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Pathways out of Poverty through Secondary Crops and Private Sector Processing as well as Institutional Arrangements in Viet Nam

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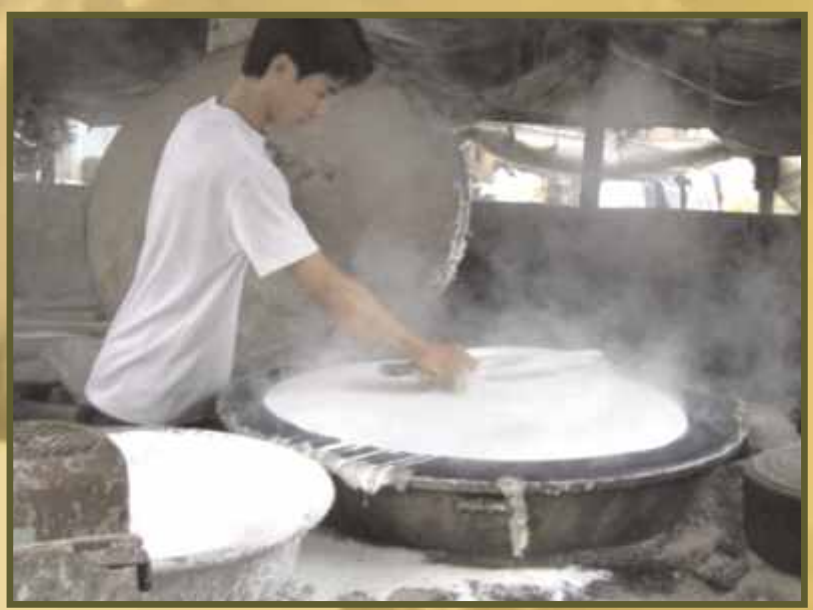

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Foreword

Most Asian countries succeeded in multiplying major cereal production through the '*Green Revolution*'. This was made possible by the introduction of high-yielding varieties and policy support which promoted the construction of irrigation facilities and the use of modern inputs such as chemical fertilizers and pesticides. However, recently the growth in productivity of major cereals has reached a plateau. Agricultural diversification has a number of positive effects, among others, food security, risk mitigation, labour absorption and conservation of biodiversity. It is crucial to be aware of the driving forces and constraints to agricultural diversification to formulate policy options which realize the coexistence of sustainable agricultural development and poverty reduction in rural areas.

Responding to this vital need, UNESCAP-CAPSA conducted a three-year research project, "Identification of Pulling Factors for Enhancing the Sustainable Development of Diverse Agriculture in Selected Asian Countries (AGRIDIV)", from April 2003, in collaboration with eight participating countries, namely Bangladesh, India, Indonesia, Lao People's Democratic Republic, Myanmar, Sri Lanka, Thailand and Viet Nam.

It is my pleasure to publish "**Pathways out of Poverty through Secondary Crops and Private Sector Processing as well as Institutional Arrangements in Viet Nam**" as a result of the second phase of the Viet Nam country study of the project. This volume presents rural surveys and case studies utilizing primary data to support policy recommendations to realize poverty alleviation through agricultural diversification.

I thank Dao The Anh for their efforts. Continuous support from the Vietnam Agricultural Science Institute (VASI) is highly appreciated. Prof. Hitoshi Yonekura, Graduate School of Agricultural Science, Tohoku University, Mr. Tomohide Sugino and Dr. Parulian Hutagaol provided useful guidance at every stage of the study as Regional Advisor, Project Leader and Associate Project Leader respectively. I extend thanks to Mr. Matthew L. Burrows for his English editing.

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Taco Bottema
Director
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Executive Summary

In Viet Nam, the diversification of CGPRT crops is the main thrust of poverty alleviation in remote and mountainous areas with new opportunities in the market. However, the sustainable development of these commodity chains is in question due to the lack of integrated policy for value chain development and assuring the participation of the poor in the value chains. Two case studies of cassava and maize commodity chains respectively in Yen Bai and Son La provinces suggest ways to encompass these challenges of diversification.

General conclusion for the cassava commodity chain

The cassava value chain has been characterized by rapid growth in cassava production, fuelled in large part by the rapid adoption and dissemination of high-yielding varieties (HYVs) that have boosted yields by 50 per cent in just five years. Current production of cassava (2003) is estimated at approximately 5 million tons. National and international extension programmes, in conjunction with larger starch processors such as VEDAN, have played a role in promoting HYVs in Viet Nam. At the same time, much of the growth has been demand driven and spurred by growing demand from cassava-using industries, particularly starch, from domestic and foreign (mainly Chinese) producers and end-users. Village clusters focusing on processing are more efficient than large factories.

General conclusion for the maize commodity chain

Based on the general assessment of maize production and market development, we are aware of the development tendencies and changes in consumption as well as in production. Besides, powerful countries also influence the market through their policies that lead to market distortion and trigger further difficulties for the integration and adaptation of new WTO members.

1. Study Objectives

The specific objectives of the second phase are:

1. To assess the impact of economic transformation and trade liberalization on secondary crop-based farming systems, diversified agricultural systems and the rural economy, welfare as well as the environment;
2. To investigate the nutritional and/or industrial importance of secondary crops as well as diversified ways of consuming them and to explore the potential of product diversification to meet changes in demand;
3. To examine constraints and potential factors (economic, agro-ecology, socio-cultural) that determine the coexistence of sustainable development and diversified agriculture; and
4. To formulate policy options and recommendations to enhance sustainable diversified agricultural production.

2. Conceptual Framework and General Methodology

'Secondary crop-based livelihoods of the poor' are closely intertwined with household food security, local staple food markets, livestock husbandry and meat markets, markets for livestock feed as well as the markets of inputs for secondary crop production. To understand the broad impacts of trade policy on secondary crop-based livelihoods of the poor, including the poverty alleviation potential of those livelihoods and the wider livelihood opportunities of poor people, the Sustainable Livelihoods Framework was used and developed.

The framework shows the flow of goods (secondary crops, inputs), key policies, key actors (producers and traders) as well as relationships at the local, national and international levels. It also indicates the importance of tariffs and other policies on inputs for maize production (fertilizers, seeds) and processing (including various subsidies, research and extension).

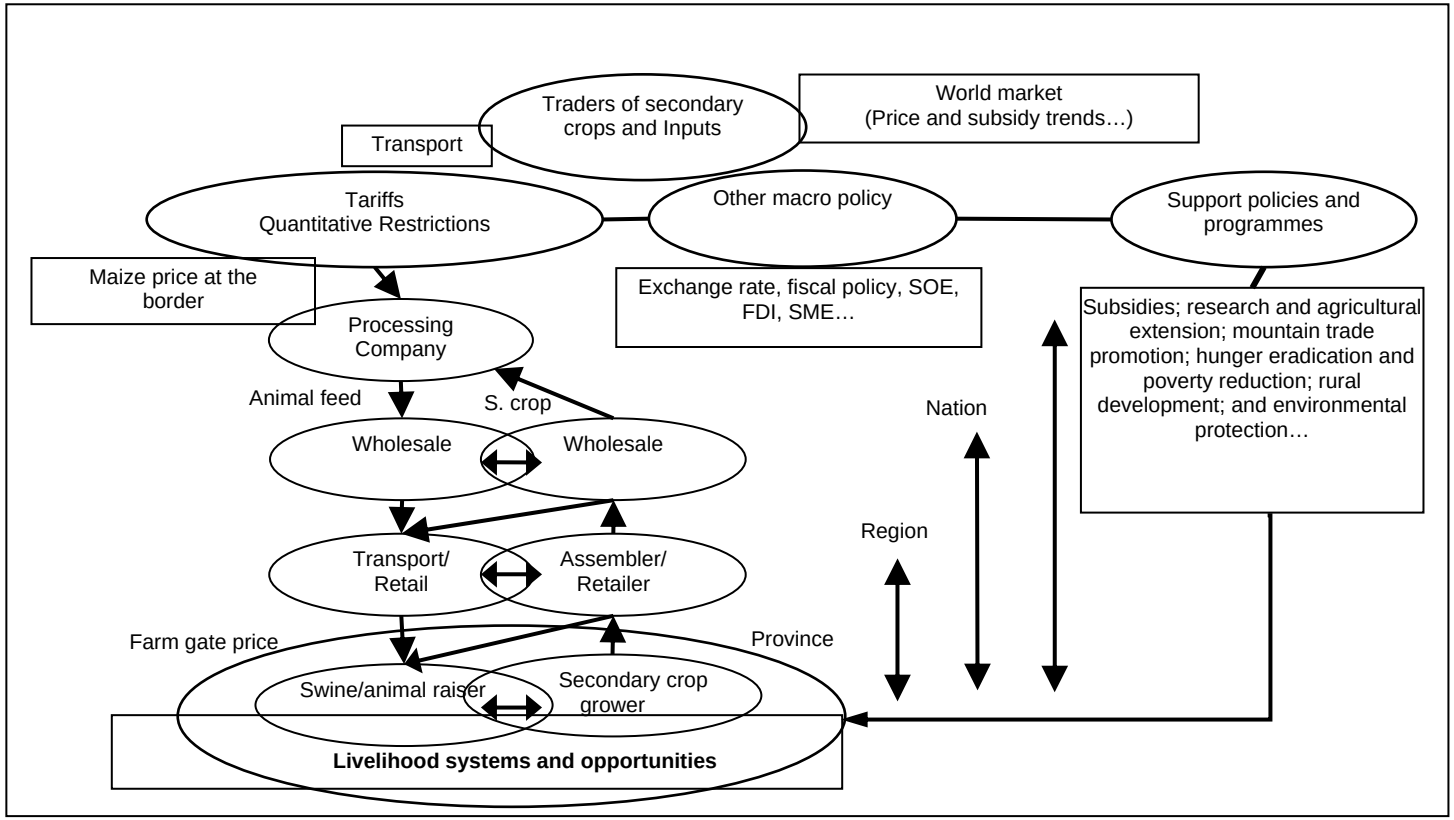
The livelihood opportunities of farmers are strongly influenced by market mechanisms and the policies shown in the framework. These relationships, flows of goods and policies are central to the analysis presented in this paper.

However, under 'livelihood systems and opportunities' in the framework some aspects have not been mentioned but conceptualized in some detail in the SLF and will be touched upon occasionally. This concerns the wider set of **assets** on which livelihoods depend (financial, natural, physical, human and social); other **policies** that affect maize-based livelihoods (land policies); and alternative diversification **livelihood strategies** (non-maize based livelihood strategies, including the migration of household members).

Furthermore, the SLF illustrates the need to remain focused on livelihoods, which are the main concern of local farmers and of the overall development strategy of Viet Nam: increase income and reduce poverty; improve social equality; reduce vulnerability; and enhance the sustainability of the environment.

This framework will be applied for cassava and maize in North Viet Nam.

Figure 2.1 Analytical framework



Part 1: Cassava in North Viet Nam

3. Methodology for the Cassava Study

3.1 Selection of crops

The current study focuses on one key secondary crop, which has the greatest participation of poor farmers: cassava.

The volume of global cassava production has been steadily rising over the past 25 years. In 2003, total production of cassava totalled approximately 190 million tons, indicating a 53 per cent rise in production since 1978. While total production has increased, worldwide cassava yields have risen erratically. FAO data shows that the average global cassava yield in 2003 was 10.76 tons per hectare. Furthermore, there has been a sharp rise in yield over the past five years in particular, however, between 1985-1998, average yield remained in a narrow band between 9.7-9.9 tons per hectare.

Cassava was selected for study for several reasons. First, it is highly complex, incorporating small and large-scale producers, a continuum of processors from SMEs to multinational firms, and an array of traders responsible for most of the interactions between the other stakeholders. Moreover, there has been growing dynamism in the sector, driven by the increasingly diversified utilization of starch by end-users that has fuelled rapid growth in the commercial cassava starch industry. The growth of this industry has boosted demand for High Yielding Varieties (HYV) in particular, which is more appropriate for industrial purposes. Widespread adoption of HYVs has augmented farmers' incomes while raising yields. Nonetheless, there remain a wide range of outlets other than commercial starch for both traditional and HYV types of cassava, such as animal feed. Cassava is part of a value chain with strong potential for poverty reduction: it is planted mainly on farms in poor areas, is grown heavily by ethnic minorities, particularly in the North, requires few inputs, and is labour intensive. Moreover, the risk of crop failure is fairly low.

3.2 Selection of research sites

The cassava value chain was studied in the provinces of Yen Bai and Ha Tay. The cassava value chain in the North has numerous intermediaries and transportation conditions tend to be poor. Small-scale producers in Yen Bai generally sell to small-scale household assemblers, who in turn sell to larger traders who either distribute cassava locally or sell to

long-distance traders who bring cassava to Ha Tay province; other sales routes include cross-border trade to China in the form of chips. Once in Ha Tay province, cassava is sold to the local market, where processors purchase cassava for wet and dry starch production. The fragmented nature of the value-chain has made subcontracting by the larger Van Yen factory difficult. Larger producers prefer the lower transaction costs in terms of lower quality requirements and higher prices received from traders. Poor farmers, who would benefit from contracting, are generally unable to deliver roots directly to the factory, and must rely on traders instead. The following communes were examined in the study.

- Yen Bai province: An Binh, Lam Giang communes, Van Yen district
- Ha Tay province: Cat Que (Hoai Duc district), and Tran Phu (Chuong My district).

3.3 Selection of respondents

For the cassava study, semi-structured interviews were used initially to acquire background information about the sector, and thereafter in order to obtain additional information from participants in focus groups or the Participatory Rural Appraisal (PRA). They were chosen to elicit information felt to be either too detailed or sensitive to emerge from the focus groups or PRA, for the participants that are unlikely to agree to attend focus groups and PRA participation (like managing directors of export companies and large-scale enterprises).

Interviews were conducted with managers of starch export companies, enterprise managers, small- and medium-scale starch processors, traders, producer group leaders, leading farmers, and other important stakeholders in the value chain. In addition, producers, processors, exporters and traders were asked to provide quantitative information during interviews to enable an approximate understanding of costs, prices and margins.

PRAs were conducted with groups of 10-15 households in communes producing cassava for industrial purposes. These PRAs were used to educe non-sensitive information best acquired through discussion with and between large numbers of individuals. The groups were separated according to their pattern of participation in cassava value chains (farmers without linkage, co-operative farmers, contract farmers and worker farmers).

Focus group discussions (FGDs) were used to acquire non-sensitive and detailed subjective information from small groups of ten individuals. FGDs were conducted with micro, small and medium-scale processors and trader groups. Each group was asked to complete a short (anonymous) questionnaire regarding their socio-economic and demographic characteristics. Quantitative information on cassava processors and traders

was collected from the focus group participants to provide a rough estimate of the costs and margins of cassava and starch production.

Within each area, the sequence of activities proceeded as follows. First, meet with processing enterprises, district and commune leadership and other community leaders to collect background information. Second, conduct FGDs associated with key informant interviews with traders. Third, perform PRA exercises through interviews with cassava producers. Finally, FGDs and interviews are conducted with processors.

3.4 Time frame of the study

The time frames for the cassava and maize studies incorporate and are limited to 2004.

3.5 Methods of analysis

Household economic status and farming system analyses were conducted for the household level for both the cassava and maize studies. Value chain analysis was applied to different stakeholders in the commodity chains of cassava and maize.

4. Profiles of the Study Site for Cassava Production and Starch Processing, the Respondents and their Households

4.1 Profile of the study site

4.1.1 Geographic and administrative setting

Yen Bai province is located in the northeast mountainous region of Viet Nam and borders China. The province has the highest output and cultivated area of cassava in the region. HYV cassava has been increasingly adopted in Yen Bai province, particularly since a starch processing factory was established in the province in the early 2000s.

In the cassava cultivation areas in the North, like Yen Bai province, outside traders play a dominant role in setting the prices paid to cassava farmers, in spite of the efforts of the starch processing enterprise (Van Yen enterprise) to establish contract farming with cassava farmers. Farmers prefer to sell cassava to local assemblers either through spot markets, oral contracts, or in some cases through trade credit. In fact, the enterprise has to pay a bonus or extra payment to local assemblers, who are the main sources of supply for the factory, in order to have enough raw material for production.

Ha Tay province is located in the Red River Delta and has a high population density. The province adjoins Hanoi, the capital of the country, and hence has good potential for market connections. Though the cassava output is not high relative to other provinces nationwide, Ha Tay is the largest production area of cassava in the Red River Delta. Furthermore, the province includes communes like Duong Lieu and Cat Que (Hoai Duc district), which have long experience in trading and processing cassava and cassava-based products.

Outside traders have trucks and close linkages with the local assemblers as well as cassava traders in domestic starch centres (like Duong Lieu commune in Ha Tay province) and in the border area with China. The majority of dry chips (as opposed to fresh roots) are exported to China since the Van Yen Factory does not procure dry chips. This is as expected as, technically, the factory cannot process dry chips. Furthermore, Chinese enterprises can process dry chips into starch more efficiently. Fresh roots are brought to the Duong Lieu Centre for sale.

In the fresh root market, outside traders pay slightly higher prices than local assemblers compared to those offered by the factory. Traders do not impose high quality standards for the fresh roots that they procure. Therefore, without administrative restrictions, it is very difficult for the factory to procure enough fresh cassava for processing. Chinese importers largely influence the price paid for dry chips. However, not all farmers are willing to produce dry chips because it depends on the weather and requires much hard work.

In the starch processing centres of the North like Cat Que commune (Ha Tay province), market information is very strong among stakeholders. Fresh roots are carried to the principle market of the two communes from other provinces. Then processors either buy raw materials from the spot markets or order through large cassava traders in the commune. In addition, there are also starch traders, who, along with the direct users of starch for maltose and food production, transmit price signals from end-users to starch processors. There is a balanced network between buyers and sellers, in which buyers and sellers know and trust each other well before participating in exchange activities.

4.1.2 Demographic profile

Table 4.1 The population of different study provinces

Province	Population 2002	Percentage urban	Percentage rural	Population growth rate 1996-2002		
				Total	Urban	Rural
Ha Tay	2 452 500	7.90	92.10	0.87	3.18	0.68
Yen Bai	707 300	19.68	80.32	1.27	2.42	0.99
Son La	938 700	12.46	87.54	2.00	0.67	2.19

Source: GSO, 2002.

Across the study provinces, the most dense in terms of population is Ha Tay province with a population density of more than 1,000 persons per square kilometre, however, the growth rate was smallest during the period of 1996-2002. Son La province has witnessed the most rapid population growth due migration from the delta.

4.1.3 Economic profile

Table 4.2 Economic profile, 1996-2002, in the study provinces

Province	Agricultural share of GDP (%)	Industrial share of GDP (%)	Services share of GDP (%)	GDP annual growth rate	Share of agricultural labour (%)	Agricultural annual growth rate	Food crops annual growth rate
Ha Tay	36	32	32	8	69	7.3	5.1
Yen Bai	42	24	34	10	85	8.4	11.0
Son La	59	11	30	10	90	13.5	10.0

Source: GSO, 2002.

Across the study provinces, Son La has the largest share of GDP from agriculture. Agriculture and food crops, including cassava, continue to play significant roles in Yen Bai province. Ha Tay province has the greatest share of industry. Socio-economic indicators show a high level of development in Ha Tay province, however, poverty remains high.

Table 4.3 Socio-economic indicators for the study sites

Location	Land availability	Ethnicity (%)	Literacy (%)	Electricity (%)	Poverty rate (%)	Rural poverty (%)	Poverty gap	Gini
Yen Bai province	1.01	49.6	83.2	68.0	57.1	66.9	0.20	0.31
Van Yen district	1.29	56.8	80.8	67.4	63.3	67.8	0.22	0.27
Lam Giang	1.41	72.7		56.7	65.4	65.4		
An Binh	0.88	77.8		67.8	56.6	56.6		
Ha Tay province	0.09	98.8	93.2	98.5	38.7	40.9	0.09	0.25
Hoai Duc district	0.05	99.9	93.1	99.3	38.7	39.2	0.08	0.24
Cat Que	0.03	99.2		98.9	52.8	52.8		
Chuong My district	0.09	99.4	92.5	98.8	44.2	46.4	0.11	0.23
Tran Phu	0.22	94.1		97.9	38.3	38.3		

Source: Statistical Yearbook of Yen Bai and Ha Tay province, 2004.

4.1.4 Agricultural profile

In the North, production of cassava is mostly concentrated in mountainous areas of the Northeast and Northwest, with small amounts grown in the Red River Delta. These three regions represent 25 per cent of planted area and 18 per cent of total production in the country. Compared to the national average, yields are low, with an average of 11.11 and 8.7 tons per hectare in the Northeast and Northwest respectively, compared to 14.7 tons per hectare nationally. Except for the Northwest, a falling trend prevails in terms of cassava area in the North, especially in the Red River Delta. In the RRD, production of cassava is not significant and continues to decline because of the lower economic value of cassava compared to other crops such as paddy. In the North, cassava is grown on sloping land or drought-prone land, which is unsuitable for rice cultivation.

Table 4.4 Planted area of cassava in the North, 1995-2003

(thousand hectares)

Region	1995	2000	2003
Red River Delta	9.0	8.3	7.7
Northeast	51.3	48.4	47.5
Northwest	31.0	35.3	37.5
Total (North)	91.3	92	92.7
Nationwide	277.4	237.6	371.9
North as a percentage	33	38.7	24.9

Source: GSO, 2004.

Table 4.5 Cassava production in the North, 1995-2003 (thousand tons)

Region	Cassava production		
	1995	2000	2003
Red River Delta	62.2	74.4	87.2
Northeast	412.3	426.7	527.7
Northwest	210.8	265.3	326.2
Total (North)	685.3	766.4	941.1
Nationwide	2 211.5	1 986.3	5 228.5
North as a percentage	31.0	38.6	18.0

Source: GSO, 2004.

Table 4.6 Productivity of cassava in the North, 1995-2003

Region	Productivity (tons/ha)		
	1995	2000	2003
Red River Delta	7.24	9.26	11.63
Northeast	7.95	8.79	11.11
Northwest	6.80	7.52	8.70
Average (North)	7.53	8.40	10.32
Nationwide	7.97	8.36	14.07

Source: GSO, 2004.

At present, the share of land area under HYVs in the North is much lower compared to the South Central Coast, the Southeast and the national average, thus, cassava productivity remains below the national average. In 2001/02, less than 10 per cent of cassava was HYV.

In the North, farmers grow only one crop of cassava per year and harvest it during November-April. As a result, processing factories in the North face shortages of raw material and consequently can only operate for six months per year from November to the following April (IFPRI, 1998; Interview with director of Van Yen starch factory in Van Yen district, 2004). Processing factories can utilize dry chips and wet starch but this raises the cost of production. Thus, dry starch factories prefer to produce dry starch from cassava roots.

According to the team research survey, cassava cultivated area in the sample varied from 48 per cent of total cultivated area in Lam Giang commune to 38.6 per cent in An Binh and 36.1 per cent Tran Phu commune.

Table 4.7 Average cultivated area (hectares)

Commune	Cassava	Peanut	Paddy	Fruit tree	Total	Percentage of cassava
An Binh	1.19	0.38	0.01	1.50	3.07	38.6
Lam Giang	1.22	0.16	0.08	1.08	2.55	47.9
Tran Phu	0.28	0.20	0.27	0.03	0.77	36.1

Source: Team Research Survey, 2004.

Different farm sizes result in differences in the cassava production model used by farmers. In Tran Phu commune, where land is scarce, farmers tend to use land more

intensively by intercropping cassava with peanut. Cassava-peanut intercropping has reduced the productivity of cassava and has made it more labour intensive, however, this generates more total income than cassava alone.

Table 4.8 Distribution of farm size in the North

Farm size (hectares)	Red River Delta (%)	Northwest (%)	Northeast (%)
Less than 0.1	84.7	60.1	34.0
0.1- 0.2	9.3	21.4	29.9
0.2 - 0.3	3.2	8.8	17.2
0.3 - 0.4	0.5	4.25	5.9
0.4 - 0.5	0.9	2.24	7.0
0.5 - 1	1.4	2.46	5.6
More than 1	0	0.75	0.51

Source: Calculation from VLSS, 2002.

4.2 Extent of unemployment, poverty and the environmental situation

4.2.1 Extent of unemployment and poverty

In the province of Yen Bai, by participatory method, the study details seven major characteristics of the poor in An Binh and Lam Giang communes:

1. Small landholdings: Poor households lack good connections to local authorities, hence to information concerning land allocation. As a result they are unable to benefit from forestry land allocation and land certificates. Poor ethnic households may have larger landholdings in upper and on sloping areas with adverse cultivation conditions.
2. Lack of capital: Poor households face food shortages and have no savings. They can only borrow from the Bank of Social Policy, though in An Binh commune they can also borrow from the trust funds of social associations (like the Women's Union or the Peasant Association). The loans received by the poor cannot exceed 5 million dong and entail a complicated lending procedure. Furthermore, poor farmers are fearful of borrowing because they have no chance to invest and consequently repay the loans.
3. Food shortages: Poor households have limited paddy land, and therefore cannot earn enough cash income to purchase food. Furthermore, inadequate infrastructure limits access to markets and raises the cost of access to food.
4. Lack of diversification in agricultural activities and reliance on wage labour: Given their small landholdings, poor households are unable to diversify with higher value

crops and commercialize their cultivation. Furthermore, their lack of capital prevents them from raising livestock.

5. Lack of technical skills: Poor households are often uneducated and rarely attend extension training workshops. Extension workers explained that their expenditure for training workshops is very limited, so they only can invite the more skilled (and often wealthier) farmers to the workshops.
6. Member of an ethnic minority: The Dao people are the primary ethnic minority living in An Binh and Lam Giang communes. They face difficult cultivation conditions on the upper, sloping land. Furthermore, harsh transportation conditions make the terms of trade very unfavourable.
7. Sickness and lack of fit adult labour: Households suffer from sickness and treatment is very costly. In some cases, they have to sell their land to afford treatment. Furthermore, poor health conditions impede their participation in economic activities.

The PRA revealed the following characteristics of poor households in Tran Phu commune:

1. Small landholdings: With limited land supply, the area of land allocated under Decree 10[1] in 1988 was too small. Poor households lack sufficient savings or access to credit to lease in land from the former state tea farm or the military camp. Some poor farmers have to sell garden land in the case of serious illness.
2. Lack of capital: Poor households have very little in terms of assets, and thus do not have valuable collateral they can use to borrow against from the Bank for Agriculture and Rural Development. Poor households can only borrow from the Bank of Social Policy. The amount of such loans is less than 2 million dong over a period of less than one year[2].
3. Lack of agricultural diversification: Given their small landholdings, poor households cannot diversify or commercialize their cultivation. Moreover, their lack of capital and assets prohibits them from raising livestock. Furthermore, without buffalo for ploughing, it is increasingly difficult to achieve good yields from cassava-peanut intercropping.

[1] Decree 10 of the Vietnamese Communist Party issued in 1988, allocated co-operative land to farm households and ended the socialist co-operative system.
[2] The interest rate is 0.5-0.7 per cent per month for loans from the Bank for Social Policy. With loans from money lenders the interest rate may creep up to 5-10 per cent per month.

4. Prone to illness and limited healthy adult labour: Poor households often suffer from illness and treatment is very costly. In some cases farmers have to sell their land to afford treatment. Furthermore, poor health conditions serve as an obstacle to their participation in economic activities.
5. Member of an ethnic minority group: There are a few *Tay* ethnic minorities living in the highlands with poor access to irrigation. In-depth interviews revealed that ethnic groups are often reported to be poorer than the *Kinh* majority.

4.2.2 Extent of environmental problems

Forty-five per cent of cassava cultivated area is on sloping land, particularly in mountainous areas in the North and Central Viet Nam. In addition, the planting density of cassava is relatively low; hence it causes significant dry soil loss. Studies by the National Institute for Soil and Fertilizers show that cassava production generates losses of 40-100 tons of dry soil annually at the experimental sites. Therefore, it is necessary to apply several solutions to prevent land erosion in cassava cultivation such as sufficient ploughing, effective fertilizer application, intercropping and building contour hedgerows with vertices grass or pineapple brush.

Starch processing and pollution issues

Starch processing is a complex multi-tiered industry through which thousands of poor peri-urban households supplement their meagre farm earnings. They supply crude starch to wealthier enterprises that refine it or turn it into finished starch-based products. The industry has also spawned a multitude of support services, such as the manufacture of starch-making equipment, the supply of enzymes needed to break down starch into maltose, as well as transport and fuel supply.

Large amounts of water are used to process starch, producing a runoff that carries a high proportion of suspended solids. CIP (International Potato Center) surveys in three villages found that a single season's processing generates some 1.45 million cubic metres of wastewater containing physio-chemical and microbiological contaminants in addition to nutrients such as nitrogen and phosphorus. However, these processing by-products are not the effluent's only ingredients. Most of the households engaged in processing also raise swine, the source of slurry that is rich in nitrogen but also contains the *Bacterium Escherichia Coli* and a high count of worm eggs, both dangerous to human health. Human excrement and household waste make the mixture even more potent. To exacerbate

matters further, most processing is carried out during the dry season, so the effluent is diluted little with rainwater.

Starch processing factories often substitute lakes in their backyard to inject wastewater. After 4-5 times of filtering, it is expected that this wastewater is less hazardous and it flows into the river. The solid waste is sold to animal feed processing enterprises. This system for waste treatment is much better than micro- and small-scale starch processing units. However, a disadvantage of this system is that it still produces a very acrid odor into the neighbourhood area due to two reasons: (i) the sewage system for waste water is open; (ii) solid waste contains moisture and cannot be transferred completely to animal feed processing units in the processing season. Furthermore, it is unclear whether the waste water is no longer hazardous after filtration.

A number of technological innovations exist to mitigate the environmental issues:

1. Build a closed sewage system for the waste water;
2. Use biotechnology to detoxify wastewater, which can be subsequently utilized for irrigation;
3. Process wastewater further to become fluid fertilizer (like VEDAGRO of Vedan);
4. Establish a plant which can process solid waste into animal feed; and
5. Dry and press solid waste before selling it for animal feed processing.

Constraining the application of new technologies to protect the environment, is the increase in the cost of production for medium- and large-scale enterprises. Furthermore, there are no strict environmental controls by the government for medium- and large-scale starch processing enterprises, particularly if the enterprises are state-owned.

The SIUPA is the CGIAR's system-wide initiative on urban and peri-urban agriculture, conducted in Viet Nam by CIP’s researcher Dai Peter, focuses on wastewater usage. The project's main activity has thus been to look for ways of cleaning the wastewater to use productively. The best potential use appears to be as nutrient-rich irrigation water for dry-season crops. If the nitrogen and other nutrients in the water could replace some or all of the purchased chemical fertilizers and manure that farmers apply to these crops, the cost of production would fall, boosting profitability.

4.3 Profiles of the respondents and their households

An Binh and Lam Giang communes are located in the mountainous area of Van Yen district. Lam Giang is situated in the uplands and is hillier relative to An Binh. Transportation infrastructure is poor in both communes, particularly for Lam Giang, which is located in a mountainous region far from the district centre.

Ethnic minorities account for about 33 and 20 per cent of the total population in Lam Giang and An Binh communes respectively. Their location in the highlands limits access to infrastructure and markets. The poverty rate is high in both communes (65 and 57 per cent in Lam Giang and An Binh commune respectively), particularly among ethnic minorities. An Binh tends to have higher living standards than Lam Giang, given the more favourable conditions for agriculture (flatter land for paddy cultivation) and better access to infrastructure (closer to the district centre). However, irrigation is underdeveloped in both communes and agriculture is mainly rainfed (People's Committee of An Binh commune, 2004; People's Committee of Lam Giang commune, 2004).

The household characteristics from the PRAs conducted with cassava producers in An Binh and Lam Giang communes show that agro-forestry and livestock represent the main economic activities of the people living in the two communes. Farmers cultivate paddy, maize, cassava and vegetables. Paddy and vegetables are grown on flat land, while cassava and maize are more developed in the highlands. Cassava is a major source of cash income for farmers, accounting for 27 and 42 per cent of total income in Lam Giang and An Binh communes respectively. Cassava is often intercropped in forested areas. Wealthier households often have larger cassava landholdings and livestock (often with more than five heads of buffalo) and also participate in aquaculture with large fishponds.

Land is distributed very unequally, with the wealthy holding up to 15 hectares and the smallest just 0.1-0.2 hectares[3]. The poor often work as hired labourers for wealthier households and traders in the communes, and wage labour is paid in cash. There are several cases of land selling by poor households, who suffer from market risk, climatic disaster, sickness and high debts. Furthermore, since paddy land is limited, food insecurity is a problem in both communes and the poor often face food shortages[4].

[3] Interviews with leaders and farmers in An Binh and Lam Giang communes.
[4] Food per capita in both communes is less than the minimum requirement of 300 kilograms per year. Furthermore, inadequate transportation prevents poor farmers from receiving good access to outside sources of food.

Table 4.9 Household characteristics in An Binh commune

Item	Wealthy	Medium	Poor
Housing	▪ Concrete house with flat roof	▪ Concrete house with tiled or wooden roof	▪ Thatched cottage
Physical Assets	▪ Access to electricity ▪ Colour TV ▪ Refrigerator ▪ Japanese or joint-venture motorbike	▪ Access to electricity, TV, Chinese motorbike	▪ No valuable assets
Occupation	▪ Agriculture and forestry ▪ Trading	▪ Agriculture and forestry	▪ Agriculture and forestry ▪ Wage labour
Access to Credit	▪ Able to borrow more than 10 million dong or possibly up to 100 million dong from the banks, thanks to high assets for collateral	▪ Able to borrow 5-10 million dong from the banks	▪ Only able to borrow less than 5 million dong from the Bank for Social Policy through trust funds (like the Commune's Women Union)
Access to extension and new technology	▪ Regular attendance in extension training workshops	▪ Regular attendance in extension training workshops	▪ Rarely attend extension training workshops
Access to Markets	▪ Live near the commune's centre	▪ Scattered within the commune	▪ Live far from the commune's centre
Ethnicity	▪ Mostly the *Kinh* majority and a few capable people of *Dao* ethnic minority	▪ *Kinh* and *Dao*	▪ Mostly ethnic *Dao* and a few *Kinh* people suffering from sickness and market risk and disaster

Source: PRA result with 11 HYV cassava producers in An Binh commune, Van Yen district, Yen Bai province.

Table 4.10 Characteristics of ethnic households in Hamlet 5, An Binh commune

Item	Wealthy	Medium	Poor
Housing	▪ House with high quality wood	▪ House with normal wood	▪ Thatched cottage
Physical Assets	▪ Colour TV, good motorbike valued at more than 10 million dong	▪ Black-white TV, *Minxk* motorbike valued at less than 10 million dong	▪ No valuable assets
Occupation	▪ Agriculture and forestry ▪ Milling service ▪ Trading ▪ Livestock (4-6 buffaloes or cows)	▪ Agriculture and forestry ▪ Livestock (1-2 buffaloes or cows)	▪ Agriculture and forestry ▪ Firewood fetching, bamboo picking in the forest
Access to Credit	▪ Maximum amount of bank loan: 10 million dong	▪ Maximum amount of bank loan: 5 million dong	▪ Afraid to borrow due to threat of default
Access to extension and new technology	▪ Attendance at extension training workshops	▪ Attendance at extension training workshops	▪ Attendance at extension training workshops

Source: PRA result with 14 Dao ethnics in Hamlet 5, An Binh commune, Van Yen district, Yen Bai province.

Table 4.11 Household characteristics in Lam Giang commune, Van Yen, Yen Bai

Item	Wealthy	Medium	Poor
Housing	▪ Concrete house with flat roof	▪ Concrete house with tiled or wooden roof	▪ Thatched cottage
Physical Assets	▪ Access to electricity, colour TV, refrigerator, transportation means	▪ Access to electricity, TV	▪ No valuable assets
Occupation	▪ Agro-forestry and more diversification ▪ Trading	▪ Agriculture and forestry	▪ Agriculture and forestry ▪ Wage labour
Access to Credit	▪ Bank loans	▪ Loans from co-operative credit	▪ Highly indebted ▪ Loans from money lenders
Access to extension and new technology	▪ Regular attendance at extension training workshops	▪ Regular attendance at extension training workshops	▪ Rarely attend extension training workshops
Access to Markets	▪ Live near the commune's centre	▪ Scattered within the commune	▪ Live far away from the commune's centre
Ethnicity	▪ Mostly the *Kinh* majority and few capable people of *Dao* ethnic minority	▪ *Kinh* and *Dao*	▪ Mostly ethnic *Dao* and a few *Kinh* people suffering from sickness and risk

Source: PRA result with 10 HYV cassava producers in Lam Giang commune, Van Yen district, Yen Bai province.

Table 4.12 Household characteristics of Tran Phu commune

Item	Wealthy	Medium	Poor
Housing	▪ Concrete multi-storey house	▪ House with tiled roof	▪ Small brick house with tiled roof
Physical Assets	▪ Big, flat-screen TV, joint-venture motorbike	▪ Second-hand colour TV, Chinese or second-hand motorbike	▪ Black-white TV and bicycle
Occupation	▪ Cultivation ▪ Medium-scale livestock: ▪ Swine: 50 heads ▪ Buffalo and cows: 3-4 ▪ Fish: large fishpond (rented)	▪ Cultivation ▪ Medium-scale livestock: ▪ Swine: 10 heads ▪ Buffalo and cows: 1-2 ▪ Fish: small fishpond on their own land	▪ Cultivation ▪ Micro-scale livestock ▪ No fishpond
Access to Credit	▪ Bank loans of 10-15 million dong	▪ Bank loans of less than 10 million dong	▪ Bank loans of less than 2 million dong
Ethnicity	▪ *Kinh* majority	▪ *Kinh* majority	▪ *Kinh* majority and many *Tay* ethnic minority

Source: PRA result with 18 cassava-peanut intercrop producers in Tran Phu commune, Chuong My district, Ha Tay.

Tran Phu commune (Chuong My district, Ha Tay province) is located in a mixed area of hills and plains. However, land per capita is very limited and irrigation systems are insufficient to supply water to the hilly areas. The commune has good access to the main road. The agricultural co-operative of the commune has been transformed from the old model of a socialist production co-operative to one that provides agricultural services to farmers such as irrigation, electricity, plant protection, as well as veterinary and extension services.

Compared to An Binh and Lam Giang communes, farmers have better living standards in Tran Phu commune; consequently, its poverty rate is lower at 38 per cent, compared to 57 and 65 per cent in An Binh and Lam Giang communes respectively. Land is distributed more equally with about 0.2 hectares of land per household and the sale of land is quite rare because most land certificates are still held by the co-operative. However, wealthier households may lease land from the former Tran Phu state tea farm and the military camp next to the commune.

There has not been any strong development of non-farm activities in the commune and young people often try to migrate to the cities to earn a better living. Most income still stems from agricultural activities. Hybrid paddy has been extensively adopted in the commune and has ensured food security for even poor farmers. Agricultural cultivation is

well diversified with other cash crops such as sweet potato, peanut, cassava and vegetables. Wealthier households often have large stocks of livestock, including buffalo, swine and poultry, as well as also being engaged in aquaculture. Poor households mostly participate in agricultural cultivation with small pieces of land and limited numbers of livestock.

Cat Que commune (Hoai Duc district, Ha Tay province) is located in the delta area of Ha Tay province, adjoining Duong Lieu commune, which represents the largest cassava and starch market centre in North Viet Nam. Located near Hanoi, land per capita is very limited and livestock and off-farm activities constitute the major sources of income and employment for farmers. The starch industry has evolved gradually since the economic reform at the end of the 1980s. Yet, compared to Duong Lieu commune, the starch industry has developed at a slower pace and the most important source of income stems from hybrid swine husbandry. Most people are from the *Kinh* majority and well educated. Compared to Tran Phu commune, people living in Cat Que have better living standards and the poverty rate is lower[5].

Table 4.13 Household characteristics of Cat Que commune

Item	Wealthy	Medium	Poor
Housing	▪ Concrete house with flat roof	▪ Concrete house with tiled roof	▪ Small concrete house with tiled roof
Assets	▪ Electricity, colour TV, refrigerator, Japanese motorbike	▪ Electricity, colour TV, some people own a motorbike	▪ Black-white TV and bicycle
Occupation	▪ Trading ▪ Large-scale livestock (300-500 swine) ▪ Small-scale dry starch processing ▪ Maltose and cake production	▪ Micro-scale dry starch processing ▪ Medium- and small-scale livestock (100-200 swine)	▪ Agriculture ▪ Hiring out labour ▪ Wet starch processing using manual techniques or renting machinery ▪ Micro-scale livestock (5-7 swine)
Accumulation and Credit	▪ Large-size loans due to collateral	▪ Medium-size loans	▪ Limited borrowing from banks ▪ Loans mostly from relatives and friends

Source: PRA result with eight wet starch processors in Cat Que commune, Hoai Duc district, Ha Tay province.

[5] The living standards survey in 1998-1999 showed that the poverty rate is higher in Cat Que commune. However, updated data shows that the poverty rate in Cat Que commune (1.7 per cent, according to the poverty line – 150,000 dong per person per month - defined by Viet Nam's Ministry of Labour, Invalid and Social Affairs) is less than half of that in Tran Phu commune (more than 4 per cent).

With limited land size, farmers mostly participate in livestock and non-farm activities. Wealthier households are often involved in trading activities, large-scale animal husbandry as well as maltose and cake production. For medium-income households, micro-scale dry starch processing and small-scale animal husbandry are the main sources of income. Poor households rent land from non-poor households for cultivation. In addition, they engage in wage labour and produce wet starch on a micro-scale. A major constraint of the poor is their lack of capital, as they do not have collateral for bank loans. Hence most of their loans, though very limited, stem from relatives and friends. Furthermore, poor households are prone to illness and limited healthy adult labour.

5. Analysis of Cassava Farming Systems

There is no information on how much employment is created in the cassava value chain. The cassava value chain in Viet Nam is very complex with numerous outputs and no direct statistical estimates on the number of workers in cassava-related activities. Cassava and starch production have created numerous permanent and seasonal opportunities for unskilled wage labourers – especially men – in cassava production, processing and trading of cassava products.

5.1 Farm size and patterns of cultivation

Table 5.1 Farm size in different study communes

Commune	Wealthy	Medium	Poor
An Binh, Van Yen, Yen Bai	▪ Large area of cassava land (4-5 hectares) ▪ Plenty of vegetable crops ▪ Large fishponds	▪ 1-2 hectares of cassava land ▪ Low production of vegetables ▪ Less than 0.1 hectares of fishponds	▪ Small area of cassava land (0.1-0.2 hectares), often located in the high and slopping areas. ▪ No vegetable crops ▪ No fishpond
Lam Giang, Van Yen, Yen Bai	▪ 4-5 hectares of cassava land	▪ 1-2 hectares of cassava land ▪ Small production of vegetables ▪ Less than 0.1 hectares of fishponds	▪ Small size of cassava land (0.1-0.2 hectares), often located in the high and slopping areas. ▪ No vegetable crops ▪ No fishpond
Tran Phu, Chuong My, Ha Tay	▪ Large area of cultivatable land, with leased land	▪ Medium area of cultivatable land with leased land	▪ Small size of cultivation land without hire-in land ▪ Some households sell land for vegetable cultivation
Cat Que, Hoai Duc, Ha Tay (starch processing)	▪ Small area of cultivatable land for rice, and often lease out land	▪ Small area of cultivatable land, and often lease out land	▪ Small area of cultivatable land, and lease in land

Source: PRA by team study, 2004.

5.2 Labour use and skills

Table 5.2 Labour use and skills in different study communes

Commune	Wealthy	Medium	Poor
An Binh	▪ Availability of healthy adult labour ▪ Adapt quickly to new knowledge	▪ Availability of healthy adult labour ▪ Adaptable to new knowledge	▪ Many children ▪ Sickness and shortage of healthy adult labour ▪ Slow adaptation to new knowledge
Lam Giang	▪ Availability of healthy adult labour ▪ Adapt quickly to new knowledge	▪ Availability of labour ▪ No willingness to expand production	▪ Sickness and shortage of healthy adult labour ▪ Laziness ▪ No business skills
Tran Phu	▪ Availability of healthy adult labour ▪ Hard working ▪ Good business relationships	▪ Sufficient amount of labour ▪	▪ Many children ▪ Sickness and shortage of healthy adult labour ▪ Laziness
Cat Que	▪ Availability of healthy adult labour ▪ Good business skills ▪ Graduated from junior high school or university	▪ Sufficient amount of labour ▪ Graduated from junior high school	▪ Many children ▪ Sickness and shortage of healthy adult labour ▪ Low level of education

Source: PRA by team study, 2004.

Nationwide, there are 24 large dry starch factories in operation that use, on average, 100 permanent workers and 50 seasonal workers (estimated from a survey of five large factories by team research). Besides, there are over 2,000 small and medium sized enterprises for wet and dry starch production in the Red River Delta and the Southeast that employ from 1 to 25 hired labourers (Team Research Survey, 2004).

Table 5.3 Labour employment by household processor type

Household type	Mean	Max	Min	SD
Unregistered HH	1.11	10	0	2.78
Registered HH	5.75	10	3	2.99
Private enterprise	24.5	90	0	43.71

Source: Team Research Survey, 2004.

Table 5.4 Average workers employed by starch processors by region

Region	Number of workers
NMM	12.00
RRD	3.63
NCC	3.59
SCC	3.24
CH	15.73
NES	9.24
Viet Nam	6.01

Source: IFPRI survey, 1998.

Workers employed in starch processing facilities are mainly seasonal and male due to the seasonality of cassava production and the heavy lifting in loading that is generally more geared towards male labourers. In starch processing households, women are only employed for culinary work.

Table 5.5 Employment by type of labourer

Household type	Seasonal female labourers	Seasonal male labourers	Permanent female labourers	Permanent male labourers
Unregisted HH	0	1.1	0	0
Registed HH	0	5.75	1	0
Private enterprises	2	22.5	0	0

Source: Team Research Survey, 2004.

The wage rate for workers depends on the wage rate between regions. In the North and the South Central Coast, the wage rate for one man-day is around 20,000 dong while in the Southeast, the wage rate ranges from 30,000 dong to 70,000 dong per man-day depending on the volume of work. Wage rates are often higher in registered and private enterprises than in unregistered households. Often, men receive higher wages given the nature of the work. However, the wage rate between men and women in modern dry starch factories is similar.

5.3 Farm productivity

5.3.1 Cassava root production costs

Production costs per 1 kilogram of cassava roots in the North are presented in the following tables. In the case of traditional varieties, total purchased input costs in Yen Bai are only 60.9 dong per kilogram, much lower than those in Ha Tay province. In both cases, fertilizers account for largest share of cost. Labour is an important cost in Yen Bai, while other costs are notable in Ha Tay.

Table 5.6 Production costs of traditional varieties (purchased inputs)

(dong/kg of cassava root)

Item	Yen Bai		Ha Tay	
	Total cost (dong/kg)	Share (%)	Total cost (dong/kg)	Share (%)
Variety	0.0	0	8.3	4
Chemical fertilizers	44.7	73.2	81.1	37
Organic fertilizers	0.3	0.5	47.3	22
Pesticides	0.0	0	5.2	2
Water fee	0.0	0	6.2	3
Machine rental	0.0	0	2.5	1
Labour	16.0	26.3	8.7	4
Others	0.0	0	58.3	27
Total	60.9	100	217.5	100

Source: Team Research Survey, 2004.

If we consider the calculation of economic cost, which includes valuing family labour and manure fertilizers at market prices, we observe that labour costs represent a much larger share of total cost for both provinces, accounting for 70.4 per cent and 55.7 per cent in Yen Bai and Ha Tay respectively. When considering economic costs, traditional varieties of cassava in both provinces are inefficient, as the economic cost is much higher than the price of the cassava roots.

Table 5.7 Production costs of traditional varieties (economic cost)

(dong/kg of cassava root)

Item	Yen Bai		Ha Tay	
	Total cost (dong/kg)	Share (%)	Total cost (dong/kg)	Share (%)
Variety	0.0	0.0	8.3	1.8
Chemical fertilizers	44.7	16.0	81.1	17.2
Organic fertilizers	38.3	13.6	47.3	10.0
Pesticides	0.0	0.0	5.2	1.1
Water fee	0.0	0.0	6.2	1.3
Machine rental	0.0	0.0	2.5	0.5
Labour	197	70.4	263	55.7
Others	0.0	0.0	58.3	12.4
Total	279.7	100.0	471.9	100.0
Selling price	270		350	

Source: Team Research Survey, 2004.

In the case of HYV cassava production, the costs of purchased inputs are higher than traditional varieties in both provinces, reflecting the higher level of investment (chiefly fertilizer and seed purchases) for HYV compared to traditional varieties. However, the share of fertilizer cost relative to total cost is lower in Yen Bai for HYV compared to traditional varieties, given that more outlay is required for seeds and labour. In Ha Tay, the share of fertilizer as a proportion of total cost is higher for HYVs than traditional varieties. Also, in the case of HYV, producers in Ha Tay tend to rent more machinery rather than hiring labour, reflecting a substitution of capital for labour.

Table 5.8 Production costs of HYVs (purchased inputs) (dong/kg of cassava root)

Item	Yen Bai		Ha Tay	
	Total cost (dong/kg)	Share (%)	Total cost (dong/kg)	Share (%)
Variety	6.7	8.0	12.3	5.3
Chemical fertilizers	42.1	50.2	117.5	50.6
Organic fertilizers	12.1	14.4	60.4	26.0
Pesticides	0.0	0.0	7.8	3.4
Water fee	0.0	0.0	0.7	0.3
Machine rental	0.0	0.0	10.9	4.7
Labour	19.5	23.2	11.6	5.0
Others	3.6	4.3	11.2	4.8
Total	83.9	100.00	232.4	100.0
Selling price	370		400	

Source: Team Research Survey, 2004.

With respect to the economic cost of HYVs, we find that profit is generated when adopting HYVs in Yen Bai province, as higher prices (100 dong per kilogram more for HYVs) offset the higher costs of production. In contrast in Ha Tay province, profits from cassava production are still negative in terms of economic costs. However, farmers in Ha Tay province still grow cassava because: (i) in Tran Phu commune, there are few alternatives other than cassava for the sloping land area (about 20 per cent of total allocated land area); and (ii) it is difficult to find off-farm employment (In-depth interviews with farmers in Tran Phu commune).

Table 5.9 Production costs of HYVs (economic cost) (dong/kg of cassava root)

Item	Yen Bai		Ha Tay	
	Total cost (dong/kg)	Share (%)	Total cost (dong/kg)	Share (%)
Variety	36.7	10.9	36.7	7.2
Chemical fertilizers	42.1	12.4	117.5	23.1
Organic fertilizers	58.8	17.4	60.4	11.9
Pesticides	0.0	0.0	7.8	1.5
Water fee	0.0	0.0	0.7	0.1
Machine rental	0.0	0.0	10.9	2.1
Labour	197	58.2	263	51.8
Others	3.6	1.1	11.2	2.2
Total	338.2	100.0	508.2	100.0
Selling price	370		400	

Source: Team Research Survey, 2004.

PRA analysis was used to assess the determinants of HYV adoption as a means to understand its benefits to producers in the cassava value chain. HYV cassava is expected to generate higher income for cassava producers, as it results in higher yielding cassava and higher starch content. However, HYV cassava production requires a number of conditions for successful use. Capital is the most important issue for HYV adoption since HYVs, like KM94, require more expense for new cultivars and fertilizer. In both communes, it is worth noting that poor farmers place more weight on capital than the non-poor. Moreover, capital is extremely important to the poor in Lam Giang, while for the non-poor in Lam Giang, a mix of issues are equally important, including land quality, transportation, proximity to sales outlets and technical training.

Table 5.10 Determinants of HYV cassava production, An Binh commune

Determinant	Poor	Non-Poor	Total
Capital to purchase breeding cultivars and fertilizer	26.8	18.7	22.4
Livestock providing manure	13.2	13.0	13.1
Transportation	14.8	11.3	12.9
Kinh majority	12.4	10.7	11.5
Labour availability	11.2	11.7	11.5
High output price	9.2	11.7	10.5
Attending technical training	6.8	9.3	8.2
Proximity to the outlet	5.6	7.7	6.7
Having drying oven	0.0	5.3	2.9
Plenty of cassava land	0.0	0.7	0.4
Rich fertile land	0.0	0.0	0.0
Total	100.0	100.0	100.0

Source: Result of PRA weighting exercise with 11 HYV cassava producers in An Binh commune, Van Yen district, Yen Bai province.

Table 5.11 Determinants of HYV cassava production, Lam Giang commune

Determinant	Poor	Non-Poor	Total
Capital to purchase cultivars and fertilizer	60.0	11.6	35.8
Less sloping land	7.6	19.6	13.6
Rich fertile land	10.4	14.8	12.6
Proximity to the outlet	8.4	10.4	9.4
Transportation	4.0	14.0	9.0
Labour availability	6.8	10.8	8.8
Attending technical training	2.0	11.6	6.8
Having drying oven	0.8	7.2	4.0
Total	100.0	100.0	100.0

Source: Result of PRA weighting exercise with 10 HYY cassava producers in Lam Giang commune, Van Yen district, Yen Bai province.

There are three main reasons for the importance of capital in HYV adoption. First, new varieties require higher expenses for new cultivars, particularly when newly introduced to the region (500 dong per cultivar, 5 million dong per hectare). Those that first adopt new cultivars – often wealthier farmers - have good access to local authorities and the extension services system. After the first crop, these innovators can sell cultivars to other households in the village. Second, HYVs require fertilizer for superior yields. In-depth interviews show that non-poor farmers often apply more fertilizer than the poor do. An alternative to fertilizer for poor farmers in An Binh commune is to use manure but it requires large livestock that the poor often do not own. Third, capital is much more important for the poor in Lam Giang commune relative to An Binh commune because Lam Giang is far from the market centre, and the resultant high transportation costs raise prices of both new cultivars and fertilizer.

In Lam Giang, land quality is a significant determinant of HYVs, while unimportant in An Binh. HYVs require higher quality land on lower slopes with more fertile soil, which, given the upland nature of Lam Giang, means that farmers appreciate the role of land quality as an important determinant for HYV adoption. This is especially true of non-poor farmers who

tend to apply more fertilizer since the steep slopes of the cultivatable area may limit the effectiveness of fertilizer application. Furthermore, high sloping land places a burden on farmers from carrying heavy manure up to cassava land or from bringing fresh roots back down after the harvest[1]. As a result, farmers in Lam Giang commune often use nets for on-farm drying of fresh cassava roots.

The bulkiness of fresh cassava roots ensures that transportation is an important determinant of HYV adoption, though less so in Lam Giang than in An Binh. For commercial purposes, farmers often use a buffalo cart to transport fresh cassava roots to sales outlets. For households without buffalo carts, transportation costs are high relative to the value of the roots. Therefore, farmers with small amounts of cassava output often sell cassava on-farm to assemblers who have means of transportation and large cassava landholdings. Transportation is less important to the poor than the non-poor in Lam Giang, possibly due to the limited commercialization of cassava by the poor. In addition, the bulkiness of the roots also explains why proximity to the sales outlets is an important determinant of HYV adoption in both An Binh and Lam Giang communes.

HYV cassava production necessitates more labour since the new varieties require deeper holes for sowing. The attainment of high yields and output from HYV cassava requires hard work at harvest and farmers have to hire labour or exchange labour for harvested cassava. As a result, it is often difficult for the poor to participate in HYV adoption because they often lack healthy adult family labour and they have limited community linkages to participate in labour exchange. Finally, the non-poor tend to attribute more importance to technical training than the poor do. Wealthier households with large landholdings are often invited to attend extension training workshops. They become the first innovators and learn correct practices from training. In contrast, technical training is not particularly important for the poor because they are not invited to attend the training workshops[2].

In short, the poor can introduce HYV cassava though they are often not the first. However, the poor cannot not fully realize the advantages of HYV cassava (higher yield, higher starch content and better market access to starch processing enterprises that require high quality cassava roots[3] due to: (i) limited capital; (ii) greater prevalence of sloping land;

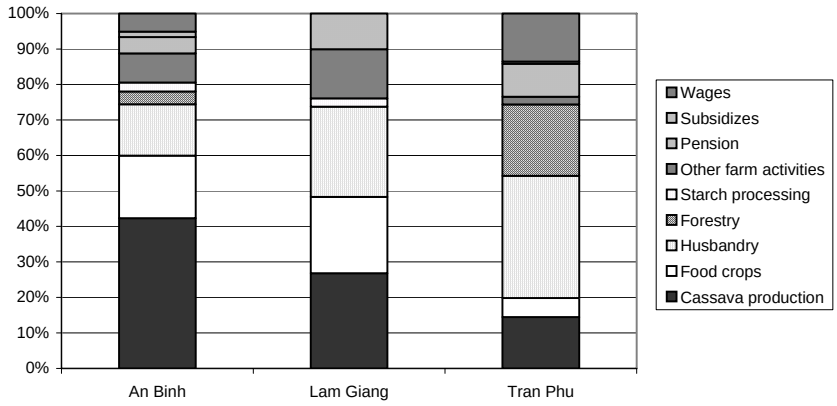
[1] For fresh root harvesting, farmers often tie the roots into bundles and roll them down to the base. This practice breaks the roots and reduces the price.
[2] The poor are reported to have bad farming practices more often than the non-poor. The most popular bad practice is high planting density of cassava cultivars.
[3] This point will be explained later in the sub-section on contract farming.

(iii) without access to power and technology, sub-optimal cassava cultivation reduces yield, negatively affecting the income of the poor and, furthermore, small landholdings do not provide incentives to devote labour to achieve higher yields; and (iv) limited access to family or hired labour.

5.4 Cost-revenue structure and farm profitability

Cassava production contributes up to 42 per cent of household income in An Binh commune where the ratio of HYV adoption is 83 per cent. The contribution of cassava production to household income is lowest in Tran Phu commune where most income originates from husbandry and off-farm activities (Team Research Survey).

Figure 5.1 Share of income from cassava production



Source: Team Research Survey, 2004.

The most important constraint to cassava production in Yen Bai and Ha Tay is the poor transportation infrastructure. Due to inadequate transportation conditions, farmers must sell produce through intermediaries. Thus, the price they receive is much lower than that if they sold directly to processors. Also, farmers still lack credit due to difficulties in borrowing sufficient money from the Agriculture and Rural Development Bank.

5.5 The role of diversified farming systems in risk mitigation

5.5.1 Cassava-peanut intercropping

For the cassava producer, intercropping is a major way to diversify the farming system and mitigate risk. It is suggested that HYV cassava production accelerates land

erosion that not only reduces the yields of successive crops, but also has negative long-term environmental impacts. Cassava-peanut intercropping is one solution that not only boosts farmers' income but also enriches soil fertility.

Table 5.12 shows the results of the PRA weighting exercise with farmers on the effects of cassava-peanut intercropping in Tran Phu commune, Chuong My district, Ha Tay province. The major positive impact of cassava-peanut intercropping is the additional peanut output with a much higher value than cassava monoculture[4]. In addition, better soil fertility is another major positive impact of cassava-peanut intercropping. The major negative impact is that cassava-peanut intercropping requires more labour for ploughing and tending to the crops.

Table 5.12 Effects of cassava-peanut intercropping, Tran Phu commune

Positive effects	Poor	Non-poor	Total
Peanut output	36.4	34.7	35.6
Increased soil fertility	28.7	31.8	30.2
Higher cassava yield	11.8	6.4	9.1
Total positive effects	76.9	72.9	74.9
Negative effects	**Poor**	**Non-Poor**	**Total**
Greater labour requirement	13.3	19.1	16.2
Thicker shell and lighter bean of peanut	9.8	8.0	8.9
Total positive effects	23.1	27.1	25.1
Overall balance	+53.8	+45.8	+49.8

Source: Result of PRA weighting exercise with 18 cassava-peanut producers (nine poor and nine non-poor) in Duong Le hamlet, Tran Phu commune, Chuong My district, Ha Tay province (2004).

It is worth noting that poor farmers receive more net positive impacts from cassava-peanut intercropping than the non-poor do. There are two reasons for this. First, poor farmers weigh 'greater labour requirement' as a less important negative impact than the non-poor do because poor farmers have limited land and surplus labour. As a result, cassava-peanut intercropping, in fact, provides poor farmers with more employment opportunities. Second, on poor soil, cassava-peanut intercropping has more marginal effects on improving cassava yield thanks to the use of post-harvest peanut residues to enrich the soil. As a result, the marginal effects of higher cassava yields are more significant for poor farmers who often cultivate on poor soils.

The major determinants of participation in cassava-peanut intercropping are as follows: (i) access to drought-tolerant peanut seeds; (ii) access to water for peanut seeds during the sowing process; (iii) access to insecticides to kill termites; and (iv) technical skill. For poor farmers, these conditions are relatively more important because: (i) they have a

[4] It was reported that the peanut price is 6,000 dong per kilogram, while it is only 400 dong for fresh cassava roots in Tran Phu commune.

smaller farm size, often on dry land, therefore access to seeds and insecticides is relatively more important; and (ii) their technical skills are lower than the non-poor farmers. By contrast, non-poor farmers with larger farm sizes pay more attention to other conditions for commercial purposes such as soil fertility, labour availability, farm size and ploughing power.

Table 5.13 Determinants of cassava-peanut intercropping, Tran Phu commune

Determinant	Poor	Non-Poor	Total
Having drought-tolerant peanut seeds	28.9	16.4	22.7
Close to water sources	22.2	17.1	19.7
Having pesticides for termites	16.2	17.3	16.8
Attending technical training	15.8	13.1	14.4
More fertile land	7.1	11.1	9.1
Labour availability	5.1	8.7	6.9
Having buffalo for ploughing	2.4	8.9	5.7
Plenty of land	2.2	7.3	4.8
Total	100.0	100.0	100.0

Source: Result of PRA weighting exercise with 18 cassava-peanut producers in Duong Le hamlet, Tran Phu commune, Chuong My district, Ha Tay province.

In short, cassava-peanut intercropping is a potential solution to improve the well-being of poor farmers, as well reducing the negative environmental impacts of HYV cassava production. Yet, to fully utilize the advantages of this farming practice, poor farmers require access to water sources and access to drought-tolerant peanut seeds as well as technical training.

5.6 Impacts on employment, income and the environment

The effects of HYV adoption on cassava producers were revealed in the PRA exercise. In both cases, the net effects of HYV adoption are positive and large, with the exception of the poor in An Binh. The major positive effects include high yields, high selling prices and high starch content. The major negative effects are accelerated land erosion, higher expenses for fertilizers, greater vulnerability to pests and insects, toxicity (HYVs are less suitable for human consumption and animal feed) and higher labour requirement. Nonetheless, the positive impacts significantly outweigh the negative ones. Overall, farmers in Lam Giang commune gave higher net impacts to HYV adoption than those in An Binh. These differences are attributable to: (i) differing net impacts on poor groups between the two communes; and (ii) different net impacts between the poor and non-poor in each commune.

In Lam Giang, the poor have a higher net impact from HYV adoption than those in An Binh as the positive effects from yield, starch content and prices in Lam Giang are much

higher than in An Binh and there are fewer negative effects of HYV adoption in Lam Giang commune. On the positive side, Lam Giang farmers with more land record high positive impacts from high yield, high sales output and high starch content. On the negative side, An Binh farmers suffer more from pests and disease as cassava is grown on lower land. Furthermore, An Binh farmers do not acquire the skills to use HYV cassava for animal feed, and poor farmers with a small cassava output often sell fresh cassava roots immediately after harvesting due to cash shortages.

Table 5.14 Effects of HYV cassava production, An Binh commune

Positive effects	Poor	Non-poor	Total
High yielding	16.0	17.3	16.7
High output price	8.8	12.3	10.7
High starch component	10.4	9.7	10.0
Fast drying	8.4	10.0	9.3
Co-operation for the village road construction	3.2	10.7	7.3
Employment generation	2.8	5.0	4.0
Purchases of more buffalo carts	0.0	6.3	3.5
Promoting labour exchange	0.0	4.0	2.2
Total positive effects	**49.6**	**75.3**	**63.6**
Negative effects	Poor	Non-poor	Total
More vulnerable to pests and insects	11.6	3.3	7.1
Degradation of soil fertility	9.2	3.7	6.2
More expenses for fertilizers	8.0	4.7	6.2
Narrow outlet	8.8	4.0	6.2
High toxicity content, not suitable for animal feed	6.4	2.0	4.0
High transportation cost	4.8	2.7	3.6
Requires more labour	1.6	4.3	3.1
Total negative effects	**50.4**	**24.7**	**36.4**
Overall balance	**-0.8**	**+50.7**	**+27.3**

Source: Result of PRA weighting exercise with 11 HYV cassava producers in An Binh commune, Van Yen district, Yen Bai province.

Table 5.15 Effects of HYV cassava production, Lam Giang commune

Positive effects	Poor	Non-poor	Total
High yielding	24.8	19.6	22.2
High output price	23.6	18.0	20.8
High starch content and fasting	12.4	16.4	14.4
Short growth cycle	11.2	10.4	10.8
Total positive effects	**72.0**	**64.4**	**68.2**
Negative effects	Poor	Non-poor	Total
Accelerated land erosion and degradation of soil fertility	7.6	14.8	11.2
High consumption of fertilizer	8.8	8.4	8.6
Labour intensive	7.6	7.6	7.6
Many branches, low planting density and waste of land	4.0	4.8	4.4
Total negative effects	**28.0**	**35.6**	**31.8**
Overall balance	**44.0**	**28.8**	**36.4**

Source: Result of PRA weighting exercise with 10 HYY cassava producers in Lam Giang commune, Van Yen district, Yen Bai province.

In An Binh commune, the overall balance is highly positive for the non-poor, but slightly negative for the poor. This difference is mainly due to four factors. Pests and insects affect the poor more than the non-poor, since the poor are less able to purchase pesticides and herbicides. Second, land erosion is more serious for the poor because they often cultivate on more undulating land. It is reported that only farmers with larger landholdings are willing to build up contour hedgerows to avoid land erosion. Third, though not highly significant, the social impact of more solidarity and co-operation in the village for road construction has had a more positive impact on the non-poor as they have become more commercialized. Finally, higher incomes from HYV adoption create more incentives for the non-poor to purchase new buffalo carts for transportation.

By contrast, both poor and non-poor groups record net positive impacts from HYV adoption. Interestingly, it is higher for the poor in Lam Giang commune. In Lam Giang commune, even the poor farmers have better access to cassava land and with a certain amount of land availability the poor may clearly see the positive impacts of high yields and high sales prices from HYV adoption. This marginal impact is more important for them compared to the non-poor. Furthermore, since both poor and non-poor farmers grow cassava on sloping land, it may be that the non-poor are more conscious of the negative impacts of land erosion since they have larger landholdings and understand the long-term environmental effects of land erosion.

5.7 Potentials and constraints to farming operations

In short, the above analysis reveals three major tentative conclusions on the determinants and impacts of HYV adoption on the well-being of cassava producers in general, and on the poor farmers in particular, in the North:

1. It is not too difficult for farmers to adopt HYV cassava. Capital is the major constraint for HYV cassava adoption as new cultivars and possibly additional fertilizers are required. Yet, it is not prohibitively costly to purchase new cultivars, which are, in part, subsidized by the district authorities. Land size is the major factor deciding farmers' incentives to adopt HYV cassava because transportation costs are relatively high and the cassava output is too small.
2. Farmers from the upper and more sloping land like Lam Giang commune are unwilling to apply fertilizers and manure due to high input prices and harsh transportation conditions. As a result, they face more negative environmental impacts from soil degradation.

3. HYV cassava creates net positive impacts for cassava producers by allowing higher yields, selling prices and starch content. The major negative impacts of HYV adoption are land erosion, additional expense for fertilizer and pesticides, toxicity and higher labour requirements.

5.8 Concluding summary

The poor can participate in HYV cassava adoption but they cannot fully utilize the advantages of the new varieties due to: (i) small landholdings with unfavourable conditions for cultivation; (ii) lack of capital to purchase fertilizers and pesticides; (iii) lack of access to technical training and bad practices for cassava cultivation on the sloping land; (iv) lack of labour to tend and harvest cassava more productively.

6. Analysis of the Marketing System for Cassava Products

6.1 Forms of products traded and the distribution channel

There are two kinds of outputs from cassava that are sold by producers: (i) fresh cassava roots; and (ii) dry cassava chips. Cassava is relatively bulky, therefore some households living far from a main road in An Binh, Lam Giang and Tran Phu communes process dry chips because the chips keep longer and higher prices are received by waiting until market conditions are more favourable. However, producing dry chips is labour intensive and therefore farmers residing near a main road prefer to sell the fresh roots.

Table 6.1 Traditional variety cassava production and utilization (tons)

Commune	Production	Human consumption	Animal feed	Fresh roots	Dry chips	Other
An Binh	3.69	0.07	0.76	0.85	2.02	0.00
Lam Giang	12.08	0.17	2.75	6.17	3.00	0.00
Tran Phu	4.58	0.00	1.19	0.00	3.39	0.00

Source: Team Research Survey, 2004.

Table 6.2 HYV cassava production and utilization (tons)

Commune	Production	Human consumption	Animal feed	Fresh roots	Dry chips	Other
An Binh	13.4	0.0	0.5	10.8	2.2	0.00
Lam Giang	12.1	0.0	0.6	10.8	0.7	0.00
Tran Phu	0.5	0.0	0.2	0.0	0.3	0.00

Source: Team Research Survey, 2004.

The cassava value chain in the North is complex because of the various types of outputs from cassava and also the proximity to sound infrastructure in cassava production, processing and consumption, particularly in Ha Tay. Thus, there are many stakeholders involved in the chain.

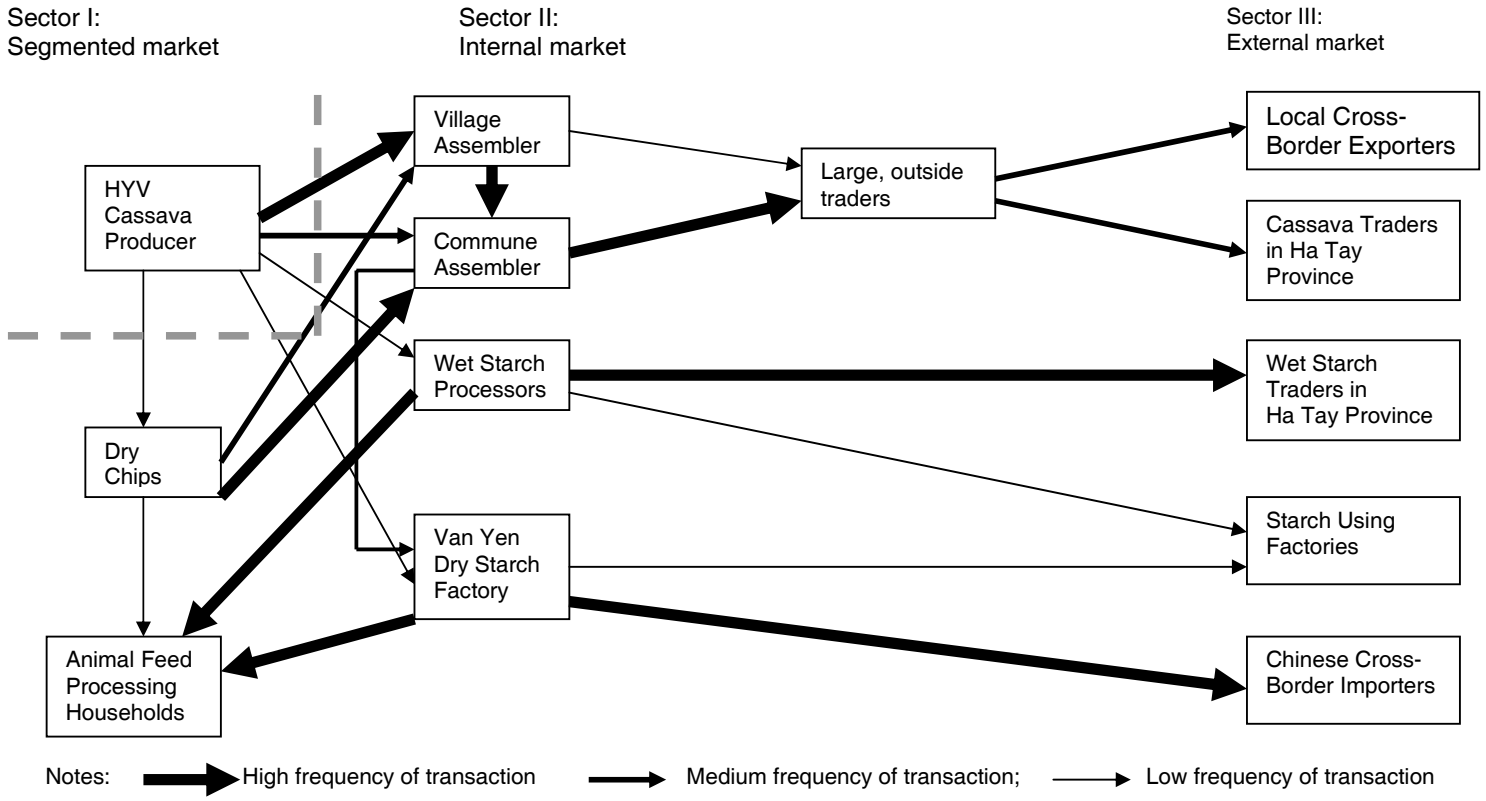
From Figure 6.1 it is clear that there are three market segments for stakeholders participating in Yen Bai's starch and cassava markets:

- Sector III - External Market (Main actors: exporters, traders in other provinces, starch-using factories outside of Yen Bai): In this sector of the value chain, close links to the Chinese and other competitive markets in Viet Nam are prevalent.

- Sector II - Internal Market (Main actors: assemblers, traders, wet starch processors, animal feed processing, Van Yen Starch Factory): Outside traders play a dominant role in setting the prices paid for cassava producers.
- Chinese importers largely influence the price paid for dry chips. However, not all farmers are willing to produce dry chips because production is dependent on prevailing weather conditions and is labour intensive.
- Sector I -Segmented primary sector (Main actor: producers).

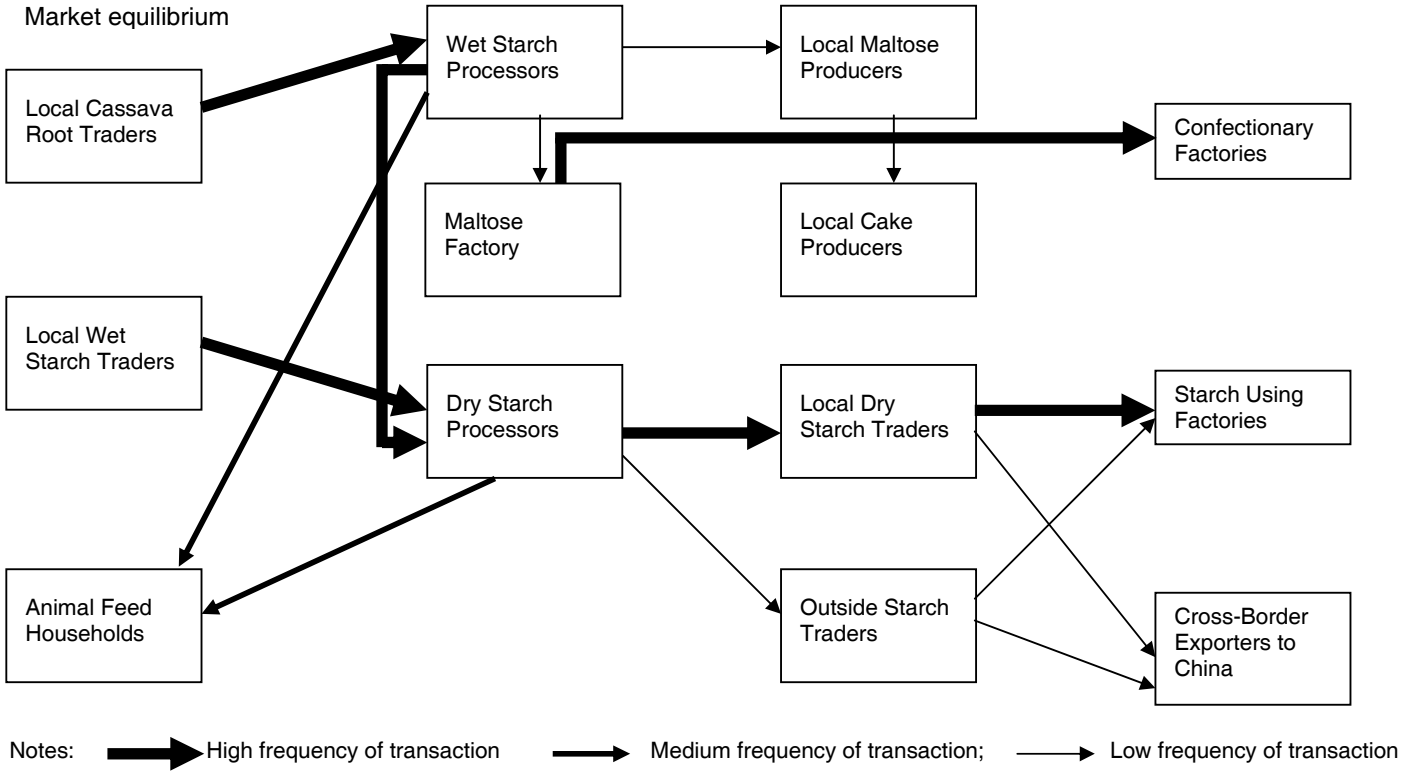
Conversely, cassava and starch markets in Duong Lieu and Cat Que communes of Ha Tay are well integrated with the domestic markets and have close links with the Chinese market (Figure 6.1). Market information is well disseminated among actors in this channel and a balanced network exists between buyers and sellers, in which buyers and sellers know and trust each other well before participating in exchange activities.

Figure 6.1 Cassava value chain in Yen Bai province



Source: Research team, 2004.

Figure 6.2 Cassava value chain in Ha Tay province



Source: Research team, 2004.

6.2 Farm gate price and margin distribution

In An Binh and Lam Giang communes, in spite of the close proximity to Van Yen factory, producers prefer to sell fresh cassava roots to private assemblers and all fresh roots and dry chips are sold to assemblers due to the poor transportation infrastructure. The undesirable transportation conditions explain why producers sell their cassava products at their home to village assemblers. The village assemblers often have buffalo or ox carts to transport the fresh roots and dry chips from the homes of the producers to the commune assemblers who often live in the centre of the commune.

Table 6.3 Volume and price of fresh cassava roots and dry chips sold by buyers in Lam Giang and Tran Phu communes

Buyer	Fresh roots		Dry chips	
	Volume (tons)	Price (đ/kg)	Volume (tons)	Price (đ/kg)
Lam Giang	25.5	293.3	3.25	950
Tran Phu	2.6	330		

Source: Team Research Survey.

Table 6.4 Share of fresh roots and dry chips sold

Commune	Farm gate	Assembler gate	Processor gate	Local market	Central market	Total
An Binh	91.67	0	0	8.33	0	100
Lam Giang	60	20	0	20	0	100
Tran Phu	100	0	0	0	0	100

Source: Team Research Survey.

6.3 Institutional arrangements

In the previous sub-section, it was suggested that limited capital constitutes the main constraint preventing the poor from fully utilizing the advantages of HYV cassava. Contract farming with Van Yen factory is one potential solution that creates mutual benefits for both farmers and the factory. On the one hand, farmers receive inputs on credit and have access to stable procurement by the factory. On the other hand, the factory can ensure a stable supply of raw materials, which represents the major constraint preventing the factory from fully utilizing its capacity.

Box 6.1 Cassava raw material procurement. The case of Van Yen

Van Yen Cassava Factory is under the management of Yen Bai Agro-Forestry Processing and Export-Import Company. The construction of the factory began in September 2001. In October 2002, the factory started to install processing equipment (NOVIBA) imported from Holland complying with EU standards. The installation was totally undertaken by Dutch engineers. Technology transfer was conducted through 'learning by doing'. Total capital for this investment amounted to 15 billion dong borrowed from the Investment Support Fund.

In December 2002, the factory officially commenced operations with a design capacity of 50 dry starch tons per day (equivalent to 200 tons of fresh cassava roots), and it was expected that the factory would operate 200-250 days per year. The factory planned to procure 40,000-60,000 tons of fresh roots annually. With modern technology and equipment, the factory placed emphasis on producing high quality dry starch according to international standards. The brand name of the factory's product is 'SAVY', which is in high demand from enterprises in North Viet Nam as intermediate inputs for confectionary, pharmaceuticals, paper and noodles.

Yet, the most important market for the factory is the cross-border export market to China through the border gate at Lao Cai (to clients in South China). Factory leaders report that Chinese clients mostly import the factory's products to refine into better quality products before exporting to Europe and South Korea, or into modified starch for various industries. The southern area of China represents a strategic market for the factory because it creates mutual benefits for both the factory and its clients. On the one hand, it is relatively simple to export to China because the factory is located near the border, saving on transportation costs; and demand from Chinese importers for dry starch is very high. On the other hand, cross-border trade helps Chinese importers evade and save 50 per cent of trade tax on dry starch. According to factory leaders, some potential Korean clients have contacted the factory to purchase the dry starch, but the factory could not serve this demand due to high taxation (about 400 per cent for Republic of Korea) on dry starch.

Before commencing its operations, the factory collaborated with the People's Committee and Extension Sub-Department of Van Yen district to encourage farmers to adopt high-yielding varieties of cassava. In 2001-2002, the factory initiated contract farming with about 1,000 HYV cassava farming households with a cultivated area of 700 hectares in the district, and committed to procure all HYV cassava spontaneously grown by farmers (about 300 hectares) in the district. With the support of the Provincial People's Committee on new HYV cultivars[1], the factory provided farmers in-kind (cultivars and fertilizer) and in-cash credit of 2.5 billion dong interest free. The floor price set by the factory for cassava procurement was 250 dong per kilogram in 2002, increasing to 330 dong per kilogram for HYV cassava and 300 dong per kilogram for local variety cassava in 2003. The factory does not procure directly at the farm gate, and farmers have to transport their fresh roots to the factory. Otherwise, traders or service organizations transport the cassava to the factory. The procurement price follows outside market prices if the market price is higher than the floor price set by the factory.

Continued …

[1] The Provincial People's Committee subsidized 1 million dong for new HYV cultivars per hectare, accounting for 45 per cent of the total cost of new cultivars at 2.2 million dongs per hectare. The remaining of 1.2 million dong, stemmed from interest-free loans to farmers to be repaid in-kind with fresh roots.

Box 6.1 Cassava raw material procurement. The case of Van Yen (continued)

The factory also planned to procure dry chips and wet starch from semi-processors in the district, but this was subsequently cancelled because Vietnamese engineering staff could not adapt the equipment to process the raw materials.

The procurement of fresh roots, in practice, is sufficient for the designed capacity of the factory. In reality, the factory only can operate for four months annually from December to the following March, and during this time factory operation is still below capacity. For instance, during the harvest season of 2002-2003, the factory could only procure 8,000 tons of fresh roots and produce about 2,000 tons of dry starch. This is far below the plan of at least 25,000 tons of fresh roots. In most of cases, farmers try to sell cassava to the outside market and repay their loans to the factory in cash. Loan default was not rare. For instance, in the season of 2002-2003 the factory only recuperated 23 per cent of total loans valued at 1 billion dong for fertilizer credit. In some communes like An Binh and Duong Lieu, where farmers received large loans from the factory, there was no procurement at all in 2002-2003, even though these communes are very near to the factory's location.

According to factory leaders, the primary constraint to the factory are shortages of raw materials due to the following reasons:

Farmers in mountainous areas have not determined cassava as their major crop, and cassava cultivation takes place primarily in small-scale and fragmented settings. It takes time to change farmers' behaviour. Cassava cultivation on fragmented and sloping land negatively affects intensive farming and harvesting, for which farmers often throw cassava bundles down the hill to the base, breaking and reducing the quality of the roots.

HYV cassava can be harvested during December to the subsequent May. Yet the best harvest lasts from December to the following February, when festivals and paddy sowing take place. As a result, farmers are unwilling to harvest all cassava products from December-February. Hence the starch content is reduced. According to factory leaders, 'this practice cannot be changed within a very short time'.

Farmers prefer to sell cassava to the outside markets at higher prices even though they have signed a contract and received inputs on credit from the factory. In this case, there is no legal mechanism for the factory to sanction farmers though the factory has tried to implement a Decree of the government on direct contract farming. Furthermore, the factory has not received the necessary support from the commune authorities to convince farmers to follow the terms of contract. Besides, factory leaders also explained that the procurement price set by the factory is unable to compete with outside market prices because the factory is forced to pay tax and a budget contribution to the state, hence increasing the cost of production and reducing the margin for the farmer.

Due to the low level of business experience and farming skill, farmers cannot harvest and deliver fresh roots on time, following the terms of contract. As a result, the factory cannot allocate its raw material inputs accurately over time: surplus supply can occur but so too shortages (it is worth noting that the fresh roots can be kept for only two days after harvesting; any longer the roots begin to decay, reducing the starch content).

Continued …

Box 6.1 Cassava raw material procurement. The case of Van Yen (continued)

To deal with the above constraints, factory leaders are trying to convince farmers to sign contracts with the endorsement of the commune's People's Committee. Another option is to collaborate with the district's People's Committee to establish cassava plantations under the management of cassava co-operatives, which will become the major agents for contract farming.

Above are listed the opinions of the factory leaders on the constraints and possible solutions for contract farming. In the main text, we will show farmers' perceptions of contract farming and why they are unwilling to implement such contracts with the factory.

Furthermore, direct contracts between farmers and the factory have almost collapsed, and currently most cassava is supplied to the factory by local traders. Often, local traders represent a certain number of cassava farmers and sign a sales contract with the factory. It is reported that the factory prefers to deal with traders controlling large amounts of cassava, rather than with small, individual farmers. This raises three major questions: (i) Why did the direct contracts between the factory and individual farmers collapse? (ii) How to institute contracts between the factory and farmer groups through group sales? (iii) What are the major constraints preventing the poor from participating in these group sales?

A PRA ranking exercise revealed that the three most important reasons for the collapse are: (i) the factory sets a low procurement price, while farmers can easily sell their products to local assemblers at the farm gate without any of the hardships associated with transportation. Though the factory leaders explained that tax and other budgetary commitments prevented them from paying a higher price to the farmers, inefficient operation is also a possible reason for the lower margin for farmers[2]. As a result, this discourages farmers from agreeing contracts with the factory; (ii) the factory requires very high quality cassava for procurement. Farmers report that cassava delivered to the factory needs to be clean and in good shape, otherwise the discount rate for starch content becomes very high, reducing the price received by farmers. Furthermore, farmers also explained that the procurement mechanism is not transparent in that procuring staff may incorrectly measure the starch content of farmers' cassava at a low level, then transferring the benefits of a higher starch content to traders with many deliveries generating a high bonus. Meanwhile, local traders do not put such strict controls on their purchases; (iii) sales to the factory have to go through complicated procedures and are very time consuming. In particular, during the

[2] Furthermore, anecdotic stories show that the factory leans on the support of the local district government to impose administrative controls over cassava sales of the farmers.

harvest season when many farmers sell cassava to the factory, they have to queue for a long time and meet with many factory staff entailing endless paperwork. This procedure does not suit farmers who are uneducated or ethnic farmers. In contrast, sales to local traders involve no paperwork at all and the procedure is very simple. Local traders may also advance some money to farmers prior to harvesting.

Table 6.5 Reasons for contract collapse, An Binh commune

Reason	Total
Low output price	H
High discount rate for starch content	H
Complicated procurement procedure	H
Requirement of massive harvesting	M
Late payment	M
Long distance transportation	L
The factory only procures fresh roots	L
The factory limits its procurement	L

Source: Result of PRA ranking exercise with 11 HYV cassava producers (five poor and six non-poor) in An Binh commune, Van Yen district, Yen Bai province.

Two other reasons for contract failure were ranked at a medium level of importance. First, the factory requires contract farmers to deliver all of their produce at one time. This creates many difficulties for farmers because they cannot mobilize sufficient labour to harvest and transport the goods given the harsh conditions of land and infrastructure. Second, payment from the factory often arrives late.

However, contract farming is still a valuable way for poor farmers to access inputs on credit and more stable outlets for sales. However, the factory cannot deal with many poor farmers individually. A potential solution suggested by both the factory and the farmers would be to organize sales associations of farmers in contract with the factory, and with the endorsement of the commune's People's Committee. The objective of this association is to group sales that can better compete with local traders to supply cassava to the factory. Furthermore, the association could provide a basis to organize a type of cassava co-operative.

With the purpose of investigating how a sales association could be established and operated successfully, a PRA was conducted with local assemblers in Lam Giang commune (Van Yen district, Yen Bai province) to address two major issues: (i) what are the conditions necessary to become a local cassava trader? (ii) what are the major constraints to their business?

Table 6.6 Determinants of participation as assemblers, Lam Giang commune

Determinant	Weighting
Large size of cassava land	22.9
Labour availability	17.7
Plenty of HYV cassava	15.1
Agricultural diversification	10.9
Capital	10.0
Transportation	8.3
Close proximity from buying to selling points	5.1
Close relationships between buyers and sellers	3.7
Kinh majority	3.1
Dao ethnic minority	3.1
Total	100.0

Source: Result of PRA weighting exercise with seven assemblers in Lam Giang commune, Van Yen district, Yen Bai province.

There are five major determinants of participation as cassava assemblers. First, assemblers themselves need to own a large area of cassava land. There are two factors behind this determinant: (i) it reduces the transportation cost as assemblers may pile cassava from other farmers in one delivery to the factory or to outside traders; (ii) assemblers need at least a certain amount of cassava inventory to sell to outside traders or the factory in urgent cases to maintain good connections.

Second, assemblers need to ensure the availability of family labour or be able to mobilize wage labour for prompt delivery, particularly in the harvesting season. Third, assemblers are required to have plenty of HYV cassava rather than local cassava because market demand for industrial uses of cassava (e.g. starch) requires HYV cassava. Fourth, agricultural diversification is also an important determinant of becoming an assembler because it helps assemblers balance their work over the year and save on transportation costs. Lastly, the availability of working capital plays a significant role because assemblers need to advance money to purchase cassava from farmers, and it takes time to receive payment from outside traders or the factory.

6.4 Potentials and constraints in the marketing system

It is worth noting that transportation conditions do not play a significant role for assemblers since they can hire transportation and still receive a certain amount of margin, given the transportation costs.

Table 6.7 Constraints faced by assemblers in Lam Giang commune

Constraint	Ranking
Lack of capital	H
Lack of transportation	H
Bad road	H
Rainy weather	M
Lack of fresh cassava supplies	M
Lack of market information	M
Lack of bargaining power over the buyers	L
Lack of dry chip supply	L
High tax	L
Sunny weather	L

Source: Result of PRA ranking exercise with seven assemblers in Lam Giang commune, Van Yen district, Yen Bai province, 2004.

The results of the PRA ranking exercise on the constraints faced by assemblers preventing them from expanding their business showed that the most serious constraints are limited capital and poor transportation conditions. Assemblers require more working capital to build their capacity to involve more farmers in their trading network. Furthermore, with poor roads, capital is necessary to buy new transportation means to save on transportation costs at larger scales of trading volume. Bank loans are insufficient to help assemblers purchase new transportation means. Besides, the commune credit co-operative does not lend for trading purposes.

It is worth noting that business expansion of assemblers also requires the growth of HYV cassava in the commune, to help utilize economies of scale. Furthermore, market information also plays a significant role for assemblers to expand their business. On a larger scale of trading volume, assemblers require market information and business skills to generate profit, rather than being satisfied with the amount of margin generated from current trading activities.

Assemblers in Lam Giang commune provide five implications for integrating poor cassava farmers into contracts with Van Yen factory. First, group sales may provide poor farmers a better outlet and raise the selling price of cassava. Second, the establishment of cassava farmer groups is necessary to provide poor farmers credit support (in-kind inputs) and technical training to improve their cultivation techniques. The development of HYV cassava, in turn, helps the factory access sufficient amounts of HYV cassava of superior quality. Furthermore, the establishment of cassava farmer groups also releases labour during the harvesting season. Third, road quality needs to be improved to reduce transportation costs. Fourth, the existing credit co-operative in the commune should play an active role in investing in transportation for cassava farmer groups. Fifth, agricultural diversification is a major constraint to the participation of poor farmers into farmer groups.

Therefore, a mixture of poor farmers and other wealthier farmers is necessary for the sustainability of group sales.

Nevertheless, the establishment of cassava farmer groups is only necessary for contracts with the factory. Contract farming will be successful if and only if the factory meets the following requirements: (i) efficient operations; (ii) transparent and simple procurement procedures; and (iii) adaptation of modern technologies to local conditions. In particular, the factory needs to innovate its technology for starch production from dry chips, because dry chips can help farmers save on transportation costs, and the factory balance its working capacity over the year.

7. Processing Cassava Products

7.1 Types of processed products and annual production

In the North, although the production of cassava is primarily concentrated in the northern mountainous area, very few processors are located in the region. There are only 1.47 per cent of the household processors (IFPRI, 1998) and 16 per cent of the dry starch factories in the area.

In Van Yen district, the main cassava producing area in Yen Bai province, very few processors are found (Research Team Survey, 2004). Most of the processors in the North are located instead in the Red River Delta. The largest concentration of processors is in Duong Lieu and Cat Que communes of Ha Tay province (Team Research Survey, 2004). In these two provinces most wet starch and dry starch processors commenced operations before 1996 (Team survey), while in the northern mountainous area all the processors were established post 1996.

In the North in general and in Ha Tay province in particular, there is a clear labour division among starch processors: wet starch processors, maltose producers, dry starch processors, and traditional food producers (Interview with processors in Duong Lieu and Cat Que communes and commune leaders in Cat Que commune).

7.1.1 Dry chip production

Dry chip semi-processing is a traditional solution to help farmers augment their income from cassava production. Dry chips have four major advantages: (i) they generate more employment and value-added for cassava producers; (ii) farmers can store dry chips as savings and speculate for higher prices; (iii) dry chips can be used as animal feed, hence providing more options to farmers to mitigate market risk; (iv) dry chips are lighter, hence saving transportation costs.

Table 7.1 Reasons for dry chip production in Lam Giang commune

Reason	Weighting
Plenty of pigs	18.0
Ability of weather forecasting	15.7
Savings	13.0
Time constraint when harvesting large volumes of cassava	11.0
Speculating for higher prices	11.0
High price of dry chips	8.3
Growing more traditional cassava	7.0
Technical skill for dry chips	6.7
Growing more HYV cassava	6.3
Cassava land far from house	3.0
Total	**100.0**

Source: Result of PRA weighting exercise with 10 dry chip producers in Lam Giang commune.

7.1.2 Starch processors

On-farm starch production is one way to upgrade the position of producers in the cassava value chain, and it is expected to generate higher value-added for the producers. Furthermore, the more refined the starch, the higher the added value to the processors. Therefore, this sub-section focuses on the following questions: What are the determinants of wet starch production? Why does starch production usually take place in communes (like Duong Lieu and Cat Que communes) without cassava production, rather than in the areas with cassava production (like An Binh, Lam Giang and Tran Phu communes)? What are the determinants to upgrade from wet starch to dry starch or maltose production? Examples for this sub-section are mostly drawn from Cat Que commune, where starch production has developed strongly, as well as some other empirical evidence from Tran Phu and Lam Giang communes. The first step is to describe the characteristics of households in Cat Que commune.

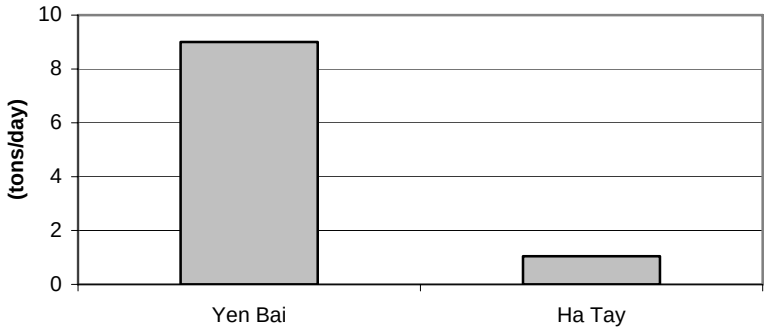
7.1.3 Wet starch processors

In the North, wet starch processors are concentrated in Duong Lieu and Cat Que communes in Ha Tay province. Wet starch processors in these two communes have a long history of processing, with over 50 per cent of wet starch processors in these communes established before 1996. In contrast, all wet starch processors in Yen Bai province were established after 1996 due to the recent jump in demand for starch. The establishment of wet starch processing businesses in Yen Bai mainly depends on relationships with processors in Duong Lieu and Cat Que communes because there is no market for wet starch in Yen Bai (most wet starch is sold in Duong Lieu market). Most wet starch processors in Ha Tay have a capacity of less than 2 tons per day. Unlike Ha Tay province,

wet starch processors in Yen Bai are medium scale. On average, the capacity of households in Yen Bai is 9 tons of wet starch per day.

In Ha Tay, the small scale is rational in the sense that: (i) the house size of processors in Ha Tay is very small, so they do not have enough area to expand production; (ii) the small scale enables processors to utilize family labour; and (iii) households in Ha Tay province consider wet starch processing as a low profit business that can only benefit households that utilize family labour and generate residual income from processing, which can be used for pig feed.

Figure 7.1 Average scale of wet starch processors in Yen Bai and Ha Tay



Source: Team Research Survey, 2004.

The number of workers employed by starch processors is related to the processing capacity. In Ha Tay, the micro and small producers only use family labour (2.56 workers) while in Yen Bai, the average number of hired labourers is 8.5 with only 1.5 family workers (Team Research Survey, 2004).

Equipment

The equipment used by most processors in Yen Bai and Ha Tay are graters and water purification pumps (Team Research Survey, 2004). Some micro processors in Ha Tay who are unable to afford the cost of a root grater can hire a mobile grater from service households in Ha Tay. In Duong Lieu and Cat Que communes it was reported that many households recently invested in mechanical filtration equipment, replacing the old manual process and benefiting from improved extraction rates and labour efficiency (Peters and Wheatley, 2002). The purpose of upgrading the technologies of these households is to

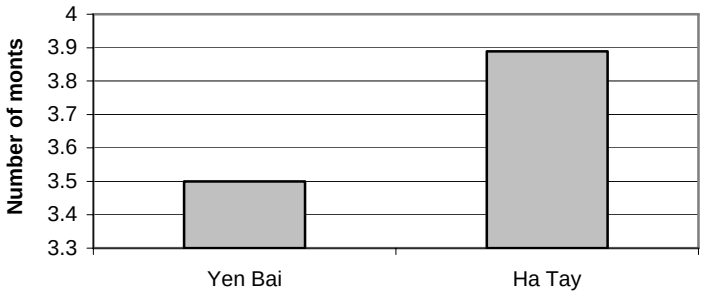
extract more starch from the cassava roots (Peters and Wheatley, 2002). Most of the equipment is made in Viet Nam.

The average current value of equipment for a wet starch processing household in Yen Bai or Ha Tay ranges from 800 thousand dong to 25 million dong depending on the type of equipment and scale of processing (Team Research Survey, 2004).

Production capacity and its use

For wet starch, the peak season for production occurs between October and February (Team Research Survey, 2004). The average number of operational months for wet starch processors is presented in Figure 7.2. In Ha Tay province, the season lasts slightly longer than Yen Bai since processors can access raw materials from different production regions.

Figure 7.2 Number of operational months

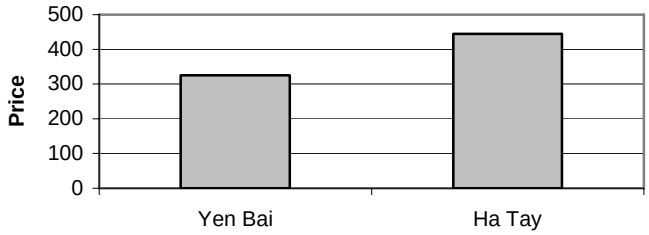


Source: Team Research Survey, 2004.

Procurement

Unlike Yen Bai, where processors can purchase fresh cassava roots directly from producers, processors in Ha Tay province procure little raw material from local sources. Local traders in Duong Lieu and Cat Que procure cassava roots from outside traders, after which the fresh roots are sold to individual household processors by local traders in a daily market in the commune, usually early in the morning. Roots are transported to the processing locations, namely each household, by handcart (Peters and Wheatley, 2002 and Team Research Survey, 2004). Given the longer distance to the material zones, the price of cassava roots procured by processors in Ha Tay is higher than in Yen Bai province.

Figure 7.3 Average procurement price (dong/kg)



Source: Team Research Survey, 2004.

7.1.4 Dry starch processors

Dry starch processors in the North can be classified as one of three kinds:

- Processors that rely on the reprocessing of wet starch for their dry starch production rather than converting roots to starch. These processors purchase wet starch from wet starch processors, refine and dry it through repeated washing, sedimentation processes as well as sun drying, to obtain a dry starch of greater purity and higher value that is better suited to non-food industrial markets such as pharmaceuticals and textiles; These processors are often micro and small scale and concentrated in the Red River Delta.
- Processors that exclusively process roots into dry starch rather than from the processing of wet starch. These processors are mostly large scale and often state-owned, large-scale starch processing factories. On average, the capacity of these parastatal factories is 50 tons per day. All of them are newly established.
- Processors that mix between reprocessing wet cassava starch and processing dry starch from cassava roots. These processors account for a very small share of the dry starch processors.

Micro and small-scale dry starch processors primarily utilize family labour, while large starch factories mainly use hired labourers; on average 40 to 80 workers (team research survey, 2004).

Equipment

The large-scale dry starch processing factories often use a complete starch system and modern equipment. For example, the Van Yen Dry Starch Factory uses a very modern, complete starch system imported from Holland at a total cost of US$ 2.1 million. Micro and small-scale processors often use equipment produced and repaired by local workshops

owned by engineers in Duong Lieu commune at a total cost of 10 million dong (Team Research Survey, 2004).

Table 7.2 Average value of equipment in Ha Tay and Yen Bai

(thousands of dong)

Commune	Value
Lam Giang (small processors)	18 000
Cat Que (micro processors)	4 250

Source: Team Research Survey, 2004.

Production

Production by small and micro-small dry starch processors can take place year round because the cassava roots for dry starch can be preserved for one or even two years. Thus, processors can preserve wet starch for production in one or even in two years time by building a large tank at their house. On average, the volume of wet starch stock is from 20 to 30 tons (Interviews with dry starch processors). Dry starch processors can also purchase wet starch from households that specialize in wet starch preservation. To produce 1 kilogram of dry starch requires 1.7 to 1.8 kilogram of wet starch (Interviews with dry starch processors). The quality of the dry starch depends on the quality of the water source (Interviews with dry starch processors). Micro and small-scale processors typically produce second dry starch. On average, production by micro and small-scale dry starch processors ranges from 200 to 300 tons per year depending on the weather (Team Research Survey, 2004).

Large factories in Yen Bai can run six months per year from November to the following April, in line with the peak season for cassava harvesting. The design capacity of SOE dry starch factories is on average 50 tons per day. However, these factories often face shortages of cassava roots. Consequently, production is unstable at around an average of 1,500 to 3,000 tons of dry starch per year.

Procurement

Micro and small-scale dry processors in Duong Lieu and Cat Que communes in Ha Tay province purchase wet starch from Duong Lieu market during the peak season, which falls between October and February. In the off season processors purchase wet starch from traders who procure from processors that specialize in wet starch preservation (Interview with dry starch processor).

Dry starch factories procure fresh cassava roots primarily from traders from November to April. The SOE factories in the North have tried to co-operate with the local

authorities to introduce HYV cassava to the farmers. Contracts were penned with cassava producers in order to create their own material zones. However, the contracts mostly failed.

Box 7.1 Van Yen dry starch factory

The Van Yen Dry Starch Factory is a newly established state-owned enterprise. It uses very modern equipment imported from Holland at a total cost of US$ 2.1 million. The factory co-operated with the local authorities to introduce HYV cassava to the farmers. Contracts were agreed with cassava producers in 2002 but the contracts mostly fell through. The contracts failed for several reasons. First, the richer farmers with more cassava acreage did not require advanced payment or inputs on credit because the cost of cassava production with HYVs is not prohibitively high for them. Only the poor cassava farmers required inputs on credit, but often their yield was too low and thus, they became indebted to the enterprise due to difficulties repaying the loans with the production generated. This limited the incentives of the enterprise to maintain contracts with poorer farmers in the future. Second, since 2002, the prices offered for fresh cassava roots and dry chips have been high thanks to the growing demand from China. Given that producers must deliver roots to the factory directly, which is far from the production area, cassava farmers prefer to sell their products to traders rather than the enterprise. Finally, the enterprise imposes strict quality control on the cassava procured from farmers. It often reduces the starch component rate of cassava delivered by farmers, and requires farmers to clean the produce and remove small roots at the two ends of the cassava before selling it. Thus, it is easier for farmers to sell on the market than to the factory.

The factory faces shortages of raw materials and consequently can only run for six months per year; from November to April. This is due in part to the inability of farmers to spread cassava crops throughout the year. Farmers grow only one cassava crop per year and harvest it during November-April. Furthermore, for the reasons stated previously, farmers prefer to sell cassava to private assemblers. In fact, the factory has to pay a bonus or extra payment to the commune assemblers, who are the main sources of supply for the factory, in order to have enough raw material for production. Such bonuses do not reach the farmer, however. The lack of HYV adoption also represents a major supply constraint for the enterprise to procure enough raw materials for its operation.

The Van Yen factory produces 10,000 tons of first class dry starch and 80 per cent of its products are exported across the border to China. The enterprise produces only one kind of starch and sells mostly to Chinese traders.

Source: Team research interview, 2004.

In terms of dry chip production in Lam Giang and An Binh continues, it is worth noting that farmers in Lam Giang commune often dry cassava on-farm using the sun, hence weather forecasting is an important determinant to know when dry chips can be produced. Furthermore, it has also been suggested that on-farm drying is a good solution for farmers avoiding the burden of work under the unfavourable conditions of sloping land far from their house, particularly for HYV cassava cultivation. The PRA exercise illustrated that Lam

Giang farmers consider four major advantages of dry chip processing: (i) use as animal feed; (ii) use as savings; (iii) reduction of work burden in the harvest; and (iv) speculation for higher prices.

Table 7.3 Determinants of dry chip production in An Binh commune

Determinant	Poor	Non-poor	Total
Labour availability	21.9	25.0	23.6
Healthy labour	21.4	19.1	20.1
Plenty of cassava	22.4	16.8	19.3
Plenty of livestock	15.4	17.2	16.4
Capital	10.4	10.5	10.5
Have a drying oven	8.5	11.3	10.1
Total	100.0	100.0	100.0

Source: Result of PRA weighting exercise with 10 dry chip producers in Hamlet 6, An Binh commune, Van Yen district, Yen Bai province.

In An Binh commune, farmers use a kind of kiln for drying cassava. Yet, capital is not the major determinant of dry chip production by either poor or non-poor farmers. It is estimated that a kiln costs only about 400,000-500,000 dong and that even poor farmers can afford this. Rather the availability of healthy family labour is the most important determinant because it is not profitable to hire labour for dry chip semi-processing. Second, dry chips are processed as savings and animal feed so farmers are willing to participate in dry chip production only if the volume of cassava output is large enough. It also explains why poor farmers regard the volume of cassava output as the most important determinant of dry chip production. With limited land and cassava output, as well as cash shortages, poor farmers often sell fresh cassava roots immediately after harvesting.

In short, dry chip semi-processing can provide a good solution for farmers to improve their well-being and for poor farmers to participate in this function of the cassava value chain. For dry chip processing, the major constraints to the participation of the poor are limited cassava output and cash shortages after harvesting.

7.2 Cost-revenue structure and business profitability

7.2.1 Wet starch production costs

The production costs of wet starch are higher in Ha Tay province, where most wet starch processors are small scale. The higher cost of wet starch production in Ha Tay can primarily be attributed to the higher cost of the cassava roots (323.1 dong higher per 1 kilogram of wet starch). Given that Ha Tay province is farther away from cassava production areas, processors are forced to procure cassava roots at a higher price due to higher

transportation costs and more intermediaries (traders, assemblers) between cassava production and processing. Due to differences in production scale, the structure of production costs is different between Yen Bai and Ha Tay. Wet starch processors in Yen Bai use more hired labour than in Ha Tay, in which mostly household labour is used, thus resulting in a higher hired labour cost. Also, again due to the larger scale, processors in Yen Bai must have their own starch processing equipment, while in Ha Tay, processors can rent a mobile grater from service households. These additional costs are reflected in the depreciation cost (included in other costs) for Yen Bai and machinery rental for Ha Tay.

Table 7.4 Yen Bai wet starch cost of production (dong/kg)

I t e m	Average	Share (%)	SD	Min	Max
Cassava roots	776.9	76.50	10.1	769.7	784.0
Labour	81.2	8.00	1.7	80.0	82.4
Electric and water fees	47.1	4.64	66.6	0.0	94.1
Transportation	77.7	7.65	17.4	65.4	90.0
Machinery rental	0.0	0.00	0.0	0.0	0.0
Packages	20.9	2.06	12.9	11.8	30.0
Others	11.8	1.16	16.6	0.0	23.5
Total	1 015.5		44.5	984.0	1 046.9
Selling price	1 075				

Source: Team Research Survey, 2004.

Table 7.5 Ha Tay wet starch cost of production (dong/kg)

I t e m	Average	Share (%)	SD	Min	Max
Cassava roots	1 100	95.07	8.4	1000	1 022.2
Labour	40.0	3.46	0.0	0	0.0
Electric and water fee	29	2.51	21.1	10	60.0
Transportation	0.0	0.00	0.0	0	0.0
Machinery rental	44.9	3.88	21.4	0	60.0
Packages	0.0	0.00	0.0	0	0.0
Others	2.9	0.25	7.6	0	20.0
Total cost	1 217	105.19	25.5	1 050	1 120.0
Sale price of residual from processing wet starch (dong/kg)	60				
Total cost after deducting residual	1 157	100.00			
Selling price	1 200				

Source: Team Research Survey, 2004.

7.2.2 Dry starch processors

Dry starch processors in the North can be classified into two main types. The first type are processors that purchase wet starch from wet starch processors, refine and dry it using repeated washing and sedimentation processes and then sun drying, to obtain dry starch. The product is second class dry starch and the operations are typically small-scale (in-depth interviews with dry starch processors in Ha Tay province). The second type of

processor exclusively processes roots into dry starch. They mostly produce first class dry starch and are often large scale.

Material costs represent the largest share of costs for both kinds of dry starch processors. Material costs account for 92.1 per cent and 67.8 per cent of the total cost of processors reprocessing dry starch from wet starch and processors that process roots into dry starch respectively. The material cost necessary to produce 1 kilogram of dry starch from wet starch is 2,400 dong, which is higher than the cost (1,740 dong) of processing dry starch from cassava roots. However, other production costs (labour, electricity and water fees, etc.) are higher for processors producing dry starch from cassava roots. As a result, the total cost of processing dry starch from cassava roots is just 38 dong per kilogram of dry starch lower than processing from wet starch.

Table 7.6 Costs of production of dry starch from wet starch (VND/1 kg dry starch)

I t e m	Total cost (dong)	Share (%)
Cassava roots	0	0
Wet starch	2 400	92.1
Labour	40	1.5
Others	166	6.4
Total	**2 606**	**100.0**

Source: Team Research Survey, 2004.

Table 7.7 Costs of production of dry starch from cassava roots (VND/1 kg dry starch)

I t e m	Total cost (dong)	Share (%)
Cassava roots	1 740	67.8
Wet starch	0	0.0
Second dry starch	0	0.0
Labour	268	10.4
Electric and water fees	280	10.9
Transportation	150	5.8
Machinery rental	0	0.0
Packages	50	1.9
Others	80	3.1
Total	2 568	100.0

Source: Team Research Survey, 2004.

The margins and profits of stakeholders that are involved in the cassava value chain are different between the two provinces.

In Yen Bai province, the margins and profits of dry starch are estimated for two channels: (i) Channel 1, including four main stakeholders: cassava producers; assemblers; traders and the first class dry starch factory; (ii) Channel 2 including only two main stakeholders: cassava producers and the first class dry starch factory.

For Channel 1, the marketing margin for cassava producers is the largest, accounting for nearly 50 per cent of the total marketing margin. Farmers also have to bear the highest unit costs (52.7 per cent) in this channel. Hence, they receive only about 18 per cent profit. By contrast, dry starch processors incur 36 per cent in unit costs but receive the highest profit share (61.8 per cent). Assemblers and local traders only have a small share of the profit in the value chain.

Table 7.8 Cost, margin and profit of dry starch in Yen Bai province (Channel 1)

Marketing agent	Unit cost		Margin		Unit profit	
	dong/kg	percentage of cost	dong/kg	percentage of sale price	dong/kg	percentage of profit
Producers	1 352.8	52.7	1 480	49.3	1 27.2	18.2
Assemblers	1 520	6.5	80	2.7	40	5.7
Traders	1 640	4.7	180	6.0	100	14.3
First class dry starch processors	2 568	36.1	1 260	42.0	432	61.8
Total	2 568	100.0	3 000	100	699.2	100

Source: Estimated from survey and interview by research team, 2004.

The estimation was made vertically through stakeholders in the value chain separately by unit cost, margin and profit from different sources to compare the structures rather than the real value. As a result, the formula; Unit profit = Unit margin-Unit cost is not calculated exactly for each stakeholder in the value chain due to the lack of information acquired from the quick interviews.

Figure 7.4 Share of cost, margin and profit of dry starch in Yen Bai province (Channel 1)

Source: Research team, 2004.

For Channel 2, there are only two stakeholders in the value chain (farmers and the first class dry starch factory). In this channel, farmers bear higher costs as a result of a higher discounted rate for starch content, a complicated procurement procedure, the

requirement of large volumes, and the possibility of late payments. However, as the analysis below shows, they can generate higher profits by selling directly to the factory provided they can overcome these issues. Indeed, farmers that are close to Van Yen factory, with a large farm size, available family labour and transportation are more willing to sell their cassava roots directly to Van Yen factory. However, for small farmers and those that live far from Van Yen factory, transaction and transportation costs are often too high and thus, in this situation, they rather sell their roots to the village assemblers.

When farmers sell their cassava roots directly to the dry starch factory, total profit for the chain is reduced but higher rent goes to the producer. The added profit in the previous channel is somewhat illusory as it reflects more rent to traders, greater inefficiency in the marketing channel and lower profits for the producers.

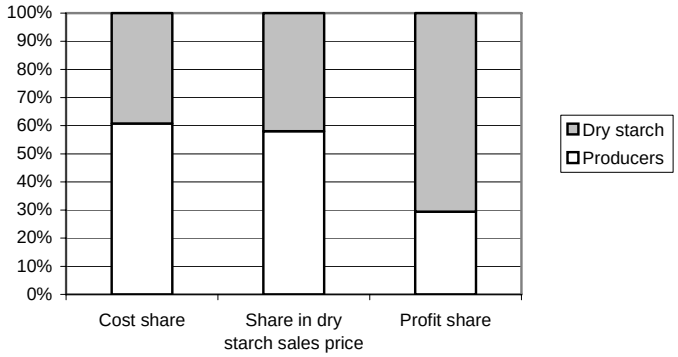
Table 7.9 Cost, margin and profit of dry starch in Yen Bai province (Channel 2)

Marketing agent	Unit cost		Margin		Unit profit	
	dong/kg	percentage of cost	dong/kg	percentage of sale price	dong/kg	percentage of profit
Producers	1 560	60.7	1 740	58.0	180	29.4
First class dry starch processors	1 520	39.3	1 260	42.0	432	70.6
Total	2 568	100.0	3 000	100	612	100

Source: Research team, 2004.

The estimation was made vertically through stakeholders in the value chain separately by unit cost, margin and profit from different sources to compare the structures rather than the real value. Therefore, the formula; Unit profit = Unit margin - Unit cost is not calculated exactly for each stakeholder in the value chain due to the lack of information from the quick interviews.

Figure 7.5 Share of cost, margin and profit of dry starch in Yen Bai province (Channel 2)



Source: Research team, 2004.

In Ha Tay province, participants in the cassava value chain include five stakeholders: producers; outside large traders; Ha Tay local traders; wet starch processors; and second class dry starch processors. As in Yen Bai province, producers still incure the highest unit costs and margins and thus they receive only 14.3 per cent profit from this value chain. In absolute numbers, the profit received is the same as in Yen Bai. However, wet starch processors in Ha Tay have the highest profit share in the value chain. The wet starch processors in Ha Tay can utilize by-products from wet starch processing for pig feeding, thus reducing net production costs (60 dong per kilogram of wet starch) and hence, higher profits in the value chain. Dry starch processors in Ha Tay only receive 21.9 per cent of the total profit of the chain because of the high price of wet starch.

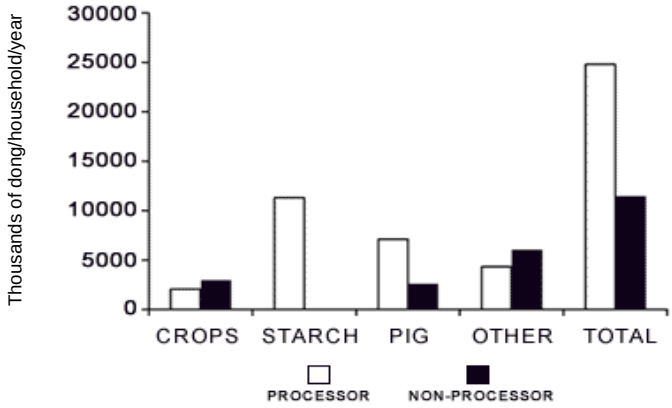
The total profit of the value chain is higher than in the case of Yen Bai. In Yen Bai, residue from wet starch production is a waste product but it is utilized for pig feeding in Ha Tay.

Table 7.10 Cost, margin and profit of dry starch in Ha Tay province

Marketing agent	Unit cost		Margin		Unit profit	
	dong/kg	percentage of cost	dong/kg	percentage of sale price	dong/kg	percentage of profit
Producers	1 352.8	48.2	1 480	49.3	127.2	14.3
Outside large traders	1 880	18.8	560	18.7	160	18.0
Ha Tay traders	2 080	7.1	160	5.3	120	13.5
Wet starch processors	2 314	8.3	400	13.3	286.4	32.3
First class dry starch processors	2 806	17.5	400	13.3	194	21.9
Total	2 806	100.0	3 000	100	887.6	100

Source: Research team, 2004.

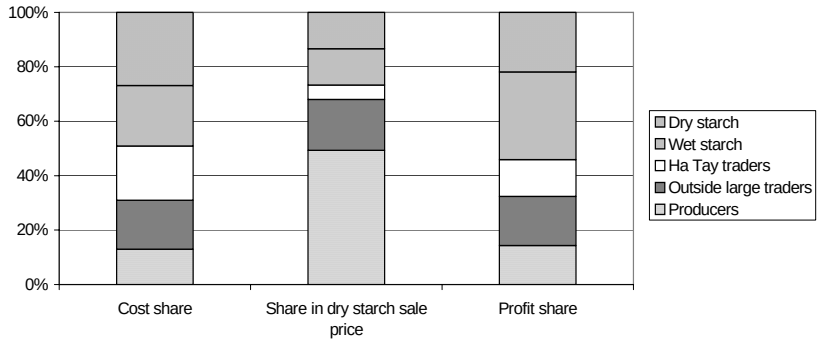
Figure 7.6 Income comparison between processors and non-processors in Cat Que commune



Source: SIUPA project, 2004.
Note: US$ 1 = VND 14,500

In the processing village of Cat Que, processor households receive higher and more diversified income comparing to non-processors. Cassava processing allows the farmers to develop livestock, while continuing to produce crops.

Figure 7.7 Share of cost, margin and profit in Ha Tay (dong/kg)

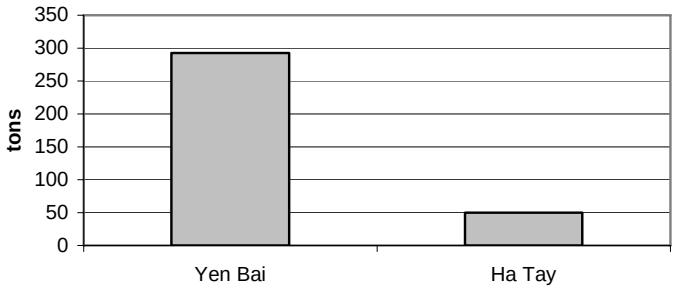


Source: Team Research Survey, 2004.

7.3 Business size

The average volume of wet starch sold by processors is presented in Figure 7.8.

Figure 7.8 Volume of wet starch sold by processors



Source: Team Research Survey, 2004.

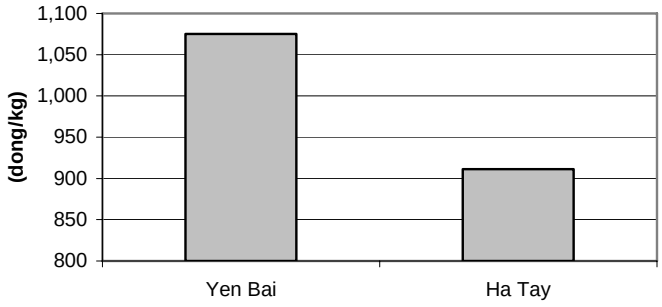
In Yen Bai province, wet starch is sold to outside traders and then to local traders in Ha Tay province. The outside traders live in Phu Tho and Ha Tay. In Ha Tay the majority of products are sold directly to starch processors. Interestingly, the price of wet starch received by processors in Yen Bai is higher than in Ha Tay province. A survey by IFPRI (1998, p.39) also showed that the sales price for wet starch is higher as the processor scale increases.

Table 7.11 Share of wet starch sold by buyers (percentage)

	Yen Bai	Ha Tay
Assemblers	100	16.7
Traders	0	0
Starch processors	0	83.3

Source: Team Research Survey, 2004.

Figure 7.9 Wet starch selling price (VND/kg)



Source: Team Research Survey, 2004.

The wet starch price seems to be lowest in Ha Tay province as the capacity is smaller.

The average distance to acquire roots in Ha Tay province is less than 1 kilometre while in Yen Bai, processors travel over 20 kilometres to obtain the roots (Team Research Survey, 2004). Wet starch sales in Ha Tay province tend to be localized but Yen Bai wet starch is sold to traders from Phu Tho and Ha Tay (Team research survey, 2004).

In Yen Bai, most information regarding technology and wet starch prices comes from processors and traders in Ha Tay, where such information originates from other processors and local traders (Interview with processors in Yen Bai and Ha Tay province, 2004).

Lack of credit for expansion is the main issue for processors. Processors reported that in order to expand production they need to borrow 30 million dong. However, the highest amount of credit they can borrow from the bank is only 10 million dong (Interviews with processors in Yen Bai and Ha Tay province, 2004). The shortage of fresh cassava roots is also a concern of the processors. With the recent establishment of large-scale processors and the increase in design capacity of small-scale processors, the supply of fresh roots to processors will be reduced without any larger gains in supply. A third problem is the pollution stemming from cassava processing. Finally, the small land area in Ha Tay constrains processors from expanding their processing capacity (Interview with processors in Yen Bai and Ha Tay, 2004).

For dry starch, the micro and small-scale enterprises in Duong Lieu sell their products to two buyers: dry starch traders and end users while SOEs sell directly to end users and export to China. The price of dry starch depends on the quality.

The main problems of large-scale, dry starch processors are: (i) shortages of fresh roots; (ii) difficulty in implementing Decree 80 given the lack of guidance for implementation; (iii) difficulty in enforcing contracts with farmers; (iv) low level competitiveness compared to enterprises in the southeast; and (iv) high trade barriers.

7.4 Determinants of starch processing

It is not too difficult for the poor to participate in small-scale wet starch production in Cat Que commune. The major determinant of wet starch processing is capital. It is not too costly to construct the tank, dig a well and buy a water pump. The most expensive equipment is the stirring machine that can be rented. Furthermore, stirring machines have been used in recent years to cope with labour shortages when production capacity expands. Another condition for the use of stirring machines is access to electricity, which appeared

only in the mid-1990s. In the past, processors used manual techniques to stir starch. Water is also important to clean the fresh roots and the sedimentation step in starch production. In the past, processors had difficulties in finding enough water for processing. Yet, access to electricity help ensure sufficient water for processing with the use of an electrical water pump to deliver water from the wells.

Table 7.12 Determinants of wet starch processing in Cat Que commune

Determinant	Weighting
Capital	20.3
Electricity	18.9
Well and pump for water sources	16.3
Large flat site	16.0
Healthy labour	14.0
Cow cart	9.4
Technical skills	5.1
Total	**100.0**

Source: Result of PRA weighting exercise with eight wet starch processors in Cat Que commune, Hoac Duc district, Ha Tay province.

Another major constraint to the participation of the poor in micro-scale starch processing is the requirement of a large flat site. Yet, farmers can utilize their available garden land for starch processing. It is worth noting that the concentration of wet processors in the same village assists the diffusion of technical skills. In addition, transportation is also available because processors can buy inputs and sell wet starch over short distances within the commune. As a result, the availability of cow carts and technical skills are not weighted as important determinants of participation in wet starch processing.

Nevertheless, it should be noted that Cat Que commune has long experience in starch processing and the commune is located next to Duong Lieu commune – the largest centre of starch processing households in North Viet Nam. In other locations like Lam Giang and Tran Phu communes, it is not easy for farmers to move from cassava production to starch processing, even using very simple methods. Major constraints to the establishment of processing units in Lam Giang and Tran Phu communes are a lack of technical know-how and market information. Lacking capital, it is also difficult for farmers in Lam Giang to purchase water pumps and dig wells for water. Thus, they depend highly on their proximity to the river for water.

Table 7.13 Constraints to starch processing in Lam Giang commune

Constraint	Weighting
Lack of capital	17.7
Lack of technical know-how	13.3
Lack of price information	12.3
High price of fresh roots	12.0
Far from water	10.7
No information on the outlet	9.7
Far from cassava supplies	8.0
Not specializing in cassava-based production	6.7
Low output of HYV cassava production	5.7
Low output of local cassava production	4.0
Total	**100.0**

Source: Result of PRA ranking exercise with 10 dry chip producers in Lam Giang commune, Van Yen district, Yen Bai province.

Similarly, in Tran Phu commune, market information and technical know-how[1] are the most important constraints preventing cassava producers from engaging in starch processing. It is worth noting that for the non-poor, technical know-how is not too important; rather they are more concerned with market information. In contrast, the poor are more constrained by technical know-how and capital.

Table 7.14 Constraints to starch processing in Tran Phu commune

Constraint	Poor	Non-Poor	Total
Unable to find buyers	18.4	50.8	34.7
No technical know-how	41.2	11.1	26.1
Inconvenient transportation conditions	15.2	16.3	15.7
Inappropriate quality of local cassava supply	11.2	13.9	12.5
Lack of capital	12.0	0.0	6.0
Low cassava output	2.0	7.9	5.0
Lack of labour	0.0	0.0	0.0
Lack of water	0.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**

Source: Result of PRA weighting exercise with 10 dry chip producers (five poor and five non-poor) in Tran Phu commune, Chuong My district, Ha Tay province.

In short, micro-starch processing units often exist with land limitation. Furthermore, clusters of processors in the same village foster technical know-how diffusion and market access. The major constraint for poor farmers to advance from cassava production to starch processing is technical know-how if they are isolated from the large starch centres. In addition, market information also plays a significant role in promoting the participation of the poor in starch processing.

[1] They even believe that water is unimportant for wet starch processing.

7.5 Potentials and constraints to the expansion of starch processing

Interviews with processors suggest that upgrading from micro-scale wet starch processing to small and medium-scale dry starch and maltose processing will not only increase processors' income but also reduce the negative impacts of pollution from starch processing. However, this upgrade is inappropriate for the poor. Similar to the determinants of upgrading cassava production to starch processing in Lam Giang and Tran Phu communes, micro-scale processors in Cat Que commune weigh market access and capital as the most important constraints. In addition, technical know-how is also important because wet starch processors do not have readily available access to the technical skills required for dry starch and maltose processing, which are primarily found in Cat Que and Duong Lieu communes.

Table 7.15 Constraints to dry starch and maltose processing in Cat Que commune

Constraint	Weighting
Unable to find buyers	26.3
Lack of capital	26.0
Lack of labour	11.5
Lack of technical skills	11.5
Not located in the same village as dry starch and maltose processors	10.5
No flat sites sufficiently large for drying the starch	10.5
Eligible for taxation	3.8
Total	**100.0**

Source: Result of PRA weighting exercise with eight wet starch processors in Cat Que commune, Hoai Duc district, Ha Tay province.

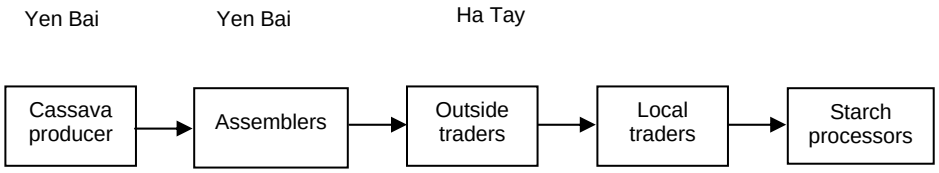
In short, upgrading from micro-scale wet starch processing to small and medium-scale dry starch and maltose processing is out of the reach of the poor since it requires a large amount of capital for investment and good market connections. However, the benefit of this move is potentially high, particularly for environmental reasons, as noted earlier. Therefore, the establishment of starch processors' associations represents one potential solution. Support for a production site may be the first step to establish processors' associations. In addition, sites for processing should be planned in clusters to reduce transportation costs and the negative impacts of pollution. Furthermore, credit support for the starch processors' group is essential in the early phase of operation.

7.6 Traders and the marketing system

In the North, given the distances from cassava producing areas to starch processing and consumption zones, there are many intermediaries involved in the trading of cassava and starch from production to consumption. Engaged in trading cassava products in the North include: (i) assemblers; (i) local traders; and (iii) large, outside traders. In the North, research only focuses on small traders, assemblers (ten assemblers in Yen Bai province and two in Tran Phu commune, Ha Tay province) and local traders (five local traders in Ha Tay province).

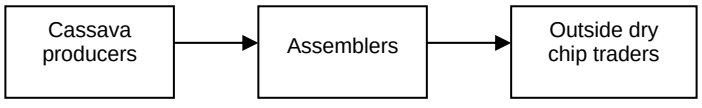
In Yen Bai, transporting cassava roots is problematic due to poor road infrastructure. Thus, cassava is transported from production sites to sales points mainly within the village and commune by cart. Assemblers have difficulties in expanding their scale of operation because of the poor transportation conditions. Hence, in Yen Bai, two kinds of assemblers exist: village and commune assemblers. Village assemblers only operate inside the village and sometimes between local villages, while commune assemblers operate between different communes within the district. Village assemblers procure cassava roots and dry chips from farmers and sell them to commune assemblers. The commune assemblers procure cassava roots and dry chips from both farmers and village assemblers and sell them to the buyer with the highest price, Van Yen factory or outside traders from Ha Tay. These outside traders transport roots, dry chips and wet starch to Duong Lieu market and sell it to local traders in Ha Tay.

Figure 7.10 Simplified marketing channel of traders in the North



Source: Research team, 2004.

Figure 7.11 Simplified marketing channel of dry chip traders in the North



Source: Research team, 2004.

Most assemblers and local traders use family labour. Transportation used by assemblers and local traders in Yen Bai and Ha Tay include motorbikes and carts. In Cat Que and Duong Lieu communes, cassava roots are transported by local traders to the processing units by hand cart (In-depth interviews with traders in Yen Bai and Ha Tay province by the team research).

Only 30 per cent of income stems from trading cassava roots, dry chips and wet starch, reflecting the diversification of assemblers and traders in the North. Besides trading cassava roots, dry chips and wet starch, farmers also participate in (i) crop production; (ii) livestock; and (iii) off-farm activities (trading other agricultural products and wine distillery, among others).

7.6.1 Procurement

In Yen Bai province, the largest volume of cassava roots is obtained at the farm-gate (73 per cent of total root procurement by assemblers), while only 27 per cent is obtained from assemblers. In contrast, in Ha Tay province 75 per cent of the cassava roots are procured from the market and, during peak season, there is a daily market for cassava roots in Duong Lieu commune where outside traders transport cassava roots from cassava production areas and, in turn, local traders procure it from outside traders.

Table 7.16 Share of cassava root procurement by location

Location	Yen Bai (%)	Ha Tay (%)
Farm gate	73	25
Business gate	27	0
Market	0	75
Total	100	100

Source: Team Research Survey, 2004.

Since Ha Tay is very distant from the cassava production areas, to reduce transportation costs, outside traders have to bring large volumes of cassava products that can fit in a car. Therefore, local traders in Ha Tay province have to procure a large volume for each transaction and are often on a larger scale than assemblers in Yen Bai. The average procurement of local traders in Ha Tay is, thus, much higher than assemblers in Yen Bai province.

Table 7.17 Average procurement volume of cassava roots (ton/year/trader)

Province	Average	Max	Min	SD
Yen Bai	269	700	20	265
Ha Tay	1 070.8	3 000	4	1 356

Source: Team Research Survey, 2004.

Due to the farther distance from the cassava production areas, the price of cassava roots procured by local traders in Ha Tay is higher than that procured by assemblers in Yen Bai province.

Table 7.18 Average procurement price of cassava roots

Province	Average	Max	Min	SD
Yen Bai	370	460.0	300.0	50.4
Ha Tay	510	550.0	350.0	65.2

Source: Team Research Survey, 2004.

In Yen Bai province, 80 per cent of assemblers noted that the procurement price is set through negotiation. This figure in Ha Tay is only 40 per cent, with an additional 40 per cent of traders setting the price themselves. Thus, traders in Ha Tay are more influential in setting the procurement price than assemblers in Yen Bai.

Table 7.19 Who decides the procurement price?

Province	Sellers (%)	Your business (%)	Negotiation (%)	Total
Yen Bai	20	0	80	100
Ha Tay	20	40	40	100

Source: Team Research Survey, 2004.

The share of assemblers engaged in the trading of dry chips and starch in Yen Bai is only 22.2 per cent, while in Ha Tay 40 per cent of traders are engaged in trading dry chips and starch. In Yen Bai province, all wet starch is sold to outside traders or sold directly to end-users. Thus, assemblers in Yen Bai only engage in trading cassava roots and dry chips. Traders in Ha Tay procure both cassava roots, dry chips, wet starch and dry starch.

Table 7.20 Share of traders engaged in dry chip and starch production

Province	Trading dry chips and starch	Cassava roots only	Total
Yen Bai	22.2	77.8	100
Ha Tay	40	60	100

Source: Team Research Survey, 2004.

The average volume of dry starch procured in Yen Bai is much higher than in Ha Tay. Most dry chip sales from Yen Bai are exported to China.

Table 7.21 Volume and procurement price of dry chips and wet starch by province

Province	Dry chips		Wet starch	
	Volume (tons)	Procurement price (dong)	Volume (tons)	Procurement price (dong)
Yen Bai	160.8	1 000	0	
Ha Tay	37.5	1 300	62.4	1 250

Source: Team Research Survey, 2004.

7.6.2 Sales

The average volume of roots' sales is similar to the volume of procurement in Ha Tay province, while in Yen Bai the sales volume is smaller. Some assemblers in Yen Bai purchase roots and process them into dry chips to wait for higher prices in the off-season. Thus, the volume of dry chips in Yen Bai province also differs from purchases. The sales price of cassava roots in Yen Bai province is 20 dong higher than the procurement price and the margin for cassava roots in Ha Tay is 40 dong/kg. The margin for dry chips in both provinces is 100 dong, much higher than the margin of cassava roots in both provinces.

Table 7.22 Average sales volume of cassava products

Province	Cassava roots (tons)	Dry chips (tons)	Wet starch
Yen Bai	165	156.8	0
Ha Tay	1 070	37.5	62.4

Source: Team Research Survey, 2004.

Table 7.23 Average sales price of cassava products

Province	Cassava roots (tons)	Dry chips (tons)	Wet starch
Yen Bai	390	1 100	
Ha Tay	550	1 400	1 300

Source: Team Research Survey, 2004.

In Ha Tay province, 75 per cent of total roots sales are destined for starch processors in Duong Lieu and Cat Que. Only 25 per cent of cassava roots obtained by assemblers in Tran Phu are destined for traders. In contrast, 81.4 per cent of sales in Yen Bai province are to outside traders and only 18.6 per cent go to starch processors.

Table 7.24 Share of cassava roots sold by buyer

Buyer	Yen Bai	Ha Tay
Traders	81.4	25
Starch processors	18.6	75
Others	0	0
Total	100	

Source: Team Research Survey, 2004.

In the case of dry chips, all of the sales in Yen Bai province go to outside traders, while in Ha Tay 80 per cent goes to traders, while the remainder is sold to end-users. In Ha Tay, all wet starch is purchased by processors (dry starch and maltose).

Table 7.25 Share of dry chip sales by buyer (percentage)

Buyer	Yen Bai	Ha Tay
Traders	100	80
Exporters	0	0
End-users	0	20
Others	0	0
Total	100.0	100.0

Source: Team Research Survey, 2004.

Table 7.26 Share of wet starch sales by buyer in Ha Tay (percentage)

Buyer	Wet starch
Traders	0
Processors	100

Source: Team Research Survey, 2004.

7.6.3 Marketing network

Most trade in cassava roots and dry chips by assemblers in Yen Bai province is conducted on a local basis (within the same district). Local traders in Ha Tay province procure cassava roots from outside traders and wet starch from both outside traders and processors in Ha Tay and sell it locally. However, outside traders have to travel over 120 kilometres to obtain cassava roots from the northwest and northeast. IFPRI (1998) found that the typical distance travelled by outside traders in the North was over 100 kilometres for root sales and procurement, wet starch sales and dry starch sales. Distances for the procurement of starch were lower in the RRD (45 kilometres and 26 kilometres, respectively, for wet and dry starch), while in the NMM, procurement distances totalled 60 kilometres for wet starch but 0 kilometres for wet starch; no information was given regarding roots or dry starch marketing in NMM.

7.6.4 Constraints to trade

Assemblers and local traders in the North face a number of constraints related to their operations. The most significant constraint to marketing in Yen Bai is high transportation costs while in Ha Tay, 'other' constraints are most important.

Table 7.27 Constraints reported by traders in the marketing of cassava products

(percentage)

Constraint	Yen Bai	Ha Tay
High transportation costs	50	0
Unstable demand	0	20
Police checks	0	0
Others	50	80
Total	100	100

Source: Team Research Survey, 2004.

8. Analysis of Institutional Support

8.1 Policy support programme for farming, processing and marketing activities

8.1.1 Development of the Viet Nam cassava programme

After ten years of development (1991-2001), intensive cassava research and extension have changed cassava from being a food crop to an industrial crop. Vietnamese cassava starch has become very promising for export and domestic use.

During the tenth Viet Nam Cassava Workshop the following seven topics were agreed upon (Pham Van Bien *et al*., 2001):

1. Determination of an appropriate strategy for cassava research and development;
2. Selection and dissemination of high-yielding varieties with high starch content;
3. Transfer of appropriate cultivation techniques to farmers in different areas;
4. Co-operation with processing factories to establish areas with stable sources of raw materials;
5. Research on the development of cassava processing technologies;
6. Structural improvement and development of the extension network; and
7. Development of local and export markets for cassava products.

8.1.2 Food diversification policies

In Viet Nam, cassava has rapidly changed from a food crop to an industrial crop with a high rate of growth during the first years of the 21st Century. Viet Nam has become the third largest exporter of cassava products after Thailand and Indonesia. Cassava is one of the seven new agricultural export products, which have caught the attention of the government and local authorities.

Cassava roots have multiple end-uses, such as for the starch industry, for food and feed processing, for the pharmaceutical industry and for export.

Cassava is a simple crop to grow. It can grow in poor soils and produces high yields when suitable management is applied. Furthermore, the crop can be grown in many areas. The average yield of cassava is currently 8-10 tons per hectare, but can be doubled in many provinces. Previously, farmers were reluctant to grow cassava because they thought that cassava caused soil degradation and generated low profits. However, in reality one hectare of cassava can produce 60-80 tons of roots and leaves. The situation has changed because

of the development of sustainable cultivation techniques and new, high-yielding varieties. Cassava has become a cash crop in many provinces of Viet Nam. Moreover, cassava starch is now being produced competitively and cassava markets are prospective. The combination of growing and processing cassava has created many jobs, increased exports, attracted foreign investment as well as contributed to industrialization and the modernization of several rural areas.

8.1.3 International trade policies

Trade of fresh cassava is generally minimal, given that it rapidly degenerates after harvest unless further processed into chips or other products.

Thailand has consistently and overwhelmingly been the top exporter of cassava products over the past ten years (Tables 8.1). Thailand has historically exported a large percentage of its cassava production in the form of chips or starch (Table 8.2), though a greater percentage of cassava has been consumed domestically in recent years (about 70 per cent was exported in 2002). Traditionally, Indonesia and China have been larger exporters of cassava products but recent trends show greater amounts of cassava surplus distributed in the home markets to meet domestic demand. Most trade in Belgium and the Netherlands consists of cassava products from other countries that have been reprocessed into modified starch and/or transshipped. Exports from Viet Nam have grown enormously, fuelled by an increase in the trade of dried cassava and starch to China.

The main cassava products exported are dried cassava and cassava starch. Exports of dried cassava from Thailand have been negatively impacted by lower grain prices in the EU, but this has been somewhat offset by rapid demand growth in China and increased domestic processing into value-added products (Henry, Westby, and Collinson, 1998). While Thailand dominates the trade of both dried cassava and starch, Viet Nam has made rapid gains.

International trade policy for the cassava value chain is free. This sector is not considered as strategically important, however, some processed products such as monosodium glutamate can be considered as having competitive advantage in Viet Nam. Fuglie and Oates (2002) noted that trade barriers have regionalized trade in the exportation of starch.

Table 8.1 Major exporters of cassava products, 1993-2002 (thousand tons of cassava equivalent)

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Thailand	19 050	15 630	11 269	12 545	15 152	11 024	14 249	13 438	16 120	11 621
Viet Nam	78	76	272	186	201	195	455	338	346	821
Belgium	-	-	-	-	-	-	-	267	471	368
Indonesia	2 971	1 779	1 482	1 239	749	1 126	1 199	444	542	325
Netherlands	1 310	858	396	437	349	207	514	620	229	216
Hong Kong	52	70	101	141	169	146	216	236	184	215
Costa Rica	56	98	112	132	132	132	140	147	160	181
Brazil	42	45	104	80	71	76	58	57	103	137
China	606	150	38	39	47	43	47	59	66	74
Ecuador	0	3	4	3	6	5	1	15	32	30
All others	1 494	1 196	587	471	422	768	428	136	125	105
TOTAL	25 659	19 905	14 365	15 271	17 298	13 722	17 307	15 755	18 378	14 093

Source: FAO.

Table 8.2 Exports of dried cassava and cassava starch to China from Viet Nam, 1995-2002 (tons, thousand of US dollars)

Quantity	1995	1996	1997	1998	1999	2000	2001	2002
Dried cassava	73 045	9 198	55 599	21 024	38 287	34 081	156 982	212 906
Cassava starch	1 329	36	260	365	9 231	24 945	82 833	116 181
Value								
Dried cassava	7 934	1 367	5 708	2 735	4 442	3 236	13 221	18 589
Cassava starch	91	11	56	98	1 936	3 167	9 771	13 916

Source: FAS Global Agricultural Trade System using data from the United Nations Statistical Office

Box 8.1 VEDAN diversifies products, expands cassava growing

"Vedan Viet Nam Ltd., is seeking to diversify exports and expand cassava-growing acreage to raise its monosodium glutamate output. "We are supplying more items including seasoning powder, cassava starch, modified starch, sodium hydroxide, inorganic acids, Javelle water, animal feed materials and fertilizers," Vedan Viet Nam deputy director Yeh Sheau Yeh told the Daily late last week. "The company earned US$ 160 million in sales last year including US$ 70 million in export revenue for which its main markets were Japan, China, the United States and the Philippines", he said. The company exports 40 per cent of its monosodium glutamate output, 80 per cent of cassava starch, 95 per cent of modified starch, 99 per cent of lysine and 60-70 per cent of condensed fermented soluble molasses used in the livestock industry. "Foreign buyers of the livestock and fisheries cultivation industry have for years used the VedaFeed molasses supplied by us. We sent more than 6,000 tons of VedaFeed to the USA last year," he said, adding that large animal feed manufacturers in Viet Nam like C.P, Proconco and Cargill are also buyers of the product. "The company annually requires one million tons of cassava, 500,000 tons of raw molasses and 120,000 tons of industrial salt but imports 50-70 per cent of the raw molasses and all of the salt due to shortages in local supplies", Yeh said. Vedan Viet Nam has committed to expanding the cassava growing areas this year as "our two cassava mills require 2,400 tons of cassava daily but are running at half capacity owing to a lack of cassava," he said. With current capital at US$ 387 million higher than the original capital, the company has built several factories with A-to-Z production lines on a 120-hectare plot in the southern province of Dong Nai." *(Reprinted from the Saigon Times Daily, No. 1598, Jan. 14, 2002).*

Box 8.2 Global trade barriers for cassava products

Global trade barriers have been cited as an external factor that could possibly mitigate the ability of developing countries to take advantage of increased demand for cassava products in world markets. Indeed, many developing countries have lamented the alleged existence of 'tariff escalation', in which tariffs are higher on value-added products than on raw materials, thus preventing opportunities for value adding within developing countries. The question that arises is whether this holds in the cassava value-chain (see Rich (2002) for a more general critique on tariff escalation).

As an exercise, tariffs for cassava (fresh, dried, or frozen HTS 0714.10), cassava starch (HTS 1108.14) and modified starches including cassava (HTS 3505.10) were collected for the most recent years available in eight major markets: the United States, European Union, Japan, China, Korea, Singapore, Taiwan, and Malaysia.

Continued …

Box 8.2 Global trade barriers for cassava products (continued)

Some comments that arise from the tariffs listed are as follows:

- It is difficult to generalize about tariffs in the cassava value-chain. For instance, in the USA, Singapore, Taiwan and Malaysia, tariffs are low, while they are relatively high in the EU. Tariffs in Japan vary by use, while they are moderate in China. Korea imposes a tariff-rate quota in which a small amount of imports are allowed at a low tariff, while the excess enters at higher rates (Fuglie and Oates, 2002). The 20 per cent tariff in China does not seem to have had much impact on slowing imports of cassava starch.
- There is a notable difference in tariffs for non-WTO members, where rates are differentiated as such. This presents significant motivation for countries that are not WTO members to find ways to obtain such access.
- Preferences through the Generalized Schedule of Preferences (GSP) are not very significant in the cassava value-chain, except (ironically) in the most processed, modified starches for Japan and the EU. The EU confers the least-developed countries (GSPL) duty-free access for all products except arms.
- The definition of GSP varies by country. For example, the USA does not give Viet Nam GSP privileges, while the EU does.
- There is no clear pattern of tariff escalation in the cassava value-chain. In some cases (USA, Korea, Malaysia), the highest tariffs are on the raw product. In the EU, there is likely tariff de-escalation as well, since the value of starch is higher than cassava, implying that the specific rate implies a lower percentage tariff.

Of course, non-tariff barriers concerning issues of food safety, pesticide residues, among others are not discussed here but there is little indication that they act as a constraint to the sector.

8.1.4 Investment policies

Building new cassava processing factories

In Viet Nam there are now 24 cassava-processing factories in action with a total processing capacity of 1.2-2.0 million tons of fresh roots annually.

Recently, large companies such as VEDAN, also invested in the cassava industry for exportation. This starch sector is very attractive for FDI in starch processing factories (Thailand, Malaysia, Indonesia) mostly in the South.

The nation produces about 400-600 thousand tons of dry cassava products annually. Exports of cassava starch are now reaching 180-350 thousand tons per year. The major markets of Viet Nam's cassava exports are China, Taiwan, Japan, Singapore, Malaysia, the Republic of Korea and countries in Eastern Europe. Vedan-Vietnam Enterprise Corp. Ltd. is one of the leading companies in cassava processing. Besides, animal feed factories also contribute significantly to the increasing demand for cassava roots.

Table 8.3 Cassava processing factories in Viet Nam in 2001

Region	Province	Number of cassava processing factories	Capacity T1,000 (cassava starch/day)	Production T1,000 (of cassava fresh root/year)	Note
Southeastern	Tay Ninh	06	420	479.1	In action
Region		03	250		Factory under construction
	Binh Phuoc	06	590	370.6	In action
	Dong Nai	05	415	284.5	In action
	Baria Vungtau	01	175	121.2	In action
Mekong	An Giang	01	60	24.0	In action
Central	Dak Lak	02	110	36.1	In action
Highlands	Gia Lai	01	50	144.0	In action
	Kon Tum	02	150	155.8	Factory under construction
South	Quang Nam	01	100	108.9	In action
Central	Quang Ngai	01	50	63.9	In action
Coast	Phu Yen	01	50	33.7	In action
	Thanh Hoa	02	110	93.1	Factory under construction
North	Nghe An	01	60	63.1	Factory under construction
Central	Quang Tri	01	60	27.4	Factory under construction
Coast	Thuathien Hue	01	100	28.3	Factory under construction
Northeastern	Bac Can	02	180	123.3	Factory under construction
Region	Yen Bai	01	50	76.2	Factory under construction
	Phu Tho	01	60	92.5	Factory under construction
Northwestern	Son La	03	150	142.8	Factory under construction
Total	**19/61**	**42**	**3 190**	**2 069.5**	

Source: Pham Van Bien, 2003.

Wide dissemination of new high-yielding varieties

From 1991-2000, the Institute of Agricultural Science of South Viet Nam (IAS) and the Viet Nam Cassava Research and Extension Network (VNCP), in close co-operation with CIAT, Vedan and other starch processing factories released six new varieties: KM60, KM94, KM95, KM95-3, SM937-26 and KM98. New, high-yielding cassava varieties and more sustainable production practices have increased the economic effectiveness of cassava production, especially in the southeastern region.

With the establishment of new processing factories in recent years, cassava has changed from being a food crop to being an industrial crop. In 2001/02 more than 94,500 hectares of new varieties were grown, mainly in the Southeast. This represents about 33 per cent of the total cassava area in the country. Increases in yield and starch content raised production by 450 thousand tons of fresh roots or 126 thousand tons of starch equating to approximately 252-378 billion dong (16.8-25.2 million US dollars) per year.

Table 8.4 Approximate cassava area, production and yield as well as the spread of new varieties in various regions of Viet Nam in 2001/02

Regions	Cassava production (1,000 t)	Fresh root yield (t/ha)	Total area ('000 ha)	Total area with new varieties ('000 ha)	Percentage with new cassava varieties
Total Viet Nam	**3 145.1**	**10.9**	**288.4**	**94.5**	**33**
-Red River Delta	74.3	9.4	7.9	0.5	6
-Northeastern Region	443.4	9.2	48.2	4.5	9
-Northwestern Region	261.3	7.8	33.5	1.0	3
-North Central Coast	269.5	7.0	38.5	1.5	4
-South Central Coast	413.7	10.5	39.4	17.8	45
-Central Highlands	515.9	11.0	46.9	12.6	27
-Southeastern Region	1 097.3	16.5	66.5	54.0	78
-Mekong River Delta	69.7	9.3	7.5	2.6	35

Source: Adapted by Hoang Kim from MARD, 2002a; MARD, 2002b; Statistical Yearbook, 2001.

Infrastructure provisions

Irrigation

Cassava is an important crop for many producers, particularly the poor. In the North, cassava is primarily grown in mountainous as well as midland regions and is a food source for ethnic minority groups. By contrast, in the South, cassava is mainly used in the starch processing industry. Cassava is typically a rainfed crop; there is no irrigation in the various regions.

Transportation

The average distance traveled to acquire roots in Ha Tay province is less than 1 kilometre, while in Yen Bai province processors travel over 20 kilometres to obtain the roots (Team Research Survey, 2004). Wet starch sales in Ha Tay province tend to be localized but Yen Bai wet starch is sold to traders from Phu Tho and Ha Tay provinces (Team research survey, 2004).

The government does not apply specific subsidies for cassava transportation as in the case of maize. However, actual road conditions mean that transport is not a major constraint in the cassava value chain.

Marketing

In the cassava cultivation areas in the North, like Yen Bai province, outside traders play a dominant role in setting the prices paid to cassava farmers, in spite of efforts made by the starch processing enterprise (Van Yen enterprise) to establish contract farming with cassava farmers. Farmers prefer to sell their cassava to local assemblers either through spot markets, oral contracts, or in some cases through trade credit. In fact, the enterprise

has to pay a bonus or extra payment to local assemblers, who are the main sources of supply for the factory, in order to have enough raw material for production.

Outside traders own trucks and have close linkages with local assemblers as well as cassava traders in the domestic starch centres (like Duong Lieu commune in Ha Tay province) and on the border with China. The majority of dry chips (as opposed to fresh roots) go to China since the Van Yen Factory does not procure dry chips. The equipment in use at the factory is technically unable to process dry chips. Meanwhile, Chinese enterprises can process dry chips into starch more efficiently. Fresh cassava roots are brought to the Duong Lieu Centre for sale.

In the fresh root market, outside traders pay slightly higher prices to local assemblers, compared to those offered by the factory. Traders do not impose high quality standards for the quality of fresh cassava roots that they procure. Therefore, without administrative restrictions, it is very difficult for the factory to procure enough fresh cassava for processing. Chinese importers largely influence the price paid for dry chips. However, not all farmers are willing to produce dry chips because they depend on the weather and are labour intensive.

In the starch processing centres of the North, like Duong Lieu and Cat Que communes (Ha Tay province), market information is well shared among stakeholders. The fresh roots are carried to the principle market of the two communes from other provinces, where the processors either buy the raw materials from the spot markets or order through the large cassava traders in the commune. In addition, there are also starch traders, who, along with the direct users of starch for maltose and food production, transmit price signals from end-users to starch processors. There is a balanced network between buyers and sellers, in which buyers and sellers know and trust each other well before participating in exchange activities.

HYV cassava requires more costly purchased inputs such as fertilizers and cultivars. In addition, labour accounts for the highest expense in terms of economic costs. As a result, large landholding cassava farmers, often in the South, tend to replace wage labour and machinery for family labour.

The cost of cassava production is high in the North and the rate of HYV adoption is low. The opposite is true in the South. In addition, better farming practices (such as cassava-peanut intercropping and cassava crop rotation) help not only economize production costs, but also bring about higher output prices and environmental benefits.

Consequently, three implications can be drawn for the upgrading of cassava producers in the value chain: (i) the availability of fertilizers and cultivars is an important determinant for the adoption of HYV cassava, which is expected to produce higher yields and starch content as well as generate high economic returns; (ii) proper use of fertilizers not only increases yield, starch content and economic returns, but also reduces dry soil losses; (iii) large landholding farmers are more likely to apply new farming practices and to make use of economies of scale in cassava production. This, in turn, suggests that group sales and cassava co-operatives may play important roles in boosting the farmers' position in the cassava value chain.

In the starch sector, starch processors generate relatively high profits with shortages of raw materials as one of the most serious constraints in the sector. The first class dry starch processors receive the highest profit in the South because they enjoy economies of scale in terms of labour costs, electricity and water fees, as well as transportation costs. In contrast, second class dry starch processors and wet starch processors receive the lowest profit both in terms of absolute and relative value in comparison with the first class dry starch processors, except in the case of micro and small-scale starch processors in Ha Tay province. As a result, we can expect consolidation in the starch industry with the predominance of medium and large-scale dry starch processors, which will make the sector more efficient and competitive. In fact, this consolidation has already taken place in Tra Co commune (Dong Nai province), where the number of starch processors has fallen from more than 100 micro and small-scale starch processors to 26 medium-scale starch processors in the last five years. This consolidation process not only enhances the profitability of starch processors, but also reduces pollution from starch processing. Furthermore, the profit of micro and small-scale starch processors is further reduced when processing sites are situated far from cassava farms due to high transportation costs. Against this backdrop, farmers and starch processors benefit most if there are direct sales of cassava from farmers to dry starch processors. Moreover, cassava farmers benefit most in places like Tay Ninh province, where there are many private starch processors with a high level of competition for cassava raw materials.

As a result, six major propositions are put forward:

1. Starch processing is very profitable but the most serious constraint to the sector is the shortage of raw cassava materials;
2. Consolidation into medium and large-scale, first class dry starch processing units not only enhances efficiency but also reduces environmental costs;
3. The development of medium and large-scale starch processors is beneficial for cassava farmers;
4. Starch processing units should be located close to cassava farms;
5. Cassava farmers and starch processors benefit most from direct sale between one another. This suggests that contract farming is a better way to bring benefits to both cassava farmers and starch processors. In addition, contract farming with inputs on credit (like cultivars and fertilizers) enhances the upgrading potential of cassava farmers in the value chains and reduces the environmental cost of dry soil losses.
6. By organizing cassava farmers in sales associations or cassava co-operatives and linking them into contracts with starch processing enterprises, we can expect the highest economic returns and lowest environmental costs for both cassava farmers and starch processors.

Combined with the information on market organization mentioned previously, the following issues need to be addressed:

1. (Given its high transaction costs), why are there so many layers of transaction from cassava farmers to starch processors in Viet Nam?
2. Why do direct contracts between medium and large-scale starch processing enterprises and farmers often fail?
3. Why do processing communes like Cat Que (Ha Tay province) still exist, though they are either far from cassava farms or operate on a smaller scale?

The answers to such questions, in turn, must be addressed from two perspectives: (i) the nature of the contracts between the starch enterprises and cassava farmers; and (ii) the nature and performance of cassava traders. For the former, it is observed that contracts often fail or exist in a very modified form, in which the starch enterprises use cassava traders as the main contractors. In-depth interviews with enterprise leaders and PRAs with cassava farmers show six major reasons for the collapse of direct contracts between starch enterprises and cassava farmers:

1. There are too many small landholding farmers as well as micro and small-scale processors prevalent in the cassava value chain. Only large-scale starch processing enterprises are willing to engage in contracts with farmers, particularly large landholding farmers, since the enterprises face shortages of raw materials and under-capacity production. Large landholding farms are rare, and such farmers have no incentives to sign such a contract (though they are mostly preferred by large-scale starch enterprises for contract farming) as there are many alternative market outlets (particularly as prices have been rising) with the existence of many small-scale private processors. On the other hand, small-scale processors have no incentives to sign contracts with farmers because they can easily buy raw materials from the spot markets or traders. In addition, though the profit of small-scale processors is lower than large-scale enterprises, they are unwilling to exit the market or expand production for two major reasons: (i) small-scale processors still offer competitive prices, even though profit is low, in order to deal with labour surplus; and (ii) there is limited space to expand the production of small-scale processors.
2. The large-scale enterprises are only willing to buy raw materials in large volume. Only rich farmers with large landholdings can meet this demand but they do not require inputs on credit or advanced payment. Therefore, it is very difficult to convince them to follow the terms of contract strictly, particularly when such farmers can sell cassava to the outside markets whenever the market price is higher. In contrast, small farmers are more willing to partake in contracts with starch enterprises as they require credit for inputs and advanced payment. However, it is too costly and complicated for starch enterprises to deal with many small farmers as a more complicated procurement procedure is required, with numerous staff needed to introduce and supervise the contracts.
3. The large-scale enterprises are only willing to purchase the raw materials at the factory gate, rather than the farm gate. Transportation costs for individual deliveries to the factory are prohinitively high for cassava farmers. Therefore, they prefer to sell to local assemblers. On the other hand, starch enterprises are not willing to locate their procurement stations near the farm because they cannot afford the cost of labour and machinery for quality control.
4. The large-scale enterprises require very high quality cassava. Farmers report that cassava delivered to the factory needs to be clean and in good condition. In

addition, the enterprises also place very strict control over the starch content. Furthermore, starch enterprises do not buy dry chips, which could help cassava farmers save on storage and transportation costs.

5. Procurement mechanism is not transparent in large-scale enterprises, in which procurement staff may incorrectly measure the starch content of farmers' cassava at a lower level, transferring the redundancy to traders with frequent deliveries for a high bonus. In addition, sales to the enterprises have to go through complicated procedures and are time consuming. Particularly during the harvest season when many farmers sell cassava to the enterprise. They have to queue for long periods of time and are then faced with numerous factory staff and abundant red tape.
6. Based on the support of the local authorities, starch SOEs may set procurement prices lower than the outside market, which discourages farmers from continuing contracts with the enterprises.

8.2 Research and development

8.2.1 Selection and development of high-yielding varieties

The aim of the Viet Nam Cassava Research and Development Project (VNCP) for the 2001-2005 period is: i) to expand the growing area of KM94 and other promising varieties up to 150 thousand hectares, or close to 55-60 per cent of the total cassava area in the country; ii) to select and release 1-2 new varieties with a high-yielding capacity of 35-40 tons per hectare, a starch content of 27-30 per cent, a growing period of 8-10 months, erect stems, short internodes, less branching, compact canopy, uniform root size, white root flesh and suitable for industrial processing; and iii) to select short-duration varieties of high quality, suitable for human consumption and animal feed.

In the 2001/02 period, five million stakes of new varieties, mainly KM94 and KM98, were distributed to various provinces under this programme; 250 cassava accessions were maintained in the germplasm bank; 12,000 hybrid seeds were either collected or introduced; more than 780 promising clones were selected, of which KM140, KM146 and KM163 will be further tested and possibly selected for release; and trials and multiplications were conducted in 25 provinces (Hoang Kim *et al*., 2002).

During the 2003/05 period, VNCP is set to promote the rapid multiplication and wide distribution of high-starch and high-yield varieties, as well as the adoption of sustainable cassava production practices, especially in the Central Coastal, Central Highlands and Mekong Delta regions.

For cassava producers, technological and environmental problems are primarily oriented towards the adoption of new high-yielding varieties (HYVs) and the application of new practices for cassava production, such as intercropping cassava with grain legumes (peanut and beans) appropriate for specific soils and extensive crop rotation.

8.2.2 Varietal improvement

Traditionally, cassava has been a subsistence and food security crop for poor farmers. Cassava helped the poor avoid starvation and was an important food for soldiers during the war. Cassava is easy to grow, though it generally generates low yields (7 tons per hectare) without proper agro-ecological management and input use.

Recent innovations in hybrid cassava varieties have led to the development of cultivars with higher yields and starch content. At the same time, HYV cassava is typically more appropriate for industry rather than food or feed uses due to the higher toxicity of the raw product; however, this can be eliminated through adequate processing. As a result, the traditional 'food security' role of cassava is being eroded by the adoption of HYVs. On the other hand, this development has contributed to greater economic returns for cassava producers, as cassava is subsequently transformed from a food crop into an industrial crop, thus better lending itself to modern starch processing enterprises.

The adoption of HYVs took place very slowly up to 1995. However, adoption has been variable and regional. The HYV adoption rate was highest in the southeast and lowest in the northwest. The figures reflect the differences among regions in terms of cultivation conditions, land availability, level of land erosion, access to new HYVs, ethnicity, level of commercialization and income.

The evolution of HYV cassava varieties produced and disseminated since the 1990s was reviewed and Table 8.5 compares the technical characteristics of the varieties, including economic profitability where available.

Experiments and Farmer Participatory Research (FPR) have shown that KM94 and KM98-5 are two varieties that have high yields, high starch content, can generate high profit and are appropriate for various ecological zones in the country. Furthermore, these two varieties complement one other as KM94 has a long growth cycle while KM98-5 has a short one. As a result, the Ministry of Agriculture and Rural Development nominated KM94 and KM98-5 as the national varieties, though only KM 94 is currently widely disseminated.

Table 8.5 Evolution of HYV cassava

Variety	Year Released	Characteristics
KM60	1993	Originally named Rayong 60, was introduced from the Thai-CIAT programme in 1989. High fresh yield. Recommended for early harvesting. Excellent agronomic traits. Good root shape but flesh colour is slightly yellow.
KM94	1995	Originally named MKUC 28-77-3 (Kasetsart 50), was introduced from the Tai-CIAT programme in 1990. High yield and starch content. Good root shape and white flesh. Good stake quality. Tolerant to major pests and diseases. Well adapted to unfavourable conditions.
SM937-26	1995	Original named SM937-26, was introduced from the Thai-CIAT programme in 1990. High yield and starch content. Good root shape and white flesh. Good plant type. Good stake quality.
KM95	1995	Selected from F1 hybrid seeds introduced from the Thai-CIAT programme in 1992 (originally named SM33-17-15). High fresh yield. Early harvest ability. Multi-purpose use for direct human consumption, feed and processing. Good root shape and white flesh.
KM95-3	1998	Selected from F1 hybrid seeds introduced from the Thai-CIAT programme in 1992 (originally named SM1157-3). High fresh yield. Early harvest ability. Multi-purpose use for direct human consumption, feed and processing. Good root shape and white flesh. Good plant type. Good stake quality.
KM98-1	1999	Selected from F1 hybrid seeds introduced from the Thai-CIAT programme in 1995 (pedigrees Rayong 1 x Rayong 5). High fresh yield. Early harvest ability. Multi-purpose use for direct human consumption, feed and processing. Good root shape and white flesh. Good plant type.

Source: Hoang Kim *et al*., 2001.

Previously, KM60 was used for HYV production and was initially introduced to Viet Nam in 1989. Farmers adopted this variety extensively post 1993. Its major characteristics are high yield (25 tons per hectare), high starch content (more than 27 per cent), a growth cycle of 8-10 months, tolerance to drought and suitability in various ecological zones in Viet Nam. Yet, as Table 8.6 shows, the yield and economic return of KM60 are much lower than those of KM94 and KM98-5, and the development of such varieties has reduced the use of KM60.

KM94 is the most popular cultivar adopted by farmers and has a bent stalk as well as being appropriate for intensive farming. The potential yield of KM94 is high at 25-45 tons per hectare, the starch content is 28 per cent and KM94 is tolerant to drought and major pests and diseases, thus saving on irrigation and pesticide/herbicide costs, as well as being adaptable to various ecological zones in the country. The growth cycle of KM94 is 9-11 months and it can be stored on-farm post harvest for more than a month, and off-farm post harvest for 1-2 days without reducing the starch content.

Table 8.6 Characteristics of selected cassava varieties

Variety	Growth Cycle (months)	Fresh root yield (tons/ha)	Dry matter content (%)	Starch content (%)	Dry starch yield (tons/ha)	Harvest index (%)	Stake grading (1-10)	Root grading (1-10)	Economic return [a]		
									Revenue	Cost	Profit
KM140	8-10	35.0	40.2	28.7	10.0	65	10	9			
KM98-5	8-10	34.5	40.1	28.5	9.8	63	9	9	10 798	7 286	3 512
KM94	9-11	33.0	40.3	28.7	9.5	58	8	9	10 395	7 086	3 309
KM98-1	8-10	32.2	38.8	27.6	8.9	66	8	9	-	-	-
KM60	8-10	24.5	38.7	27.4	6.7	56	8	8	7 470	6 220	1 250
HL23	9-11	16.5	36.3	25.3	4.2	53	8	7	-	-	-

Source: Tran Ngoc Ngoan, 2003.
Notes: [a] Estimated at 2003 prices, thousand dong per hectare.

The major disadvantage of KM94 is that it is only appropriate for intensive farming in good soil. This restricts the participation of the poor because their farms are often located on impoverished, sloping land and they have limited access to capital to purchase fertilizer.

KM98-5 is currently undergoing the registration process to become the national dominant variety. KM98-5 has a short growth cycle, high yield and adapts to various ecological zones with the following prime characteristics:

1. Short growth cycle of 8-10 months (it can be harvested, however, after 7-8 months) and can complement KM94 to support crop rotation for cassava farmers and stabilize raw material supply to enable the starch processing enterprises to utilize their full capacity.
2. Significantly higher yield (34.5 tons per hectare) and starch content (28.5) than those of other varieties like KM98-1, KM60 and HL23.
3. Medium-height stalk, tolerant to windy conditions, strong growth of stalk and early leaf defoliation to cover surface soil, harvest index of 63 per cent and dry matter content of 40.1 per cent.
4. Good root shape and white flesh; attractive to starch processing enterprises.
5. Tolerant to pests and diseases.
6. Adaptable to various ecological zones.
7. Untidy stalk shape, and short, on-farm preservation time (harvesting after more than 10 months will lower starch content).

In short, KM98-5 has many superior characteristics. In addition, the stalk of KM98-5 is not too tall and resists windy conditions. Therefore, the variety is particularly appropriate for cultivation on sloping land, accounting for 45 per cent of cassava cultivated area in Viet Nam. Furthermore, KM98-5 is better for soil conservation. Finally, the short growth cycle of KM98-5 helps increase crop intensity (three crops in two years) and KM98-5 can be rotated with other crops (a growth cycle of 3-4 months).

Throughout the country, the adoption of HYV cassava has brought about sharp hikes in yield because often HYV cassava is cultivated on newly settled land. The problem is how to maintain soil fertility because cassava yield decreases as soil fertility drops. This suggests that HYVs must be adopted in tandem with improved cultivation techniques as discussed in the subsequent section.

8.2.3 Cultivation techniques

Forty-five per cent of cultivated cassava area is on sloping land, particularly in mountainous areas in the North and the Centre. In addition, the planting density of cassava is relatively low, hence it causes a large amount of dry soil loss. Studies by the National Institute for Soil and Fertilizers show that cassava production generates losses of 40-100 tons of dry soil annually at the experimental sites. Therefore, it is necessary to apply several solutions to prevent land erosion from cassava cultivation such as sufficient ploughing, effective application of fertilizer, intercropping and, in particular, building contour hedgerows with vertiver grass or pineapple brush.

Therefore, along with the adoption of new HYV cassava, it is also necessary to introduce farming practices that help reduce dry soil losses and promote environmental sustainability. Research institutes have paid attention to these issues for many years and some experiments have been conducted successfully (see appendices 1-5 for more detailed information).

1. Cassava-peanut Intercropping: one row of peanuts between two rows of cassava (varieties KM94, KM98-5 on alluviant and impoverished land). This experiment was conducted in Dong Nai province and showed that both yield and economic returns are high. Profit was 5.24 million dong per hectare and 60 per cent of farmers preferred this farming practice.
2. Cassava-peanut Intercropping: two rows of peanuts between two rows of cassava (peanut variety MD7, cassava variety KM94 on hilly land). This experiment was conducted in Thach That district, Ha Tay province, and doubled profit compared to cassava monoculture (15.75 and 7.47 million dong per hectare respectively). Such cropping patter generated more profit than the practice of one row of peanuts between two rows of cassava (only 12.8 million dong per hectare). Fifty-six per cent of farmers preferred this farming practice.
3. Experiments to compare farming practices in terms of intercropping and monoculture: The Thai Nguyen Agro-Forestry University conducted an experiment to compare the economic returns of different farming practices on 10^0 sloping land, using the same level of fertilizer, manure and powdered lime. Results of the experiment are shown in Table 8.7:

Table 8.7 Economic returns and dry soil losses of selected cultivation models

Model	Return (million dong/ha)	Dry soil loss (tons/ha) (Slope 10^0)
Cassava monoculture	1.25	31.24
Cassava-peanut intercropping	3.63	24.03
Cassava-soybean intercropping	0.29	28.50
Cassava-mung bean intercropping	2.65	28.61
Cassava-black bean intercropping	1.68	28.64
Cassava- cook bean intercropping	0.05	28.14

Source: Tran Ngoc Ngoan, 2003.

Table 8.7 shows that cassava-peanut intercropping generates the highest profit; three times higher than the profit generated by cassava monoculture, and cassava-green bean intercropping realized profit that was two times higher than cassava monoculture. Furthermore, intercropping helps reduce dry soil losses. The best model to preserve soil was cassava-peanut intercropping with two rows of peanut between two rows of cassava. With cassava monoculture, dry soil losses represent 31.24 tons per hectare, while cassava-peanut intercropping causes only 24.03 tons of dry soil loss per hectare.

Further experiments at the Thai Nguyen Agro-Forestry University (TUAF) showed that cassava-peanut intercropping is the most efficient method in terms of both farmers' income and soil protection. There are various ways to intercrop cassava with peanut.

Table 8.8 Yield and economic returns of cassava-peanut intercropping TUAF Experiment Station, 1998

Trial	Yield (tons/ha)		Revenue (million dong/ha)	Cost (million dong/ha)	Profit (million dong/ha)
	Cassava	Peanut			
1. Cassava-peanut intercropping (one row of peanut between two rows of cassava)	30.00	0.58	15.22	7.33	7.69
2. Cassava-peanut intercropping (two rows of peanut between two rows of cassava)	29.18	0.90	16.17	8.72	7.45
3. Cassava-peanut intercropping (three rows of peanut between two rows of cassava)	27.32	1.15	17.07	9.20	7.87
4. Cassava-peanut intercropping (four rows of peanut between two rows of cassava)	24.79	1.23	16.04	9.63	6.41

Source: Trinh Phuong Loan, 2003.

Trials 1-3 return similar profits. Yet, farmers prefer to intercrop one to two rows of peanut with cassava, although the model with three rows of peanut generates high profit it requires more, skilled labour.

The development of cassava crop rotation coincides with the transformation to commercial HYV cassava and depends on climatic conditions in specific ecological zones.

Therefore, it is necessary to conduct experiments to determine the appropriate model for cassava crop rotation.

Yet, in principle, cassava crop rotation can simply be practiced with long growth cycle varieties (like KM94: 9-11 months) and short growth cycle varieties (like KM98-5 and KM60: 8-10 months), given KM94 can be stored on-farm for one month without reducing yield and starch content. As a result, the combination of KM94 and KM98-5 (or KM60) on the same farm helps extend the harvesting season for more than three months. In addition, a time lag of two weeks in the planting of two different varieties can extend the harvesting season by four months.

Cassava crop rotation prevents price slumps during the peak season. In addition, it minimizes the underemployment of farm labour and equipment. Furthermore, crop rotation supports starch processing enterprises to fully utilize their capital year round.

8.2.4 Micro and small-scale processors

Cassava production and cassava processing in certain households were established in the evolution of a commodity-driven economy from a planned, self-sufficient economy. The new commodity-driven economy is based on scientific and technological advances. Improvements in equipment and processing lines were always linked to environmental considerations. In line with such developments, a labour division combined with specialization was also established within families, between households, hamlets and villages. Therefore, many traditional cassava-processing units were established, such as in Duong Lieu (Ha Tay), even though they do not grow cassava.

This section is confined to a discussion on micro and small-scale processing with manual and semi-mechanized techniques as well as their environmental impacts.

A number of methods can be employed in the production of starch. The traditional method is manual requiring little capital and simple equipment as well as facilities, which are commonly available in farmer households. The process is described as follows:

After picking the cassava, a blunt knife or piece of bamboo is used to peel the outer layer of the cassava.

1. Using a sharp knife to remove the rachis (1-2 cm) and bulb (1-2 cm), a line is scratched from the top to the bulb with the knife to remove the velamen (which can be dried for livestock feed).
2. The cassava is cleaned and stored in a jar and filled with clean water.
3. After 2-3 days, the cassava should be overripe. Hands or some bamboo can be used to dissolve the cassava starch into water.

4. Using a water basin or tube, the cassava liquid is poured onto a thin basket above another jar, straining the liquid into the jar and leaving the residue cassava waste and remaining starch in the basket. To separate the remaining starch from the mixture, the basket with the cassava mixture is submerged in a large water basin. The cassava waste can be dried for livestock feed.
5. The crushed cassava residue is separated through a sieve and place over another jar to refine the starch, draining the starch liquid into the jar.
6. More water is poured into the jar, left to stand overnight and then the water is drained off (overflowing water will smell pungent). The black and poor-quality surface layer is picked to dry for livestock.
7. The jar is stored for one more day draining off the water 1- 2 times.
8. When the starch in the jar has formed into a 'block', a knife is used to skim the surface layer and bottom layer and then dried for livestock.
9. To whiten the cassava, a cloth is used to squeeze a piece of cassava and then it is dried in extremely hot weather. The cassava may not need much squeezing but must be scattered over a basket.
10. When the starch is dry, it is placed in a jar for storage. It is edible all year round and between 40 and 100 kilograms of white cassava can be produced.

This process has created a traditional trade, however, the process contains some disadvantages including damaging the environment. Therefore, applying the process requires certain terms and conditions, such as:

1. Gardens and yards should be relatively large;
2. There should be a well in the garden or nearby;
3. Existing equipment such as jars and baskets should be used;
4. Labourers should be taught and trained; and
5. Producers really want to process and consume as well as launch into the market.

During this process, micro-scale cassava processors have also improved their processing technology by purchasing large jars; constructing large water containers with three drain valves: bailing out pure water, extracting black powder and starch; digging holes; and setting up culverts to direct waste water, reducing environmental pollution. This has also led to an increase in productivity and some households have been able to purchase small machinery. As a result, many trade villages have developed steadily, gaining higher

economic efficiency (processing 100 kilograms of fresh manioc earns 20,000 dong profit) from 1975 to 1990.

Some micro-scale processing units (approximately 200-500 kilograms of manioc per day) face difficulties competing with larger ones because of low productivity. In the past, processing 100 kilograms of manioc earned 20,000 dong in profit. Now that amount is only 5,000 dong (Reported by Commune Leaders of Cat Que, Ha Tay). Many households were forced to abandon their livelihoods and seek income through other work. To overcome the difficulties, cassava processing technology was improved. On the other hand, some processors under the right conditions created small grinders in 2003. Washing, peeling and stirring, however, remain manual. In general, this success marked a new step forward in processing technology renovation from manual to semi-mechanical processes.

What follows is an explanation of the semi-mechanical cassava process:

1. Cassava materials: If the material has recently been picked or bought, it requires immediate processing during the first couple of days to avoid a reduction of cassava content.
2. Method of washing, peeling: Dig a hole, put the cassava into the hole, trample to remove the soil, sand as well as shells and then wash before placing in grinder.
3. Using the grinder: Grind all the peel and the manioc into powder (however, to produce higher quality cassava, it is better to grind manioc after peeling it and cleaning with water).
4. Filter the powder by hand: In order to separate cassava grounds and starch a net should be placed above a filter screen. Under the filter screen a cistern, which has a hose connected to another basin should be in place. The powder, after being filtered through the net, will again be filtered through the filter screen and poured into the cistern following the hose into the basin. After a while, the starch will settle at the bottom of the basin.
5. Draining for black and white starch layers: After filtration two layers of starch will be present at the bottom of the basin. The white layer of higher quality starch lies beneath the black layer of lower quality. Therefore, in the basin, three holes are bored. The first hole in the black layer is opened first to drain out the pure water, after that a second hole adjoining the white layer is opened to remove the black layer, the final hole, in the bottom of the basin, is subsequently opened for the white starch.

6. Reversing wet starch: Wet starch is also considered a commercial product. Wet starch can be sold right after processing. If the price doesn't satisfy the sellers or they tend to dry the wet starch, they can dig holes to preserve the wet starch. The size of the hole depends on the volume of the starch. The hole is dug where the soil is smooth but steady and doesn't need to be covered by bricks; however it is better if the hole is surrounded by bricks. In the hole there must be a canvas or oil cloths to retain the moisture.
7. Drying wet starch: For households that process dried starch on a small scale like those in Tinh Khe commune, Quang Ngai, wet starch should be immediately dried in the sun. There should be drying areas set aside; drying frames with scales depend on the volume of the wet starch and the capacity of each household as well as the processed groundwork.
8. Preserving dried starch: Dried starch that is not for sale, needs to be preserved. The dried starch should be packed into bags, weighing 25 or 50 kilograms each. Because dried starch has a strong exsiccative character, the shed in which it is stored must be dry and protected from sunlight.

8.2.5 Development of extension service networks

The project 'Improving the Sustainability of Cassava-based Cropping Systems in Viet Nam' sponsored by the Nippon Foundation, was implemented with CIAT's technical support. The use of Farmer Participatory Research (FPR) in the development and transfer of new technologies to cassava households has been quite successful in the mountainous and hilly areas of the North, the central coast and southeastern region.

Several suitable cassava cultural practices were developed: i) erosion control by growing vetiver grass and other plant species along contour lines; ii) balanced fertilizer application of about 60 kilogram N, 40 P_2O_5 and 120 K_2O per hectare, together with animal manure; iii) intercropping cassava with peanut and/or mung bean; iv) planting new high-yielding varieties; v) using the herbicide Dual (2.4 l/ha); and vi) using silage from cassava leaves and roots for animal feeding (Tran Ngoc Ngoan and Reinhardt Howeler, 2002; Nguyen Huu Hy *et al.,* 2002; Thai Phien and Nguyen Cong Vinh 2002). Farmers supported the project actively because it helped them make effective use of available local resources and developed better cassava cultural practices through their own selection (Nguyen The Dang, 2002; Le Van An *et al*., 2002; Nguyen Thi Cach *et al*., 2002; Tran Thi Dung and Nguyen Thi Sam, 2002).

8.2.6 Use of cassava leaves and roots in animal feeds and food processing

Cassava leaves have a high protein content (20-25 per cent of the dry leaves), while cassava roots have 25-30 per cent starch but are low in protein (1-3 per cent). High-yielding cassava varieties usually have high HCN content, limiting the use of roots and leaves for animal feed. Drying or ensiling cassava leaves and roots will markedly reduce their HCN content. Many studies have shown the effect of different processing methods on the chemical content and nutritional value of cassava leaves and roots (Pham Sy Tiep, 2001); the use of cassava roots and leaves for feeding pigs (Le Duc Ngoan and Nguyen Thi Hoa Ly, 2002); young stems and leaves for feeding cows (Doan Duc Vu, 2001); the use of cassava dried leaf powder as animal feed for chickens and pigs (Duong Thanh Liem *et al*., 1998); feeding cassava leaves to silkworms (Tran Cong Tien *et al*., 2001); as well as using cassava stems to grow mushrooms (KCM TN, 2002). Studies regarding the use of cassava leaves in industrial processing and for feed by Glon-Sanders Inc. and Proconco Company were conducted in the southeastern region (Froehlich and Thai Van Hung, 2001).

8.2.7 Applying biotechnology to cassava breeding and multiplication

Tissue culture techniques were applied to improve cassava breeding and multiplication (Hoang Kim *et al*., 2002). These techniques are being studied to maintain cassava germplasm in-vitro, for rapid multiplication of new high -yielding varieties, to make wide hybridizations, and for mutation breeding.

8.2.8 Cassava starch industry and high quality products

The cassava starch industry is already highly developed in Thailand, China, Republic of Korea and Japan. However, only a few studies have been conducted in Viet nam concerning the hydrolysis of cassava starch using amylase enzymes for alcohol production (Ngo Ke Suong and Hoang Kim Anh, 2001).

8.2.9 Cassava market information and trade contacts

FAO, IFAD and other international organizations have developed a global cassava strategy to co-operate and support cassava growing countries. Information on cassava production in Viet Nam can be found at:

- http://www.globalcassavastrategy.net;
- http://www.ciat.cgiar.org;
- http://danforthcenter.org/iltab/cassavane;
- http://www.agroviet.gov.vn;

- http://mard.gov.vn; and
- http://www.vneconommy.com.vn.

8.3 Potentials and constraints in the development of technology and the extension service network

In the activities framework of state extension, there is not a programme specific to cassava extension. The recent cassava growth requires a new strategy for sustainable cropping on slopping land.

The project 'Improving the Sustainability of Cassava-based Cropping Systems in Viet Nam' sponsored by the Nippon Foundation, provided FPR training courses for extension workers.

At the beginning of the project in 1994 none of the project staff, both from CIAT and the national programmes, had any experience in farmer participatory methodologies. Thus, the project commenced with a one week Training-of-Trainers (TOT) course on farmer participatory methodologies with staff from CIAT and others with more experience presenting their ideas. After lengthy discussions about methodologies, as well as extensive sessions in the classroom and with farmers in the field, most participants felt more or less comfortable with the new approach and were willing to test it in their own countries.

This initial course in English was followed by several TOT in–country courses for researchers and extensionists of national programmes taught partially in English (with translation) and partially in the native tongue by resource persons from that country. Project staff that had participated in the first phase and had gained experience with the methodologies then served as resource persons in subsequent TOT courses for staff joining the second phase. By that time, manuals on farmer participatory approaches had been prepared in Chinese, Thai and Vietnamese, making the teaching more efficient. Table 8.9 provides details about the training.

Table 8.9 FPR training courses conducted as part of the Nippon Foundation project in Viet Nam

Year	Type of training course	Location	Number of participants
1997	Researchers and extension workers	Thai Nguyen	28
1999	Researchers and extension workers	Ho Chi Minh	29
2000	Farmers and local extension workers	Thai Nguyen	29
2001	Farmers and local extension workers	Ho Chi Minh	24
2001	Farmers and local extension workers	Hue	29
2002	Farmers and local extension workers	Van Yen	53
2002	Farmers and local extension workers	Hue	34
2003	Farmers and local extension workers	Nhu Xuan	66
	Total number of participants		**292**

Source: Tran Ngoc Ngoan, 2003.

Subsequent to training the project staff on TOT courses, focusing mainly on tools and methodologies used in participatory diagnoses, in the implementation of FPR and FPE as well as in participatory monitoring and evaluation (PM&E), the emphasis shifted to training local extension workers together with key farmers from each pilot site. By inviting one sub-district extension worker together with two farm leaders from a project site in that sub-district it was hoped that this three-man (or woman) team could form a local 'FPR team' that would work together in teaching others in the community to conduct FPR trials or adopt new technologies. Although these FPR teams were never formalized as such, the people that had participated in the FPR training courses would often lead the village as co-ordinators of the FPR trials or as officers on the Administration Committee of the 'Cassava Development Villages'.

The training courses were extremely important to create a cadre of people with knowledge and experience in farmer participatory methodologies and to motivate people to work enthusiastically in extending the project to more and more sites. Similarly, the training of local extensionists and farmers was not only useful in extending knowledge about FPR and cassava production technologies, but also to motivate and empower local extension workers and key farmers to work together as a team for the benefit of members of the community.

8.4 Concluding summary

From the implementation and results of the second phase of the Nippon Foundation project the following conclusions and lessons can be drawn:

1. To achieve widespread adoption of new technologies, as many farmers as possible should be involved in conducting FPR trials, participating in field days and in training courses; this can only be achieved by the active collaboration of many research institutions, universities and extension offices, at national, provincial, district and sub-district levels. This allows the project to expand rapidly to many sites. Active and enthusiastic participation of the local extension workers is crucial for the success of the project.
2. Training of project staff in FPR methodologies is not only essential to impart knowledge about the various tools and methods, but also to motivate people to work enthusiastically with and for the benefit of farmers.
3. Training of farmers and local extension workers together in FPR methodologies and cassava production technologies was an effective way to exchange knowledge and experiences between farmers from various regions, and to encourage farmers to experiment, to innovate and to draw their own conclusions.
4. Conducting FPR erosion control trials on their own fields allowed farmers to see the actual soil losses as a result of erosion and that simple agronomic practices can markedly reduce erosion. Participating in these trials and in training courses were the determinant factors in the adoption of soil conservation measures. Most farmers are not aware or not concerned about soil erosion and may not be interested in conducting FPR erosion control trials. The simultaneous testing of other technological components such as new varieties, fertilizer practices and intercropping that are likely to have more immediate benefits is a good way to involve farmers in testing soil conservation measures. Only a whole package of 'improved' practices (including soil conservation measures) will have an immediate beneficial effect on income.
5. The beneficial effects of various hedgerow technologies become apparent only after some time. As such, some erosion control experiments should be continued for many years to show the long-term effects on terrace formation and increased yields to visiting farmers and extension workers.
6. Besides hedgerows, there are other 'soil conservation' measures, such as closer plant spacing, balanced fertilization (including animal and/or green manures) and

contour ridging, that are effective in reducing erosion and may be more easily adopted by farmers.

7. Vetiver grass contour hedgerows are one of the most effective ways to control erosion and the grass never becomes a weed. However, its establishment from vegetative planting material is slow and costly. For that reason vetiver grass should be used strategically only in those areas where it is most needed, i.e. across natural drainage ways or gullies; this may require the use of sand bag barriers for initial establishment. Hedgerows of seed-propagated species such as *Palpalum atratum, Brachiaria brizantha* or *Tephrosia candida,* can be planted more quickly and cheaply, and these will serve well in the higher and convex parts of the landscape.
8. Every agricultural research and extension institution, both national and international, has its own areas of strengths as well as weaknesses. By pooling the strengths and working together they can become more effective in solving problems, which contributes to the development of the country and will benefit poor farmers.

9. Enhancing Diverse Agriculture through Cassava Promotion

9.1 Overall assessment of potential

Global starch demand has increased, particularly in Asia and China. Viet Nam has rapidly increased exports (mainly to China), which have grown from 21,000 tons in 1998 to nearly 300,000 tons today. Most exports appear to be of native starch, which is relatively undifferentiated and low-value compared to chemically modified starches. Currently, world prices for native cassava starch are about $190-195 per ton, while modified starches fetch over $400 per ton. At the same time, modified starches have specific end-uses that require close co-ordination with customers to develop. While this has occurred in Thailand, particularly between Thai starch producers and Japanese end-users, the extent that such upgrading has occurred in Viet Nam is not yet clear.

Markets for other types of cassava products have followed a downward trend. World prices of cassava chips and pellets fell during the 1990s due to a decline in demand from the EU. There has been a rise in demand recently from China, however, and research from the study indicates steady cross-border trade in chips from Viet Nam to China.

The starch industry itself has grown rapidly, as noted earlier, and production is estimated at about 500,000 tons. This is a tremendous increase from the level estimated by IFPRI (1998) of 131,000 tons just six years previously. Roughly 50 per cent of cassava production is used for starch production; the remainder is used in animal feed, chips or for own consumption. It is estimated that about 70 per cent of starch production is exported, mainly to China or Taiwan, with VEDAN and other large factories playing a major role in exports of both starch and end-products from starch (for example, MSG). Other large players have entered the market in the last three to four years and some 15-20 large factories were under construction as of 2001, mainly in the South.

Cassava is often grown on land under unfavouravle cultivation conditions (drought and high attitude, sloping land). Previously, poor farmers used most cassava for human consumption and animal feed. Then the development of the starch processing industry and its demand for fresh cassava roots provided good opportunities for cassava farmers to commercialize their agriculture and improve their income. Such processing opportunities

contributed to the diversification of agriculture and intra-branch diversification of the cassava value chain.

Due to the high demand for cassava-based products, the adoption of HYV cassava is the first step to improve the well-being of the poor in the cassava value chain. The major positive impacts of HYV cassava adoption are high yield and starch content, and obviously higher income for the cassava producers. Yet, HYV adoption also brings about negative impacts such as rapid land erosion; expense for fertilizers, pesticides and herbicides; high toxicity content and greater labour requirement.

Cassava-peanut intercropping helps improve the well-being of poor farmers, as well as reducing the negative environmental impacts of HYV cassava production. The major positive impact of cassava-peanut intercropping is the much higher income than cassava monoculture. Better soil fertility is another key positive impact of cassava-peanut intercropping. To fully utilizing the advantages of this farming practice, however, poor farmers need: (i) access to water sources; and (ii) access to drought-tolerant peanut seeds and technical training.

Cassava crop rotation often takes place with highly developed commercial agriculture and large landholdings. It helps stabilize the income of cassava producers over the year, avoids price slumps at harvest time, and reduces the cost of wage labour. Particularly, crop rotation is extremely beneficial for the environment because it reduces dry soil losses. However, poor farmers may not benefit from crop rotation as much as the non-poor do because they have limited landholdings and mostly use family labour for cultivation.

9.2 Overall assessment of constraints

Conditions for HYV cassava adoption are more challenging in mountainous areas, compared to on the plains. The poverty rate and poverty gap are far higher for populations living in mountainous areas, where 45 per cent of cassava land is located. Furthermore, the rate of HYV cassava adoption is lowest in mountainous areas. Therefore, the integration of poor farmers with HYV cassava is imperative.

Determinants for participation in HYV adoption are not too restrictive for poor farmers but they are unlike to fully utilize all the advantages of HYV cassava with the existing circumstances. Poor farmers often grow cassava on small pieces of sloping land, hence HYV adoption stimulates more dry soil losses. In addition, high transportation costs and labour shortages limit poor farmers from receiving good prices for HYV cassava. In addition, compared to wealthier farmers, poor farmers often receive lower prices with limited amounts

of cassava output. Furthermore, cash shortages often force poor farmers to sell immediately post harvest, possibly spurring seasonal price slumps. Furthermore, a lack of capital prevents poor farmers from applying fertilizer, pesticides and herbicides correctly, hence reducing cassava yield. In addition, poor farmers may depend totally on local traders for new cultivars, food supplies and cash during the pre-harvest period, hence they receive depressed cassava prices from local traders. Without proper technical skills, poor farmers cannot use HYV cassava for human consumption or animal feed due to the high toxicity of the new varieties. This problem becomes more serious in areas where paddy land and food supply are limited. As a result, signals abound indicating that the development of HYV cassava may witness further rural differentiation.

Most farmers are unaware or unconcerned about soil erosion and, therefore, are uninterested in conducting FPR erosion control trials. The simultaneous testing of other technology components such as new varieties, fertilizer practices and intercropping that are likely to have more immediate benefits is a good way to involve farmers in testing soil conservation measures. Only the whole package of 'improved' practices (including soil conservation measures) will have an immediate beneficial effect on income.

The improvement of agro-enterprises, whether urban, peri-urban or rural requires the accurate identification of where the problems and constraints lie. In the case of Cat Que, the technology was developed appropriately and effectively. The problems were limited space, wasted labour and environmental pollution.

On the negative side, there has been consolidation in the starch sector, with large players expanding at the expense of smaller processors who lack the ability to provide advance payments to farmers for the procurement of raw material. It is unclear whether processors formerly engaged in processing are worse off or whether they have diversified into other activities. The sector may also be beset by overcapacity.

Contract farming does not work well in Viet Nam's cassava value chain and most transactions take place on the spot market or through oral contracts as well as trade credit between cassava farmers and processors. In addition, there is discrimination in which large landholding farmers are likely to become local traders and make direct sales to processors. In contrast, poor cassava farmers with small landholdings and food and cash shortages are most likely to participate in trade credit with local traders under very unfavourable terms of trade. The current market organization brings about three major implications for the development of the cassava value chain in Viet Nam:

- The cassava value chain in Viet Nam is not efficient with many layers of transactions between cassava farmers and starch processors. This is a result of the small size of cassava production and starch processing sectors. In such an environment, it is difficult for contract farming between large-scale starch enterprises and cassava farmers to be effective unless greater organization or consolidation of farmers/processors takes place.
- The current market organization of the cassava value chain generates three negative impacts. It potentially discourages the adoption of HYV cassava and application of new farming practices because cassava farmers are willing to accept low prices paid by local traders without considering cassava quality and the environmental cost. Behind this behaviour is the unavailability of necessary inputs (fertilizers and cultivars) for HYV cassava cultivation and high transportation costs. In addition, the existence of micro and small-scale starch processing not only creates inefficiency but also high environmental costs in terms of pollution. While market transactions can persist indefinitely, it is less clear whether the cassava value chain can advance into higher value production without greater co-ordination among actors in the value chain. Moreover, it is not clear whether the current forms of organization impinge on Viet Nam's competitiveness in cassava *vis-à-vis* Thailand.
- The development of contract farming will thus likely require greater consolidation of enterprises into medium and large-scale starch enterprises, improvements in transportation conditions, and land consolidation in cassava and/or the establishment of group sales as well as cassava co-operatives. Indeed, greater organization of cassava farmers would remedy the problems faced and move their produce to large-scale enterprises directly as well as reducing the rent-seeking behaviour of traders and procurement staff in the value-chain. At the same time, consolidation may threaten the existence and living standards of small-scale private processors and whether they can continue to participate in the cassava value chain.

9.3 Search for strategies and policies to enhance the sustainable development of cassava

The shortcomings of HYV cassava adoption require three major solutions for poor farmers to fully utilize its advantages: (i) creating better linkages for poor producers to

access input supplies and output demand; (ii) process and product upgrading of poor producers in the cassava value chain; and (iii) functional upgrading of poor producers in the cassava value chain.

Contract farming is a potential solution to create access for poor farmers to input supplies and output demand. Yet, farmers often refuse or break contracts with starch processing enterprises for one of the following reasons: (i) unstable and low procurement price offered by the factory; (ii) high discount rate determined by starch content; (iii) complicated procurement procedures and late payments; (iv) non-transparency in measuring starch content at time of procurement; and (v) non-adaptation of modern processing technologies to local conditions.

However, contract farming is likely to be more advantageous for poor farmers than non-poor because poor farmers are more limited by capital availability, technical skills and market access. Without state intervention, the poor are likely to be neglected from the increasing benefits of the cassava value chain.

Group sales are a potential solution to integrate farmer groups into contracts with starch processing factories. On the one hand, group sales may offer poor farmers better outlets and raise the sales price of cassava. On the other hand, the establishment of farmer groups is a necessary condition to provide poor farmers credit support (in-kind inputs) and technical training to upgrade their cultivation techniques. The development of HYV cassava, in turn, helps the factory access sufficient amounts of HYV cassava of good quality. Furthermore, the establishment of farmer groups also eases the labour shortage during the harvesting season.

Nevertheless, the example of Lam Giang commune shows that a successful link between farmer groups and starch processing enterprises also requires three other supportive factors. First, road infrastructure needs to be improved to reduce transportation costs. Second, the existing credit co-operative in the commune should play an active role investing in transportation for the farmer group. Third, agricultural diversification is the major constraint for the participation of poor farmers in farmer groups. Therefore, a mixture of poor farmers and wealthier farmers is necessary for the sustainability of group sales.

There are three main solutions for process and product upgrading, namely dry chip semi-processing, cassava-peanut intercropping and cassava crop rotation. Dry chip semi-processing is a good solution for farmers to improve their well-being by: (i) creating more employment and value-added cassava products; (ii) using dry chips as savings and speculating for higher prices; (iii) using animal feed, hence offering more choice to farmers

to mitigate market risk; (iv) saving transportation costs since dry chips are lighter than fresh roots. Furthermore, it is easy for poor farmers to participate in dry chip semi-processing. The major constraints for the participation of the poor are limited cassava output and cash shortages after harvesting.

On-farm starch processing is an excellent solution to functionally upgrade cassava producers. Poor farmers can expect higher incomes and more employment from micro-scale starch processing. The major constraint for poor farmers to move up from cassava production to starch processing is technical know-how if they are isolated from a large starch centre. In addition, market information also plays a significant role in promoting the participation of the poor in starch processing.

Upgrading from micro-scale wet starch processing to small and medium-scale dry starch and maltose processing not only helps increase the income of processors but also reduces the negative impacts of pollution. However, this functional upgrading is inappropriate for the poor, since it requires large amounts of investment, good market connections and a reliable supply of water.

In terms of environmental problems in the processing village clusters, the solution came from within the community itself, when other production systems were observed and compared to the constraints faced.

10. General Conclusions and Policy Recommendations

10.1 General conclusions

The cassava value chain is characterized by rapid growth in cassava production, fuelled, in large part, by the rapid adoption and dissemination of high-yielding varieties (HYVs) that have boosted yields by 50 per cent in just five years. Current production of cassava (2003) is estimated at approximately 5 million tons. National and international extension programmes, in conjunction with larger starch processors such as VEDAN, have played a role in promoting HYVs in Viet Nam. At the same time, much of the growth has been demand-driven and spurred by growing demand from cassava-using industries, particularly starch, from domestic and foreign (mainly Chinese) producers and end-users. The village clusters process cassava more efficiently than large factories:

Major constraints in the cassava value chain that were identified in the study include the following:

- Difficulties in the procurement of consistent volumes of cassava by medium and large-sized factories, particularly through contracts, given the high levels of competition, strict quality control from factories, and procurement practices that discourage direct sales by small-scale producers;
- Variable and regionalized HYV adoption, due to capital (for inputs and cultivars) and agro-ecological (sloping land) constraints, variable access to training and extension, and poor infrastructure;
- Variable soil management and intercropping practices that could raise incomes, due to capital, labour and resource constraints;
- High transport costs in many regions (North, portions of the South) due to poor infrastructure.
- Numerous intermediaries in distribution, particularly in the North; and
- Environmental consequences of HYV adoption and starch production in village clusters. For the former, a cassava plantation financed by FDI and a national enterprise need to be considered to develop environmental sustainability. For the latter, small-scale producers are particularly constrained by waste management problems stemming from production.

10.2 Policy recommendations

The cassava value chain and starch processing contributed to the diversification of agriculture and helping the poor. However, high-risk production requires public policy support.

We propose the following policy aims in support of Vietnamese cassava growers:

(a) Enhance the contribution of cassava to staple food security, particularly as a home-grown food crop of specific groups of households in marginalized localities, in environmentally sustainable ways;

(b) Enhance the productivity of market-oriented cassava growing in specialized areas, in environmentally sustainable ways. This means enhancing investment in land, as well as human and other assets, for which profitability needs to remain comparatively high;

(c) Enhance cassava intra-branch diversification by growing and marketing diverse processing products and niche markets for fresh consumption in urban areas; and

(d) Improve swine-raising conditions, especially for small-scale pig-raisers.

Other support measures generally fall into the WTO's 'Green Box', and help improve production, processing and marketing. The following are livelihood support measures, which are not specific to national trade deregulation but mitigate (potential) negative effects. Most of them already exist but should be reinforced and better targeted:

(e) Develop community-based (producer group-based) initiatives for active collective actions to improve market access and expand contract management;

(f) Improve transport infrastructure further, especially in remote villages;

(g) Improve processing technology through research for small and medium-scale farmers to improve starch quality;

(h) Provide better information on prices, seasonal production and stock;

(i) Develop niche products for niche markets for fresh cassava; and

(j) Use a farming systems approach to research and extension, particularly socio-economic extension to raise cassava productivity, reduce production costs and dissipate risks. Promote crop diversification, alternative products and environmentally sustainable cropping patterns. Follow a participatory approach and make an effort to reach ethnic minorities and include women.

(k) Terrace and cover vegetation in upland areas and also small-scale irrigation can make cassava production more sustainable and help develop local agricultural

production as well as diversification potential. Economic feasibility and social impacts need to be carefully assessed, and more capital with improved implementation is required. This infrastructure should be developed in participatory ways;

(l) Public plant breeding organizations should focus their resources on varieties suitable for upland ecological areas, respond to the need for the food and income security of poor farmers, and help select as well as improve local varieties;

(m) Credit and savings groups of farmers, women and the youth should be encouraged further. To be fully successful, adult literacy and numeracy in ethnic minority communities must be addressed. Subsidized interest rates for credit should go hand in hand with the promotion of sustainable agricultural technology;

(n) The establishment of starch processor groups is a potential solution. In addition, sites for processing should be planned in clusters to reduce transportation costs and the negative impacts of pollution. Furthermore, credit support for starch processor groups is essential in their early phase of operation;

(o) Promote community management of the local environment in processing villages and in the use of sloping land in a sustainable way;

(p) FDIs and the national enterprise need to take responsibility for the promotion of environmental conservation; and

(q) The environmental economics of the cassava value chain urgently requires study.

Part 2: The Case of Maize in Son La, a Mountainous Area in North Viet Nam

11. Methodology of the Maize Study

The following methodology was applied:

- While statistics were used for the analysis of preliminary data, the current situation of production and the market price of Vietnamese and international maize products are analysed and assessed based on specific conditions. Moreover, this method is based on the trends of the development process to predict the development trends of the Vietnamese and international maize markets.
- Interviews were conducted with specialists in different aspects of production management, science as well as technology and husbandry feed processing in order to assess the current situation and development potential; as well as competitive opportunities for maize products, and the current situation of industrial feed production.
- Production characteristics and conditions were used to carry out zoning for goods production factors, specialization and extension trends.
- Market and product analysis methodologies were used to assess current market activities and product channels in the production and farming areas. The role of production is described via circulation channels; the relationship between production areas and consumption areas.
- A study of the national economy aims to assess production levels and product quality. Furthermore, the study also includes an assessment of central and local government policies, which have affected production and market promotion.
- Participatory Rural Appraisals (PRA, Expert meetings) were carried out aimed at ranking households based on their economic standing, in line with levels of commercial maize production, levels of poverty and maize's role in poverty alleviation. Based on this, appropriate policies can be formulated for each household type and help towards the development of stable and sustainable production.
- Analysis of the household economy in several ecological areas enabled assessment of the effectiveness of maize production, the role of maize in the

household production system, and a household's chance of success if it were to enter the market. Also analysed in the study was the perceived impact of the integration process in relation to production activities and the competitive advantage of Vietnamese maize at the household level.

Household ranking helped adjust the local poverty threshold in concordance with the present trend, namely 150,000 dong per month per capita (recently defined by the government for mountainous areas) compared to the local threshold of 80,000 dong per month per capita (defined by the provinces several years prior).

To carry out the household surveys, two communes from each province were selected, one commune has developed commercial maize and has market access, the other is poor (commune 135) and facing difficulties with maize production and market access. Prior to meeting the households, surveys were conducted and an assessment of the current situation of the local maize market was assessed. Up-to-date information on existing product channels and the mechanisms involved in goods exchange was also collected to link markets and production activities, provide an overview on market supply-demand relationship, linkages between product channels as well as local and delta consumption areas. Based on the results of the commercial system survey, two villages were selected from each commune under varying production conditions and characteristics to be surveyed.

In each village, surveys with 20 households were conducted, selected according to their poverty and maize production ranking. The survey aimed to clarify each household's situation, especially the poorest ones, as well as any possibilities to access different local channels and identify the limits of the poorest households who are unable to access the new market channels.

12. Profiles of the Study Site, the Respondents and their Households

12.1 Profile of the study site

12.1.1 Maize profile in Son La province

As Viet Nam is an agricultural country, maize production is closely linked with soil and irrigation conditions to maximize production activities. At present, maize is produced with two cropping cycles:[1]

- *Winter maize (from September to December.):* is cultivated in the delta areas like the Red River Delta, North Central provinces and the Mekong River Delta. This is an additional crop for multi-cropping to maximize the effectiveness of wet soils. However, production of winter maize is currently facing competition from other crops with higher economic value.
- *Summer – autumn maize (from June to October) or spring – summer maize (from February to June):* cultivation areas are mostly concentrated in the central highlands and mountainous areas of Son La. This has helped the development of production activities on the sloping lands and overcome irrigation problems. At present, this type of production is an advantage to Viet Nam to meet the growing demand for feeds for husbandry and contributes significantly to alleviate poverty in remote areas.

12.1.2 Maize production and the selection criteria

One of the factors encouraging the development of maize in Son La is rapid market[2] development. The demand for maize from the husbandry industry and for the cattle feed processing has created conducive conditions for farm households to expand their cultivation areas. Maize production on sloping land is traditionally carried out by mountain farmers who owned 64,900 hectares of this land in 2002. Son La has become the leading maize producing province in North Viet Nam and is an important maize supply market to the Red River Delta.

[1] Dao Duc Huan, Vu Trong Binh, Dao The Anh, maize product and sustainable development in Son La.
[2] Maize commodity sector in North Viet Nam, 2002 - Dao Duc Huan, Vu Trong Binh, Dao The Anh – Agriculture Subject – Viet Nam Institute of Agricultural Sciences and Techniques.

The development of a commodity producing area is very much influenced by comparative advantage to generate competitive advantage in the market. The current development and position of Son La maize in the market was assessed and found to have the following advantages:

- Favourable natural conditions such as sloping land with basalt and black soils. In addition, forestry land has created good conditions for households to expand their areas;
- Scientific advances and new farming techniques are important factors in changing the production methods of farmers, such as the introduction of hybrid maize and fertilizers; and
- Market accessibility is the most decisive factor for production development. Provincial maize production has developed very strongly along Highway No. 6, for example.

Mai Son is a district with production development heading in the direction of specialized farming. Production has developed in terms of area, productivity and intensity. District production has developed strongly, especially in terms of productivity with many new varieties of maize put into production like Bioseed, DK999, DK888 and LVN10. These represent advanced scientific achievements effectively implemented by farmers. Many areas have achieved productivity of 50-60 quintals per hectare and in the period of 1995-2002, average maize productivity in Mai Son rose from 19.3 quintals per hectare in 1995 to 43.2 quintals per hectare in 2002. This was higher than that of the high intensity delta provinces such as Ha Tay and Thai Binh. Moreover, the district's production area continued to expand. The cultivated area of maize increased from 29.9 per cent in 1995 to 66 per cent in 2002 of the district's total food crop area.

Being an area with a high commodity production level, Mai Son was selected for further study. The area has such features as:

- Production and the markets have been connected. Producers have made changes in the household economy so studies in this area were aimed at addressing the issues of adapting households to the market. The cause of poverty within the region was also studied in this context;
- Relationships between poverty and food safety issues were examined, commodity production development was shown in the context of change and adaptation that farming households have and are continuing to face; and

- The development process of trading agents and their reactions to market changes were studied in specific production areas.

Economic integration is a synthetic interaction process of all the issues from production and trading to consumption. For such reasons, Mai Son was selected for study to create a panoramic view of the maize market in North Viet Nam.

12.2 Extent of unemployment and poverty

Phieng Pan commune – an area adopting commodity production to meet the challenges of poverty reduction

Being a commune in Area 3, where people of ethnic minorities live (H'mong and Sing Mun), socio-economic development issues in general and agricultural development in particular are characterized by:

- People dependent on agricultural production growing traditional food crops like rice, maize and cassava. A number of additional crops have been introduced such as soybean and edible *canna* over the last few years;
- Farm production conditions are very harsh: production relies on nature. Cultivation is predominantly on sloping land. The area set aside for rice production to ensure food security is not large and is unevenly distributed among areas. Many villages do not own wet rice fields. Absorption of scientific advances and production techniques remain slow due to low intellectual levels and reluctance to change traditional production habits;
- Nomadic farming on sloping land is common. Furthermore, husbandry activity has not developed;
- The maize production activities of poor farmers are supported by many policies such as allowances and subsidies to buy seeds and funding for settled farming;
- Relationships between production and the market are different compared to those in Co Noi:
    - The use of chemical fertilizer for maize cultivation has been introduced in the last couple of years and relations between farmers and material suppliers are strong.
    - As post-harvest handling techniques are limited, farmers often sell their maize immediately after harvest. Local maize is preserved on the field.

  - Transporting maize is beset with problems, especially during the rainy season which coincides with the main maize crop. This has led to private traders often paying less than the real price of maize.
- Being one of the areas that has introduced hybrid varieties into production since the 90's (together with Co Noi), production should be greater but this represents an area that slowly developed in terms of increasing farming intensity and in their reaction to the changing markets. Production habits and poverty are still main causes of this phenomenon.

There have been positive changes in agricultural production, especially in maize production, such as improved market access through the construction of access roads to fields, the use of chemical fertilizers and the production of maize for sale in order to purchase food.

This is a very poor commune in a remote area. The study focuses also on the contribution of maize intensification towards poverty reduction.

12.3 Extent of environmental problems

Co Noi – a developed area with market advantage and environmental problems

Being a commune in Area 1 of Mai Son district, Co Noi is the commune with the most significant contribution to the district budget. With favourable market conditions (located on Highway No.6), access to modern technology like hybrid seeds and fertilizers, and with nutritional basalt soils, Co Noi has become the most specialized farming centre in Mai Son district.

- Thai, Hmong and Kinh are the three principal ethnic groups of the commune. People of ethnic groups are distributed evenly throughout the main villages so the differences in habits and customs in daily life and production are not an obstacle to regional socio-economic development;
- The production system is rather simple with three principal crops as follows:
  - Wet rice cultivated at the edge of fields backing onto the stream to make use of the naturally running water.
  - Maize is the main crop of the commune. In 2003, the maize area accounted for 49 per cent of the total cropped area.

  - Sugar cane was introduced in 2001 in accordance with the provincial crop structure converting policies. In 2003, the commune's sugar cane area was 507 hectares distributed on flat land.

- Currently, agricultural production primarily relies on natural water. Increasing the intensity is difficult because of poor irrigation. Under such conditions, the development and expansion of maize is the first option open to farmers;
- Pig husbandry has not developed because production knowledge and the practice of using maize has not existed for long, so maize has become a commodity crop. However, there are still a number of problems in the existing production process, such as poor transportation in the rainy season. Furthermore, no solutions have been found to the problem of impoverished land;
- The gap between rich and poor has widened because of the selling or renting of land by the poorest households only to be hired by other people. People renting land mainly come from the plains. They developed production by introducing intensive farming methods. However, the farming area is not large due to difficult irrigation conditions (in 2003, the area was only 14.7 hectares);
- The intensification of maize in this area also causes severe soil erosion of sloping land; and
- Characteristics of the production and trading systems of Co Noi form the basis to consider the impacts of existing and future markets on production activities and the livelihoods of the poor as well as environmental sustainability.

13. Analysis of the Maize Farming System

13.1 Average size of farm operation

Soil conditions as well as other factors such as irrigation and the market price of maize are decisive in influencing farmers' lives within the area. With habitual characteristics and limited knowledge in the area, agricultural development has always been a priority.

13.1.1 Characteristics of local agricultural production

Current local agricultural production has a crop structure dictated by the soil type (basalt soil) and poor irrigation. Therefore, the production system is characterized by:

- Agricultural production on sloping land with no irrigation and very much dependent on nature. Two croppings of wet rice exist along streams but the system is limited by farming area;
- A mono crop maize system is common and is a principal source of income. Prolonged, intensive commercial maize farming has led to land increasingly becoming exhausted. In the meantime, husbandry and services have not developed and farmers mainly rely on cultivation for their income;
- In Co Noi, production is influenced by production planning policies and the appearance of sugar cane, but maize is still more popular for farmers with developed commodity production systems that have been in existence for over ten years. Furthermore, maize farming requires less investment and labour than sugar cane. The area is mainly populated by ethnic Thai people; and
- Phieng Pan contains a variety of ethnic groups like H'mong and Sing Mun so production systems are simple. Maize dominate the agricultural production systems of households, both in terms of suitability to production conditions and economic efficiency.

Under existing production and market development conditions, maize remains the first choice production system of most categories of household, especially ethnic minorities. However, commercial maize production is very much influenced by the external consumption market, in particular the Red River Delta.

13.1.2 Production systems of various categories of household

Households were categorized based on their actual income. The poor threshold was based on 150,000 dong per month per capita. The medium and well-off were defined by the chief of the commune qualitatively. The results are shown in Table 13.1.

Table 13.1 Characteristics of the production systems of various categories of household

Criteria	Unit	Co Noi area			Phieng Pan area		
		Poor	Medium	Well-off	Poor	Medium	Well-off
Prevalence of household	%	18.5	40.7	40.7	25.64	46.15	28.21
Production conditions							
Thai	%	100	100	100			
H'Mong	%				40	50	54.55
Sing Mun	%				60	50	45.45
No. of heads/household	Person	8.60	7.09	6.09	7.50	7.44	7.00
Labour/household	Person	2.80	2.73	2.64	3.10	2.56	2.91
Agricultural land area	m^2	12 080	21 090	34 955	17 540	25 009	32 432
Forest land area	m^2	800	909	5 000	1 000	9 700	7 728
Production system of farming households							
Maize	m^2	10 800	14 090	24 182	15 490	22 550	28 818
Rice - Rice	m^2	800	2 227	773	2 050	2 459	3 614
Sugar cane	m^2	0	4 227	7 000	-	-	-
Rice - Bean	m^2	480	545	3 000	-	-	-
No. of pig/household	Heads	1.0	0.0	0.4	0.9	2.2	4.1
No. of cattle	Heads	1.2	1.3	2.8	1.8	2.5	6.0
No. of poultry	Heads	19.0	9.2	13.2	5.8	15.7	28.2

Source: Survey by the Agrarian System Department, VASI, 2005.

The production systems of various categories of households in the same area were similar. The main factors leading to differences in income were the size of the cultivated land area, intensity of farming and the number of heads per household. Each category of household was specifically characterized by:

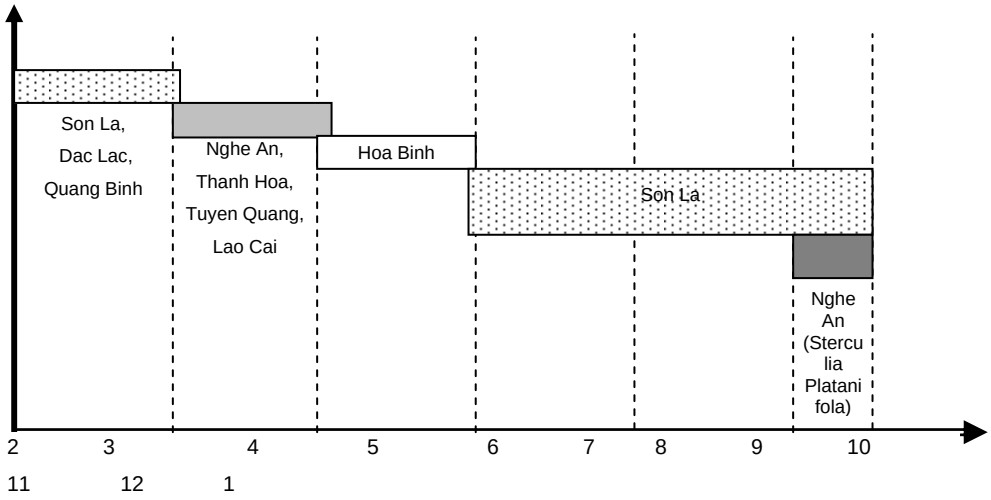
	Co Noi	***Phieng Pan***
Poor households	Accounting for 18.5 per cent of the households in the area this category was found to have a lot of heads per household and little agricultural land. Production with two systems of maize and wet rice of which wet rice production is insufficient to ensure food security so commodity production developed more slowly and the intensity of maize production is still limited.	Many heads per household with good labour conditions but limited land create constraints to production development. Wet rice production is insufficient for the family food requirement. Many households do not have wet rice land area so starvation still occurs each year. Commercial maize production is low and very much depends on external investment. Households of this type account for 25.64 per cent of the total number of households.
Medium households	With 21,090 m^2 of agricultural land, households of this type employed all the common crop systems of the area, namely maize, sugar cane and wet rice. However, as land area generally corresponded to the number of heads per household, accumulation of production is still limited. The intensity of production was found to be high.	Households of this type are common in the area accounting for 46.15 per cent of the total. The production systems are based on rice and maize but land conditions are better, thus partly solving the starvation problem.
Well-off households	Households of this type had a few heads per household and lots of land compared to the other types of household. Food safety was secured so it was possible to invest in commodity production, especially maize and sugar cane. Well-off households accounted for 40.7 per cent of the total number of households.	Adequate land allowed households to ensure sufficient food during the year. With more than 28,800 m^2 of maize land, households of this type had the highest level of commodity production and intensive farming. Husbandry combined with cattle trading is a common form of accumulation that has become a relatively large source of supplemental income.

Under current conditions, maize is the most dominant crop, although hardly any substitutes exist (considering maize economic efficiency and suitability to the conditions; and without an irrigation system present), especially on sloping land. Commercial maize development could still be maintained under favourable market conditions.

13.1.3 Patterns of cultivation

The main supply of maize from Son La is provided to the Red River Delta market from August to December. This is the longest supplying period in the year. For other months, maize is supplied from other provinces as indicated in the diagram. Maize is preserved to March of the following year (Figure 13.1).

Figure 13.1 Son La maize supplied to the Red River Delta market



Source: Agrarian System Department survey, 2004.

The main supply of maize from Son La is provided to the market from Aug. to Dec. Maize is preserved until March of the following year. The appearance of other sources of maize has been triggered by the following:

- Maize shortages in the market lead to price hikes; and.
- Bilateral circulation of products, namely maize from different provinces is transported to the Red River Delta and other products are sent to the supply areas.

13.1.4 Labour use

The production systems are not only dependent on the nature of the soil but also individuals' conditions such as food supply, size of land area and financial capacity for investment that ultimately decide crop selection and production efficiency. Factors such as work opportunities, chances to expand land area and finance are all limited for the poor households.

Household labourers: One factor that can affect a household's average income is the number of members a household has. In most of areas, a high number of household members is an important factor leading to poverty. Except in Binh Son (Nghe An) with an equal number of labourers living in different household types, the number of labourers is higher in the poorer families. The highest level of labourers was found in Co Noi (Son La), Dong Tam (Dac Lac) and Lung Phing (Lao Cai).

Table 13.2 Human resources for production

	Average land/person (square metre)		Number of household members/labourers (persons/labourers)		Material cost/hectare of maize (dong)	
	Poor households	Better-off households	Poor households	Better-off households	Poor households	Better-off households
Mai Son - Son La province						
Co Noi	1 405	5 739	3.07	2.31	1 713 360	1 793 569
Phieng Pan	2 339	4 633	2.42	2.41	720 868	892 837

Source: Survey by the Agrarian System Department, VASI, 2005.

13.1.5 Farm productivity

Intensity of maize production

Commodity production development and more conducive economic conditions have generated different characteristics in terms of farming intensity, as well as similarities between the various categories of household.

Co Noi underwent early commercial maize production development so farmers are more experienced and able to invest in fertilizer. Intensive farming for relatively long periods (many maize *milpas* have grown maize for 15 consecutive years) without any soil improvement measures has exhausted the soil. Therefore, additional investment in fertilizer has to be made annually to be able to maintain productivity. There were no stark differences in intensity between the various categories of households. The difference was the use of chemical fertilizers. It was difficult to make an accurate assessment of the impacts of fertilizer on production since soil conditions and the age of each maize *milpas* would have also had small impacts. However, when the value of fertilizer on production was assessed, the medium households invested most but production results were worse when compared to the two other categories of household.

In Phieng Pan, there was a greater difference in farming intensity between the various categories of household. This area is relatively far from the centre. Farmers' lives are still very difficult. Moreover, commercial maize, (especially hybrid maize) was only introduced in 2000, so investment in intensive farming remains low.

Differences can be seen in investment levels and economic efficiency of maize production between the two areas: high-level commercial maize production and the developing areas. There are many challenges to overcome in the development of commercial maize production, for example:

- Rational utilization of production resources to avoid climatic risk. Seed use is very important. Farmers in Co Noi know how to obtain high quality seeds (they purchase seeds in Ha Tay) for production;
- Rational use of fertilizer that is appropriate to economic conditions;
- Receive updated market information from various sources;
- Possibility of selling corn-on-the-cob instead of corn seed; and
- Rational harvest timing to avoid poor weather.

To overcome such problems, support and assistance from the government is required, in particular to change the production habits of ethnic people. Consequently, production efficiency has improved and competitiveness has increased.

13.2 The role of diversified farming in risk mitigation

13.2.1 The economic role of maize

Household income is dependent on the production systems employed. As a result, income structure is often characterized by:

- Large differences in the regional average income of poor and well-off households. The average income of well-off households is 3-4 times higher than that of poor households.
- Income depends on maize production, upon which poor households were more reliant. While income from maize to poor households accounted for up to 78 per cent in Co Noi and 76 per cent in Phieng Pan, for well-off households it was only 61.5 per cent and 65 per cent respectively.
- Income in well-off households is more diversified in terms of general structure. Sugar cane is a relatively good supplementary source of income in Co Noi, and husbandry and cattle trading are in Phieng Pan.

Therefore, it can be seen that poor households would be most strongly affected by changes in the maize market. Supplementary sources of income for households of this type are very limited so their vulnerability remains difficult to abate.

Table 13.3 Production efficiency and investment of various categories of farmer household

Criterion	Co Noi			Phieng Pan		
	Poor	Medium	Well-off	Poor	Medium	Well-off
Productivity (kg)	5 668	5 369	5 706	3 664	4 357	4 502
Total cost (dong)	1 898 995	2 284115	2 127 201	885 378	909 785	1 054 074
Turnover (dong)	10 523 222	10 291 572	11 216 264	5 602 533	7 373 975	7 792 931
Profit (dong)	8 624 227	8 001 247	9 083 011	4 717 155	6 464 191	6 738 857
Labour productivity	50 767	52 614	60 176	32 698	51 328	55 451
Quantity of used materials/ha of maize						
Seed quantity (kg)	18.64	19.68	19.24	16.42	18.64	18.33
Nitrogenous fertilizer (kg)	139.71	267.98	223.29	47.56	99.02	154.48
Phosphate (kg)	273.96	256.13	346.77	108.75	82.90	119.62
NPK (kg)	278.88	226.67	106.57	0.00	2.63	0.00
Total fertilizer (kg)	692.55	750.78	676.64	156.31	184.55	274.10
Hired labour	5.04	3.04	11.73	6.02	2.13	8.06

Source: Survey by the Agrarian System Department, VASI, 2005.

Table 13.4 Income structure of farmer households

Criterion	Unit	Co Noi			Phieng Pan		
		Poor	Medium	Well-off	Poor	Medium	Well-off
Average income/head/month	VND	111 579	204 466	493 898	102 515	211 603	378 542
Rate of income from cultivation	%	94.04	89.21	95.01	97.97	95.06	79.63
Rate of income from maize/total income	%	78.08	57.66	61.54	76.27	78.68	65.10
Rate of income from rice/Total income	%	3.73	3.29	1.65	20.22	15.43	13.91
Rate of income from other crops/Total income	%	12.22	28.26	31.82	1.48	0.95	0.61
Non-agricultural income rate	%	3.02	10.79	3.68	1.32	2.04	10.11
Rate of income from husbandry	%	2.94	0.00	1.31	0.70	2.90	10.26

Source: Survey by the Agrarian System Department, VASI, 2005.

13.2.2 Impacts on employment, income and the environment

During the last decade, maize production in Viet Nam has rapidly developed due to influences from the market. However, domestic maize yields have remained stable as competing maize areas have also contributed. Maximizing the advantages found in the central and mountainous areas, production converted from domestic to commercial. Maize is gradually replacing other traditional crops in household production systems such as cassava, upland rice and soybean. In the delta region it is difficult for maize to compete with other staples thus maize yield has slowed over recent years. Maize production in the study areas has benefited from:

- Technological developments and government policies, such as those for land extension and seed support programmes. These have assisted farmers access and more easily apply new, highly productive hybrid variants of maize including new species such as LVN 10 and DK 888;
- The development of commercial production areas with high intensity farming like in Son La is linked with seed and fertilizer services and supplies. The private service system supplies 80 - 100 per cent of seeds and fertilizers to Son La;
- Incomes of the various household types are largely under the influence of maize production. Due to very limited diversification in Son La, maize production is the main activity, the poorest households are dependent on maize. Therefore, any changes to maize production will affect the poorest households most;
- In terms of product development, in areas that have developed production, the poverty rate is lower, for example in Co Noi poor households account for 15.8 per cent.

Table 13.5 Production and the poverty level

	Percentage of poor households	Average income/person/month (dong)		Percentage of income generated from maize production/total income	
		Poor households	Better-off households	Poor households	Better-off households
Mai Son - Son La province					
Co Noi	15.80	111 579	493 898	78.08	61.54
Phieng Pan	25.84	102 515	378 542	76.27	65.10

Source: Survey by the Agrarian System Department, VASI, 2005.

- There are different levels of market penetration by the poorest farmers in different areas. As farmers in Son La are specialized in commercial production, there is a higher percentage of households selling maize.

Table 13.6 Market participation level of farmers

	Percentage of maize sold by poor households	Product cost (dong/kg)		Percentage of households that sell to the collectors	
		Poor households	Better-off households	Poor households	Better-off households
Mai Son - Son La province					
Co Noi	97.20	1 857	1 966	77.78	63.64
Phieng Pan	89.74	1 529	1 731	60.00	81.82

Source: Survey by the Agrarian System Department, VASI, 2005.

- Differences in farmers' knowledge and market access have created different prices and relationships with output agents in every region. The biggest difference between household categories is the price of the product, of which the poor sell at the lowest price. The main reason for this seems to be the selection of the selling time, output agents and product type.
- Household selling is not only dependent on the scale of production, but also on the relationship between households and the output agents, transportation and household production. The percentage of produce sold to the collectors clearly distinguishes the different household types and the difference in market penetration between the poor and non-poor. This shows that the collectors are important agents for product consumption in each area.

Given the favourable natural conditions, production services and markets, maize is becoming the most valuable crop in the production systems of the studied areas. Therefore, in the areas with high levels of production specialization such as Son La, such favourable conditions have been effectively exploited. Though there are still limits in terms of production effectiveness due to the effects of changes in the production material market, it is possible for these areas to generate competitive advantage in the maize market in coming years.

Any development is linked with risk. The risks associated with maize products during the development process are as follows:

- Commercial risks: can occur to any or all of the agents participating in the market. The economic integration process is ongoing, leading to domestic products having to compete more and more with high quality imported products, like American maize and Chinese 'lamp-hanging' maize[1].

[1] It is similar to Vietnamese 'lamp-hanging' maize and produced in upland areas following the traditions of ethnic Chinese people.

- Ecological risks: intensive maize production on sloping land is causing erosion unlike other dry cultivation areas. No effective solutions exist once the erosion has occurred, and consequently many maize areas in Son La cannot be used for maize or any other cultivation activity due to soil exhaustion and erosion. Our surveys indicate that cultivation potential in these areas has been seriously jeopardized after just several years of production due to the increased amount of chemical fertilizers being used damaging the soils mechanical structure and reducing nutrition.

Table 13.7 Soil characteristics in some mono and rotational production areas

Type of production	pH KCl	Total (%)				P_2O_5 (mg/100 g of soil)	Exchanged Cation (meq/100 g of soil)			
		OM	N	P_2O_5	K_2O		K^{2+}	Ca^{2+}	Al^{3+}	CEC
Rotational production of maize – cassava	6.2	3.37	0.17	0.12	1.32	6.34	0.26	8.42	0.70	15.38
Maize monoculture	5.5	2.26	0.14	0.10	1.32	3.12	0.18	4.17	1.13	12.28
Maize – fallow	6.3	3.82	0.21	0.13	1.41	8.93	0.39	10.38	0.60	18.12

Source: Le Quoc Thanh, Institute of Agriculture Science and Technology of Vietnam, Doctoral Thesis, 2004.

The results indicate that although maize monoculture caused least soil atrophy compared to other crops like upland rice and soybean, the annual erosion rate still remained at 12 tons per hectare[2]. If rotational cropping patterns or fallow solutions are not implemented, maize monoculture soil has the lowest level of restoration. Data shows that the current production systems in Mai Son (Son La) are facing the largest ecological risks.

The survey results indicate that most households are aware that maize monoculture can lead to nutritionally degraded soil. This has been proven as productivity is very low in areas where no fertilizer is used.

Table 13.8 Percentage of households aware of production impacts in Son La

Evaluation criterion	Son La
Declined nutrition	81.05
Impossible to grow alternative plants	75.36

Source: Survey by the Agrarian System Department, VASI, 2005.

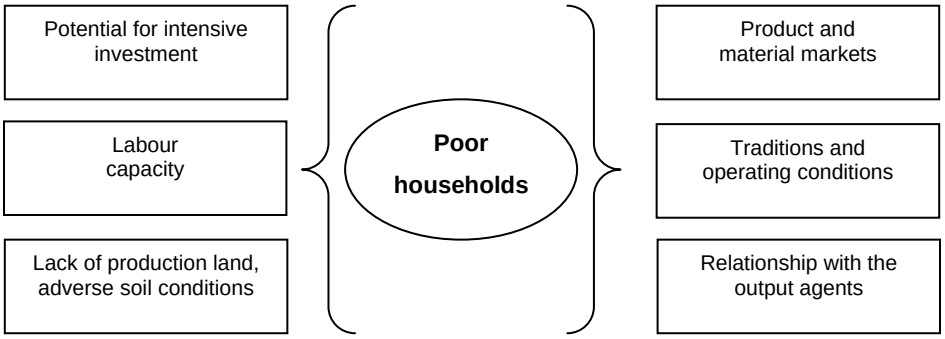
[2] Bertoni *et al.*, 1972, Doctoral Thesis of Le Quoc Thanh, Institute of Agriculture Science and Technology of Viet Nam.

Ecological risks potentially exist but are hidden behind the profits generated by maize production. This will directly impact production and the markets in future.

13.3 The poor and issues to be overcome

The income of the poor is a result of different production factors such as production source, cultivation conditions and market penetration potential. Effective use of many of these factors and sources to aid household production as well as active participation in the market will help improve household income.

Figure 13.2 Dependence of poor households on production and market factors



Source: Research team, 2004.

Poor households face various difficulties, of which there are two main causal factors, more specifically production sources and the market.

13.3.1 Potentials and constraints to farming

Agricultural land: Labourers have to work much harder when land is limited. Limitation of agricultural land results in income limitation whilst husbandry remains undeveloped and non-agricultural activities are almost not existent, for example in areas of minority groups. The average land area for agricultural production per household member of poor households is only about 25-50 per cent of the better-off households. This has created difficulties for Son La because household incomes is primarily dependent on the cultivation of crops.

Financial investment for production: Limited lands for production plus a lack of finance for intensive production result in suboptimal maize production. The poor households

themselves find it impossible to accumulate capital. Furthermore, the private credit system also considers the payback potential of each household type. Therefore, except in intensive farming areas like Co Noi, where maize productivity is quite similar, the investment capacity of the poor households in other areas for maize production is very low compared to better-off households. Particularly in remote areas like Phieng Pan (Son La) and Ea So (Dac Lac), the financial capacity is lower as they have less access to funds and investment opportunities compared to the better-off households under similar regional conditions.

Effective use of labour sources, land and capital is a limitation of the poor households. However, other factors such as production output and market penetration potential need to be considered to decide whether the above mentioned factors can lead to the competitive advantage needed for product success. These limitations can become supportive conditions for poor households upon large changes in the market. The poor households need to diversify the maize species that they are using, namely local species for food purposes and hybrid species for commercial purposes. These activities require support from government agricultural services.

13.3.2 Participation in the production market

Inputs are an indispensable part of the production process such as seeds and fertilizer. Changes in production factors, particularly prices, lead to changes in household incomes. Moreover, it would also effect household investment decisions.

The market in Son La is very conveniently located so farmers have ready access to supply sources. However, the selection of supply sources depend on a households' financial status.

- There is a difference in the sources of inputs between the two areas and between various categories of farming household, to which in Phieng Pan, farmers highly depend on the trading system. Materials supplied by government agencies are still very limited in terms of quantity. Poor households in the two areas are more dependent on private traders.
- When farmers are considered financially viable to choose their sources, they often select government sources because of their trust in supply quality. In Co Noi, 63.64 per cent of well-off households use inputs supplied by the government while in Phieng Pan the figure is only 45.45 per cent.

Table 13.9 The number of households purchasing inputs from various sources

(percentage)

	Co Noi			Phieng Pan		
	Poor	Medium	Well-off	Poor	Medium	Well-off
Seeds						
From the government	40.00	63.64	63.64	0.00	16.67	18.18
From private traders	60.00	36.36	36.36	100.00	83.33	81.82
Fertilizers						
From the government	40.00	63.64	63.64	10.00	44.44	45.45
From private traders	60.00	36.36	36.36	90.00	55.56	54.55

Source: Survey by the Agrarian System Department, VASI, 2005.

It can be seen that the relationship between produce supply and produce consumption is supportive and binding. Ignoring unofficial mechanisms, the relationships are in favour of the development processes and also show the dependence on the market.

14. Analysis of the Maize Marketing System

14.1 Products traded and distribution channels

14.1.1 Maize grain market

Farmers in Son La participate heavily in the market through the amount of sold maize that they produce.

In Co Noi, there was no difference in production purposes between the various categories of household, selling 96-99 per cent of their maize at the market. The remaining maize was used for human consumption but not as a substitute for food and was only used for traditional and habitual reasons.

For the H'mong and Sing Mun peoples of Phieng Pan, the pattern was similar. However, many households walk the tightrope of starvation and are forced to eat maize to survive (poor households). There were also households using maize through choice and not because of food shortages. Therefore, the amount of maize used for human consumption accounted for a higher percentage, but still only between 5 and 10 per cent.

There were differences in the market participation capacity of the various categories of household. Farmers could time their sales and the quantity sold, although poor households often had few chances to select the number of sales due to demand and pressures arising from financial debt. This could also be interpreted as a result of the difficult conditions of labour and transport. More clearly this was shown in Phieng Pan, where farmers often had to sell maize as corn-on-the-cob at their *milpas.*

Poor farming households were more dependent on suppliers and buyers. They had very few chances of direct transactions with agents or transporters due to binding priorities.

The above characteristics can be shown in the differences in sales price of the various categories of households. Well-off households could sell at higher prices while in the same area poor farmers had to sell at low prices. Moreover, sales prices reflect in the most comprehensive manner all the influencing factors of the market such as sales time, sales agent, type of produce.

Table 14.1 Participation in the maize grain market

Criterion	Unit	Co Noi			Phieng Pan		
		Poor	Medium	Well-off	Poor	Medium	Well-off
Maize quantity/year	kg	6 440	7 355	13 814	6 022	10 224	14 273
Amount of maize sold per year	%	97.2	99.0	96.1	89.74	93.66	90.97
Amount of maize consumed by humans	%	2.8	1.0	3.9	9.78	5.39	7.80
Amount of maize for husbandry/year	%	0.0	0.0	0.0	0.48	1.00	0.93
Number of selling times and sales agents							
Number of households selling once	%	80.00	72.73	54.55	70.00	61.11	36.36
Number of households selling twice	%	20.00	27.27	27.27	30.00	22.22	27.27
Number of households selling three times	%	0.00	0.00	18.18	0.00	16.67	36.36
Sales to buyers	%	77.78	72.22	63.64	60.00	72.73	81.82
Sales to agents	%	22.22	16.67	9.09	40.00	18.18	0.00
Sales to transporters	%	0.00	11.11	27.27	0.00	9.09	18.18
Free sales	%	40.00	63.64	45.45	20.00	27.78	54.55
Sales to material suppliers	%	60.00	36.36	54.55	80.00	72.22	45.45
Produce sales price	dong/kg	1 857	1 917	1 966	1 529	1 692	1 731

Source: Survey by the Agrarian System Department, VASI, 2005.

14.1.2 Feed processing companies

The system of the feed companies is extensive, in line with the development of husbandry and demand for industrial feed uses. However, development of this system is always coupled with input accessibility. As a matter of fact, there is always demand from feed companies and the number of companies who use 100 per cent domestic products is quite high. There were only four companies who imported maize in 2003, out of 200 companies involved in this field. Every company has its own mechanism and purchasing system. However, the common mechanism is that input materials must be supplied with a VAT invoice, ensuring that the main suppliers to plants must be trading companies with legal status.

Input purchases for production at CP-Viet Nam company, one of the largest capacity plants in Viet Nam, are as follows:

- Due to advanced desiccating machinery with a high capacity (150 tons every 2-3 hours), most purchased maize is a raw material, accounting for 80 per cent of the company's total purchased domestic maize;
- The company only buys desiccated maize in times of maize shortage. According to the trading supplier in Chuong My, the local system provides about 12 per cent of imported maize, and the remaining 8 per cent is desiccated in Nghe An or Son La provinces, through intermediaries;
- Company requirements are not too stringent, and are often based on criteria such as maize should not be musty, with high uniformity, impurities below 1 per cent, and without hilum scars;
- According to the suppliers, the company, because of low humidity and the high percentage of protein and starch,
- prefers maize from Son La; and
- For product purchases, the company has changed from a signboard to a telephone system.

At present, the company's demand for maize is 80,000-120,000 tons per year. The company purchases 60 per cent of this from the northern provinces (of which 48 per cent is from Son La), the remaining 40 per cent is bought from Nghe An, Thanh Hoa and the Central Highlands.

Before 2003 the company often imported maize from China. Since 2003, however, imports from China have stopped due to the following reasons:

- Due to a higher gluten content, domestic maize has a darker yellow colour and is of higher quality than Chinese maize. This characteristic is the major influence on the import decision, as gluten content corresponds with maize colour;
- Domestic supplies have remained stable thanks to contributions from different sources. The company finds it easy to access supply sources;
- Company policy in regard to maize imports during recent years was not to solve the problem of material shortages, but instead was to stabilize the market when domestic prices jumped rapidly; and
- Company policy has been to use domestic materials in accordance with market extension and husbandry development.

Import tax is not a significant barrier to company activities as the company still uses domestic maize when the import price falls below 200-300 dong per kilogram. This will become an important factor in maize market development.

Feed companies will be directly influenced by economic integration. In the current context of domestic production, development of the market system and maize import issues have created an advantage for production areas. Only large feed companies have decided to import maize, while the middlemen like food companies take very little part in this activity. Within the current context of the regional maize market, there are three decisive factors for the feed companies, namely supply sources, price and quality.

14.2 Farm gate price and margin

Different commodity channels have different forms of profit sharing even when produce is passed through the same agent. Therefore, each trading agent wishes to reduce the roles of intermediaries to increase the profit of their own operation. This characteristic creates competition between the different commodity channels. Maize is distributed from Son La to the Red River Delta through four main channels. Between Channel 1 and Channel 4, though the price compared to husbandry is the same, Channel 1 is more competitive; as profit for local agents is 2.39 times higher than that found in Channel 4. Therefore, if profits for local agents in Channel 4 were as high as those in Channel 1, the price for the end-user would be 64 dong per kilogram higher.

Table 14.2 Pricing through agents in Son La to the Red River Delta

	Channel 1	Channel 2	Channel 3	Channel 4
Producers	2 000	1 900	1 880	1 950
Net profit	1 596.2	1 496.2	1 476.2	1 546.2
Buyers	-	-	2 030	2 080
Net profit	-	-	99	79
Local agents	2 226	-	-	2 226
Net profit	110	-	-	46
Transporters	2 396	2 250	2 250	2 396
Net profit	20	155	70	20
Large delta agents	2 486	2 340	2 340	2 486
Net profit	20	20	20	20
Small delta agents	2 536	2 390	2 390	2 536
Net profit	50	50	50	50
Husbandry households	2 536	2 390	2 390	2 536
Commodity channel linked with cattle feed companies				
Trading companies	2 411	2 480	2 250	2 411
Net profit	15	30	15	15
Feed companies	2 411	2 480	2 265	2 411

Source: Survey by the Agrarian System Department, VASI, 2005.

Note: Channels 1 and 4: dry-cured maize; Channels 2 and 3: dried maize, figures for farming households were calculated on average from Co Noi

In Phieng Pan, there are only two principal channels, 3 and 4, of which in Channel 3 farmers sold corn-on-the-cob at 1,707 dong per kilogram (calculated based on the rate converted to dried maize). In Channel 4, farmers sold corn-on-the-cob at 1,829 dong per kilogram.

Son La is an area with more development in terms of commodity channels distributing produce from the production area to the consuming markets. There were similarities in the local agents used between commodity channels leading to the two consumption markets. Exclusive of the transport agents, the two systems somewhat operated separately. The two systems themselves mutually compete, which is adjusted by cattle feed companies through imports.

14.3 Nature of market structure and competition

14.3.1 Market characteristics and operating scale of agents

The market characteristics and operating capacity of the trading agents determine the supply capacity of the whole system. Under developing conditions, supply capacity becomes one of the advantages in generating competitive advantages of maize over other products. Son La maize has become a trademark not only effective in free market systems but it also plays an important role in the cattle feed companies. Under such conditions, the local maize market is characterized by the following:

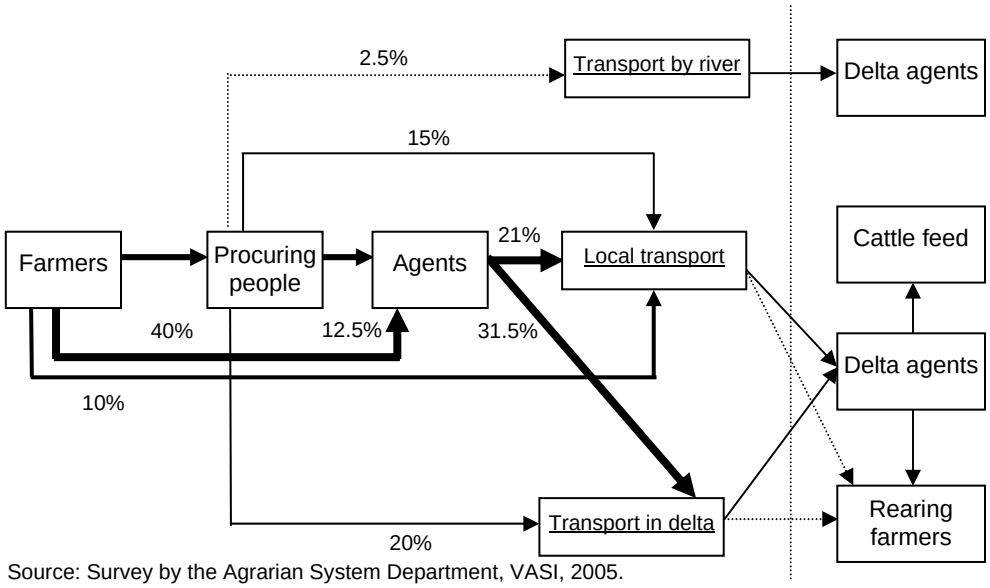
- The maize market has begun to develop strongly over the last decade, of which the development was combined with the development of hybrid maize and the suitability of maize in the fertile soil conditions found in the area;
- The system of agents participating in the market developed strongly both in terms of scale and supply capacity. Specialization of agents was high showing the professionalism in their operations, of which the most important characteristics were information accessibility and meeting the demands of the market;
- Local agents play an important role in regulating the market by changing the amount and quality of maize reaching the market. Besides this, the introduction of quality standards; through the use of a humidity metre, also triggered positive changes in the trading system;
- The linkage between the supply market and the consumption market is relatively diversified and best when there is sufficient linkage between the two main consuming systems of the free market and the feed companies; and
- The system of market agents and the production system have a relatively close relationship in supplying input materials and output produce. The relationship allowed the formation of stable sources of supply but also created difficulties for producers to participate in produce pricing.

The commodity channels and distribution of produce from Son La to the Red River Delta are rather diversified. The roles of the agents are highlighted as follows:

- Local agents of dealers co-ordinate the sources of supply and link them to the consumption markets;
- Trading companies represent the intermediate link in the introduction of produce to the feed companies. Besides this, they also look for inputs to supplement the commodities in the market during the low season for maize in Son La; and
- Local agents of dealers are the link between demand from the husbandry system and sources of commodity supply.

The relationships between agents in the market are shown in Figure 14.1.

Figure 14.1 Maize commodity chain in Mai Son district - Son La province



Source: Survey by the Agrarian System Department, VASI, 2005.

The agents participating in the four commodity channels consumed the most maize from farmers in Son La, thus evidencing market participation by farming households. There was a difference in the category of produce between the various commodity channels. The appearance of local dealer agents confirmed their roles in dry-cured maize supply.

Figure 14.2 The four maize commodity chains in Son La province

Channel 1 (Dry-cured maize)	Farmers		Local agents	Transporters	First system to consume for free market and for cattle feed companies
Channel 2 (Dried maize)	Farmers			Transporters	
Channel 3 (Dried maize)	Farmers	Procuring people		Transporters	
Channel 4 (Dry-cured maize)	Farmers	Procuring people	Local agents	Transporters	

Source: Survey by the Agrarian System Department, VASI, 2005.

The trading system was characterized by zoning for operations between local agents and buyers. Moreover, the supply capacity of agents as well as of mobile buyers also depends on the system. Therefore, the operating areas of agents and transporters are continually expanded through the settled buyers. The market has been further enlarged to remote areas heightening risk as follows:

- Risk of accidents when transporting maize for procurement (due to car accidents, landslides);

- Risk of loss of investment due to crop failure or the unfeasibility of debt repayment despite a bumper crop (because farmers sell at higher prices than buyers, or buyers refuse to pay, or farmers do not have sufficient human resources for debt repayment); and
- Risk of wrongly assessing the conversion coefficient of corn-on-the-cob to corn seed.

Local agents have improved their stable supply capacity themselves through a storage system. Storage facilities are not only available to agents but also to buyers and transporters.

Table 14.3 Operating scale and characteristics of local agents

Characteristic	Settled buyers	Mobile buyers	Local agents	Transporters
Produce sold based on value	- 90% of corn-on-the-cob - 10% corn seed	- 85% corn-on-the-cob - 15% corn seed	- Maize: 60-70% - Food, production materials: 30-40%	- Maize: 60-70% - Others: 30-40%
Purchased produce/ year (tons)	200-300	600-700	1,000-2,500	1,000 – 1,500
Working capital (million dong)	100-200	300-400	800-1,000	100-150
Family labour (persons)	1-2	1-2	2-3	1
Seasonally hired labour (persons)	1-2	3-4	10-15	1
Procuring area (commune)	Villages in the surrounding area	The whole district	The whole district	Operating in the whole district
Set up relationships with commodity agents	Seed and fertilizer investment	Regular commodity purchase	- Funds investment for procurement - Investment of funds, materials and food for farmers	Two-way produce supply
Input agents	100% farmers	100% farmers	- Farmer: 25% - Procuring people: 75%	- Farmers: 10 - Local agents: 40% - Procuring people: 50%
Output agents	- Local transporters: 30% - Local agents: 60% - Transport by river:10%	- Delta transporters: 10% - Local transporters: 35% - Local agents: 55%	- Transporters: 40% - Delta agents: 35% - Trading companies: 25%	- Delta agents: 45% - Trading companies: 55%
Number of regular output agents	2-3	4-5	- Transporters: 4-5 people - Delta agents: 2-4 - Trading companies: 1-2	- Delta agents: 3-5 people Trading companies: 1-2 companies

Source: Survey by the Agrarian System Department, VASI, 2005.

14.3.2 Relationships between agents in the commodity sector

In addition to the trading relationships, there are different relationships between farmers and trading agents. These relationships aid the activities of agents but also somewhat restrict their operations. Specifically:

- Production material supply relationships: trading agents supply food and production materials to farmers who lack funds for credit. Supply price is determined at a fixed level without interest or charging the market price + transport charge + interest rate (commonly 2 per cent per month). At the end of the maize crop, farmers can pay with maize or in cash.
- Local agents often have their own buyers who provide funds and commodities for their operations. Their relationship, besides the economic benefits, is also influenced by their acquaintance.

In reality, private credit services include services which promote production development. Like other surveyed areas, credit relationships between producers and agents in Son La have developed but these relationships have had various effects, notably:

- A change in the bargaining power of farmers from when there were many output agents who wished to invest. Moreover, farmers can partially be self-sufficient in terms of food so they are less afraid of losing their food supply and are really only interested in purchasing production materials. Under these conditions, they may turn to output agents if suppliers fail to pay the market price for their produce. However, this situation also occurs in households under relatively good economic conditions and after some time of stable production; and
- Poor farmers are very much dependent on output agents both in terms of production materials and regular food demand. Farmers are not only worried about materials but about their whole source of food supply so it is difficult for them to change their relationship. It is not easy for these households to participate in produce pricing.

Apart from the above characteristics, inconvenient transport and adverse weather conditions also disadvantage the farmers. It is difficult for farmers to select consumption agents, especially being that the trading system is zoned with respect to the procurement system.

14.4 Potentials and constraints in the marketing system

The concept of a market is understood as a comprehensive market comprising of each household's production factor. The more farmers using production sources, the more the market may influence the farmer. The major markets that can affect household maize production as well as agents' activities are:

- Seed market;
- Fertilizer market;
- Labour market; and
- Market for other services: production and processing services (seeding, ploughing, transportation, storage, among others).

The survey results from Mai Son – Son La indicated that in 2004, most of the materials and services for production were used in higher amounts compared to 2002 levels, especially fertilizers (52 per cent), with the remainder rising by 20 per cent, as detailed in Table 14.4:

Table 14.4 Percentage of cost increase for some products in Mai Son (Son La) in 2004 compared to 2002

Description	Increase percentage
Seed cost	25
Urea cost	52
Seeding service	20
Farmers' selling price of maize	45.5

Source: Survey by the Agrarian System Department, VASI, 2005.

For the labour markets, the current production situation in different locations shows that the number of hired labourers is very low, as most households prefer mutual help. Therefore, the effects generated from the labour market are not discussed in this section. One of the major effects on farmers as a consequence of market changes is a change in the selling price of maize. Farmers have not complained much over the last two years with regards to production effectiveness as they can still sell at a price 45.5 per cent higher than before. This hike in the selling price partially helped curb the effects felt from other changing factors.

The effects felt from adjusting market prices to production are quite similar for the two markets of seeds and services. The major difference is found in the fertilizer market. Consequently, poor households are affected less due to the limited use of fertilizers compared to better-off households.

To evaluate the constraints to production and sales, the following three factors were chosen, namely fertilizers, sales prices and transportation.

Table 14.5 Percentage of households aware of production constraints

(percentage of households)

	Son La	
	Poor	Total
High cost of fertilizer	25	33.2
Low selling price of maize	5	5.7
Transportation difficulties	25	35.7

Source: Survey by the Agrarian System Department, VASI, 2005.

The percentage of households who think that higher fertilizer prices will adversely affect intensive maize production is dependent on the scale of household investment. However, household perceptions are only relative because many of the people interviewed only considered one market and lacked knowledge of the causal relationship of the changes in the maize market.

Though farmers' evaluations are subjective, they indicate that poorer farmers are less concerned about the effects of changing material markets.

14.5 Competitive advantage is visible through selling prices

It is difficult and complicated to assess a product's competitive advantage as changes in the product market are under the influence of many different factors. At the point of production, the basis for competitive advantage is evaluated using two parameters:

- **Comparative advantage** of a product in a certain area is evaluated, based on the product's opportunity costs compared to other products; and
- **Competitive advantage** is represented using the three main factors of the selling price, quality and supply capacity of the product channel

These two advantages are linked. Comparative advantage is necessary for the subsequent generation of competitive advantage, as the product can only be competitive in a market once it has entered into the production system.

Analysis of the above data indicates that maize in the study areas has developed comparative advantage in the production system compared to other crops. The effectiveness of maize cultivation is higher than other competing crop systems.

Specific criteria for the assessment of product competitiveness were used in different regions or in different areas within a region.

Table 14.6 Constraints to production for the poor households

	Income/1kg of maize kernel (dong)*		Rate of income/unit cost of production expenses (time)	
	Poor households	Better-off households	Poor households	Better-off households
Mai Son - Son La				
Co Noi	1 288	1 497	5.3	6.4
Phieng Pan	1 521	1 592	4.5	4.3

Source: Survey by the Agrarian System Department, VASI, 2005.

* as this was calculated based on the farmers' selling price, there may be some differences with the table as the mentioned product is desiccated maize.

Even poor farmers can generate high income compared to their expenditure. The evaluation of farmers' incomes based on a kilogram of dried maize kernel indicated that incomes in Son La are much higher than in other areas. It is also showed that with the same production conditions, farmers in Son La could raise their incomes at a faster rate than farmers in other areas. The profit potential per production cost unit also highlighted differences between areas and household types. This forms the basis for an assessment of comparative advantage for maize products in different production areas in the market. In general, the poor households displayed lower production effectiveness compared to other household groups under the same production conditions. This shows the necessity of agricultural land expansion and more economically effective use of input services so that poor households may increase the competitiveness of their maize.

15. Industrial Processing of Maize

15.1 Types of products processed and annual production

15.1.1 Structure of maize consumption in Viet Nam

Human maize consumption

Economic development has lead to income improvements and changes in people's consumption habits. The evolution from not using foods other than rice is considered as an important change, especially for those people living in the highlands and mountainous areas. However, maize still remains significant in some areas and regions, especially remote areas. The results from surveys on people's living standards (VLSS) indicated that 25.86 per cent of the surveyed households used maize in 1998 and this figure remained unchanged in 2002. The areas with the highest percentage of households consuming maize as food were the Central Highlands (43.69 per cent in 2002) and Northwest (29.87 per cent). The two regions with the lowest level of maize consumption were the Red River Delta and the Southeast totaling 19.75 per cent and 18.88 per cent respectively.

In terms of ecological area, the percentage of households consuming maize as food is falling, especially in the Central Highlands, down from 76.45 per cent in 1998 to 43.69 per cent in 2002. The two areas with increasing trends in this field are the coastal areas of the south central region and the Mekong Delta. The percentage of households consuming maize in the south central region in 2002 was 1.59 times higher than in 1998, and similarly 1.94 times larger than that found in the Mekong Delta.

The highest quantity of maize used per capita in 2002 was found in the Northeast at 27.8 kilograms per person per year, followed by the Northwest and the Central Highlands. Due to differences in the number of surveyed households in 1998 and 2002, as well as alterations to the survey objectives[1], comparing the quantity of maize used per capita per annum does not represent fully the tendency and differences between regions in the country. The quantity used per capita per annum is low in the delta areas and high in the central and mountainous areas.

[1] The survey in 1998 was conducted with 6,002 households. The survey in 2002 used a sample of 26,206 households.

Table 15.1 Percentage of maize consumed as food and feed

Region	Average quantity of maize use/person/year[a]				Husbandry consumption (%)[b]		
	1998[c]	Households with maize consumption (%)	**2002[c]**	Households with maize consumption (%)	**1993**	**1998**	**2002**
Red River Delta	2.50	31.12	2.80	19.75	72.10	84.65	73.57
Northeast	18.15	32.10	27.80	28.80	37.02	63.76	66.69
Northwest	7.79	46.9	15.30	29.87	31.30	36.91	17.90
North Central	3.08	26.55	5.20	26.51	52.80	53.66	63.93
Coastal areas of South central	14.67	17.19	4.30	27.00	6.80	40.30	27.73
Central Highlands	3.70	76.45	12.50	43.69	35.61	30.22	10.02
Southeast	4.90	19.48	6.40	18.88	35.10	21.79	5.85
Mekong River Delta	3.77	13.57	3.10	26.41	8.94	2.08	0.60
Nationwide	**6.60**	**25.86**	**9.30**	**25.53**	**39.6**	**42.34**	**14.6**

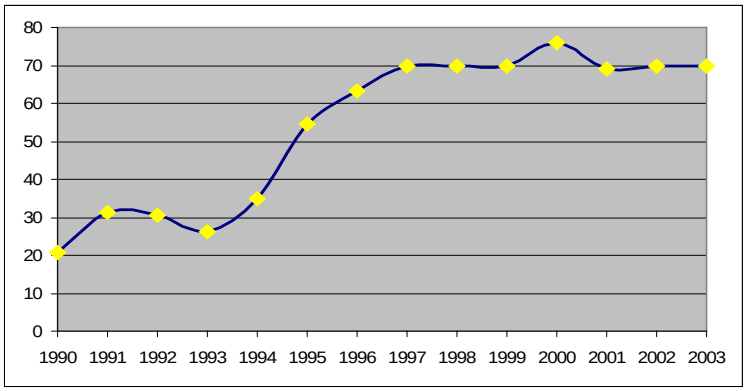
Source: Data from VLSS, 1993, 1998, and VHLSS, 2002.
Note: [a] Calculation based on the number of households consuming maize as food,
[b] Calculation based on the number of households cultivating maize,
[c] kg/person/year.

Maize consumption for husbandry

High demand for feed is linked to the development of husbandry activities. Once household husbandry is developed and transformed into commercial husbandry, the use of maize is a simple solution for households. In swine specialized farming areas like Hai Duong, Thai Binh and Ha Tay, the percentage of maize in feeds is around 40-60 per cent. This indicates the increasing demand for this product.

Nationally, the quantity of maize produced for husbandry keeps growing. Only 20 per cent of total maize produced was used for husbandry in 1990. This figure increased to 70 per cent in 2003 and to 76 per cent in 2000. Viet Nam has a higher percentage of maize consumption for husbandry compared to the world average. Since 1997, this percentage has stabilized at 70 per cent, meanwhile domestic maize yield keeps rising suggesting that the demand for maize from husbandry is also on the up.

Figure 15.1 Percentage of maize consumption for husbandry in Viet Nam



Source: FAOSTAT, 1990-2001; Agricultural Department – Ministry of Agriculture and Rural Development, 2002-2003.

Areas with developed commercial maize production are found to have a low percentage of maize use for household husbandry. This is a characteristic of the production and consumption system (Table 15.2). The Northwest, Central Highlands and Southeast are found to have very low percentages of maize use for husbandry, more specifically 17.9 per cent in the Northwest, 10 per cent in the Central Highlands and 5.8 per cent in the Southeast in 2002. Areas with a highest percentage of maize use in 2002 were the Red River Delta (73.57 per cent) and the Northeast (66.69 per cent).

The percentage of maize used for household husbandry shows clearly the level of self-demand and self-supply of these households. The higher the percentage is, the higher the level of self-demand and self-supply. The lower the percentage is, the higher the level of commercial production. The Northwest, Central highlands and Southeast are the major commercial production areas and they have also achieved higher levels of market penetration than other regions.

15.1.2 Production capacity and its usage

The relationship between husbandry development and feed demand

During the last decade, husbandry in Viet Nam has improved, both in quantity and quality. The total number of farmed animals in the period from 1993-2003 has increased at a rate of 5.05 per cent per annum, of which swine increased by 5.28 per cent per annum and poultry increased by 7.09 per cent per annum.

The use of maize for husbandry continues to rise. At the beginning of the '90s, husbandry developed slowly, swine only increased, on average, at a rate of 2.88 per cent per annum (1983-1993), resulting in only 5 per cent of the total maize yield being used, but since 1994, both the number of farmed animals and the proportion of maize used keeps on rising.

A lot of research indicates that producing animal feeds accounts for about 70 per cent of the cost[2]. Due to high production costs, Vietnamese husbandry finds it difficult to compete with the import markets, especially for pork and pork derivatives. In order to reduce production costs, the most feasible solution is to increase self-supply feeds, especially in processing of industrial feeds. During the past four years Viet Nam has maintained 70 per cent of maize used for husbandry, and increased the maize portion in refined feeds up to 21.62 per cent in 2003. Will this percentage increase further upon more conducive conditions for the development of husbandry in Viet Nam?

Table 15.2 Quantity of refined feeds and maize used for husbandry

	1992	1995	2000	2001	2002	2003
Consumed quantity of refined feeds (million tons)	5.5	6.5	8.2	8.5	8.9	9.5
Consumed maize (million tons)	0.230	0.640	1 524	1 494	1 758	2 054
Percentage of maize/refined feeds	4.18	9.85	18.59	17.58	19.75	21.62

Source: FAOSTAT, 1992-2001; Agricultural Department, Ministry of Agriculture and Rural Development.

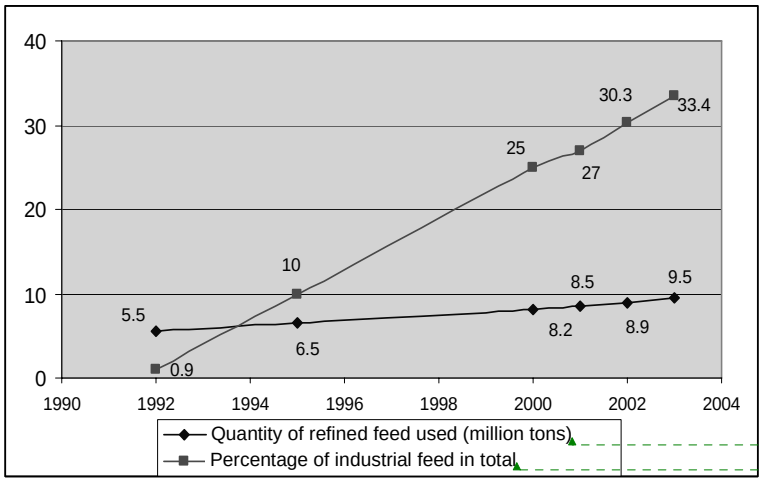
[2] Associate Professor, Dr. Nguyen Dang Vang – Director of the National Husbandry Institute.

Vietnamese development plans up to 2010 are aimed at increasing the number of pigs to 33 million and poultry up to 380 million. This represents an increase of 30 per cent for pigs and 48 per cent for poultry compared to 2004. With this target, Viet Nam requires 13.5 million tons of refined feeds and if Viet Nam retains 70 per cent of maize yield for husbandry with 21 per cent of maize in feed (as in 2003), Viet Nam will require 4.05 million tons of maize. Hence, at least 1.25 million hectares of maize area with productivity at 3.2 tons per hectare is required or 1 million hectares if productivity can reach 4 tons per hectare. The latter solution is more feasible, taking into account the potential of maize productivity. It is difficult to rapidly increase cultivation area in Viet Nam, but productivity can be increased if many commercial production areas are secured and the potential market penetration of maize farmers is improved.

15.2 Industrial feeds and their input requirement

The percentage of industrial feeds in total refined feeds for husbandry has continued to rise rapidly. In 1992, industrial feeds only accounted for 0.9 per cent of the total refined feeds. Currently, it accounts for 33.4 per cent; a rate of 15.67 per cent per annum from 2000-2003. This is due to the efforts of the Vietnamese industrial feed production system.

Figure 15.2 Demand for refined feed from the husbandry industry in Viet Nam



Source: Agricultural Department, Ministry of Agriculture and Rural Development, 2004.

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The development of processing plants has partially satisfied the development of commercial husbandry. By May 2004, the number of feed processing plants nationwide reached 197. Joint-venture or foreign invested companies have contributed significantly to the development of husbandry feed production; accounting for 18.3 per cent of the total number of plants and representing 65 per cent of production by May 2004.

According to the Husbandry Association of Viet Nam, although prices of industrial feeds have increased, supply shortages remain. With a 35 per cent inclusion rate of maize in industrial feeds, in 2004 Viet Nam needs to produce 1,905 millions tons of maize grain. Assuming that the production system of Viet Nam can satisfy material demand, what is the necessary maize yield? In order to maximize productivity to 5.445 millions tons, we will need 1.905 millions tons of maize, equal to 3.529 millions tons for husbandry and 5.04 million tons for production.

Above is a simple calculation based on the available data of 2003 but it can be seen that the productivity of the feed processing system will not stop at 5.445 millions tons; it will increase further. Likewise, demand for maize will not stop at 1.905 millions tons. However, the production system of Viet Nam cannot produce these levels and the only solution is to import.

Table 15.3 Number and productivity of feed processing plants in Viet Nam

Ownership	2001		May 2004		2001		May 2004	
	Number	Percentage (%)	Number	Percentage (%)	Total productivity/year (tons)	Percentage (%)	Total productivity/year (tons)	Percentage (%)
State-owned	23	18.3	32	16.2	391	11.8	613	11.3
Joint stock	5	4.0	10	5.1	73	2.2	143	2.6
Private	79	62.7	119	60.4	848	25.6	1151	21.1
Joint Venture and 100% foreign invested enterprises	19	15.1	36	18.3	2 001	60.4	3 538	65.0
Total	**126**	**100**	197	**100**	3 313	**100**	5 445	**100**

Source: Agricultural Department, Ministry of Agriculture and Rural Development, 2004.

16. Analysis of Institutional Support

16.1 International trade policies for maize

Thailand, Indonesia, the Phillippines and Viet Nam have the fastest rates of maize development within Asia, after China who leads Asia and is ranked second in the world in terms of maize yield. In the period from 1980-2003, maize production in the region followed two major trends:

- Thailand and Malaysia, showed constant stable maize yield of about 4.5 million tons per year; and
- Viet Nam and Indonesia rapidly increased their maize production. While Viet Nam maintained stable growth, Indonesia could not due to difficulties in maintaining a stable production area over many years.

In the Southeast Asian countries, maize production area is primarily concentrated on sloping areas, creating problems for water supply and drainage. Hence, extension of the cultivation area is limited, thus making it difficult for the continuous development of maize production. This trend is also visible within the developed agricultural economies, such as China.

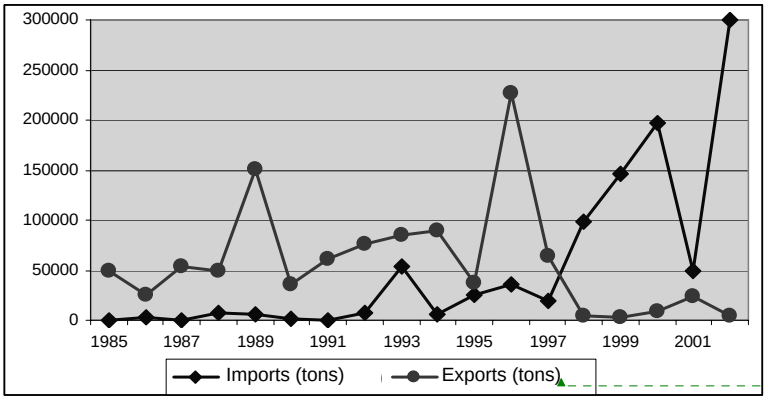
From the Asian countries listed in the world's top 25 countries with the highest yield in 2003, except for China and Thailand in some recent years, all the rest have achieved yields lower than the average level of Asia and the world average. However, the yield of China has been almost constant for the last 10 years (1993-2003).

This rapid growth in yield is to the advantage of the Southeast Asian countries, who have a yield increase rate higher than the average level of Asia and the world, namely the average annual productivity increase rate of Thailand in 1993-2003 was 3.08 per cent, of the Philippines 3.13 per cent, of Indonesia 4.23 per cent, and Viet Nam achieved the highest rate of 5.3 per cent. The current maize productivity of Viet Nam, however, is only 70 per cent of the world average and 82 per cent of Thailand's average. This shows potential for Viet Nam to increase maize yields in the forthcoming years.

16.2 Exportation and importation of maize

According to Mr. Le Ba Lich – Chairman of the Husbandry Feeds Association of Viet Nam, at present, 60-65 per cent of industrial feeds in Viet Nam are imported, including materials that are rich in protein and energy. Maize is a product that accounts for 35-40 per cent of the material inputs in livestock feed processing; therefore, import demand is dependent on the demand and capacity of the feed companies. The movement of imported maize volume within the period from 1985-2002 indicated that real import demand from Viet Nam emerged at the beginning of the '90s.

Figure 16.1 Maize import and export figures for Viet Nam



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Source: Informatics Centre of the Ministry of Agriculture and Rural Development.

The quantity of maize imported varies, more specifically from 50,000 tons in 2001, it increased to 300,000 tons in 2002, then seemed to decrease in 2003 (according to unofficial data from the Husbandry Feed Division, Agriculture Department, Ministry of Agriculture and Rural Development, the import quantity in 2003 was 101,431 tons).

Imported maize to Viet Nam comes from various sources and there remains no fixed mechanism. Maize imported to Viet Nam is not only from Asian countries, but also from America, France and Germany, among others. In 1996, Viet Nam primarily imported from Thailand, accounting for 61.73 per cent of the total imported maize. But Chinese maize has recently dominated the Vietnamese market, accounting for 73.8 per cent of the total national maize imports, while Thai maize only provided 6.6 per cent. Diversification of the import sources has meant greater penetration to the Vietnamese market for Southeast Asian

countries like the Philippines, Myanmar and Malaysia, as well as America. However, American maize still only accounted for 3.6 per cent of the total import value in 2000.

When maize importing activities of Viet Nam are evaluated the following characteristics are found:

- The main importing companies are large feed processing companies like CP-Viet Nam, Cargill – Viet Nam, DAFACO Co. in Bac Ninh and Proconco. In 2003, with 101,000 tons of imported maize, the three companies accounted for 96.1 per cent of the total imported yield;
- Maize imports to Viet Nam is often occur when there is a shortage and domestic prices are higher than import prices. According to Mr. Le Ba Lich, companies often import maize from November to June, as during this time, it is impossible to source Vietnamese maize and domestic prices are higher than the imported ones; and
- Import activities are not only dependent on demand, but also on other factors, most importantly, a sufficient amount of maize is required to save transportation costs. For example, it requires 40,000 tons of American maize to ensure a transportation cost $20/ton. Therefore, companies often co-ordinate imports with each other to reduce transportation costs.

At present, Chinese and American maize products account for a major share in the Vietnamese market, especially Chinese maize. Taking advantage of the geographical location and export prices, it is quite easy for China to penetrate the Vietnamese market, not only to obtain and sell materials for processing, but also for free markets. However, there is an advantage to Vietnamese maize which is that the quality is often better than the other types. Vietnamese "semi-stone" maize is often evaluated higher (hard endoderm and preferred colours) than American and Chinese "horse teeth" maize (soft endoderm and high starch content[1]). Another difficulty with American maize are the GM species. At present, these species account for about 50 per cent of the American maize yield. According to American regulations, a mix with less than 20 per cent of GM maize is still considered as normal maize. Viet Nam does not accept genetically modified maize and has implemented a ban on importing these species, although Viet Nam still has no inspection system to detect GM maize. Currently, assessment and quality management are entirely dependent on the suppliers' commitment.

[1] According to Prof. Dr. Ngo Huu Tinh – Director of Maize Research Institute.

16.3 Changes in import tax inViet Nam

Laws concerning import tax on products and services made in 1987 stipulate that the import tax for maize should be 10 per cent, which was reduced to 7 per cent in 1992 as per Decree ND 110 - HDBT dated 31/3/1992, and then increased to 7.5 per cent in 1999 as per Decree QD 44/1999/QD - TCHQ 20/1/1999. With this tax rate, the government allowed all companies and business enterprises with licenses for importing and exporting agricultural products to take part in maize imports and exports. Up to now, the Agriculture Department only maintains a role of influencing management and control of the import system of feed processing companies through their annual progress reports. The process of CEPT/AFTA integration has been implemented since 1/1/2004. Viet Nam has since reduced the maize import tax to 5 per cent.

16.3.1 Export

Changes in the amount of exported Vietnamese maize share similar characteristics as the imported maize. Before 1997, import and export activities did not have any similarities, however since 1997, it seems that export activities have had an opposite tendency to imports, namely when the imported quantity rises, the exported quantity falls and vice verse.

Annual maize yield for exports in Viet Nam have shown a falling trend. In the ‘90s, export volume from Viet Nam was relatively high, especially in 1997 when it stood at 227,000 tons, but this quantity was only 4,774 tons in 2002. For many years, only the issue of limiting the import quantity for protection of domestic production was considered, neglecting maize exports. There is insufficient information on who is exporting, where products are exported to, and how the exports are carried out. However, according to our data, Viet Nam mainly exports maize to neighbouring countries such as China, Lao People’s Democratic Republic and Malaysia on a small-scale.

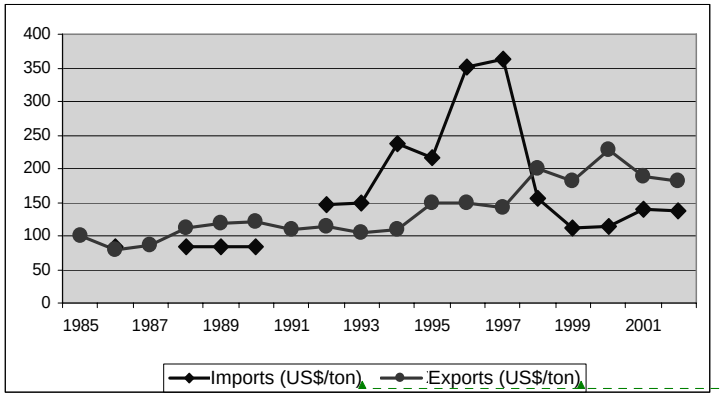
The issue of small scale exports needs to be thoroughly studied in the near feature; which raises the following questions: is it correct that maize is exported because of high exporting prices? Shall exports be carried out at cropping time? Should commercial maize or seeds be exported?

16.3.2 Maize import and export prices in Viet Nam

Strong changes without any clear pattern is the main characteristic of maize import and export prices in Viet Nam. When the international maize price drops, there are a lot of

changes in the import prices in Viet Nam, although for the last three years it has continued to increase. Many specialists believe that the import price of maize in Viet Nam increased due to more sea transportation and higher loading/uploading costs, together with adjustments in the export policies from countries like China and Thailand, who focus on maize use for husbandry rather than export. Moreover, import demand from the major importers like Japan, Korea and Malaysia is rising.

Figure 16.2 Maize import and export prices in Viet Nam



Source: Informatics Centre of the Ministry of Agriculture and Rural Development.

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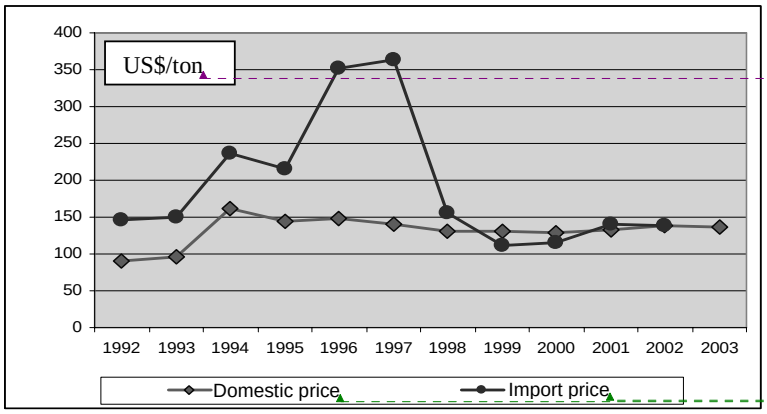
Together with quality issues, complicated customs' procedures and conditions on the import volume have made feed companies prefer domestic products. Hence, they do not import while the domestic market can satisfy their material demand. Importing activities increase when domestic prices reach a certain level. For instance, in 2004, companies did not import when prices in the domestic free markets remained at less than 2,700 dong/kg. Despite available imports from convenient sources such as China and America, they only started to import when the prices increased to 2,700 dong/kg. This shows that price is not the only factor influencing maize imports, but also there are several others like product quality, demand quantity and paperwork involved.

Comparison of the average domestic price and import prices in Viet Nam indicates that the gap between the two prices has narrowed since 1999. In the period from 1999-2000, the maize domestic price was often 14-17 US$/ton higher than the import price. Since 2001, import prices have been higher than domestic prices; 8 US$/ton higher in 2001 and 0.8 US$/ton higher in 2002.

Figure 16.3 The maize domestic maize and import prices in Viet Nam



Source: Informatics Centre of the Ministry of Agriculture and Rural Development.

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However, comparison of the annual domestic and import prices was not fully able to explain all the activities of the maize market. Besides the cropping factor, market structure also needs to be emphasized as a factor, i.e. the distance from sources to markets and the structure of product channels. The product channel structures have a close relationship with infrastructure conditions, and the adaptability of agents, which are important to clarify the impacts from the integration process to the whole product line.

16.3.3 Situation of maize imports in Viet Nam from some major exporting countries

Information on sources of imported maize is important for a complete assessment of market impacts on domestic maize products which trigger policy change. At present, there are two major exporters of maize in the world, China and America. Based on collected information during the past five years, most of the commercial maize import into Viet Nam originates from China. According to data from the Customs' Department of Hai Phong City, a small amount of maize is officially imported via the port; there were only 6,050 tons imported in June 2003 for the whole period of 2001-2003, and then no more maize has been imported up to the end of 2004. According to unofficial information, maize could have been imported in a different manner, without customs clearance, or there has been a severe reduction in the actual imported amount. However, the collected information from customs is in line with information gathered from feed companies like CP, and Golden Pig, among others.

For American maize, Viet Nam has continued to import maize products from America during the last decade. Below is official data from the Department of Commerce, with regard to maize imports to Viet Nam during 1995-2004:

Table 16.1 Quantity and value of American maize exported to Viet Nam

	Unit	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Quantity	Ton	15 076	32 531	16 541	60	6 989	125	159	199	296	269
Value	US$	1 846 961	5 591 424	2 014 696	22 149	729 354	51 407	68 240	89 735	159 914	132 505

Data source: Department of Commerce, U.S. Census Bureau, and Foreign Trade Statistics.

However, popcorn is the main product imported by Viet Nam, not commercial corn. In 1999, 6,907 tons were imported and 20 tons of yellow corn No. 3 was imported in 2004 at the FOB price in America of 463.5 US$/ton. Non-tariff barriers are the main constraints to assess the impacts from American maize on the Vietnamese market.

The integration process of Viet Nam is ongoing with the implementation of many tax reduction policies. The government of Viet Nam has apportioned an import quota in 2005 for maize. However, this policy has faced reaction from quota apportioned agencies and it will be abolished in the second quarter of 2005.

The route of tax reduction in Viet Nam in the near term is as described in Table 16.2.

Table 16.2 Tax reduction for imported maize in Viet Nam

Agreements	2005	2006	2010	2015
AFTA – ASEAN Commitment	5	0	0	0
ASEAN – China free trade areas	5	5	5	0-5
Viet Nam – US Bilateral Trade Agreement (1)				0
WTO entry (2)	5	5	5	0

Corn kernel is beyond the commitment of tax reduction

The negotiating proposal of Viet Nam

According to the tax reduction plan of Viet Nam, import tax for commodities from ASEAN will be zero per cent in 2006. China will apply a tax rate of 0-5 per cent for 10 years. Upon WTO entry, Viet Nam wishes to apply a tax rate of 5 per cent up to 2010. Therefore, after 2010, domestic policies on production support through tax and quotas will be abolished in most countries.

Based on the import prices and practical expenses, we have calculated maize import prices at Hai Phong port for Chinese and American maize. The results show that the price of Chinese imported maize to Viet Nam is 2.089 dong/kg at the port gate. This price fluctuates,

in line with the consumption market and contribution of transport cost and profits of the agents in the free markets.

Table 16.3 Maize import price at Hai Phong port, following assumptions on import tax

Criteria	Import tax to Viet Nam (%)							
	0	1	2	3	4	5	6	7
Imported maize from China								
CIF import price (USD/ton)	120	120	120	120	120	120	120	120
Import tax (USD/ton)	0	1.2	2.4	3.6	4.8	6	7.2	8.4
Marine service charges (2.5%)	3	3	3	3	3	3	3	3
Uploading charges (USD/ton)	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Price at port gate (USD/ton)	126.2	127.4	128.6	129.8	131.0	132.2	133.4	134.6
Price at port gate (VND/kg)	**1 959**	**1 977**	**1 996**	**2 015**	**2 033**	**2 052**	**2 070**	**2 089**
Imported yellow corn No. 2 from America								
CIF import price (USD/ton)	126.3	126.3	126.3	126.3	126.3	126.3	126.3	126.3
Import tax (USD/ton)	0.00	1.26	2.53	3.79	5.05	6.32	7.58	8.84
Marine service charges (2.5%)	3.16	3.16	3.16	3.16	3.16	3.16	3.16	3.16
Uploading charges (USD/ton)	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Price at port gate (USD/ton)	132.7	133.9	135.2	136.5	137.7	139.0	140.3	141.5
Price at port gate (VND/kg)	**2 059**	**2 079**	**2 098**	**2 118**	**2 137**	**2 157**	**2 177**	**2 196**

Note: The exchange rate is 15,518 VND/USD.

Based on these results, maize prices will develop in different markets with the assumption that products are distributed through the channels in the delta regions. The market price is competitive in different areas.

16.4 Market institutions concerning maize products

The institutions generated by the market and those operated by the government are mentioned in this section. They are important to the objective of competitiveness within the whole production line.

16.4.1 Institutions between product agents

Every agent of the operation process, from user to producer, needs to develop a relationship with an input, output and service agent. For commercial agents, every agent generates a stable supply and regular output system. This relationship is not only tied commercial maize, but is also influenced by business activities. Within the present maize production system, feed processing companies play such a decisive role that their decisions and policies greatly influence market operations.

The policy of importing maize during recent years was heavily influenced by agents' decisions. To assess the influence of by feed companies, the policies of CP-Viet Nam, the biggest feed company in Viet Nam at the moment on consumption of both domestic and imported maize are described as follows:

Maize material purchasing activities of this company are under the influence of the following main factors:

- Company production plans;
- Maize quality;
- Maize price; and
- Supply capacity of the supply system.

During the past two years, though the price of Vietnamese maize has continued to rise, the company still purchases domestic maize. The reasons for this are outlined as follows:

- The company's sales plan has been influenced by the bird flu epidemic, which has limited demand for produce;
- The company trusts the quality of domestic maize. A change in maize type would affect the quality and colour and imported maize from China does not have the same colour as Vietnamese maize;
- Though imported maize is cheaper than domestic maize, imported maize can only be bought in large quantities. Imports are challenged by domestic maize prices, although many companies have employed a strategy of importing small quantities in order to reduce the domestic price; and
- The supply capacity of the free market system can now satisfy demands. Maintenance of the two production systems in the North and in the South has created conducive conditions for companies to coordinate material demand.

The constraints to import maize are not higher prices due to import tax, but reduced quality and unsatisfactory price differences between the imported maize and domestic maize.

Together with agents' policies, the commercial supply system has become more efficient, in terms of supply sources and product quality. Trading companies favour the closed market supply system in different areas to satisfy their supply requirement.

Given these characteristics, it is though that under current conditions, the product channel system in Viet Nam has satisfied the demand from feed companies. However, change in demand is unavoidable, particularly when these companies expand, leading to greater demand for maize and, therefore, new supply areas will have to be sought.

16.4.2 Policies and technological support

Government policy shows little difference when compared to policies governing other agricultural products. However, domestic production is still protected by the government using a tariff system and by maintaining the maize import tax.

Another important policy has been to lend support through the technological development programme. Research into and the application of new maize species has expanded production, and the development of various technologies to improve processes like seeding, desiccation and preservation not only helped to increase production, but also to reduce production risks, and most importantly improve product supply to the market.

The largest limitation to producers and commercial activities is that there is a lack of market information and a poor transportation system in remote areas. There are some areas where producers have no information or access to transportation during periods of adverse climatic conditions. These problems skew the markets and limit supply to the markets.

Improved development policies must be appropriate and adaptable. Meetings with feed companies indicated that the largest constraint to their import activities is not import tax, but quality and supply capacity. An important aspect for the maize industry Viet Nam is not only price, but quality and supply capacity.

17. Enhancing the Sustainable Development of Maize

17.1 Integration tendency by scenario

Based on integration, the tariff rate of Viet Nam can be 0 per cent or 5 per cent. Therefore, these two tariff rates will form the basis for two scenarios in 2005 and 2010. After 2010, the tariff rate will be reduced to zero.

Scenario 1: Domestic maize will have to compete with imported maize. Assuming that the current conditions of the product channels persist and commercial agents are retained, all market effects will be felt by farmers.

This scenario is based on the following assumptions:

- Domestic maize will have to face competition from imported maize year round (the imported maize season is not considered);
- Prices of imported maize are based on desiccated maize with a humidity value of 14 per cent, the difference between Son La dried and non-dried maize is 146 dong per kilogram, in Nghe An it is 200 dong per kilogram (because maize in Nghe An is harvested three months later, humidity is higher);
- All of the agents within the product line will operate with the same profits and costs as at present; and
- Factors such as the fertilizer market and services that affect farmers remain unchanged in this model.

Results of the scenario:

Case 1: Maize import tax rate of Viet Nam remains at 5 per cent until 2010.

Income tax changes lead to changes in the whole product line. However, for commercial agents their profit in comparison with total sales is quite small, so it is unlikely to vary much. Changes can only occur between product channels. Assuming that the conditions of the product channels remain unchanged, the results from Nghe An and Son La are as follows:

- **In Son La:**
  - Farmers' incomes would be affected; the degree to which depends on the structure of the product channel. Channel 1 allows the highest incomes for producers and commercial agents. Besides, the adaptability of commercial agents to market changes would also affect the farmers. If the local agents in Channel 1 reduced their profit to the level of Channel 4, selling prices would tumble, or if selling prices remained constant, farmers could increase their incomes by 64 dong per kilogram. This allows for competition to develop between product channels;
  - Chinese maize is more likely to influence the market than US maize due to lower import prices;
  - Poor households will be affected the most as they have to sell at the lowest prices. However, in areas with low levels of specialized maize production, incomes of poor households will be less affected; and
  - Comparison of low specialization areas showed that the effects seen in Phieng Pan would be lower than in Co Noi because of lower investment in production.

Based on the above changes, it is possible to control production cost increases so that farmers can maintain stable production, particularly when there are no other crops that can replace maize based on economic value.

However, in reality, in a practical production situation in a specialized area like Co Noi with crop failure due to natural calamities and soil degradation, it is extremely difficult to stabilize production. Moreover, nobody can confirm that fertilizer costs will not increase in the near future, as the government also cannot assure fertilizer prices for a period of 5 -10 years.

Table 17.1 Channels of maize production in Son La by tax bracket

		Co Noi areas				Phieng Pan area	
		Channel 1	Channel 2	Channel 3	Channel 4	Channel 3	Channel 4
	New incomes from 1 ha/incomes of 2004						
Import tax of 5% for Chinese maize	Poor HH	0.93	0.86	0.85	0.89	0.995	1.050
	Average HH	0.93	0.86	0.85	0.89	0.996	1.043
	Better-off HH	0.93	0.87	0.86	0.90	0.996	1.043
	Profit						
	Poor HH	4.21	3.91	3.85	4.06	5.30	5.59
	Average HH	3.24	3.01	2.96	3.13	7.07	7.41
	Better-off HH	3.98	3.71	3.65	3.84	6.37	6.67
	New incomes from 1 ha/incomes of 2004						
Import tax of 0% for Chinese maize	Poor HH	0.87	0.80	0.79	0.83	0.923	0.977
	Average HH	0.86	0.80	0.78	0.83	0.933	0.980
	Better-off HH	0.87	0.81	0.80	0.84	0.934	0.981
	Profit						
	Poor HH	3.93	3.64	3.58	3.78	4.92	5.21
	Average HH	3.03	2.79	2.74	2.91	6.63	6.96
	Better-off HH	3.73	3.46	3.40	3.59	5.97	6.27
	New incomes from 1 ha/incomes of 2004						
Import tax of 5% for US maize	Poor HH	1.00	0.93	0.92	0.96	1.077	1.131
	Average HH	1.00	0.93	0.92	0.96	1.066	1.114
	Better-off HH	1.00	0.93	0.92	0.97	1.066	1.113
	Profit						
	Poor HH	4.52	4.23	4.17	4.38	5.74	6.03
	Average HH	3.49	3.26	3.21	3.37	7.58	7.91
	Better-off HH	4.26	3.99	3.94	4.12	6.82	7.11
	New incomes from 1 ha/incomes of 2004						
Import tax of 0% for US maize	Poor HH	0.93	0.87	0.85	0.90	1.001	1.055
	Average HH	0.93	0.86	0.85	0.90	1.000	1.048
	Better-off HH	0.94	0.87	0.86	0.90	1.001	1.047
	Profit						
	Poor HH	4.23	3.93	3.87	4.08	5.33	5.62
	Average HH	3.26	3.03	2.98	3.14	7.11	7.44
	Better-off HH	3.99	3.73	3.67	3.86	6.40	6.70

Source: Research team calculation, 2004.
Note: HH = Households.

Scenario 2: Domestic maize and fertilizer prices will change due to maize imports

This scenario aims at assessing the affects that will be felt from the input and output factors of production. The basis for this model is as follows:

- Changes in fertilizer prices in Viet Nam in the period from 1999-2003 have increased on average by 27.8 per cent for all three types of fertilizers, namely urea, phosphate and potassium based fertilizer; and

- Prices of maize within this period remained almost unchanged. As the price of Vietnamese maize increased more than that of US maize for the same period, the latter will form the basis for calculations of income improvement. Concomitantly, this is also considered to be the percentage change of imported maize into Viet Nam.

Table 17.2 Price changes of some commodities within the period 1999-2003

Commodity	Increase level (%)
Price of domestic fertilizers	27.8
Price of domestic maize	17.1
Price of US maize	14.7

Source: Informatics Center, Ministry of Agriculture and Rural Development.

The factors not integrated in the model are: variations in some services like labour and transportation, among others.

17.2 Outcomes of the scenario

Table 17.3 Maize turnover reduction from 2004-2008

	Poor HHs	Average HHs	Better-off HHs	Poor HHs	Average HHs	Better-off HHs
	Fertilizer cost/total production costs (%)			Increase level of total production costs (%)		
Co Noi	87	92	84	24.36	25.76	23.52
Phieng Pan	81	90	82	22.68	25.20	22.96
	Costs/total turnover (%)			Reduction level of turnover due to cost increase (%)		
Co Noi	18.05	22.19	18.97	4.40	5.72	4.46
Phieng Pan	15.80	12.34	13.53	3.58	3.11	3.11
Turnover increase caused by price changes (%)						
Co Noi	9.60	8.28	9.54			
Phieng Pan	10.42	10.89	10.89			

Source: Research team calculation, 2004.
Note: HHs = Households.

The results show that changes in fertilizer price would lead to a different level of turnover in various areas. This difference depends on levels of fertilizer use and production services. The areas that would be most affected are Dac Lac, followed by Nghe An. However, the reduction would be much lower than the increase in maize production.

This scenario indicates that changes in the fertilizer market would not affect farmers' incomes, provided that the maize market also changes at the same rate.

The limitation of this scenario is that it does not take into account fluctuations in currency values (inflation and exchange rates). However, the most important observation is that rises in fertilizer price would be compensated by rises in the selling price of maize.

17.3 Changing tendency of production

The integration process will affect both market and household production. Development of the two market systems indicates two possible directions for the development of the product line.

The system of supply to feed companies would be affected greatly, as this is a direct consumption system and it would maintain the major market share of imported maize. However, with regards to the length of the product channel and professional level of the consumption agents, these factors can be exploited and would therefore be easier to adapt to new market conditions. Consequently, agents and trading companies would be more active in seeking inputs, extending supply routes and supply quantities. Upon embarking on the integration process, this system would find it difficult to change because demand from companies would not suddenly alter.

This system may undergo greater modification when the integration process liberalizes in 2010, increasing output and the reputation of participating trading agents. Enhancement of specialization and supply for these agents would be the main change to the system.

The current supply system to the free market is not a large consumption market but with this system there are higher risks involved than with other markets. As the market continually changes in response to consumer demand together with the changing trends of industrial feed use, this market would find the integration process troublesome. Therefore, the drive of this market must be towards adaptation in order to lower maize prices. This would lead to more competition between product channels, which, in turn, will reduce transaction, and middlemen costs in the market, and consequently, reduce market prices. However, this change would be limited in its scope by the increased profits of the trading agents. Therefore, this system would again be placing pressure on farmers.

Every system from present to 2010 will undergo change, although slower than necessary, as access to products is limited by import taxes, little demand and vast market changes. The greatest change will only occur in Viet Nam when tariff-supporting policies are modernized or entirely removed.

17.4 Affects on the poor

17.4.1 Different affects to every area and region

Effects from the integration process depend on two main factors, namely household production and the practical skills available in each area.

The choice by the farmer whether to grow maize commercially or traditionally is a decisive factor in assessing market impacts on an area. The affects from the market are greater when farmers' incomes entirely depend on maize production. Within the surveyed areas, Son La remains the area where production is carried out with the only purpose of selling to the market. The local farmers have no other means to generate income when they face market problems. Given these characteristics, Son La is the area at greatest risk from integration.

Production skills and the level of specialization show how production depends on the market. When conducting surveys on household production characteristics, we realized there are differences between the areas. The common characteristic in all areas is that farmers work and gain profit from their labour and as the cost of labour services in Son La is higher, farmers in this area will see the effects on their incomes generated from maize production more so than other areas due to high production costs.

Based on the analysis of the market and production and the two common factors above, the area that would be most affected by integration is Son La .

17.4.2 Integration will lead to a reduction in the incomes of the poor

The largest effect of integration will be price reduction for domestic products for farmers. As household production costs will increase due to higher investment, the results will be that farmers' profits will decline.

- Incomes of non-poor households will be less affected than that of poor households because the poor households invest less. In addition, households in remote areas with low levels of production specialization will also be less affected; and
- Poor households will be suffer more because of low and undiversified incomes that lead to a higher dependence on maize and greater reduction in household income.

Son La will be the area most affected, showing a high level of dependence on maize. This area will require much support after 2010.

Table 17.4 Poor household income changes due to integration in Son La

(percentage)

	Co Noi		Phieng Pan	
	2005	2010	2005	2010
Channel 1	5.68	10.45		
Channel 2	10.82	15.58		
Channel 3	11.84	16.61	0.37	0.92
Channel 4	8.25	13.01	-3.78	0.98

Source: Research team calculation, 2004.

The results indicate that commercial production areas will respond differently to market changes. The level is dependent on production characteristics, the intensity level of farming and the degree of contact with the markets of each production area. This analysis forms a very important basis for the development of appropriate policies for production promotion and the protection of these areas.

Part 3: General Conclusions and Policy Recommendations

18. General Conclusions

Based on the general assessment of maize production and market development, we can clearly be aware of the development tendencies and changes in consumption as well as production. Besides this, powerful countries also influence the market through their implementation of policies that distort markets and further constrain the integration and adaptability of new WTO members. This study helped draw the following conclusions:

18.1 Production

- Maize production in the world keeps rapidly growing, especially in Asia and USA. Developed countries may maintain production and increase yields through intensive production that result in increased productivity;
- Technological development, in terms of hybrid seeds, has changed the Vietnamese maize industry by increasing cultivation area and productivity. Domestic production has formed large specialized areas like Son La. However, production is also facing high risks in terms of damaging the ecological environment and from the market; and
- Production development has contributed to changes in living standards and traditions in many areas, especially in the areas of minority groups. It has also helped to improve household incomes, in particular for the poorest households.

18.2 Consumption demand

- The world market is divided into two separate areas, namely the production area in USA and the consumption area in Asia. The trend of using maize for husbandry keeps rising. There are many sources leading to variations in the markets, in terms of prices and circulated yields, of which most recently market expansion of Chinese maize caused a reduction in the US share in the Asian market; and
- Together with production development, the demand for maize for husbandry and feed production continue to increase and domestic maize production cannot satisfy this demand. Husbandry activities have formed in specialized areas such as the Red River Delta.

18.3 Market

- With competition developing between the two most powerful maize markets of China and USA, there have been many changes in the global market. The export support policies of these two countries have distorted the global market;
- Viet Nam has balanced the demand and supply of maize by importing. However, this method is still limited, with mainly Chinese products, and a tiny proportion of maize coming from USA and some other Asian countries. The tariff system designed to support production is still in use, but trade liberalization has created pressure to remove this policy. In future, China may reduce export support, due to the rising expense of the policy;
- The maize market in Viet Nam is relatively active. The development of the private system and increasing levels of professionalism of the trading agents exemplifies this; and
- Different levels of market penetration by different types of household have resulted in a complicated chain from the market all the way down to the production areas, while local and government policies for production support are not comprehensive or thorough enough.

18.4 Market and integration

- Under current maize production and operating conditions, domestic maize can compete successfully with imported maize, especially that from China and USA, and will continue to do so until 2010 if Viet Nam maintains its tariff protection policy with an import tax rate of 5 per cent;
- After 2010, the domestic market forcing the price of domestic maize down in order to compete with cheaper Chinese maize will feel open, negative effects. However, this problem will not be too serious as changes in the world market and the better product quality of Vietnamese maize will still give Vietnamese maize the edge;
- It should not be considered a serious problem if domestic markets are penetrated by US maize as this situation is unlikely to lead to a decline in domestic production, as the price of US maize will be maintained at its current high level. At the same time, activities of the product channel are and will become more diversified, causing less difficulty for domestic production; and

- As the production system in Viet Nam adapts to the integration, the better-off households, who invest most and carry out intensive farming, will feel the greatest effects from increased maize imports. However, the poor will suffer the most, due to a reduction in income, especially in the areas where maize is the sole income for farmers, like in Son La.

19. Policy recommendations

Maize production and development within the last decade have almost been totally based on internal forces. For integration, there are set issues, ie: how to reduce foreign influences, especially on production. The biggest problem for farmers in commercial maize production areas is not technological, but a combination of irrigation, capital, market information and infrastructure deficiencies, worsened by climatic hazards and environmental damage.

There are issues that are more complicated to solve due to a lack of both technology and capital, such as developing irrigation systems, improving transportation and road construction, overcoming climatic risks and developing sustainable farms that are both productive and protect the environment. It is also impossible to change the production system completely like converting to husbandry in minority areas. Our proposed solution is to improve the capacity for market penetration through better market organization, especially for remote areas. Our present agricultural extension system is focused on techniques, but not on issues like production organization, both post-harvest and in the market, meaning that farmers are still selling fresh or raw maize locally and are unable to participate in the negotiation process.

Another factor that could also improve production would be the stabilization of fertilizer and seed costs. Though this is difficult to achieve, would it not be better to replace transportation cost support to the mountainous areas with material cost stabilization support?

Under current conditions, the Vietnamese maize market is able to compete successfully and will maintain itself upon integration. However, if demand from feed companies increases, would the present commercial supply satisfy demand? If Viet Nam becomes a WTO member, policies currently implemented to limit the business of foreign companies and individuals will be removed, causing the market not only to face a price problem, but also new competition in terms of supply capacity and financial capacity for market regulation. At that time, the maize market in Viet Nam will face increased competition in terms of quality, price and supply from foreign imports. These issues will need further study, as it is currently difficult to assess market demand changes at a time when household husbandry is still in the process of adapting to the market.

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