks of pre- and postharvest contamination of produce. However, more attention by government and traders is needed to improve supply flows and reduce product losses and logistical costs.

Trade development needs to be market-focused and undertaken in partnership with exporters and processors to identify opportunities for export and investment, and to expand existing markets and develop new markets. Import liberalization should bring net benefits to Vietnam: consumers will gain from price and variety, traders will gain from reciprocal liberalization by other markets, and all supply chain stakeholders will benefit in the longer term from the discipline of improving cost efficiencies, packaging, and quality, and from making demand-based choices in cropping.

Modernization of the wholesale sector *in partnership with the traders* is necessary to improve efficiencies and reduce losses, with attention to the trading sector's perspectives on where markets should be located, how they should be managed, how transport, logistics and regulatory clearance could be improved, and what traders, farmers, and consumers really need. Similar efforts are needed in the processing sector, supported through taxation incentives and foreign investment.

Policy frameworks should focus on delivering benefits to consumers and farmers, while facilitating access to finance and land, industry modernization, investment, and capacity building. In the longer term, the private sector should be encouraged to take the lead in export and processing sector development, and in the development of supermarket supply chains.

5.3 Issues for focus

Capitalize more on the opportunities provided by modernization and rising incomes, and improve the industry's capacity to meet the delivery and quality requirements of consumers, supermarkets, exporters and processors through attention to equitable opportunity for both progressive and poor farmers; "appropriate" contract farming; expansion of production unit size and cooperative marketing; and attention to GAP, food safety, and supply chain improvements.

Develop and implement strategies and policy initiatives that minimize the marginalization of remote and poor farmers and traditional retailers; improve access to land; streamline supply chains; encourage value-adding; and focus attention on safe production to facilitate industry expansion and modernization.

Encourage (or mandate) cross-institutional and private/public collaboration in R&D to reduce duplication and improve the efficiency and productivity of investments.

Continue the revamping of agricultural education and training and increase the skills-base and remuneration of the current cadre of scientists, technicians, and extension workers to improve capabilities and incentives for delivery of enhanced outcomes.

Looking ahead, the industry should continue to strive for productivity gains and cost-containment while seeking new opportunities through niche markets and capitalizing on germplasm diversity (indigenous vegetables) and value-adding.

6 Recommendations for R&D

Strengthen statistics collection and market analysis

Agricultural statistics and marketing data collection and analysis need urgent attention. Data is often incomplete or inconsistent. The regulation and methodology for data collection for imports and exports should be improved to establish reliable baselines against which to measure progress, and to identify trends, shortfalls, and oversupply. The market price reporting service initiated under the SUSPER project (Moustier and Danso, 2006) should continue, and be emulated nationwide.

Implement policy and regulatory systems that liberalize marketing

Policy and regulatory framework revision should continue to enhance the enabling environment for liberalization of the agricultural markets (including fruit and vegetables). More effort is needed to eliminate restrictions on internal movement and arbitrary police control of vehicles transporting fresh produce.

Strengthen attention to GAP and SPS compliance

It is critical that the government continues efforts to meet their commitments under the Sanitary and Phytosanitary (SPS) agreement of WTO and requirements for GAP certification to enable development of export markets and to more closely regulate imports. Key skill/technology capability development and institutional capacity building areas that require attention include: pest and disease surveying for pest list development for export crops (necessary for market access); pest-risk analysis (to allow preparation of export submissions and assessment of import applications); contaminant monitoring (pesticides, microorganisms, toxins) and regulation; regulatory certification frameworks and enforcement; and GAP certification and agreements with markets and buyers (buyers can be more stringent).

Strengthen regulatory compliance capabilities and enforcement

Much of the background technical information for safe vegetable production is known, but may need adaptation for tropical and small-farm conditions. To build credibility of certification systems with domestic and export markets, regulatory enforcement (pesticide quality, use and residues) needs to be strengthened. Options for extending safe practices (including use of resistant varieties) to poor farmers should be given priority.

Foster development and uptake of improved technologies

The vegetable industry potential, through adoption of improved cultivars and optimal production, postharvest and marketing practices, has not yet been fully realized. Efforts to extend industry modernization need to be strengthened, with attention to issues that discourage uptake (affordability, lack of training or education, access to land and finance, cooperative working arrangements).

Streamline supply chains and marketing

Facilitating the development of the supermarket sector and supply arrangements that are mutually acceptable and beneficial to farmers and traders should be encouraged. This may require policy adjustment, enhancement of supply chain mapping, and analysis by R&D agencies combined with attention to socioeconomic and technical gaps.

Promote vegetable production and marketing in remote and marginalized communities

Sustainable vegetable production and wild harvesting in subsistence systems linked to practical options for SME processing and marketing can boost community nutrition and incomes. It could also reduce deforestation pressures on highland areas.

Foster development and uptake of superior varieties

Public sector breeding should focus on breeding-line and open-pollinated varieties rather than hybrids (which are already covered by the private sector), and enhancement of plant variety rights protection and seed marketing regulation. Within these activities strategies are needed to evaluate and conserve indigenous germplasm that may provide sources of pest and disease resistance, bioactive compounds, and other commercial traits. Frameworks for the evaluation and release of genetically modified vegetable varieties are also needed.

Enhance land access and credit arrangements

Land reform processes, which continue to eliminate formal and informal restrictions on the use of rice land for other crops (such as intensive vegetables) needs to be accompanied by reforms of the credit sector to facilitate investment and modernization (Do and Iyer, 2007; Marsh et al., 2007; Hung et al., 2007). Land-use regulation should also give attention to environmental protection and regulation of deforestation.

Boost processing and marketing

Upgrading of the processing sector should be through market opportunity analysis and private sector investment (an IFPRI MARD survey indicated that equipment was not a limiting factor). Private sector investment could also stimulate marketing and storage sectors. There is a role for government in assisting with market identification and product development, accessing finance (at wholesale level) and promoting grower cooperatives to invest in and use infrastructure and services.

Strengthen industry bodies

A key challenge for vegetable sector development is to strengthen industry associations and their operating arrangements. Effective associations can play a primary role in identifying industry needs and addressing them in ways that are practical and cost-effective.

Encourage equitable contract and cooperative arrangements

Within the framework of industry development, cooperatives and contracts have potential roles, and the government and the finance sector can help to develop modalities so they can operate efficiently and can deliver fair benefits to farmers and traders. IFPRI (2002) suggested that government support for professional associations could make vegetable marketing more efficient. Associations could serve as focus points for negotiations on farmer and trader issues, delivery points for dissemination and collection of information, access points for grade standards establishment, and promote dialogue between producers and researchers on priorities, support to extension services, and policy development.

Facilitate private actor involvement

Much can be gained for industry development by encouraging the involvement of the private sector in farmer training and the improvement of postharvest technology use and marketing.

Continue public sector reforms

In stimulating development of the vegetable industry, attention to public sector research and development should focus on arrangements with government and industry to provide appropriate levels of technical and financial support without the need to “grow their own funds.” Research stations should focus on conducting research, development and extension, and maintaining germplasm collections. While it is important that research stations be managed efficiently, they should not be operated as income-generating farms, as this runs the risk of compromising scientific rigor for profit.

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8 Appendixes

Appendix 1. Indigenous plant species (including naturalized species) used as vegetables in Vietnam

Scientific name	Family	Common name	Vietnamese name	Part(s) consumed as vegetable
<i>Acalypha lanceolata</i> Willd.	Euphorbiaceae	Nettle leaf acalypha	Tai tuong tro (Viet)	leaves
<i>Alocasia macrorrhizos</i> Schott	Araceae	Giant taro Giant alocasia elephant ear	khoi sap, ray, ray aun, bac ha	leaf petioles corms
<i>Alpinia galanga</i>	Zingiberaceae	Galangal Greater galanga Languas	Riềng ảm, Riềng nếp, son nai, hong day khau	rhizome, also as spice
<i>Alpinia officinarum</i>	Zingiberaceae	Lesser galangal	Riềng, Riềng thuốc	rhizome, also as spice
<i>Alternanthera sessilis</i>	Amaranthaceae	Sessile joyweed Dwarf copperleaf	Diec khong cuong, rau deu	leaves young shoots
<i>Amaranthus spinosus</i>	Amaranthaceae	Pigweed prickly amaranth spiny amaranth spiny pigweed	Den gai	leaves young shoots
<i>Artemisia vulgaris</i>	Asteraceae	mugwort	Co linh li	leaves and shoots
<i>Bambusa bambos</i>	Poaceae	Indian bamboo	Tre mo	young shoots
<i>Bambusa vulgaris</i>	Poaceae	Common bamboo	Tre van soc	young shoots
<i>Boesenbergia rotunda</i>	Zingiberaceae	Chinese keys	Bong nga truat, Cu ngai, Ngai num kho	rhizome, also as spice
<i>Canna indica</i>	Cannaceae	Canna Indian shott	Chuai hoa	rhizomes
<i>Centella asiatica</i>	Apiaceae	Asian pennywort Indian pennywort	Nước rau má, Rau má xiêm	leaves young shoots
<i>Cinnamomum cassia</i>	Lauraceae	Cassia Chinese cinnamon	Que don	Bark, as spice
<i>Cinnamomum loureirii</i>	Lauraceae	Vietnamese cinnamon	Que thanh, Que quy	Bark, as spice
<i>Cleome gynandra</i> L. (ABOUT <i>pentaphylla</i> L.; <i>Gynandropsis pentaphylla</i> DC.; <i>G. gynandra</i> Briquet)	Capparaceae	Spider plant Bastard Mustard Cat's Whiskers	Mang mang trang	leaves shoots
<i>Coccinia grandis</i>	Cucurbitaceae	ivy gourd scarlet gourd	Day bat (young fruit), rau manh bat (leaves	leaves young shoots fruits

			and shoots)	
<i>Coriandrum sativum</i>	Apiaceae	coriander cilantro	Ngo ta, mui ta	leaves young shoots seeds
<i>Curcuma longa</i> (<i>Curcuma domestica</i>)	Zingiberaceae	Long rooted curcuma, turmeric, yellow ginger	Khuong hoàng, Nghe, Uât kim	rhizome, also as spice
<i>Curcuma zedoaria</i>	Zingiberaceae	white turmeric Zedoary turmeric Zedoary	Bông truât, Ngái tim, Nga truât, Tam nai	rhizome, also as spice
<i>Cymbopogon citratus</i>	Poaceae	Citronella grass Lemongrass	sa	swollen stem bases, also as spice
<i>Cymbopogon nardus</i>	Poaceae	Ceylon citronella Citronella grass Geranium grass Nardus grass	Củ sả, Sa diu	swollen stem bases, also as spice
<i>Dendrocalamus asper</i>	Poaceae	Giant Bamboo	Manh tong	emerging bamboos shoots
<i>Dendrocalamus latifolia</i>	Poaceae	Sweet dendrocalamus	Manh tong ro te	emerging bamboos shoots
<i>Dioscorea alata</i>	Dioscoreaceae	Greater yam Water yam Winged yam White yam	Khoai ngọt	tubers
<i>Dioscorea bulbifera</i>	Dioscoreaceae	Air yam potato yam	Khoai dai, khoai troi	tubers
<i>Dioscorea esculenta</i>	Dioscoreaceae	Chinese yam lesser yam	Khoai tu, Cu tu	tubers
<i>Dioscorea persimilis</i>	Dioscoreaceae	Mountain yam	khoai chup, Hoai son, Son duoc, Khoi mai	tubers
<i>Diplazium esculentum</i>	Athyriaceae, Aspleniaceae	Vegetable fern	Rau don	young unfurled fronds
<i>Eichhornia crassipes</i>	Pontederiaceae	Water hyacinth	Beo naht ban, beo sen, Luc binh	leaves
<i>Eleocharis dulcis</i>	Cyperaceae	Water chestnut	Nang cu, cu nang, co nang	root
<i>Elettaria cardamomum</i>	Zingiberaceae	Cardamom Cardamon Cardamon seeds Cardomom Ceylon cardamom Lesser cardamom Malabar cardamom	Tiểu đậu khấu	fruit as spice
<i>Elscholtzia ciliata</i>	Asteraceae	Vietnamese balm Vietnamese mint	Kinh gioi	leaves, also as spice
<i>Emilia sonchifolia</i>	Asteraceae	Emilia sow thistle	Rau ma la rau muong	leaves young shoots
<i>Enhydra fluctuans</i>	Asteraceae	Buffalo spinach	Rau ngo thom, rau ngon trau	leaves young shoots

<i>Eryngium foetidum</i>	Apiaceae	Cilantro long coriander	Ngo Gai, Ngo Tay, Mui tau	leaves also as spice
<i>Feroniella limonia</i>	Rutaceae	Elephant apple wood apple monkey fruit	Da da, canthan	raw fruit pulp, eaten as vegetable
<i>Fleurya interrupta (Laportea interrupta)</i>	Urticaceae	Hens nettle	Nang hai, Ngua	leaves
<i>Garcinia cowa</i>	Clusiaceae	Cowa mangosteen kandia	Tai chua, Doc	young leaves and shoots, acid fruits used in crab and fish soups
<i>Glinus lotoides</i>	Molluginaceae	Lotus sweetjuice hairy carpet weed	Rau dang	leaves young shoots
<i>Glinus oppositifolia</i>	Molluginaceae	Bitter leaf slender carpet weed	Rau dang dat	leaves young shoots
<i>Gynura procumbens</i>	Asteraceae	Purple velvet plant	Bau dat	leaves young shoots
<i>Hemerocallis fulva</i>	Liliaceae	Orange or Tawny Daylily	Kim chan, hoa hien	unopened flowers
<i>Houttuynia cordata</i>	Saururaceae	Fish mint lizard tail	Diep ca, rap ca, Giap ca, la giap	leaves
<i>Hydrocotyle sibthorpioides</i>	Apiaceae	Lawn pennywort	Rau am mo	shoot leaves
<i>Illicium verumm</i>	Illiciaceae	Star anise	Hat hoi	fruit, seed
<i>Ipomoea aquatica</i>	Convolvulaceae	Kangkong water convolvulus water spinach	Rau muong	leaves young shoots
<i>Limnocharis flava</i>	Butomaceae	Sawah lettuce velvet leaf	Luc binh	young leaves unopened flowers
<i>Limnophila aromatica</i>	Scrophulariaceae	Rice paddy herb	Rau om, ngo om	leaves young shoots
<i>Limnophila chinensis</i>	Scrophulariaceae	Chinese marsh weed	Om trung quoc, rau om can	leaves young shoots
<i>Limnophila heterophylla</i>	Scrophulariaceae	ambulia	Ngoc nuoc	leaves young shoots
<i>Limnophila sessiliflora</i>	Scrophulariaceae	Dwarf ambulia	Ngoc nuoc khnong cong, Om khnog cong	leaves young shoots
<i>Luffa acutangula</i>	Cucurbitaceae	Angled luffa ridged luffa	Muop khia	immature fruit
<i>Luffa aegyptiaca</i>	Cucurbitaceae	Smooth luffa sponge gourd	Muop huong	Immature fruit
<i>Luwidgia adscendens</i>	Onagraceae	Water primrose	Rau muong	leaves young shoots
<i>Lycium chinensis</i>	Solanaceae	Chinese boxthorn Chinese wolfberry	Cau khi, koi tu, cau k tur	leaves fruits
<i>Melientha suavis</i>	Opiliaceae	Melientha	Rau sang, rau ngot rung	young shoots leaves inflorescence

<i>Momordica charantia</i>	Cucurbitaceae	Balsam pear Leprosy pear Leprosy gourd Bitter gourd Bitter cucumber bittermelon	Muop dang, kho qua	young leafy shoots fruit
<i>Momordica cochinchinensis</i>	Cucurbitaceae	Spiny bitter- cucumber Chinese bitter- cucumber	gac	fruit
<i>Monochoria hastata</i>	Pontederiaceae	Arrow-leaved monochoria	Rau mac thon, la mac thon	leaves
<i>Monochoria vaginalis</i>	Pontederiaceae	Oval-leaved Monochoria	Rau mac bao, la mac bao	leaves
<i>Musa spp</i>	Musaceae	Musa blossoms	Bap chui	blossoms
<i>Nelumbo nucifera</i>	Nelumbonaceae	lotus	sen	leaf stalks seeds roots
<i>Neptunia oleracea</i>	Fabaceae	Water mimosa	Rau rut	young shoots leaves
<i>Nymphaea lotus</i>	Nyphaeaceae	Water lily	Sung trang	leaf stalks seeds roots
<i>Ocimum americanum</i>	Lamiaceae	Hoary basil	E, Hung que	leaves young shoots
<i>Ocimum basilicum</i>	Lamiaceae	Sweet basil Thai basil Asian basil	E, Hung que	leaves young shoots
<i>Ocimum gratissimum</i>	Lamiaceae	Shrubby basil	Huonh nhu trang	leaves young shoots
<i>Ocimum tenuiflorum</i>	Lamiaceae	Holy basil sacred basil	E rung, E tia, E do, Húng quế, Huong nhu tia, Cay e tia, Cay co e rung, E to, Rau quế	leaves young shoots
<i>Oenanthe javanica</i>	Apiaceae	Water dropwort	Can ong, Can com	leaves young shoots
<i>Pandanus amaryllidifolius</i>	Pandanaceae	Sweet pandan leaf	Dua thorn, dua huong	leaves, also as spice
<i>Passiflora foetida</i>	Passifloraceae	Running pop Stinking passionflower	Lac tien, Nhan long, Mam nem	young leaves shoot fruit
<i>Peperomia pellucida</i>	Piperaceae	Peperomia pepper elder rat's ear shiny bush	Cang cua	leaves
<i>Perilla frutescens</i>	Lamiaceae	Perilla purple perilla beefsteak plant	Tia to	leaves
<i>Phytolacca acinosa</i>	Phytolaccaceae	Indian poke	Thu ong luc	leaves
<i>Piper lolot</i>	Piperaceae	Wild betel leaf	La lot	leaves
<i>Piper sarmentosum</i>	Piperaceae	Wild betel leaf	Lot nui	leaves

<i>Plantago asiatica</i>	Plantaginaceae	Common plantain	Ma de hoang dai	leaves
<i>Plantago major</i>	Plantaginaceae	Greater plantain	Rau ma de	leaves
<i>Plectranthus amboinicus</i>	Lamiaceae	Country borage Indian borage	Hung canh, tan day la	leaves, also as spice
<i>Pluchea indica</i>	Asteraceae	Indian fleabane	La luc	leaves
<i>Polygonum odoratum</i>	Polygonaceae	Vietnamese coriander	Rau ram	leaves shoots
<i>Polyscias filicifolia</i>	Araliaceae	Fern leaf aralia	Dinh lang la xe	leaves young shoots
<i>Polyscias fruticosa</i>	Araliaceae	Polyscias ming aralia	Dinh lang la rang	leaves
<i>Portulaca oleracea</i>	Portulacaceae	Purslane garden purslane	Rau sam	leaves young shoots
<i>Rumex acetosa</i>	Polygonaceae	Sorrel	Rau chua, rau boxoi, toan thao	leaves
<i>Sauropus androgynus</i>	Euphorbiaceae	sweetbush	Rau bi, rau ngot. Bo ngot	leaves young shoots
<i>Sesbania grandiflora</i>	Fabaceae	Agati Sesban	So dua	young leaves flowers
<i>Solanum americanum</i>	Solanaceae	Glossy nightshade	Ca den, lu lu duc	young leaves fruits
<i>Solanum torvum</i>	Solanaceae	Plate brush	Ca phao dai	young fruits
<i>Solena amplexicaulis</i>	cucurbitaceae	Clasping-stemmed solena	Hoa bat, cau qua	unripe fruits
<i>Spilanthes iabadicensis (S. acmella)</i>	Asteraceae	Spot flower	Co nut ao rau, cuc ao	leaves young shoots
<i>Spilanthes paniculata</i>	Asteraceae	Paniculated spot flower	Co nut ao	leaves young shoots
<i>Talinum triangulare</i>	Portulacaceae	Waterleaf purslane	Sam dat	leaves young shoots
<i>Telosma cordata</i>	Asclepiadaceae	Cowslip creeper Tonkin jasmine Tonkin flower	Hoa thiên lý	flowers
<i>Trapa natans</i>	Trapaceae	Water caltrops	Au nuoc, au dai	submerged fruit
<i>Wedelia chinensis</i>	Asteraceae	Chinese wedelia	Sai dat	leaves young shoots
<i>Zingiber officinale</i>	Zingiberaceae	ginger	Gừng, Can khương, Sinh khương	rhizome, also as spice
<i>Zingiber zerumbet</i>	Zingiberaceae	Shampoo ginger (Hawaii) Zerumbet ginger wild ginger	Gung dai	rhizome, also as spice

Source: Trinh et al. (2003) and Lim et al. (2007).

Appendix 2. Vegetable trade data for Vietnam: Exports

Items/year	Exports Value (1000 US \$)						Exports Quantity (1000 tonnes)					
	2000	2001	2002	2003	2004	2005	2000	2001	2002	2003	2004	2005
Fresh:	2,479.0	5,366.3	8,082.4	10,823.2	10,971.8	23,748.5	23.04	52.11	87.87	82.91	101.35	201.33
Artichokes										0.00		
Asparagus		0.7	3.6	2.7	1.7	3.2		0.00	0.00	0.00	0.00	0.00
Beans, green	4.5	3.6	3.6	56.9	34.4	38.4	0.01	0.01	0.01	0.11	0.08	0.09
Cabbages and other brassicas							11.76	16.94	11.22	11.47	16.50	38.42
Carrots and turnips	86.6		16.1	83.0	69.6	25.9	0.52	0.00	0.11	0.19	0.23	0.11
Cauliflowers and broccoli							0.29	0.40	0.49	0.54	0.25	0.20
Chicory roots								0.01	0.08	1.83	0.10	0.05
Chilies and peppers, green	122.3	255.7	486.6	658.3	1,082.0	1,586.6	0.20	0.43	0.69	0.90	1.59	1.84
Cucumbers and gherkins	87.5			21.4	7.1	21.8	0.20	0.00		0.08	0.00	0.00
Eggplants (aubergines)	1.2	3.1	8.8	7.8	0.9	8.3	0.00	0.01	0.01	0.00	0.00	0.01
Garlic	912.6	514.3	437.5	85.7	170.5	27.7	1.84	0.57	0.69	0.24	0.39	0.05
Leeks, other alliaceous veg.	14.7	63.4	189.7	162.7	200.3	336.5	0.03	0.20	0.26	0.19	0.11	0.30
Leguminous vegetables, nec.	68.8	111.9	120.5	17.0	21.4	8.0	0.19	0.44	0.34	0.06	0.06	0.02
Lettuce and chicory							0.24	0.41	0.58	0.78	0.36	0.33
Maize, green							0.01	0.20	0.04	0.10	0.04	1.15
Mushrooms and truffles	12.2	25.0	68.8	1,067.3	26.8	64.3	0.03	0.02	0.08	0.05	0.02	0.12
Onions (inc. shallots), green	447.3	1,122.3	740.2	1,851.8	2,334.8	4,145.5	1.64	4.77	2.71	7.19	9.09	15.95
Onions, dry	290.2	1,033.0	183.5	1,725.8	469.6	981.2	1.52	4.58	0.66	8.56	1.73	4.34
Other melons (inc.cantaloupes)	49.1	54.5	105.4	141.1	106.2	132.1	0.03	0.04	0.06	0.07	0.06	0.07
Peas, green	157.1	681.3	842.4	1,093.8	539.6	634.8	0.35	1.90	2.23	2.61	0.85	0.92
Pumpkins, squash and gourds					5.4	2.0				0.00	0.00	0.01
Spinach	3.6	2.8	11.4	15.8	18.3	51.8	0.01	0.02	0.00	0.00	0.01	0.06
Tomatoes							0.04	0.05	0.10	0.16	0.03	0.01
Vegetables, nec.							1.21	1.32	3.10	3.37	3.08	4.42
Watermelons	221.4	1,494.8	4,864.4	3,832.2	5,883.0	15,680.4	2.92	19.79	64.41	44.41	66.77	132.86
Processed:	25,333.4	27,957.5	28,824.2	34,640.5	43,845.4	50,237.5	39.38	43.16	48.41	54.66	66.93	74.53

Canned mushrooms	2,407.1	1,954.5	3,079.5	3,286.3	3,852.7	5,983.0	2.64	2.37	3.86	3.71	4.03	6.35
Chilies and peppers, dry	650.9	1,082.8	661.6	1,362.5	676.7	898.9	1.37	1.26	0.75	1.15	0.82	0.87
Dried mushrooms	1,290.9	865.2	605.5	569.6	600.1	563.6	1.19	0.60	0.37	0.28	0.24	0.27
Ginger	179.5	263.2	350.3	357.1	739.3	778.3	0.52	0.57	0.80	0.91	1.50	0.97
Homogen.veget. prep	46.4		4.5		3.6	2.1	0.22	0.00	0.02	0.00	0.00	0.00
Juice of tomatoes												
Juice of vegetables nes.	74.1	14.3		0.9	29.5		0.08	0.02		0.00	0.02	0.00
Oth vegetbles, otherwise prep., not frozen	3,458.8	3,329.8	3,576.0	6,272.3	8,055.2	6,577.5	7.49	8.40	10.86	16.43	17.89	14.34
Other vegetables, dry	2,862.4	2,883.4	3,483.8	4,215.5	4,189.3	4,909.3	2.14	1.43	2.15	2.86	2.20	1.44
Paste of tomatoes			0.9	12.5	15.5	65.2			0.00	0.02	0.04	0.18
Sweet corn, frozen	270.4	741.1	595.9	952.7	1,231.3	1,083.9	0.19	0.62	0.64	1.11	1.26	1.28
Sweet corn, prep or preserved	10.7	98.2	152.7	102.3	258.9	251.4	0.02	0.20	0.19	0.21	0.37	0.49
Tomato, peeled			5.4	48.2	17.0	61.6			0.00	0.01	0.04	0.09
Veg.in tem. preservatives	9,097.3	9,951.8	8,740.2	8,015.2	7,440.2	6,810.7	18.17	19.62	17.95	13.39	12.27	11.28
Veg.prep., or pres. frozen	1,633.0	2,567.1	2,537.5	2,150.0	2,746.1	3,967.0	1.08	2.36	1.97	1.38	2.04	2.39
Veg.prod., fresh or dried	750.0	1,207.6	1,073.4	887.9	877.7	638.3	0.66	1.44	2.48	0.98	1.06	0.80
Vegetable, frozen	1,568.8	1,737.5	2,343.8	3,504.5	9,674.1	11,337.4	1.44	1.64	2.22	3.72	10.31	11.77
Vegetables in vinegar	1,033.0	1,261.2	1,613.4	2,903.0	3,438.4	6,309.3	2.17	2.63	4.15	8.50	12.84	22.01
Total	27,812.4	33,323.8	36,906.6	45,463.7	54,817.2	73,986.0	62.42	95.27	136.28	137.57	168.28	275.86

Source: FAOSTAT (2007) (accessed 28/8/07).

Appendix 3. Vegetable trade data for Vietnam: Imports

Items/year	Imports Value (1000 US \$)						Imports Quantity (1000 tonnes)					
	2000	2001	2002	2003	2004	2005	2000	2001	2002	2003	2004	2005
Fresh:	3,564.1	2,483.6	18,588.0	28,730.1	25,326.6	29,599.6	20.77	13.50	95.51	153.66	123.49	160.19
Artichokes					957.6						1.00	
Asparagus	5.6		15.7		4.5	37.0	0.00		0.00		0.00	0.01
Beans, green		2.2	5.6	7.8	140.0	31.4		0.02	0.02	0.02	0.03	0.06
Cabbages and other brassicas							0.03	0.07	0.22	0.74	1.39	7.94
Carrots and turnips	1.1	16.8		16.8		3,052.0	0.01	0.04		0.16		12.00
Cauliflowers and broccoli							0.01	0.01	0.08	0.27	0.05	1.95
Chicory roots												
Chilies and peppers, green	7.8	4.5		1.1		2.2	0.02	0.01		0.00		0.02
Cucumbers and gherkins			5.6		3.4				0.00	0.00	0.01	
Eggplants (aubergines)		7.3						0.01				
Garlic	2,432.6	1,027.0	13,606.9	19,980.8	18,559.5	17,517.9	16.29	5.78	67.37	91.61	81.37	72.77
Leeks, other alliaceous veg.	57.1	461.4	145.6	716.8	426.7	366.2	0.61	3.51	1.32	7.65	3.54	3.75
Leguminous vegetables, nec.	5.6	22.4	97.4	2.2	7.8	9.0	0.03	0.03	0.13	0.01	0.01	0.00
Lettuce and chicory									0.23	0.47	0.00	0.00
Maize, green												
Mushrooms and truffles	292.6	1.1	26.9	82.8	20.2	60.5	0.02	0.00	0.00	0.01	0.01	0.12
Onions (inc. shallots), green	32.5	59.4	86.2	113.1			0.10	0.17	0.24	0.31		
Onions, dry	440.2	129.9	2,778.7	5,633.6	3,662.4	5,872.2	1.87	1.09	20.59	39.95	27.02	42.68
Other melons (inc.cantaloupes)	107.5	285.6	729.6	1,244.3	1,244.3	2,406.9	0.22	0.53	1.46	2.81	3.15	5.97
Peas, green	53.8	435.7	759.4	740.3	287.8	221.8	0.12	1.31	2.28	2.58	0.86	0.81
Pumpkins, squash and gourds												
Spinach						2.5			0.00	0.00	0.00	0.00
Tomatoes							0.10		0.00	5.65	4.75	10.76
Vegetables, nec.							0.19	0.45	0.16	0.13	0.12	1.11
Watermelons	127.7	30.2	330.4	190.4	12.3	20.2	1.15	0.47	1.41	1.29	0.18	0.24
Processed:	3,387.7	4,912.0	7,695.0	11,017.5	12,575.4	16,244.9	3.79	8.86	17.36	24.30	23.46	30.68

Canned mushrooms	3.4	41.4	3.7	1.7	81.0	524.2	0.00	0.04	0.00	0.00	0.08	0.40
Chilies and peppers, dry		2.7	48.2	329.6	118.8	64.9	0.00	0.00	0.05	0.59	0.07	0.07
Dried mushrooms	490.5	857.9	1,131.2	1,557.4	1,257.6	2,081.6	0.16	0.33	0.34	0.52	0.30	0.47
Ginger	44.8	57.1	184.8	121.0	68.3	580.2	0.18	0.49	1.55	0.76	0.17	2.20
Homogen.veget.pPrep	1.1		2.2	10.0	24.3	7.8	0.00		0.00	0.00	0.01	0.00
Juice of tomatoes	62.3	68.3	61.6	44.8	21.8	17.9	0.09	0.13	0.10	0.04	0.03	0.01
Juice of vegetables nes.			7.8	169.1	54.9	26.9			0.01	0.21	0.07	0.03
Oth vegetbles, otherwise prep., not frozen	470.0	544.3	1,091.9	1,597.4	2,067.5	2,612.2	0.25	0.36	0.71	4.37	3.17	2.65
Other vegetables, dry	500.6	703.2	980.9	1,138.7	727.4	1,263.4	0.67	2.60	3.78	3.77	0.44	0.59
Paste of tomatoes	132.2	360.6	719.0	733.6	1,071.8	1,112.2	0.25	0.69	1.13	1.17	1.70	1.63
Sweet corn, frozen	892.6	1,290.2	841.1	999.0	654.1	1,305.9	0.79	1.36	0.71	0.84	0.53	0.92
Sweet corn, prep or preserved	123.2	77.3	80.6	34.7	47.0	86.2	0.07	0.08	0.06	0.05	0.06	0.12
Tomato, peeled	41.4	13.4	507.4	945.3	35.8	55.9	0.04	0.02	1.15	1.38	0.03	0.06
Veg.in tem. preservatives	292.3	26.9	53.8	467.9	1,646.4	1,519.4	0.77	0.04	0.11	0.84	2.47	2.06
Veg.prep. or pres.frozen	7.8		3.3	21.3	68.3	142.2	0.00	0.00	0.00	0.02	0.02	0.10
Veg.prod.fresh or dried	90.7	662.2	1,775.2	2,278.1	3,201.1	4,029.9	0.30	2.41	7.41	9.23	13.01	18.61
Vegetable frozen	212.8	150.6	149.0	520.4	1,338.4	730.2	0.20	0.28	0.21	0.50	1.24	0.67
Vegetables in vinegar	22.0	55.7	53.3	47.6	90.8	84.0	0.02	0.03	0.04	0.01	0.06	0.09
Total	6,951.8	7,395.6	26,283.1	39,747.6	37,902.0	45,844.6	24.56	22.36	112.87	177.96	146.95	190.87

Source: FAOSTAT (2007) (accessed 28/8/07).

Appendix 4. Laws and government directives of Vietnam relevant to the vegetable industry

Under an amendment to the Law on Laws, 2002, the National Assembly of Vietnam required that all regulations be published for 15 days in the Official Gazette before coming into effect and in 2004, a new "Law on Local Laws," laid out for the first time clear requirements for publishing local regulations. The Vietnamese Chamber of Commerce and Industry has an online forum (in Vietnamese) for posting draft laws and regulations for public comment (www.vibonline.com.vn) (USAID, 2007).

MARD Site

The website of the International Support Group of MARD has some laws, ordinances, and planning documents:

www.isgmard.org.vn/Information%20Service/Legal%20docs/Legaldoc.asp

The Ordinance on Plant Varieties, ORDER No. 03/2004/L-CTN OF APRIL 5, 2004:

<http://www.isgmard.org.vn/Information%20Service/Legal%20docs/Agriculture/Ordinance%20on%20Plant%20Varieties-e.pdf>

The 5 year Socio-economic Development Plan, 2006-2010 Ministry of Planning and Investment:

http://www.isgmard.org.vn/Information%20Service/Legal%20docs/General/sedp_edited_eng_16_3.pdf

Directive Issued by the Minister of the Ministry of Agriculture and Rural Development on the planning for agriculture and rural development of 5 year duration 2006-2010 Hanoi, October 21, 2004

<http://www.isgmard.org.vn/Information%20Service/Legal%20docs/General/Chi%20thi%2052%20BNN-KH-e.pdf>

Decision 99/2005/QD-TTg dated 9 May 2005 of the Prime Minister re: Establishment of the Vietnam Sanitary and Phyto-sanitary Notification Authority and Enquiry Point (Vietnam SPS Office). ([Vietnamese version only](#))

Directive No. 52 CT/BNN-KH 2004. Issued by MARD Minister on the planning for agriculture and rural development of 5 year duration 2006-2010.

<http://www.isgmard.org.vn/Information%20Service/Legal%20docs/General/Chi%20thi%2052%20BNN-KH-e.pdf>

Decision 52/2007/QĐ-BNN dated 5th June, 2007 approving the planning of vegetable, fruit and ornamental plants development by 2010 and vision 2020. Continuing the program of developing vegetable, fruit and ornamental plants based on the exploitation of weather and diversified ecological advantages in different regions (tropical, temperate, subtropical). In combination with improving miscellaneous gardens, conducting intensive farming and new planting towards extensive production and using advanced technologies, the plan sets out targets and methods to achieve by 2010 and vision 2020.

Laws relating to the vegetable sector

<http://www.rauhoaquavn.vn/default.aspx?ID=100&LangID=2&tabID=10&NewsID=2859> (Rau Hoa Qua Viet Nam, 2007). The following is quoted (with some editing to enhance readability):

Decision No 182/1999/QĐ-TTg on Sep 3, 1999, contains an agreement on the 1999 – 2010 development project for the vegetable, flower and ornamental tree industries.

Business tax: The Ministry of Finance Circular No 18/2002/TT-BTC provides guidance on Government-level Decisions No 30/1998/NĐ-CP and No 26/2001/NĐ-CP on business tax law. Businesses in favorable sectors (e.g. waste land fruit tree cultivation, vegetable processing) are exempted from tax for the first 2 years of taxable revenue, and to pay 50% tax for the next 3 consecutive years; newly established businesses in favorable sectors are exempted from tax for the first 4 years of taxable revenue, and to pay 50% tax for the next 7-9 consecutive years.

Value added tax: The Ministry of Finance Circular No 91/2000/TT-BTC dated Sep 6, 2000 provides guidance on Government-level Decision No 09/2000/NQ-CP dated June 15, 2000. Businesses are exempted from both value added tax and business tax on agricultural products in circulation.

Agricultural land tax: Government-level Decision No 129/2003/NĐ-CPP dated Nov 3, 2003 stipulates details on implementation of the National Congress-level Decision No 15/2003/QH11 dated June 17, 2003 on exemption and rebate of agricultural land tax. Poor farmer households and extreme poverty stricken communes are exempted from agricultural land tax against their total cultivation area; farmers and operative members who are assigned agricultural land by contract are to some extent exempted from agricultural land tax; farmers have the right to contribute their assigned plots of land setting up a cooperative in accordance with the law on operative.

Other financial policy: The Government-level Decision No 80/2002/QĐ-TTg dated June 24, 2002 on the policy to encourage sales of agricultural products by contract stipulates that those who are engaged in production and distribution of agricultural products are guaranteed to get loans from banks favorably in various mortgage forms.

ANU site

A selection of Vietnamese law documents translated into English (update 1998) is available on the website of the Australian National University:

<http://coombs.anu.edu.au/~vern/luat/luat.html>

[Title: Agreement On Trade And Economic Co-operation Between Australia And The Socialist Republic Of Vietnam](#)

[Title: Decision By The Chairman Of The Council Of Ministers On Policies For The Use Of Bare Land, Denuded Hills, Forests, Alluvial Flats, And Water Bodies \(327CT\)](#)

[Title: Instruction by the prime minister on policies and methods for continued economic and social development in mountainous areas \(525TTG\)](#)

[Title: Order Of The Chairman Of The Council Of Ministers Urgent Measures To Stop Immediately Deforestation \(90CT\)](#)

[Title: Decree of the council of ministers regulating in detail the implementation of the law on foreign investment](#)

[Title: Decree Of The Council Of Ministers Regulating In Detail The Implementation Of The Law On Foreign Investment](#)

[Title: On Implementation Of Decision No 327-ct With Respect To Appraisal And Approval Of Projects And Compilation Of Programme 327](#)

[Title: Circular On Guidelines on management and provision of credits from the State for programmes and projects for use of bare land, degraded hills, forests, alluvial flats and water bodies](#)

[Title: Circular Guidelines for the Allocation of Land in Accordance with Decision 327-CT](#)

[Title: Decree To Promulgate The Regulations For Allocating Forest Land To Organisation, Household, Individual To Use Sustainable And On Long Terms In Forestry \(02CP\)](#)

[Title: Decision On The Reorganisation And Renewal Of Management In State Enterprises In The Agriculture Sector \(12CP\)](#)

[Title: Government Regulation On Reorganisation And Renewal Of Management Of State Enterprises In The Agriculture Sector](#)

[Title: Decision On Agricultural Extension \(13CP\)](#)

[Title: Government Regulation for agricultural extension](#)

[Title: Enactment Of Government Promulgating The Regulation For Producing Household Crediting To Develop Agro-forestry, Aquaculture, Salt Career And Rural Economy \(14CP\)](#)

[Title: Stipulation Of Policy For Producing Household To Credit A Loan To Develop Agro-forestry, Aquaculture, Salt Career And Rural Economy](#)

[Title: Decree on providing guidance for the implementation of the Law on Environmental Protection \(175CP\)](#)

[Title: Law On Environmental Protection](#)

[Title: Law On Foreign Investment In Vietnam](#) [12 November 1996]

[Title: Land Law](#)

[Title: Politburo Decision On Guidelines And Main Policies For Economic And Social Development In The Mountain Area \(22NQTW\)](#)

[Title: Guidelines For The Implementation Of The Regulations On The Operation Of Foreign Non-governmental Organizations In Vietnam](#)

Trade law

http://www.mot.gov.vn/moten/tag.vportal.render.userLayoutRootNode.uP?uP_root=n77

Customs law

<http://www.customs.gov.vn/Default.aspx?tabid=478>

Vietnam laws on line

[Vietnam Laws Online Database](http://www.vietnamlaws.com/online_database.aspx) is an online (subscriber) searchable database of English translations of over 3,000 Vietnamese laws covering a wide range of subject areas relevant to foreign investment and beyond operating since 2004 operated by Allens Arthur Robinson.

http://www.vietnamlaws.com/online_database.aspx

The Law on Investment 2001 is accessible via a “free tour” but has been replaced by Law on Investment 2005 - Foreign Investment - Domestic Investment - Investment Registration & Evaluation - Investment Certificates - Incentives [Note: Effective as of 1 July 2006.]

www.vietnamlaws.com/freelaws/Lw59na29Nov05CIL%5BVLOD%5D.pdf

UNESCAP

The United Nations has a database on selected laws relating to population, employment, social development, and family planning, health, and the advancement of women. Selected laws covering health, employment from:

http://www1001.unescap.org/esid/psis/population/database/poplaws/law_viet/vi_title.htm

[Strategy for Socio-Economic Stabilization and Development up to the years 2000](#)

[Orientations and Tasks of the 1996-2000 Five Year Plan for Socio- Economic Development](#) (Report of the Central Committee, the VIIth Tenure, to the VIIIth National Congress)

[Decision No.126/1998/QD-TTG on Approving the National Target Program for Employment till the Year 2000](#)

[Decision No. 133/1998/QD-TTg Ratifying the National Target Programme on Hunger Elimination and Poverty Alleviation in the 1998-2000 Period](#)

[The Second National Report on the Implementation of the UN Convention on the Elimination of all Forms of Discrimination Against Women](#)

[Labour Code of the Socialist Republic of Viet Nam](#)

[Constitution of the Socialist Republic of Viet Nam 1992](#)

[Education Law \(No. 11/1998/QH10\)](#)

Appendix 5. Ministry of Agriculture and Rural Development institutional arrangements

Diagrams are located at:

http://www.isgmard.org.vn/Information%20Service/MARD%20structure/MARD%20Brochure_E.pdf

http://www.isgmard.org.vn/Information%20Service/MARD%20structure/MARD%20Brochure_E.pdf.

(MARD, 2007) lists responsibilities of MARD leaders.