

Cassava in North Central Vietnam – Desk Study

Part of a 3 value chain analysis and programme development study



Companies



Connected with



Smallholders

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Netherlands

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Introduction and acknowledgement

Early 2008 SNV Netherlands Development Organisation started an analysis for pro-poor economic development in agriculture and forestry dependent livelihoods in North Central Vietnam. The focus of this analysis was on people living in these districts that are still furthest below the Vietnam poverty line. In the six selected districts in three provinces¹ households, local businesses and entrepreneurs as well as local authorities and government departments were interviewed to identify potential products and value chains that can be enhanced for income and employment generation. Through an initial quick scan of key economic drivers for change and multi stakeholder validation workshops three main agriculture and forestry value chains were selected. These are Acacia (for pulp or timber), Rattan (for furniture or handicrafts) and Cassava (for starch or dried chips).

A more in depth study was commissioned by SNV over the June – August period of 2008 to identify opportunities and constraints for pro-poor value chain development. This study was carried out by two teams of consultants supported by SNV advisers in part of the field work and the validation workshops with stakeholders. One team of international and national experts² analysed the value chains from markets back to producers and the second team of national experts³ who did a baseline study in the same geographical area with special emphasis on the three selected value chains.

The two teams have produced a series of reports of which this report forms part. For each value chain a desk study and a detailed field study report was produced as well as a detailed report with recommendations and suggestions for implementation of value chain development interventions. The whole set of reports was completed with a baseline report.

SNV Vietnam would like to thank the two research teams and all stakeholders involved for their work and effort put into these studies which bring about a wealth of information on these selected three value chains.

The results of these studies are used to continue our work in North Central Vietnam in our efforts to contribute to the lasting reduction of poverty.

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¹ A Luoi and Nam Dong in TT Hue province; Dakrong and Huong Hoa in Quang Tri province; Minh Hoa and Tuyen Hoa in Quang Binh province. Later also Tan Ky and Thanh Chuong in Nghe An were added as SNV with partners is implementing the Pro-Poor Forestry Project in these districts.

² This team was lead by Mr. Chris Wheatley and Ms. Dai Peters and further included staff of the Hanoi based Handicraft Research and Promotion Centre and EDC of Lao PDR who participated in a smaller study for only rattan in Savannakhet province.

³ This team was from the Centre for Rural Development in Hue.

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1 - Cassava Overview

1.1 South-East Asia Region

FAO statistics show that in the SE Asia region, the traditional major cassava production countries of Thailand, China and Indonesia have maintained a fairly constant area in cassava production since 2000, while the area in Vietnam has more than doubled. Yields have increased across the region, but by a greater percentage in Vietnam than in other countries as a result of the (apparently) later adoption of higher yielding industrial varieties. Consequently, total cassava production has increased more in Vietnam than other countries in the region – Vietnam has passed from producing only 50% of the amount harvested in 2000 in China, to more than double that country's production in 2007 (Table 1). Vietnam's total cassava production during this period has increased by nearly 350%, while the other countries have grown by between 14% (China) and 38% (Thailand).

Table 1. Changes in cassava harvested area, yields and total production in major SE Asian countries for the period 2000-2007 (source FAOSTAT)

Cassava	Country	2000	2004	2007	% Change 2000-2007
Harvested Area (1000 ha)	Thailand	1,130	1,057	1,152	+1.9%
	China	239	246	269	+12.5%
	Indonesia	1,284	1,255	1,207	-6.0%
	Vietnam	237	389	560	+136.3%
Yield (ton/ha)	Thailand	16.9	20.3	22.9	+35.5%
	China	16.0	15.5	16.2	+1.3%
	Indonesia	12.5	15.5	16.2	+29.6%
	Vietnam	8.4	15.0	15.9	+89.3%
Production (million tons)	Thailand	19.06	21.44	26.41	+38.6%
	China	3.82	3.82	4.37	+14.4%
	Indonesia	16.09	19.42	19.61	+21.9%
	Vietnam	1.99	5.82	8.90	+347.2%

FAO statistics for cassava exports and imports in the SE Asia region show that Thailand is the major exporter of both starch and dried cassava (Table 2). Data for Vietnam are not available for starch exports, but dried cassava exports increased from 135,000 tonnes to 534,000 tonnes between 2000 and 2005. China is the main country importing cassava starch and dried chips (the other countries in the region have minimal imports), with volumes of starch varying considerably (from 0.48 to 1.09 million tonnes/y) while dried cassava imports expanded dramatically from only 257,000 tonnes in 2000 to 3.35 million tonnes in 2005.

Table 2. Cassava starch and dried chip imports and exports

Exports		2000	2004	2005
Starch (1000 tons)	Thailand	906	1,040	1,353
	China	2	3	4
	Indonesia	7	185	72
	Vietnam	N/a	N/a	N/a
Dried cassava (1000 tons)	Thailand	3,246	5,019	3,031
	China	0	0	0
	Indonesia	151	234	230
	Vietnam	135	750	534
Imports				
Cassava starch (1000 tonnes)	China	438	1087	760
Dried cassava (1000 tonnes)	China	257	3473	3345

Producer prices for cassava roots are not available for Vietnam on FAOSTAT, but prices in both Thailand and Indonesia more than doubled between 2000 and 2005 (Table 3), probably due to increases in demand for the different end uses and intermediate products. Producer prices in China are reported as extremely high (US\$600/tonne) but this is because in China cassava is considered a grain crop and data is reported on a dry weight basis, using a conversion factor of 5:1. Therefore actual fresh root prices are only 20% of those reported by FAOSTAT for China. However, even after making this conversion, this still leaves cassava root prices in China higher than in Thailand or Indonesia (over US\$100/tonne fresh roots in both 2000 and 2004), and explains the rationale behind the increasing imports of starch and dried chips into the country from other countries in the region.

Table 3. Cassava fresh root producer prices in SE Asia (US\$/tonne)

	2000	2004	2005
Thailand	15.21	21.89	34.09
China	600.47	537.15	-
Indonesia	39.43	76.25	83.22

1.2 Vietnam overview

Vietnam is increasingly focusing cassava production on the Central and South Easterly regions of the country. In 2006, the cassava planted area reached 497,000 ha, of which about 12% was located in the North Central Coast region. During the 1980s and 1990s cassava production in Vietnam was in decline. Since 2000 it has increased from 1.99 million tones to 7.98 million tones in 2007. This is associated with it's changing role from a food crop to an industrial crop, with a high rate of growth during the first years of the 21st Century. Vietnam is now the second largest exporter of cassava products, after Thailand. Cassava is now one of seven new agricultural export products, which has caught the attention of the government and local authorities.

This has been achieved through both area expansion, from 237,600 ha in 2000 to 497,000 ha in 2007 (14.3% annual growth), and marked increases in yield, from 8.36 tons/ha in 2000 to 16 tons/ha in 2007 (13.4% annual growth), Table 4. New high-yielding cassava varieties and more sustainable production practices have increased the economic effectiveness of cassava production. In year 2006/07 about 300,000 -350,000 ha of new varieties, mainly KM94, KM140, KM98-5, KM98-1, SM937-26, KM98-7 were grown, this corresponds to about 75 % of the total cassava area in whole country.

Table 4. Development of cassava in Vietnam 2001-2007

	Unit	2001	2002	2003	2004	2005	2006	2007	Average growth rate		
									2001 - 2005	2005 - 2007	2001 - 2007
Area	1,000 ha	292.3	337.0	371.9	383.6	390.0	475.2	497.0	7.5	12.9	9.2
Yield	Quilta l/ha	120.1	131.7	142.8	145.2	145.0	163.8	160.7	4.8	5.3	5.0
Output	1,000 ton	3,509	4,438	5,308	5,572	5,650	7,782	7,984	12,6	18,9	14,7

Cassava output in each region/province corresponds to the planted area and yield. This greatly depends on the adoption of the new high-yielding cassava varieties in each province. The North Central Coast is the fourth biggest centre of cassava production in Vietnam (Table 5) with a total area of almost 60,000 ha, of which Nghe An and Thanh Hoa are two biggest producers. Nghe An itself has 16,200 ha of cassava in 2007 (and accounts for almost 27% of the region). Cassava is generally planted in monoculture in the NC, after many years of cassava monoculture which is often without application of fertilizers from the farmers; soil productivity is often reduced due to erosion and nutrient exhaustion, resulting in a decrease of cassava yields.

Table 5. Area and output of cassava by regions during 2000 – 2007

Region in Vietnam	Area (Thous. ha)			Output (Thous. Ton)		
	2000	2006	2007	2000	2006	2007
1. Red river delta	8,3	7,1	7,5	74,4	83,3	89,9
2. Northeast	48,4	53,7	55,4	426,7	681,3	719,6
3. Northwest	35,3	41,3	42,9	265,3	399,9	419,1
4. North Central Coast	38,4	55,9	58,9	255,2	854,7	906,2
5. South Central Coast	37,1	61,5	65,3	329,5	975,8	1021,3
6. Central Highlands	38,0	125,9	129,9	351,5	2058,8	1976,6
7. Northeastern South	24,4	123,8	130,8	215,5	2664,5	2779,0
8. Mekong river delta	7,7	6,0	6,3	68,2	64,2	73,2
Whole country	237,6	475,2	497,0	1.986,3	7.782,5	7.984,9

Source: *Statistic book, 2007.*

The specific areas for cassava by districts in the surveyed provinces are shown in Tables 6-9.

Table 6. Cassava area and output by districts – Quang Binh province

District	2005		2006		2007		2008(ha)
	Area (ha)	Output (ton)	Area (ha)	Output (ton)	Area (ha)	Output (ton)	
Whole province	5.577	74.577	6.134	90.445	5.971	94.939	5.575
1. Le Thuy	865	13.912	934	12.534	800	12.800	800
2. Quang Ninh	390	4.359	364	4.554	370	6.158	224
3. Dong Hoi	44	275	38	241	36	231	50
4. Bo Trach	2.328	38.865	2.855	56.403	2.874	62.932	3.026
5. Quang Trach	550	3.850	550	3.960	571	3.141	575
6. Tuyen Hoa	600	6.004	593	5.633	500	3.550	300
7. Minh Hoa	800	7.312	800	7.120	820	6.150	600

Source: *Statistic book, 2007 Quang Binh*

Table 7. Cassava areas and output by districts – Thua Thien Hue province

District	2005		2006		2007	
	Area (ha)	Output (ton)	Area (ha)	Output (ton)	Area (ha)	Output (ton)
Total	6.628	102.621	7.075	103.944	7.339	113.959
1. Hue City	142	796	115	627	95	589
2. Phong Dien	1.490	30.918	1.700	32.407	1.730	30.787
3. Quang Dien	316	5.731	332	2.384	346	4.228
4. Huong Tra	750	10.315	905	14.385	905	14.021
5. Phu Vang	860	15.433	861	15.064	896	13.639
6. Huong Thuy	395	6.411	400	4.400	390	5.345
7. Phu Loc	900	15.255	893	8.712	850	14.438
8. Nam Dong	475	7.025	603	7.861	737	13.417
9. A Luoi	1.300	10.737	1.266	18.104	1.390	17.895

Cassava can be used in fresh condition or processed ones, usually the dry chip, starch (dry and wet) and its by-products. The following applications of cassava are found in Vietnam:

Fresh cassava

For human and animal consumption, on-farm and marketed

Dry chip

For animal feeding/further processing /both local use and export (mainly export)

For ethanol processing

Dry starch

For home consumption/ food processing and for several industrial purposes such as textiles, pharmaceuticals, cardboard, monosodium glutamate (MSG), glucose, maltose and plywood... /both local use and export (mainly export)

Wet starch

For speciality food and noodle production / Local market use

By-products (The peel, cellulose and latex)

For animal feeding (further processing)/ Local use

There is no updated figure on the proportion of every product, but dry starch and dry chips are the major products to be processed, and mostly for export purposes. The production cost of several household-based cassava products are as follows:

Table 8. Production cost of dried cassava chips

No.	Item	Unit	Unit price	Quantity	Amount (VND)
1	Expenditure (calculation based on 1 kg of dried cassava)				2,821
1.1	Fresh root	Kg	800	3	2,000
1.2	Fuel	VND/kg of dried cassava			536
1.3	Labour	VND/kg of dried cassava			100
1.4	Depreciation				35
1.5	Transportation	Kg	150	1	150
2	Dried cassava	Kg	3,000	1	3,000
3	Profit/1 kg of dried cassava				179
4	Annual output	Ton		400	
5	Annual profit	VND mil			71.6

(Household Cao van Tung, Nghia Binh commune, Tan Ky, Nghe An, 2007)

Table 9. Cost of wet starch production at household level

No	Article	Unit	No.	Unit price	Result (VND)
1	Spending				92.000
1.1	Cassava in roots	Kg	100	800	80.000
1.2	Electricity, Fixed assets Depreciation				6.000
1.3	Fuel	Litre	1	12.000	6.000
2	Income				124.000

2.1	Wet starch	Kg	40	2.800	112.000
2.2	By-products	Kg	40	300	12.000
3	Earnings	Vnd/day	0,5		32.000
4	Processing Amount per year	Tons (fresh cassava)	70		
5	Earnings in a year (for 2 labors, working 7 months in a year)				22.400.000

(Household of Mr. Duong Thanh Dan – hamlet 4, Dong Trach commune –Bo Trach district, Quang Binh province, 2007)

2 - Cassava value chains in the North Central region of Vietnam

The value chain in the NC is characterized by several layers of transaction between cassava farmers, collectors, and starch processors including small producers, traders, household processors, and large-scale starch factories.

The governance mechanisms in the cassava value chain are still underdeveloped. Value chain participants operate in an uncoordinated and un-organised way. Contract farming in the NC does not work well, and most transactions take place in the spot market with very low trust.

Cassava farmers (small producers) in NC generally sell to village and commune collectors. The commune collectors will either process into chips or keep as it is then, in turn sell to larger traders (often in the district) that either distribute cassava locally to the starch factories or sell it to China in chips through border-cross traders. The cassava producers are also selling their fresh cassava to wet processors (purchase cassava roots for wet starch production) or process themselves into wet starch before selling to the collectors in the commune, who will often buy this starch and sell to the traders in the big market in the region (e.g. Dong Ba market in Thua Thien Hue province).

Growers are mainly smallholder farmers with little land, small production scale (as a result, this causes problems for starch factories to invest directly). KM94 is the main variety used by the farmers in NC region now. It has been used continuously since 2002-2003 and now has a high risk of degeneration. In addition, the farmers also have their local cassava variety but its starch content is much lower than KM94 and can be used only for on-farm food or animal feed. Most of farmers in NC are also still not practising intensive cultivation as well as other techniques to improve the land use efficiency. Therefore, the quality of soil and, as a result, the productivity of cassava is reduced considerably after 3-4 years of continuous plantation.

The growers can sell their cassava for anyone who are willing to pay them the better price. There's often no agreement between growers and buyers, and as a matter of fact, even with the agreement, the way of doing business of growers are not much changed – selling to the one who pay them higher price (e.g. the case between starch factory in Thua Thien Hue and growers in Dakrong commune (Quang Tri province).

One issue that the growers face is the difficulty in transporting their cassava from the field to the factories/collectors/ traders. Without appropriate appointments, the growers may have to keep their cassava in the field for couple of days, in which case the quality of cassava may well deteriorate.

There is competition between buyers (traders and starch factories). All of them try sourcing the cassava with good quality at low prices. This creates short-term opportunities for the growers but at the same time puts them in a position of uncertainty.

At national level, on average, labour cost accounts for 59.9% of cassava production costs. In some regions, like the Binh Dinh and the Gia Lai, this may be as low as 52.8% and 68.7%, respectively⁴. The average labour requirement is 125 man days/ha. The second largest cost item is fertilizer, constituting 41.8% in Binh

⁴ Prof. Dr. Hoang Kim

Dinh province and 24.7% in Gia Lai, depending on farmers' investment in fertilizer. With the selling price of fresh root of 900 VND/kg; farmers can earn 10,720 to 11,200 thousand VND/hectare. The total variable cost of cultivation in 2007 was about US\$ 455- 567.5/ha, at an average root yield of 22.0 t/ha, the production cost would be US\$ 20.68- 25.79 /t fresh roots. Gross income is US\$ 1,155- 1,237.5 /ha. Net income is US\$ 670 - 700/ha.

In the NC, the gross income is less than the average level - mainly resulting from lower yields (low level of intensive cultivation) and also from the poor quality of seedlings - ranging from VND12,600,000 (USD763) to VND17,500,000 (USD1,060)

Table 10. Cost of KM94 cassava production KM94,

No	Article	Household with intensive cultivation (VND)	Household without intensive cultivation (VND)
1	Spending	9.810.000	7.360.000
1.1	Physical spending	3.410.000	1.760.000
	Seed/ Seedling	0	0
	Fertilizer	3.410.000	1.760.000
	+ NPK (8:10:3)	800.000	400.000
	+ Nitrogenous Fertilizer	1.200.000	600.000
	+ Phosphate	750.000	375.000
	+ Potassium Fertilizer	660.000	385.000
1.2	Labors spending	6.400.000	5.600.000
-	Land processing	2.400.000	2.400.000
-	Caring (weeding, put down fertilizer)	2.400.000	1.600.000
-	Harvesting	1.600.000	1.600.000
2	Gross income	17.500.000	12.600.000
	Net income	14.090.000	10.840.000
	Profits	7.690.000	5.240.000

Tay Trach commune – Bo Trach district – Quang Binh province (for 01 ha, 2007) Source: HRPC, 2008

There are six starch factories in 4 surveyed provinces and they are the major buyers of all cassava in the region. Every year, their buying quantity tends to increase and some factories are currently upgrading/expanding their production capacity.

3 - Market linkages and demand

As stated above, cassava utilization can be divided into on-farm consumption (human and animals), further processing (and sales) and sales of fresh roots. Cassava chips and starch are now an important source of cash income for small farmers, who either use it for animal feeding or for sale to starch factories. While eighteen years ago there were no medium- or large-scale cassava starch factories in Vietnam, there are now 60 cassava processing factories in operation with a total processing capacity of 3.2- 4.8 million tones of fresh roots/year. Total cassava starch production in Vietnam was about 800,000- 1,200,000 tones, of which 70% was exported and 30% used domestically.

Vietnam is now the second largest exporter of cassava products, after Thailand with 4.46 and about 0.81 million tones of cassava products exported, respectively. Most of cassava export volumes (both starch and chip) is through Quy Nhon Port (500,000 and 700,000 tons in 2006 and 2007, respectively), of which about 10% provided by Binh Dinh and 90% collected from surrounding provinces. Major markets of Vietnam's cassava exports are the P.R. of China and Taiwan, Japan, Singapore, Malaysia, South Korea and countries in Eastern Europe. Besides, animal feed factories also contributed significantly to the increasing demand for

cassava roots. Although in Vietnam cassava processing is a relatively new business and export volumes are still low, the cassava processing factories are new and modern. That is why Vietnam's cassava products may have a competitive advantage in the world market.

In NC, There are six starch factories in the 4 surveyed areas, consuming almost 440,000 tons of fresh cassava for 109,775 tons of cassava starch (Table 11).

Table 11. Cassava starch factories in the NC region

	Name of cassava processing factory	Designed capacity	Fresh cassava consumption in 2007 (ton)	Cassava starch produced 2007 (ton)
Nghe An province				
1	Thanh Chuong Cassava Starch Factory	250 ton/day	84,000	21,000
2	Yen Thanh Cassava Starch Factory	200 ton/day	66,000	16,500
3	Other small starch processing units		50,100	12,525
Quang Binh province				
1	Song Dinh Cassava Starch Factory	200 - 300 ton/day	45,000	11,250
Quang Tri province				
1	Huong Hoa Cassava Starch Factory	150 ton/day	44,000	11,000
2	Quang Tri 150 Starch Factory (FOCOCEV Quang Tri)/ Hai Lang	100 ton/day	50,000	12,500
Thua Thien Hue province				
1	Fococev Thua Thien Hue Starch Factory	250 ton/day	80,000	20,000

The export market price for starch is depending on the world market and much depending on the cost of cassava in Thailand. Generally, it's increasing in the recent 2 years, offer the exporters (the starch factories) better opportunities to expand their production.

Many countries in the SE Asia region – including the southern provinces of China – are making serious investments and policy commitments to the use of cassava as a raw material for bio-fuel production (ethanol). There are several advantages to the use of "gasohol" over normal gasoline:

- 1) It reduces the consumption of imported oil and thus saves foreign exchange and increases the country's energy security.
- 2) Ethanol is an octane booster that can replace the imported chemical additive MTBE.
- 3) Ethanol combustion in cars pollutes the air less and produces less CO₂ than normal gasoline, thus reducing global warming.

Cassava is a competitive option as a raw material for ethanol production, producing 150 litres ethanol/tonne fresh roots (or 3,000l/ha/y if yields of 20tonnes cassava roots/ha are obtained), better than for rice or maize, but less than sugar cane.

In China, a policy decision to ban the use of maize and other grains as a feedstock for bio-fuel production leaves cassava as the main raw material. Guangxi province had initially planned to produce around 1million tonnes of bio-ethanol/y from the country's first bio-fuel plant, from February 2008, using cassava as a raw material. This has been scaled this down to about 200,000tonne in 2008 due to a shortage of raw material. The plant has been using dried cassava chips imported from Vietnam and Thailand. As a result of this new demand, cassava chip prices have increased to more than \$200 a tonne, including costs and freight, helped by market anticipation that the bio-fuel plant will need to source as much as two-thirds of its cassava requirements from abroad. Dried chip prices were only \$100 when the Guangxi bio-fuel project began construction late in 2006. China already imports about 2.5-3 million tonnes of cassava chips each year to make alcohol and starch. Increased cassava production in south China is not seen as likely, as farmers find sugar cane more profitable, and potential for area increases is very limited. The bio-fuel factory will require 1.5 million tonnes of fresh cassava roots to operate at full capacity.

Since 2000 Thailand has had a "gasohol" or E10 programme which aims to replace 10% of petrol with ethanol made from locally produced sugarcane (or molasses), maize or cassava. The rapid increase in the demand for cassava roots due to the additional demand from this new market has already resulted in the doubling of the price of fresh roots, dry chips and starch as compared to 2003. By the end of 2007 3 factories using cassava were operational, with another 12 factories due to be completed by the end of 2008, producing in total 3.4 million litres of ethanol per day. This will require an additional six million tonnes of fresh cassava roots, additional to the 25 million tonnes produced in Thailand before 2007. Since the cassava growing area cannot increase substantially due to competition from other crops, the increased supply can only be met through increases in yield, of about 30%.

In Vietnam, bio-fuel production is also advancing quickly, with major developments in 2008. The country needs an annual supply of 300,000 tonnes of ethanol to meet the E10 policy of including ethanol in petrol fuel at a 10% rate. However, Vietnam currently exports about 1.2 million tons of dried cassava chips to China and South Korea each year – enough to supply 400 million litres of ethanol, sufficient for national demand. The Viet Nam Oil and Gas Group (PetroVietnam) is investing in ethanol through joint ventures by its service company Petrosetco with Japan's Itochu Group. The first factory with US\$100 million investment will start operations in 2009 with a production of 100 million litres a year, 99.8 per cent of which will come from sliced cassava. Such capacity meets one third of the current demand. Another plant is also being planned, in Quang Nai, with investment from three subsidiaries of the Vietnam National Oil and Gas Group (PetroVietnam). This US\$120 million factory is expected to use 220,000 tonnes of cassava every year as the main feedstock to turn out annually 100 million tonnes of ethanol. The factory is scheduled for completion by 2010 and is an investment of the Central Oil and Gas Biofuel Joint Stock Company, jointly set up by PetroVietnam Tourism and Service Company (Petrosetco), the Binh Son Refining and Petrochemical Company and the PetroVietnam Finance Company. Finally in August 2008, the Petrochemical and Bio Fuel JS Company (PVB), under PV Oil, has also got a license from northern Phu Tho province to build a US\$80 million ethanol production plant using cassava and sugar cane as raw material.

Thus, three major cassava producing countries in the region, Thailand, Vietnam and China, are all embarking on a rapid expansion of bio-ethanol production capacity using cassava as the major feedstock. This comes at a time when demand for the existing cassava markets (starch and animal feed) are also expanding, and is already putting pressure on raw material prices. Although China is only in the initial stages of biofuel production, there is already a shortage of raw material, caused in part by policies that ban the use of other potential feedstocks (e.g. maize). If the new market for cassava based on its use for biofuel production is to be realised, significant production increases will be required (on a sustainable basis) across the region.

4 - Institutional and policy environment

4.1 Institutional framework

The Ministry of Agriculture and Rural Development responsible for the cassava programme in Vietnam. The main experiences in linking cassava R&D activities in Vietnam include:

1) Establishment of the Vietnam Cassava Program (VNCP) including advanced cassava farmers, researchers, extension workers, managers of cassava research and development projects, cassava trade and processing companies, and 2) The establishment of on-farm research and demonstration fields (farmer participation research FPR), and 3) Ten mutual link-up activities (10 T – in Vietnamese):

1. Thu nghiem (Trials)
2. Trinh dien (Demonstrations)
3. Tap huan (Training)
4. Trao doi (Exchange)
5. Tham vieng (Farmer tours)
6. Tham quan hoi nghi dau bo (Farmer field day)
7. Thong tin tuyen truyen (Information, propaganda)
8. Thi dua (Competition)
9. Tong ket khen thuong (Recognition, praise and reward)
10. Thanh lap mang luoi nguoi nong dan gioi (Establish good farmers' network)

After eighteen years of development (1991-2008), intensive cassava research and extension has changed cassava from being a food crop to being an industrial crop. Vietnam cassava starch is now very promising for export and domestic use. VNCP has agreed to emphasize the following seven topics:

1. Determination of an appropriate strategy for cassava research and development
2. Selection of cassava doubled haploid lines derived from materials of CIAT and applying mutation in cassava breeding; Selection and dissemination of high-yielding varieties with high starch contents; Selection and development varieties with high root yield, short duration and improvement of quality and nutritional value of cassava
3. Research on integrated cultivation techniques and transfer of appropriate cultivation techniques to farmers to increase the productivity and economic efficiency of cassava production in different eco-regions.
4. Cooperation with processing factories in establishing areas with a stable source of raw materials; Use of cassava for bio- ethanol.
5. Research on the development of cassava processing technologies; Use of cassava leaves and roots in animal feeds and food processing.
6. Structural improvement and development of the extension network.
7. Development of local and export markets for cassava products

4.2 Policies related to cassava development

The Government of Vietnam considered 3 biggest issues for cassava development in Vietnam.

- The spontaneous development of cassava tends to increase. In some places, farmers destroy sugar cane to plant cassava, while some farmers in Central Highland even destroy forest to plant cassava illegally. The spontaneous development does not only affect the master plan of other trees, have bad effect to environment and also create the risk of "supply surplus demand", which cause risk for both consumers and producers.
- Sustainable cultivation was not applied in many places. Extension cultivation practices during years in a high sloping land without any erosion prevention creates high production cost and bad effect to the environment.
- The structure of cassava varieties and its quality are still inadequate. The area needs to plant new varieties with 30% higher yields.

To control and improve the sustainable production of cassava, there are 3 major legal documents orienting for cassava development in Vietnam.

- Decision No. 150/2005/QĐ-TTg dated 20 June 2005 of the Prime Minister
- Order No.750/CT-BNN-TT dated 30 March 2006 of the Minister of the Ministry of Agriculture and Rural Development
- Order No. 1140/CT-BNN-TT dated 28 April 2008 of the Ministry of Agriculture and Rural Development

The basic contents of these documents are as follows:

- Limitation the expansion of cassava area, especially raising awareness for farmers not to plant cassava in the area which planned for other trees, or not to plant cassava in high sloping areas (more than 20o); Reinforce checking and take measures for the case of deforest to plant cassava.
- Reinforce the intensive activity, give guidance to farmers in applying sustainable cultivation techniques, especially applying new varieties with better yield and suited to industrial processing such as: KM60, KM94, KM95-3, HN124, NA1...; implement terraced fields or plant cassava beds on the areas of the same height; intercropping and rotation with legumes (peanut, soybeans), increase the quantity of organic and micro organism fertilizer.
- Concerning cassava processing: The Department of Processing, Trading agro-forestry and aquaculture products and Salt trade gave guidance to rechecking and evaluating cassava processing units. Temporarily, do not accept newly set up processing factory without any feasible cassava material source. Create favourable conditions for high-tech processing unit to buy dry chips for higher value added products such as starch, ethanol, and feed. Limit the export of raw material. Supervise closely the environment matters of cassava processing units; give strong actions and treatment with those who pollute the environment.

The Ministry of Agriculture and Rural Development (MARD) has planned for a stable cassava area around 380,000 to 400,000 hectares from 2006 –2010, and plans to increase fresh root yields from 14.61 ton/ha in 2005 to 18 ton/ha in 2010 with a total production increasing from 5.7 million tons in 2005 to 7.6 million tons in 2010 by using new technologies, especially in plant breeding.

Previously, people were reluctant to grow cassava because they thought that cassava caused soil degradation and produced low profits. But in reality one hectare of cassava can produce over 20 tonnes/ha of roots, with potential for double that in good conditions. 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 Vietnam. Cassava starch is now being produced competitively, and cassava markets are promising. The combination of growing and processing cassava has created many jobs, has increased exports, attracted foreign investment, and contributed to industrialization and modernization of several rural areas (Table 12)

Table 12. MARD plans for cassava area, yields and production to 2020

	Unit	In 2007	Plan			Average growth rate		
			2010	2015	2020	2007-2010	2010-2015	2015-2020
Area	1000 ha	497	400	400	400	-7,0	0,0	0,0
Yield	Ton/ha	16.1	18.0	21.0	25.0	3,9	3,1	3,5
Output	1000 ton	7,985	7,200	7,111	6,383	-3,4	-0,2	-2,1

Source: Plant Department, MARD - 2008

5 - Previous relevant projects/ programs – successes and failures

The National Root and Tuber Crops Program of Viet Nam (under MARD), with the cooperation and assistance of CIAT (Centro Internacional de Agricultura Tropical), has drawn up a plan for strengthening the research and development capacity, with the objective of improving cassava production in Viet Nam. In the area of cassava agronomy, the program has obtained the following results:

- Among various intercropping systems, the interplanting of cassava with peanut, mungbean or maize were the most promising on high fertility soils, while intercropping with peanut was most promising on the poorer soils.
- Intercropping cassava with black bean or peanut and planting contour hedgerows of *Tephrosia Candida* was the best way to control soil erosion. Cassava alley cropped with hedgerow species like *Gliricidia sepium* and *Leucaena leucocephala*, initially did not show a significant effect on yield, but a positive effect was observed in the long term (after 5–6 years).
- Cassava populations of 10,000–14,000 plants/ha and 12,000–16,000 plants/ha should be recommended for the red Latosol and grey Podzolic soils, respectively.
- Long-term NPK trials have shown that the response of cassava to fertilizers is very different for the various types of soils: on the more fertile Latosols the response was not clear even in the third year, but on the grey Podzolic soil in the south and on red-yellow Ferrasols in the north the response of cassava was highly significant even in the first year, with the main response to K and N, respectively.

5.1 Examples of improved cassava production

1. Profit from cassava intercrop with corn in Thuan commune (Huong Hoa district, Quang Tri province)

Thuan commune, one of 8 communes belonging to Lua area of Huong Hoa district, where mainly gathered by Van Kieu ethnic people. There are 750 ha of cassava planted in the commune which contributed to hunger elimination and poverty reduction. Some households have income of more than VND 70 million/year. In order to increase production yield and income on the same area, Thuan commune has implemented cassava intercropping with hybrid corn which bring back good profit for farmers

There are 33 households among total 37 Van Kieu households in Hamlet No. 5 to plan cassava intercrop with corn. The lowest income household receives VND 4 million per crop. Many other households have income of more than VND 7 million such as Mr. Pa Lan, Pa Phuan, Pa Puan. According to Mr. Pa Lam, he has income of VND 31 million per 1.6 ha cassava intercrop with hybrid (VND 19 million for cassava and VND 12 million for hybrid corn)

2. Model of cassava intercrop with peanut

The model was implemented in 2008 in Dinh Chu commune (lap Thach district, Vinh Phuc Province) with peanut variety L14 intercrop with cassava in the area of 3 ha, with the participation of 31 households. According to report from Agriculture and Rural development of Lap Thach, the model of peanut and cassava has been developed well thanks to better care. Even though cassava is still not yet harvested (it shall be harvested in December) but peanut harvesting show that peanut quality is better than mono-crop. According to data from participating households, fresh peanut yield is 180 kg/“sao”, dried peanut is 81 kg/“sao” which is equivalent to 2.2 ton/ha. The peanut mono-crop with intensive cultivation only gives a yield of 1.8-2.0 ton/ha. Besides, peanut trunk and leaf shall be buried as fertilizer for cassava

Annex 1 - Area and output of cassava by province

No	Province	Cassava area (by province) (unit: thousand ha)			Cassava output (by province) (unit: thousand ton)			
		2005	2006	2007	2005	2006	2007	
Red river delta	01	Hà nội	0.2	0.2	0.2	1.8	1.4	1.8
	02	Vĩnh Phúc	2.5	2.3	2.4	23.6	22.5	23.6
	03	Bắc Ninh	0	0.1	0	0.5	0.5	0.4
	04	Hà Tây	2.7	2.2	2.4	34	27.6	30.6
	05	Hải Dương	0.1	0.4	0.5	1.8	4.7	6.7
	06	Hải Phòng	0.1	0.1	0.1	1	1.2	1.3
	07	Thái Bình	0.1	0.1	0.1	0.7	0.7	0.8
	08	Hà Nam	0.4	0.3	0.4	5.4	4.7	3.8
	09	Nam Định	0.3	0.3	0.3	1.3	2	2
	10	Ninh Bình	0.9	1.1	1.1	12.4	18	18.9
		Total	7.3	7.1	7.5	82.5	83.3	89.9
Northeast	11	Hà Giang	2.6	2.5	2.9	19.8	19.4	23.3
	12	Cao Bằng	2.2	2	2	21.6	19.4	20.4
	13	Bắc Cạn	2.1	1.8	2	21.2	19.4	21.9
	14	Tuyên Quang	3.7	5.3	5.1	44.4	68.8	67.5
	15	Lào Cai	5.6	6.1	6.8	63	70.1	79.1
	16	Yên Bái	12.7	13.4	14.5	227.4	250.6	272.5
	17	Thái Nguyên	3.6	4.1	3.8	35	39.9	37.8
	18	Lạng Sơn	4.6	4.7	5.1	40.7	42.3	45.9
	19	Quảng Ninh	1.2	1.3	1.2	9.9	10.4	9.2
	20	Bắc Giang	3.4	4.7	4.5	36.6	50.8	53.6
	21	Phú Thọ	7.7	7.8	7.5	88.8	90.2	88.4
		Total	49.4	53.7	55.4	608.4	681.3	719.6
Northwest	22	Điện Biên	7.2	7.3	7.4	51.8	52.9	54.6
	23	Lai Châu	5.5	4.8	5.4	42.1	39.6	48.9
	24	Sơn La	17.8	18	18.6	192.3	201	207.9
	25	Hoà Bình	10.7	11.2	11.5	102.1	106.4	107.7
		Total	41.2	41.3	42.9	388.3	399.9	419.1
North Central Coast	26	Thanh Hoá	15.1	14.5	15.2	126	142.8	158.1
	27	Nghệ An	13.9	15.2	16.2	248.2	313.4	334.3
	28	Hà Tĩnh	3.9	3.7	4.1	36.6	38.9	32.8
	29	Quảng Bình	5.6	6.1	6	74.6	90.4	95
	30	Quảng Trị	7.8	9.3	9.9	121.8	165.3	170.5

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	31	Thừa Thiên Huế	6.6	7.1	7.5	102.6	103.9	115.5
	Total		52.9	55.9	58.9	709.8	854.7	906.2
South Central Coast	32	Đà Nẵng	0.2	0.3	0.3	1.2	1.9	1.9
	33	Quảng Nam	13.2	13.5	14.1	180.2	191.2	199.3
	34	Quảng Ngãi	17.9	19.2	19.3	268.1	310.8	322.2
	35	Bình Định	12	13.1	13.2	212.2	239	219.6
	36	Phú Yên	10.6	10.4	13.1	173.2	155.2	184
	37	Khánh Hoà	5.9	5	5.3	81.9	77.7	94.3
	Total		59.8	61.5	65.3	916.8	975.8	1021.3
Central Highlands	38	Kon Tum	27.7	32	35.8	372.3	448.1	504.1
	39	Gia Lai	31.9	47.7	51.1	383.4	605.7	596.2
	40	Đắk Lắk	13.2	20.8	19.9	296.2	460.4	388.7
	41	Đắk Nông	15.4	23.7	21	381	526.4	456.9
	42	Lâm Đồng	1.2	1.7	2.1	13.7	18.2	30.7
	Total		89.4	125.9	129.9	1446.6	2058.8	1976.6
North-eastern South	43	Ninh Thuận	1.4	1.5	1.8	12.4	28.6	30.7
	44	Bình Thuận	18.9	21.4	25.7	216.9	308.5	382.9
	45	Bình Phước	22.1	23.2	25	493.8	505.9	542.9
	46	Tây Ninh	43.3	45.1	44.5	1071.8	1120.7	1120.9
	47	Bình Dương	6.5	6.7	6.6	117.8	124.7	124.2
	48	Đồng Nai	19	18.6	19.7	442.2	425	418.5
	49	Bà Rịa - Vũng Tàu	7.8	7.2	7.4	144	150.2	158.2
	50	Tp. Hồ Chí Minh	0.1	0.1	0.1	0.9	0.9	0.7
	Total		119.1	123.8	130.8	2499.8	2664.5	2779
Mekong river delta	51	Long An	0.8	0.7	0.9	7.1	6.1	8.6
	52	Tiền Giang	0.3	0.2	0.3	3.4	1.4	3.4
	53	Bến Tre	0.4	0.2	0.3	3.7	2.1	2.3
	54	Trà Vinh	1.1	1.3	1.3	14.1	17.1	17.2
	55	Vĩnh Long	0.2	0.2	0.2	2.4	3	3
	56	An Giang	0.6	0.8	0.8	14.5	18.2	16.1
	57	Kiên Giang	1.5	1.1	1	8.5	6.5	11.3
	58	Cần Thơ	0	0	0	0.1	0.1	0.2
	59	Hậu Giang	0		0	0.1		0.1
	60	Sóc Trăng	0.7	0.7	0.7	5.7	5.7	6.6
	61	Bạc Liêu	0.3	0.4	0.4	2.2	2.3	2.4
	62	Cà Mau	0.5	0.4	0.4	2.2	1.7	2
	Total		6.4	6	6.3	64	64.2	73.2
Whole country			425.5	475.2	497	6716.2	7782.5	7984.9



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SNV is dedicated to a society where all people enjoy the freedom to pursue their own sustainable development. We contribute to this by strengthening the capacity of local organisations.