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AGRICULTURAL TRADE IN THE GREATER MEKONG SUBREGION

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A project of the Greater Mekong Subregion–Development Analysis Network (GMS-DAN)
Cambodia, Vietnam, Laos, Thailand and China

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Acronyms and abbreviations

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
ADS	Air-dried Rubber Sheets
AFS	Agro Forestry System
AFTA	ASEAN Free Trade Area
ANRDC	Animal Nutrition Research and Development Center
APB	Agriculture Promotion Bank
ASEAN	Association of Southeast Asian Nations
B/C	Benefit-Cost
BAAC	Bank for Agriculture and Agricultural Cooperatives
Baan	Village
CATAS	Chinese Academy of Agricultural and Tropical Sciences
CDRI	Cambodian Development Resource Institute
CIAT	International Center for Tropical Agriculture
CSU	Collection and Sales Unit
DAF	District Agriculture and Forestry
DAFI	Development of Agriculture, Forestry and Industry
DAN	Development Analysis Network
DFID	Department for International Development, UK
DMC	Dry Matter Content
DOA	Department of Agriculture
DOF	Department of Forestry
DRC	Domestic Resource Cost
DTIS	Diagnostic Trade Integration Study
EHP	Early Harvest Programme
EO	Extension Office
EU	European Union
FAO	Food and Agriculture Organization
FME	Faculty of Management and Economics
FRC	Forestry Research Center
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GMS	Greater Mekong Subregion
GOL	Government of Laos
GSO	General Statistics Office
GTZ	German Federal Enterprise for International Cooperation
HH	Household
HYV	High Yielding Variety
IFPRI	International Food Policy Research Institute
IJV	International Joint Venture

IRR	Internal Rate of Return
IRSG	International Rubber Study Group
ITRO	International Tripartite Rubber Organization
JTEPA	Japan-Thailand Economic Partnership Agreement
KUST	Kunming University of Science and Technology
kW	Kilowatt
LNB	Lao National Bank
LNCCI	Lao National Chamber of Commerce and Industry
MAF	Ministry of Agriculture and Forestry
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOAC	Ministry of Agriculture and Cooperatives
MOC	Ministry of Commerce
MRA	Mutual Recognition Agreement
NAFES	National Agriculture and Forestry Extension Service
NAFReC	National Agriculture and Forestry Research Center
NAFRI	National Agriculture and Forestry Research Institute
NGO	Non-Governmental Organisation
NPK	Nitrogen, Phosphorous, Potassium
NPV	Net Present Value
NR	Natural Rubber
NSEDP	National Socio-Economic Development Plan
NTFP	Non-Timber Forest Product
NUOL	National University of Laos
OAE	Office of Agricultural Economics
ORRAF	Office of Rubber Replanting Aid Fund
PAFO	Provincial Agriculture and Forestry Office
PRA	Participatory Rural Appraisal
R&D	Research and Development
RGAF	Rubber Growers Association Fund
RGC	Royal Government of Cambodia
RMB	Renminbi
RRIM	Rubber Research Institute of Malaysia
RRIT	Rubber Research Institute of Thailand
RRIT	Rubber Research Institute of Thailand
RSS	Ribbed Smoke Sheet
RTWG	Rubber Technical Working Group
S&T	Science and Technology
SADU	Small-scale Agro-enterprise Development in the Uplands
SCR	Standard China Rubber
SDC	Swiss Agency for Development and Cooperation
SDT	Special and Differential Treatment
SIDA	Swedish International Development Cooperation Agency
STR	Standard Thai Rubber
TNSR	Technically Specified Natural Rubber

TSR	Technical Specified Rubber
TTDI	Thai Tapioca Development Institute
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
US	United States
VAT	Value-added Tax
VDC	Village Development Committee
VDF	Village Development Fund
VND	Vietnamese Dong
VRGAF	Village Rubber Grower's Association Fund
VRWF	Village Rubber Welfare Fund
WTO	World Trade Organization

Agricultural Trade in the Greater Mekong Subregion: Synthesis of the Case Studies on Cassava and Rubber Production and Trade in the GMS Countries

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Agricultural Trade in the Greater Mekong Subregion: Synthesis of the Case Studies on Cassava and Rubber Production and Trade in the GMS Countries

Like the river that links them, agriculture represents one factor that gives a sense of commonality and regional connection among the countries of the Greater Mekong Subregion (GMS). Indeed, the contribution of the sector to the economies of the GMS countries varies, with such contribution being huge in Laos and Cambodia and much less so in China, Thailand and Vietnam. However, there are certain commonalities in the characteristics of their agricultural sectors which general trends have come to corroborate, as follows:

- The agriculture sector is a major source of employment. The sector employs about 75 percent of the labour force in Laos, 50 percent of that in Cambodia and Vietnam, and 40 percent of that in Thailand and China (ADB 2008; IMF 2009). Altogether, it employs about one-third of the subregion's population.
- Development of the agricultural sector is a vital component of poverty reduction strategies. This is because poverty, according to available data (World Bank 2008), is more concentrated in the rural areas and these rural areas are largely agriculture-based. Because most of these rural poor are the farmers or primary producers (as opposed to the other actors in the value chain), pro-farmer agricultural development has been considered imperative.
- Growth of the agricultural sector has been outstripped by growth in the industrial and service sectors. Despite the comparative advantage in agricultural production due to rich natural resource endowments and huge stock of cheap labour, the export potential of agricultural products has not been fully exploited and has generally lagged behind the performance of some other major exports of the GMS countries such as textiles for Cambodia, Laos, Vietnam and China.
- Impediments and challenges to agricultural development now range from the traditional reasons of yield gaps, below-potential productivity and lack of investment to non-traditional challenges such as animal disease epidemics and competition between biofuel and food production.

In recognition of their commonalities and the benefits of adopting a regional approach to addressing national problems, the GMS countries agreed in 1992 to the GMS Economic Cooperation Program initiated by the Asian Development Bank (GMS Program). This Program paved the way for the formal acknowledgement of the subregional grouping. It aims to develop individual countries through deepening of their regional economic ties. The achievement of this goal has been driven by the strategy of putting in place the "hardware" of national and regional growth, i.e. infrastructure. Since its inception, the Program through the investments facilitated through it has been significantly influential in shaping the development of the Mekong region, and the decisions made under it have had major impact on the livelihoods of farmers and fishers in the GMS countries.[1]

1 See the ADB webpage for the GMS Program, http://www.adb.org/GMS/strategy.asp. See also Oxfam Australia (2008).

Agriculture has been identified as one of the priority sectors under the GMS Program. At the policy level, a Ministerial Conference coordinates regional cooperation while at the operational level, a Working Group on Agriculture (WGA) identifies measures to address the issues affecting agriculture in the region. In their Joint Ministerial Statement issued in 2007 and integrated in the Strategic Framework for Subregional Cooperation in Agriculture 2006-10, the agriculture ministers of the GMS countries acknowledged the new challenges confronting agriculture and reaffirmed their commitment to strengthen subregional cooperation in cross-border agricultural trade, investment and exchange of agricultural information.[2] Echoing this, the WGA during their Fifth Meeting in September 2008 highlighted the bigger room for cooperation in light of the recent food and energy crises and the challenges posed by climate change. More than any other sector, agriculture has the potential to uplift people on a mass scale. Critical to that is the coordination and promotion of agricultural trade strategies supported by the regional exchange and dissemination of agricultural information.[3]

The five country case studies aim to help fill the gaps in the availability, quality and exchange of information on each of the GMS countries' agricultural production and trade particularly in cassava and rubber. In this sense, they complement the regional group's vision of an enhanced agricultural information system that is crucial to the facilitation of cooperation in other areas.[4] Individually, the GMS national governments are likewise in need of in-depth analyses that can guide the determination of their trade strategies and on this, the case studies should also prove extremely valuable. Researched by respected institutions,[5] the studies constitute one part of a series of research studies on the GMS housed under the Development Assistance Network (DAN) and coordinated by the Cambodia Development Resource Institute (CDRI). Key research methodologies used were desk research and field survey and interviews.

Cassava and rubber: The future of agriculture?

As mentioned, cassava[6] and rubber were chosen to be the focal areas of study. While there are reasons supporting the importance of these two agricultural products that may be specific to individual countries, there are common reasons among the GMS countries that signify the value of cassava and rubber to their economies and the households dependent on them. For one, cassava is an important food crop, being a good substitute for rice, the staple food in most GMS countries, and feed for livestock. It has become a profitable cash crop as the demand for it in the biofuel industry, paper industry and food-processing industry has expanded. Cassava is also a key "crisis crop" given its crucial attribute as a highly adaptable commodity that can be easily resorted to in the event of a food crisis. The attraction of rubber production, on the other

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2 Strategic Framework for Subregional Cooperation in Agriculture (2007).

3 Summary of Proceedings of the Fifth Meeting of GMS Working Group on Agriculture in Laos, 22-24 September 2008.

4 Under the GMS Program, the Agriculture Information Network Service (AINS) was launched in 2007.Several problems beset AINS including lack of stable support for the main site and lack of stable funding for information collection and analysis. For this, see the Summary of Proceedings of the Fifth Meeting.

5 The case studies were undertaken by or under the following research institutions/researchers: for China, the ASEAN Regional and Industrial Development Research Centre, Faculty of Management and Economics, Kunning University of Science and Technology; for Cambodia, CDRI; for Laos, Dr Linkham Douangsavanh, Dr Bounthong Bouahom, and Mr Bounthieng Viravong; for Thailand, Thailand Development Research Institute Foundation; and for Vietnam, the Nong Lam University

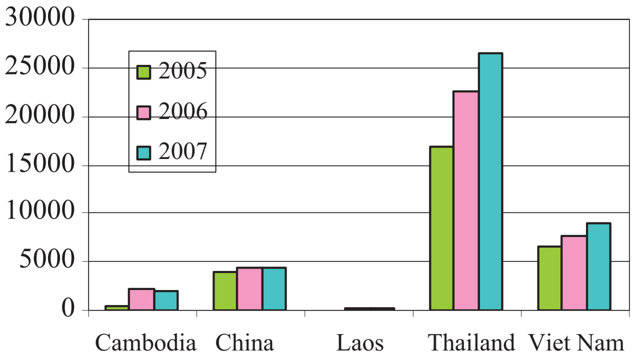
6 With the exception of the case study on Laos.

hand, has heightened immensely over time given surging market demand along the value chain and rising world prices (subject to the effects of the global economic crisis, see Box 1.1). Both commodities play a central role in employment creation and poverty reduction.

On cassava

Aggregate cassava production in Cambodia, China, Thailand and Vietnam (GMS-4) has risen over time (see Figure 1.1 for pre-crisis levels). While an increase in cultivation areas accounts in part for this trend, a more notable causal factor was the improvement in yield. In China for instance, cassava production increased over the period 1996-2007 during which planting areas declined. It is estimated that China during that period posted a 3 percent average growth per year in yield. By the same token, growth of cassava production in Thailand, the world's largest cassava producer, far surpassed the growth of its harvested areas for the period 1999-2007 (6.1 percent vs 0.9 percent average annual growth), posting an average growth in yield of 5 percent per year. Another notable causal factor explaining the increase in GMS cassava production was the overall improvement in workers' productivity. Estimated increase in agricultural value-added per worker from 1990-92 to 2001-03 was 17 percent for Thailand (coming from a relatively higher base), 35 percent for Vietnam and 45 percent for China (Figure 1.2). In positions in trade, Thailand is the largest cassava exporter in the world with domestic demand accounting for about 25 percent of total production. China is a major net importer, with its demand for cassava driven by growth in its ethanol industries. Vietnam is similarly a major exporter while Cambodian exports lag behind.

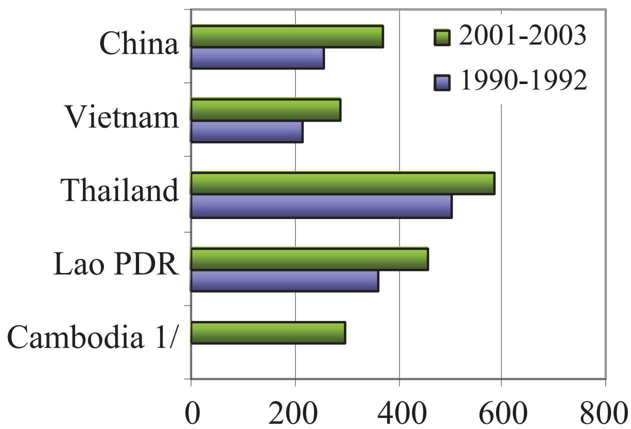
Figure 1.1: Cassava production, thousand tonnes



Source: FAOSTAT data and estimates

Cassava is a highly adaptable crop. It is able to grow in diverse climates and low fertility soils. It is normally planted during the rainy season and usually harvested 10-12 months after planting to optimise its starch content. The marketing and trading chains for cassava (with case-to-case variations) generally have a number of layers and key players involved including farmers, collectors, factory agents, local traders, foreign traders, cross-border traders, local processing factories, foreign processing factories and exporters. Despite the relative ease of producing cassava, several constraints more or less common to the GMS-4 are barring greater growth in production and trade:

Figure 1.2: Agricultural value added per worker, constant 2000 USD



1/ No available data for 1990-92
Source: World Development Report 2008

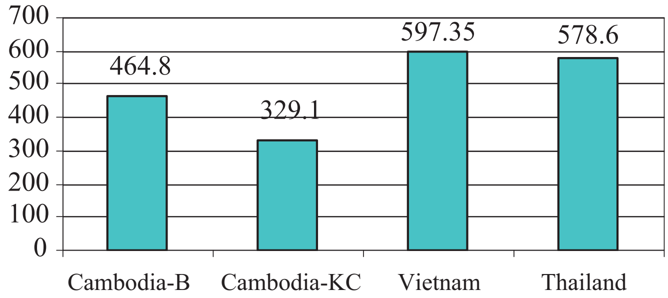
- *Increasing production cost.*
  Agricultural production is labour-intensive and for reasons such as labour migration, labour costs have shot up. Costs of other inputs such as chemical fertilisers have surged as well due to high inflation. Land rental too has become more expensive.

Figure 1.3 compares the production costs in Vietnam, Thailand and Cambodia, as surveyed. Noticeably, the costs in the surveyed Cambodian provinces were significantly lower than in Vietnam and Thailand.

- *High cost of credit.* To pay for higher production costs and to finance agricultural investments, many cassava farmers have resorted to credit. In Thailand, an estimated 90 percent of cassava growing households are in debt. However, the main source of their credit is the state-owned Bank for Agriculture and Agricultural Cooperatives, which offers loans at comparatively lower rates. By contrast, many Cambodian farmers turn to private moneylenders for loans even though they charge very high rates of interest (though microfinance institutions have been assuming a greater role in agricultural lending).

- *Insufficient market information.* Information on price movements in the regional and global markets has been generally scarce and inaccessible. This has confined GMS farmers to the role of price-taker, unable to negotiate the price of their produce, while traders and processors have become price-setters and been reaping the better part of the margin. This predicament highlights the imperative of pro-farmer agricultural development, which carries big gains for poverty reduction.

Figure 1.3: Production costs USD/ha



Notes: Cambodia-B and Cambodia-KC stand for the production costs in Battambang and Kampong Cham provinces, as surveyed and for the period 2007; Production cost for Vietnam was the cost for average cassava production in Tay Ninh province as of 2007; That for Thailand was for 2006/07; see the case studies for details.

- *Outdated planting technologies.*
Many farmers still use traditional cassava varieties and cultivation methods. Adoption of high-yielding varieties (which may have lower market price but entail fewer production requirements) and new cultivation techniques is lagging.

- *Demand and supply mismatches.* Supply is yet to catch up with domestic and external demand. In Vietnam for instance, a considerable gap exists between the supply of and demand for cassava raw materials in the country. Of a different nature is the problem experienced in Thailand where lack of marketing and management planning results in oversupply of cassava around December and February when most cassava farmers harvest their crops. This glut on the market forces prices, hence profits, down.

- *Poor processing industry.* The value-added of cassava along the chain remains low. This as one of the chief problems facing Cambodia whose cassava outputs are mostly exported to Thailand and Vietnam for further processing. High input costs, distance from the centre and lack of official trade support and priority attention are among the factors said to be inhibiting the development of Cambodia's processing industry. Meanwhile, in China, although there are more than 300 cassava-processing factories in the country, few of them are capable of producing advanced processed products with higher value-added.

- *Poor transport infrastructure and high trade facilitation costs.* Poor condition of the roads leading to the processing factories, urban centres or borders pushes up the cost of transport. In Thailand, the underdeveloped state of the railway system poses a huge problem. Transporting cassava by this mode is less costly than the more popularly used road transport. Quality control and administrative procedures are cumbersome and the exaction of informal payments at the borders continues to be a highly frustrating practice.

On the bright side, there are many opportunities that, with prudent management and appropriate supporting resources, can generate huge gains for cassava production and trade while cushioning the concomitant costs. Prominent among these are:

- *Growing demand for biofuels.* The share of biofuels in global energy supply and energy consumption is small and will probably remain so in the immediate decades. Biofuels account for a mere 1.9 percent of total bioenergy and 0.9 percent of transport energy consumption. By 2015 and 2030, its share of transport energy consumption is projected to increase only to 2.3 percent and 3.2 percent, respectively. While minimal, this expansion has significant implications for agriculture. Liquid biofuel production, particularly ethanol, uses agricultural commodities such as the common sugar crops and the starchy crops, maize, wheat and cassava. Mounting demand for ethanol, expected to resume despite the global crisis, is expected to push up the prices of these products. An estimate is that the price of cassava will increase by 11 percent on average because of biofuel expansion. This impact can very well revive agricultural growth long depressed by low prices (temporarily halted during the food crises) and encourage greater flow of investment and aid towards the sector. However, the opportunity comes with a threat to the food security of the world's poor as well as to environmental sustainability; it will take certain measures for biofuel expansion to coexist with these other pillars of development.

- *Rising Chinese demand.* China's industrial growth is inevitably accompanied by mounting demand for raw materials. China is the biggest importer of dried cassava in the world. More than 80 percent of its imported dried cassava is used to produce ethanol. The advantages of using cassava are its higher ethanol productivity as well as higher revenue streams compared with maize for instance. Considering the foreseen growth in its ethanol and alcohol industries despite the global crisis, the gap between the demand for and supply of dried cassava in the country is projected to reach 7-7.5 million tonnes by 2010. This suggests wider room for imports. With their membership in the WTO, the ASEAN-China free trade agreement (ACFTA), and partnership under the GMS Program, the GMS countries stand to fill in the supply gap as they already are doing. The top dried cassava exporter to China is Thailand, followed by Vietnam.

- *Expansion of other forward linkage industries.* Apart from the biofuel industry, expansion is also seen in other downstream industries subject to the effects of the global economic slump. In Thailand, cassava demand is expected to increase in view of projected bigger orders for cassava chips and expansion in starch industries such as seasoning and textiles. In Vietnam, some cassava processing factories were operating below potential at just 60 percent of their full capacity due to lack of cassava supply. Satisfying this shortage is considered a pressing need; some processing factories go so far as to offer floor prices for cassava.

- *Widening use of HYVs.* While many farmers still use traditional varieties and methods, there has been a widening adoption of high yielding varieties in the GMS countries. This trend should lead to better productivity and output.

One other opportunity relates to the price of the cassava which prior to the crisis was growing at an average rate of 12 percent per year. Greater demand for cassava is expected to sustain this upward trend. However, cassava prices have historically proven to be volatile and such fluctuations have hurt the income of the poor farmers the hardest. The recent sharp drop in cassava price following the global economic meltdown exemplifies this risk (see Box 1.1).

Box 1.1: Declining prices: Impact of the global crisis

The global economic downturn has brought the commodities boom to an abrupt end. Cassava and rubber were two of the commodities hit by the crisis, so much so that cassava farmers in Thailand at one time sealed off the country's Ministry of Commerce to demand price support (Pratruangkrai 2009), Cambodian authorities asked cassava farmers to delay harvest (Thet and Nguon 2009), and Thailand, Malaysia and Indonesia have banded together to seek a global solution to the global rubber price crash. Faced suddenly with significant cutbacks in demand, prices have nosedived and trade has contracted, leaving ordinary farmers shocked by how record-high incomes from last year can be abruptly slashed by half or even more. The average price of cassava flour and starch, which peaked in March 2008, went down by 30 percent six months afterwards (FAO 2008b) while rubber prices had dropped by more than 50 percent in mid-March 2009 from pre-crisis levels (Chun 2009). Protectionist policies in response to these developments have worsened the situation and increased the frustration of some affected parties. Cambodia for instance has been affected by how the Thai government has reportedly instructed its businesses to buy from Thai farmers only and blocked cassava supplies at the border (Thet and Nguon 2009; Khouth 2009).

According to the World Bank, recent price trends concerning agricultural products need to be considered from a longer term perspective and policy responses need to take into account the cyclical nature of commodity markets (World Bank 2007). While the outlook for 2009 on the rubber and cassava industries remains uncertain, from a longer-term perspective, the forecasts continue to be optimistic on Chinese expansion and demand for bioenergy. Growth forecasts indicate that China will continue to grow at a high though slower rate. The case study on China also points out that the Chinese government has already taken measures to counter the effects of the crisis such as increasing the export tax rebate for rubber made products. Continued rise in the demand for biofuels will also shore up the production, trade and prices of cassava. Furthermore, it must be remembered that prices are driven not only by demand considerations but also by supply constraints. Hence, in the scenario where declining prices depress production and no improvement is seen in addressing the structural impediments to production growth (such impediments serving as main explanations for the preceding food crisis), there will be upward pressure on the prices and this can eventually prompt production and trade to pick up again.

On rubber

Thailand, Vietnam and China are frontrunners in global rubber production (Figure 1.4). Thailand has been the world's number one rubber producer since 1991, surpassing Indonesia. It has also emerged as the world's largest rubber exporter. Around 90 percent of its produced rubber is exported and China, Japan, Malaysia and the US are its primary markets. China is among the top rubber producers in the world as well but it is also the world's number one consumer of rubber. Vietnam is both a major producer and exporter. While Cambodia and Laos have minimal shares in global rubber production and trade, rubber is a major commercial crop and export earner for Cambodia and holds great promise for Laos due to the interest of foreign investors. In addition, for all GMS countries, the labour-intensive rubber sector is a vital source of employment for the rural poor. Growth in rubber production has been attributed to increase in cultivated areas, the adoption of HYVs, and foreign investment. Progress in improving yield however seems to be mixed and, at least in recent years and based on available data, has not been as significant or pronounced as that for cassava.

While Thailand has achieved a notable rise in yield in the past two decades, the growth in China's rubber production was more a consequence of the expansion in cultivation areas as no significant improvement in yield was recorded. Rubber production growth in the GMS countries seems to have been government-led through policies such as the distribution and privatisation of state-owned plantations for the benefit of both big private companies and smallholders, and various forms of state support including subsidies and credit. In Cambodia, smallholder rubber plantation has soared following the government's decision to offer parts of the state plantations to rubber farmers employed in the government. In China, the role of the private rubber industry has been depicted as an important driving force in rubber sector development. Compared with state plantations, private rubber enterprises have had more room for development in terms of technology, production and cultivation size. In Laos, the government has identified rubber sector development as key to elevating the economic status of upland farmers and replacing opium cultivation. In recent years, some Chinese investors in the rubber industry have flocked to the country. In Vietnam, about 70 percent of rubber production comes from state farms, or those supported by the government in terms of land, credit and technology. In Thailand, smallholdings account for 93 percent of total rubber plantations and thus dominate rubber production in the country. Thailand's rubber production growth has been traced as far back as 1960 when the Act of Rubber Replanting Aid Fund was adopted.

The economic life of a rubber tree can be divided into two stages: the first 6-7 years while young trees are maturing, and 25-30 years while the trees are productive. The production costs and profit margins are different for these two stages. In Thailand, average production cost for years 1-6 was estimated at USD432.6 per year and for years 7-25 at USD797.3 per year. Meanwhile, estimated production cost for year 7 in Cambodia, excluding land rental, is USD580 per hectare. For Vietnam, the surveyed total production cost (for the whole production cycle) reached USD321.3 per tonne of rubber latex. For Laos, the surveyed total cost for year 1 reached KAP11,980,000 (around USD1400); for years 2-6, KAP16,350,000 (around USD2000); and for years 7-25, KAP143,610,000 (around USD17,200).   Though again with case-to-case variations, the marketing and trading chains for rubber in the GMS countries generally consist of farmers, cooperatives, collectors, wholesalers, local traders, foreign traders, processors and exporters.

Like cassava, rubber has its own appeal as an agricultural commodity owing to its low input requirements, long economic life and high market demand. However, like cassava as well, several major constraints and opportunities confront the rubber sector, the interplay of which is bound to shape the sector's future. Among the key challenges commonly identified in the case studies are:

- *Increased production costs.* Costs of inputs have risenswelled. LaborLabour costs have gone up for several reasons such as shortage of laborlabour (given competition with other agricultural sub-sectors and non-agricultural activities) and demand for higher wages in light of higher costs of living. Together with farmland prices, laborlabour cost in Cambodia has been increasing and is currently at USD$2-2.5 per day per worker. In Thailand, the prices of fertiliszer, rubber varieties and chemicals have gone up as a resultbecause of inadequate supplies.

- *Underdeveloped scientific and technological knowledge and capacity.* This problem was is particularly emphasiszed in the case of China case study where low-yield ageing rubber farms are said to account for a significant percentage of the aggregate. Underpinning the low-yield scenario are such problems such as outmoded rubber seeding and tapping techniques, lack of choice on and limited adoption of the new varieties, and insufficient knowledge of the optimum conditions for rubber planting.

- *Adverse weather conditions.* From droughts to typhoons, a host of adverse horrid weather conditions challenge rubber production in the Mekong region. China's natural environment is not very really suitable for rubber production. The country's main top provincial rubber producing provinceer, Hainan, is frequently hit by typhoons while its second major producer, Yunnan, faces the problem of frost during winter. Meanwhile, growth fluctuations in Cambodia's agriculture as a whole have occurred due to droughts, floods, and attendant disease and pest outbreaks.

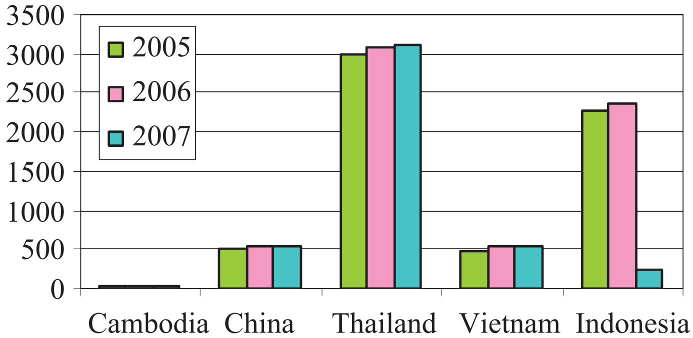
- *Insufficient market information.* Akin to the case of cassava, information on rubber price movements has been scarce. In Laos PDR, such information is said to be virtually non-existent. This inadvertently renders makes the Lao farmers susceptible to misinformation by the traders and unfairly pushes down the price afforded to them. Again, a pro-farmer agricultural development in the Mekong region would help has to tackle this predicament.

- *High cost of logistics.* This problem forces up the transaction and export costs along the value chain. Logistics costs in Vietnam approximately accounts for almost 20 %percent of GDP or 50 %percent of total export value. In Thailand, these costs are driven up by the inefficiency and inadequacy of train transportation in the country and the underutiliszation of Thai ports.

Three other constraints, each specified in a particular case study, are also worth mentioning:

- *High informal cost of investment.* In Cambodia, some businesses have raised the problem of unfair competition from national or foreign counterparts that engage in corrupt practices or tax evasion or take advantage of the weak legal enforcement in the country.

Figure 1.4: Natural rubber production, thousand tonnes



Source: FAOSTAT data and estimates

- *Inefficiencies of state farms.* While state farms in Vietnam are superior in terms of economies of scale, credit, technology and human resources, they suffer from management problems and limited working incentives. These result in inefficiencies and harm the competitiveness of the country's rubber sector.

- *Below-potential operations of rubber processing factories.* This is a key issue in China. Rubber processing factories on the state farms have an average processing capability of 1600 tonnes per year, well below the annual rubber production of 10 thousand tonnes for Southeast Asia's main rubber producers.

Along with the constraints, opportunities impinge on the future of rubber production. One particular opportunity – and probably the most important for the GMS countries – is the expected continued rise in Chinese demand (see Figure 1.5) albeit the global economic crisis may have slowed down the pace of expansion. Much of the envisioned increase in world rubber consumption stems from China's economic enlargement. A strong positive correlation was discovered between China's GDP and rubber consumption; GDP growth of 1 percent coincides with rubber consumption growth of 0.9 percent. The China Rubber Industry Association projected that Chinese natural rubber consumption will increase from 2.2 million tonnes in 2007 to 2.8 million tonnes by 2010, 3.5 million tonnes by 2015 and 4.5 million tonnes by 2020. Several factors are expected to drive this upward trend including the development of China's automobile industry, highway transport and related industries (e.g. coal, electricity, construction) and increased investment in the tyre industry and expansion of rubber exports (subject to easing of trade frictions). Due to limitations in cultivated areas and scale of planting, domestic production will fall short of the country's rubber demand. Therefore, a sizeable opportunity exists for rubber exporters especially for China's partners in the GMS. Thailand is already China's top major exporter and Vietnam has some export share though it could be more competitive than non-GMS exporters. The export shares of Cambodia and Laos are practically negligible, however. Laos and Cambodia will have to upgrade their rubber sectors and seize the benefits made possible under the ASEAN-China FTA, the ASEAN protocol on rubber, their WTO memberships and the GMS Program.

Yet again, the expected upward pressure on rubber prices due to rising demand may be taken as an opportunity. However, like cassava prices, rubber prices have historically proven to be very volatile, exacting a huge burden especially on the farmers. The global financial crisis demonstrated this volatility.

Conclusions and policy recommendations

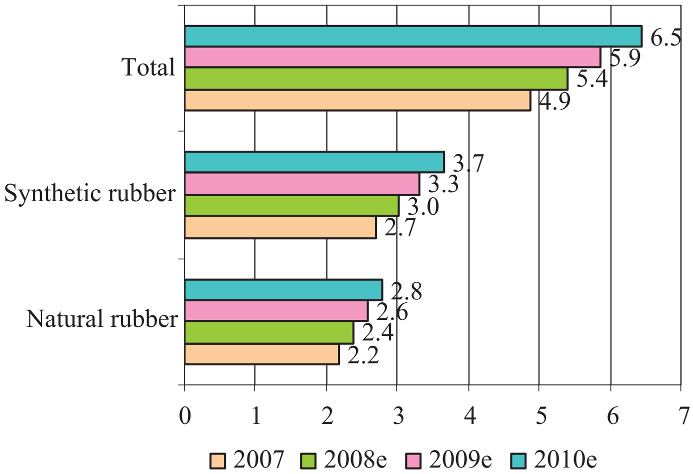
All GMS governments have situated agriculture at the centre of their national strategies and plans because of the vital role that it plays in employment generation and poverty reduction. While the opportunities appear to remain despite the harm inflicted by the global economic downturn, existing and anticipated constraints on cassava and rubber production and trade have to be dealt with if GMS countries are to let these two commodities reach their maximum potential and provide a bright future for their agricultural sectors and the poor households reliant on them.

Given variations in their cassava and rubber sectors, there is no one-size-fits-all solution applicable to all the GMS countries. It must also be kept in mind that the GMS countries are primarily and ultimately competitors in the world rubber and cassava markets. However, it is also true that the countries are confronted with common problems and that the development of their individual sectors relies on the development of cross-border links, such as the hardware component of regional infrastructure or the software element of information exchange. The China factor is of course by itself a major force entailing GMS partnership and coordination. For these reasons and more, national and regional policies must complement one another in moving towards the successful capture of the available opportunities and easing of the constraints.

The case studies put forward policy recommendations that reflect the abovementioned purpose. These proposals resonate with the thrust of the GMS Program on agriculture. Following are some key recommendations:

- *Knowledge, skills and technology transfer.* It has been pointed out that one reason underpinning the "productivity and profitability gap" is the "information and skills gap" (World Bank 2007). Technological gap can be added to this, and there is the capacity gap that largely explains the divergence in agricultural performance in the GMS and the world. Several of the common problems mentioned in the previous discussions constitute this gap. Addressing it entails specific measures such as improving agricultural extension services, through provision of training and technical advice or promotion of HYVs; improving AINS and developing other information exchange systems; increasing R&D; and investing more in the transfer of knowledge and technology pertaining to crop management, biotechnology and other innovations. Because of the greater benefits and lesser costs attached to achieving economies of scale, these measures would be more gainfully undertaken in the framework of public-private partnerships or regional cooperation. Already, the GMS Program under its Core Agricultural Support Program 2006-10 has accommodated most of these proposed measures in its strategies. Whether or not such frameworks exist, public investments must be made in support of the recommended actions.

Figure 1.5: Chinese rubber demand, million tonnes



Source: China Rubber Industry Association, as referred to in the case study on China

- *Improved hardware for improved trade.* Investments under the GMS Program have been funneled towards the improvement of physical infrastructure, the hardware component of GMS growth. Indeed, the problems of poor road conditions, underdeveloped rail transport systems and, high logistics costs underscore the significance of putting in place this component. Greater public investment in physical infrastructure must remain a policy priority in the GMS countries. Facilitating external investment through the GMS Program is undoubtedly productive as it distributes the financial and management burden.

- *Lower trade facilitation costs.* Probably the first step towards fulfilling this objective is to push for greater harmonisation of quality control standards. This will simplify inspection and clearance procedures. In Vietnam, it was suggested that there should be a mutual recognition agreement (MRA) on product standards. However, an equal if not greater challenge to lowering formal trade facilitation costs is the challenge of eliminating informal trade facilitation costs. The solution ranges from greater computerisation of systems to weeding out corrupt officials.

- *Increasing the value-added.* Obtaining results for this objective entail better promotion of industrial forward linkages. Farms will have to be better linked with the firms in the value chain while they themselves are simultaneously supported into becoming lucrative agribusinesses and the downstream industries are made more competitive through consolidation. There are other specific means such as the proposed promotion of rubber wood in Thailand and China as a way of increasing the value-added of rubber and income of the rubber industry.

❖ *Support for smallholders.* With the forces of globalisation and liberalisation dominating the cassava and rubber markets, there is a real threat to the survival of smallholders. GMS governments have to make sure that they give the same priority attention to the needs of smallholders as to those of big commercial producers. GMS governments have not lost sight of this lesson, possibly because smallholdings contribute significant shares in their countries' rubber or cassava production. The GMS Program has also acknowledged the imperative of greater engagement with smallholders. Beyond acknowledging and planning however, more action has to be taken in ensuring state support. Assistance can range from securing land rights and promoting microfinance agricultural lending to improving rural infrastructure and enhancing seed and fertiliser markets and distribution systems.

❖ *Diversification of markets.* Production and export strategies appear to be directed mainly towards expanding niches in China. While this is justifiable because of China's even bigger prospective demand for rubber and cassava, the importance of identifying potential in smaller and new markets must not be discounted.

While on the right track, there are three caveats that must be borne in mind when considering the policy recommendations. There is no one-size-fits-all solution to the challenges faced by the GMS countries. A "best-fit" approach complemented by a regional approach is bound to result in bigger gains. The fact that the GMS countries are competitors in the global cassava and rubber markets leads to the second caveat, which is the need to promote "complementary development" in the Mekong region. GMS countries must exploit the opportunities in the spheres where they have comparative advantage. The last caveat relates to the observation that agricultural development does not have an automatic effect on poverty reduction. In the case of the GMS countries where majority of the rural poor are farmers, it is crucial to raise the questions: Is the envisioned agricultural development pro-poor, pro-farmer? Do the national and regional policies, say under ASEAN or the GMS Program, take into account this important caveat? Pro-farmer agricultural development would lead to policy choices that prioritise smallholder engagement, rural infrastructure and grassroots dissemination of market information, among others. If cassava and rubber are to become the future of agricultural production and trade for GMS countries and the region, these policy recommendations and caveats must be taken to heart.

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Agricultural Trade in the Greater Mekong Subregion: The Case of Cassava and Rubber in Cambodia

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1. Introduction

Cambodia's agricultural sector accounted for 27 percent of gross domestic product in 2007 and employed approximately 56 percent of the total labour force, especially the poor (IMF 2009). However, the sector has grown at a sluggish pace, an average of 3.3 percent per year, over the last decade, and trade in this sector has not contributed significantly to the country's total trade. In 2007, total agricultural exports reached USD106.3 million or 2.6 percent of total exports, while agricultural imports amounted to USD282.1 million or 5.2 percent of total imports (WTO 2009). Cambodia's agricultural exports to other countries within the Greater Mekong Subregion (GMS) represented about 22 percent of the country's total agricultural exports, while agricultural imports from the GMS accounted for 62 percent of total agricultural imports. Thailand has been Cambodia's largest trading partner in agricultural products, followed by China (second largest source of imports and third largest export destination) and Vietnam[1].

Cambodia's agricultural trade with countries in the GMS is governed by the ASEAN Free Trade Agreement-Common Effective Preferential Tariff for ASEAN members and the Early Harvest Programme, and agreement on trade in goods under the ASEAN-China Free Trade Agreement for China. These agreements require Cambodia to reduce and eliminate tariff and non-tariff barriers on agricultural products in exchange for wider market access for agricultural exports in its partners' markets (the "principle of reciprocity"). In principle, this will stimulate more movement of agricultural goods within the region and thus lead to specialisation according to countries' resources. Although Cambodia has a potential competitive advantage in the primary sector due to its abundance of cultivable land, it is short of skills (Toshiyasu et al. 1998[2]). Even with comparable competitiveness in certain agricultural goods such as maize, soybeans and cassava, Cambodia's agricultural exports are limited. This could mean that the country has yet to fully exploit the benefits from trade arrangements. The major factors leading to this outcome include limited supply capacity, weak infrastructure connecting production centres with export gates, lack of marketing information and trade services, and high cost of trade facilitation.

Having recognised the importance of agricultural trade development in boosting economic growth and reducing poverty, the government of Cambodia's approach has been to enhance agricultural exports while developing the sector. Under the leadership of the Ministry of Commerce, and with support from UNDP and other donors, the government launched a trade strategy known as the Diagnostic Trade Integration Study (DTIS) 2007 in mid-2006 to develop a strategic view of trade development. The specific objectives of DTIS 2007 are to identify possible priority products or services as a basis for strengthening and diversifying exports, to identify bottlenecks, and to serve as a basis for formulating trade development priorities. Of the 19 products identified in DTIS 2007 as potential exports, nine are agricultural goods: cashew nuts, cassava, maize, fish, livestock, rice, rubber, soybeans, fruit and vegetables.

1 UN ComTrade 2008 accessible at http://comtrade.un.org/

2 These writers investigated the determinants of comparative advantage of selected ASEAN countries based on empirical evidence from a cross-country study by Wood (1994).

The DTIS 2007 involved an in-depth analysis of export performance, demands from world markets, domestic supply conditions and human development implications, as well as trade-related legal and institutional action plans for 19 potential exports intended to strengthen the business and investment environment for exports. However, it did not touch upon other important aspects such as comparative production costs of selected agricultural goods, marketing chains, challenges and opportunities for agricultural production and marketing and regional market flows. Since no study has focused on these issues with a view to enhancing agricultural trade in the GMS, this study is designed to fill this gap. The overall objective is to examine how agricultural trade in the region can be promoted in a manner that will optimise the benefits and minimise the negative impacts. The study selected cassava and rubber for in-depth analysis for two reasons: (1) they have not been significantly studied in the past, and (2) their potential importance for employment creation and poverty reduction.

This report is structured into five sections. Section 1 introduces agricultural production and trade. Section 2 discusses research methods used in the study. Section 3 looks at production components for cassava and rubber with emphasis on production practices, costs, challenges and opportunities. Section 4 examines cassava and rubber trade in cassava focusing on trade flows, trade costs and margins and marketing challenges and opportunities. Section 5 presents policy recommendations and conclusions.

2. Methodology

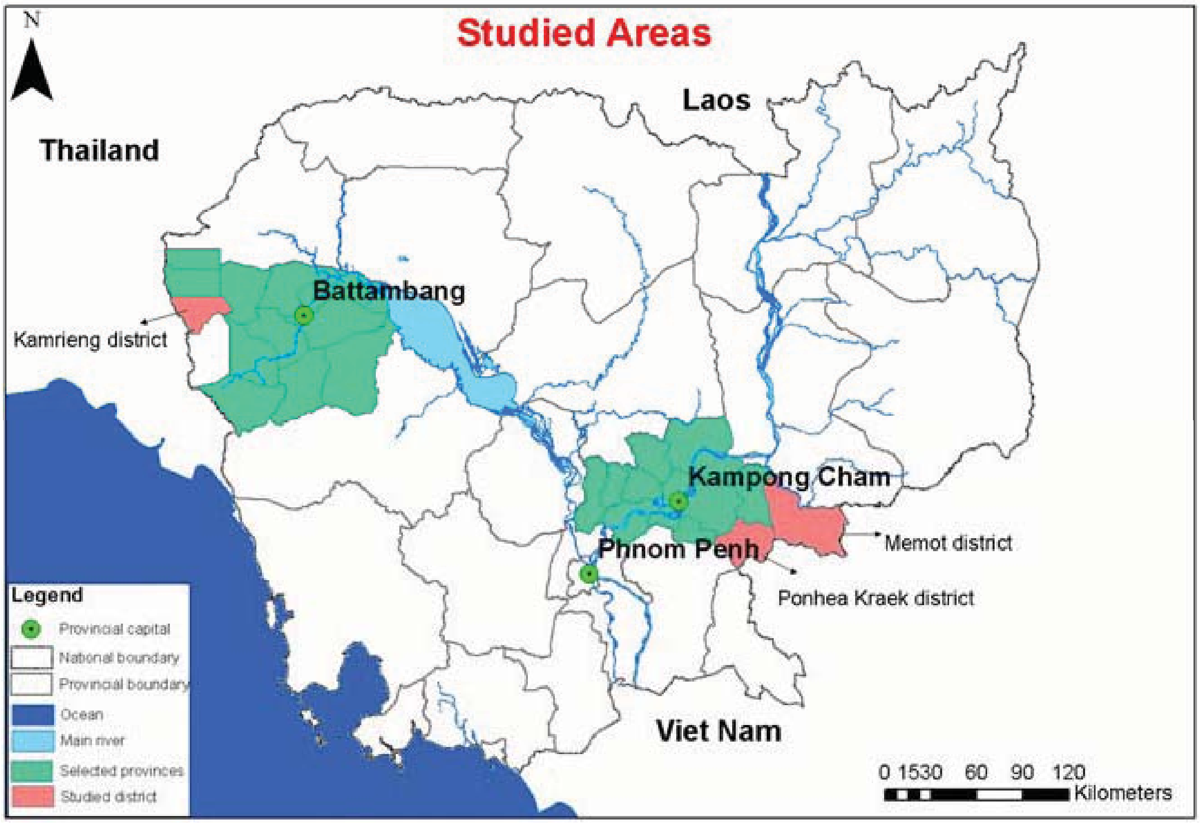
The study used a combination of two approaches: desk research and field survey. The desk research included a review of policy documents, the literature and an overview of statistical data. The field survey consisted of a farmer survey, trader survey and interviews with village and district chiefs, district agricultural officials and representatives of processing companies. Field surveys were conducted in May 2007 in two provinces, Battambang and Kompong Cham, where the commodities under study are produced and significant cross-border trade with neighbouring countries occurs. Kompong Cham is located in the east, while Battambang is located in the western part of the country. Memut and Ponhea Kraek districts of Kompong Cham were chosen as study sites for both rubber and cassava, while Kamrieng district of Battambang was selected for the cassava survey.

The farmer survey was conducted to collect information on production processes and costs, production challenges, pricing and margins. For cassava, 37 farmers in Battambang were randomly selected and 32 in Kompong Cham. For rubber, the survey was made only in Kompong Cham, and 39 farmers were selected.

The trader survey was used to collect information on marketing chains, trade flows and associated costs and margins. Structured questions were asked to capture certain common issues while not revealing the whole story. To compensate for this weakness, the study also conducted in-depth interviews with traders to learn their activities and understand the overall picture of commodity trade in their regions.

Several in-depth interviews were conducted with village chiefs, district chiefs and agricultural officials in order to understand the overall situation and conditions of agricultural production and trade in their villages and districts. The research team also conducted interviews with representatives of cassava and rubber processing factories in Kompong Cham to understand their sourcing and selling.

Figure 2.1: Map of study site



3. Production

3.1. Cassava

3.1.1. Overview

Figure 2.2 illustrates the historical development of cassava production in Cambodia. The graph suggests that cassava production experienced rapid expansion between 2005 and 2006. Total production reached 2.19 million tonnes in 2006, up from 0.54 million tonnes in 2005 and 0.18 million tonnes in 2000. The jump was attributable to a rapid increase in cultivated area and higher productivity. The total cultivated area reached 96,324 ha in 2006, about four times larger the area in 2005 and seven times larger than the area in 2000. The average yield in 2006 was 22.65 tonnes per ha, compared to 17.87 tonnes in 2005 and 10.47 tonnes in 2001.

Kompong Cham was the largest production centre in 2005, with a cultivated area of 11,719 ha and production of 244,605 tonnes; the average yield in this province was the second highest at 20.9 tonnes per ha. Kompong Speu was the second largest cassava producer, followed by Siem Reap, Kompong Thom, Battambang and Preah Vihear (more details in Table 2.1). The cultivated area in the top five provinces represented about 78 percent of the total while their production accounted for 92 percent of national production.

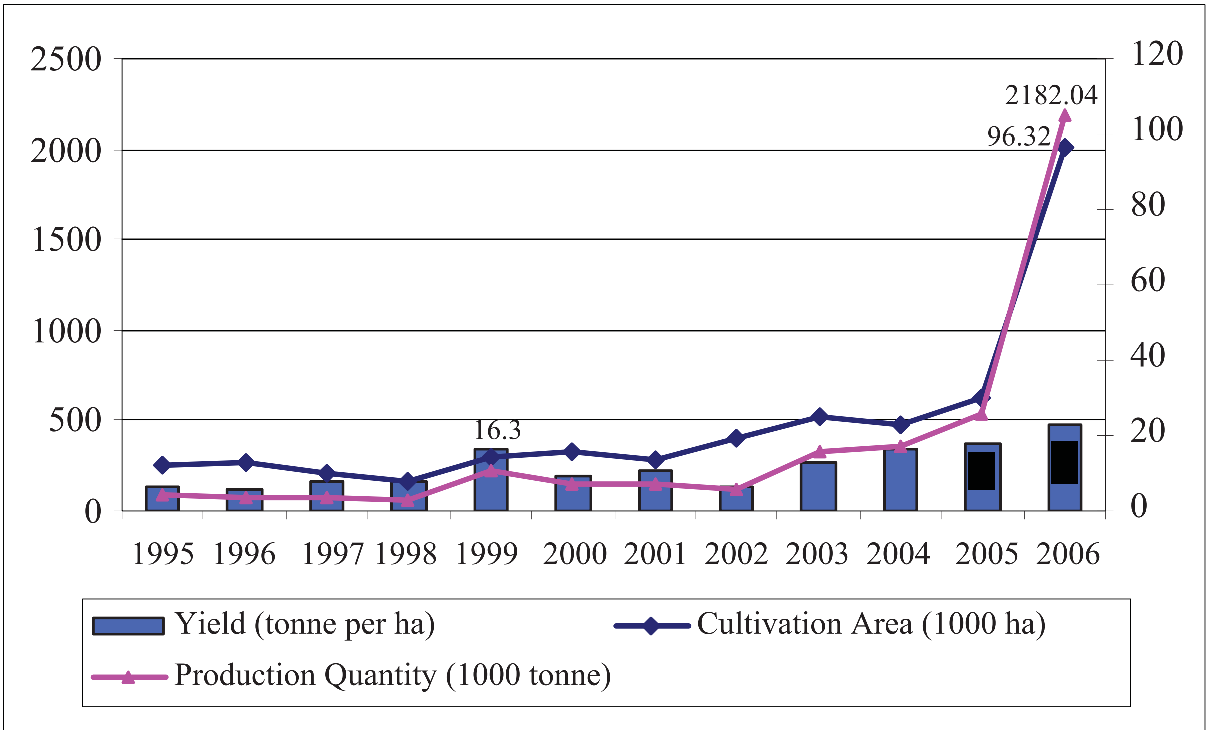
Productivity varies significantly across provinces, the highest yield being 27 tonnes per ha and the lowest 2.5 tonnes in 2005. Battambang had the highest productivity, followed by Kompong Cham, Koh Kong (19 tonnes per ha), and Kompong Speu. The lowest productivity was in Pursat, followed by Kompong Chhnang (3.2 tonnes per ha), Kampot (3.7 tonnes), Stung Treng (4.0 tonnes), and Svay Rieng (4.5 tonnes).

Table 2.1: Cassava production of selected provinces, 2001 and 2005

	2005			2001		
	Cultivation area (ha)	Yield (tonne/ha)	Production (tonne)	Cultivation area (ha)	Yield (tonne/ha)	Production (tonne)
Kampong Cham	11,719	20.90	244,605	4639	11.97	55,520
Kampong Speu	3269	14.70	47,698	1200	6.80	8160
Siem Reap	1182	11.60	13,698	1222	8.59	8118
Kampong Thom	895	7.00	6009	1927	6.52	10,295
Battambang	770	27.00	20,813	1148	12.00	13,775
Preah Vihear	681	10.00	6810	93	10.00	900
Takeo	582	6.00	3499	695	8.98	6179
Others	3651	-	18,918	5355	-	44,816
Total	22,749	16.08	362,050	16,279	9.61	147,763

Source: Agricultural Statistics 2000-2001 & 2004-2005 of MAFF

Figure 2.2: Cassava production in Cambodia



Source: FAOSTAT

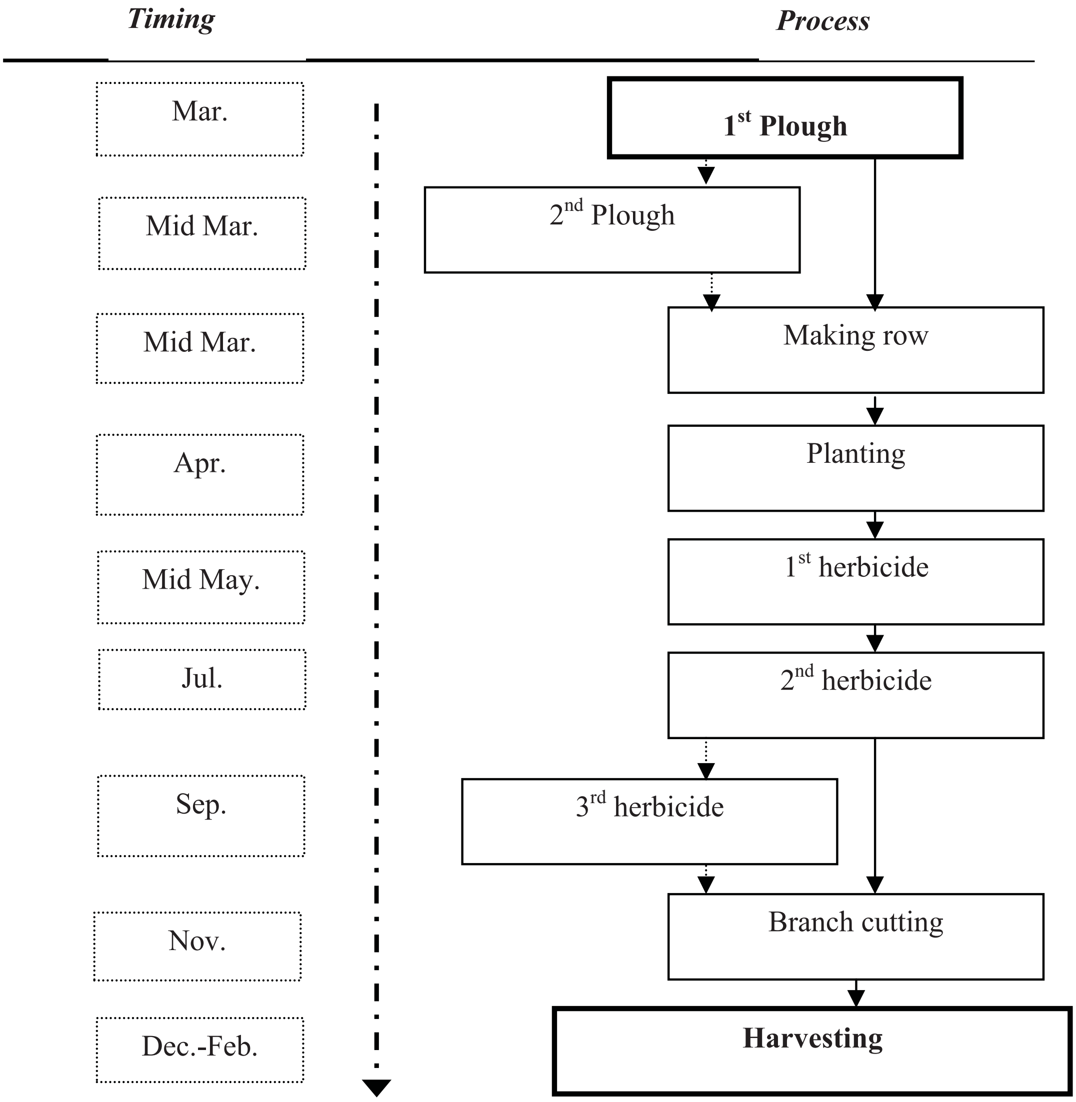
3.1.2. Cultivation practices

Cassava is adaptable to diverse climates and can be grown in soil with low fertility. It is planted either as a single crop or intercropped with maize, legumes, vegetables, rubber or other plants. Cassava is normally planted during February to April and harvested in eight to 12 months depending on market price and the availability of labour for harvesting. Cultivation practices in western and eastern Cambodia are similar, with a few notable differences due to different soil and climate conditions.

In Kamrieng district of Battambang, cassava is mono-cropped and usually planted in March; the earliest planting is in February and the latest in April. The first ploughing starts in early March before the forecast rain followed by a second ploughing and row making in the middle of March. Most farmers hire a local tractor owner to plough and hire labourers to make rows for planting. Most have their land ploughed twice, which results in a greater yield, while about 5 percent do it only once due to lack of financial resources.

Planting seeds usually takes place in March. The majority of farmers use their own cassava seeds from the previous harvest. Herbicide is necessary in Kamrieng and needs to be applied at least twice because weeds grow high and thick. The first application is made in the middle of May and the second a month and a half later. A third application of herbicide might be made, depending on weed conditions and farmers' financial resources. Finally, some branches are normally cut a month or so before harvesting to admit enough sunlight for the root to grow bigger.

Figure 2.3: Cassava cultivation



Cassava production in Memut district is very similar. Cassava is mostly planted with other crops, especially rubber, during April-May and harvested in December-January. Farmers mostly use more labour instead of a tractor for land preparation in order not to disturb the other crops. Unlike farmers in western areas, farmers in Memut use minimal amounts of herbicide. This saves considerable amounts of money and lowers production costs.

3.1.3. Production costs

The costs of cassava production include land rent, land preparation, labour and credit. Production cost differed considerably between the two study sites.

Western Cambodia

Expenditures are grouped into two categories: imputed cost of family inputs and cost of purchased inputs. Almost all farmers (99 percent) grow cassava on their own land. Although this does not cost them rent, the imputed expense in 2007 is estimated at USD119.95 per ha based on the market price of land rental.

Land preparation involves expenses for ploughing and row making, for which farmers usually hire a local tractor owner. On average, the first ploughing cost USD48.53 per ha, while the second cost USD41.75 per ha in 2007. Herbicide and seeds are the only major inputs for cassava production, and their total cost in 2007 was USD85.52 per ha, with herbicide costing USD46.16 and seeds, USD39.36.

Table 2.2: Cost of cassava production in Kamrieng district, Battambang, 2007

Itemised costs	**Unit**	**Imputed family inputs**			**Purchased inputs**			**Total**
		Quantity	*Unit price*	*Value*	*Quantity*	*Unit price*	*Value*	***Value USD***
A. Cost of land	USD	-	-	**119.95**	-	-	**2.03**	**121.98**
B. Cost of land preparation	USD	-	-	0	-	-	**90.28**	**90.28**
- 1st plough	USD	-	-	0	-	-	48.53	48.53
- 2nd plough	USD	-	-	0	-	-	41.75	41.75
C. Cost of inputs	USD	-	-	**26.24**	-	-	**59.28**	**85.52**
- Plants	-	-	-	26.24	-	-	13.12	39.36
- Herbicide	can	0	0	0	37.8	1.22	46.16	46.16
D. Labour cost	person-day	8	2.77	**20.89**	25	2.77	**68.4**	**89.29**
- Land preparation	person-day	1	2.77	3.19	0	2.77	0.27	3.46
- Planting	person-day	2	2.54	6.09	10	2.54	25.98	32.07
- Weeding	person-day	4	2.89	10.13	8	2.89	22.91	33.04
- Branch cutting	person-day	1	2.77	1.48	7	2.77	19.24	20.72
E. Cost of loan	% per month	-	-	0	-	3.42%	**60.8**	**60.8**
F. Other costs	USD	-	-	0	-	-	**16.91**	**16.91**
Grand total	USD	**-**	**-**	**167.1**	**-**	**-**	**297.7**	**464.8**

Source: Author's calculation based on data from CDRI's cassava farmer survey 2008

The intensive labour required is also a significant production expense. In addition to family workers, farmers hire labourers for the whole production process. A shortage of labour is common, and thus labour cost is rather high at USD2.77 per person per day on average or USD89.25 per ha in total. Another emerging expense is credit. About 78 percent of farmers borrow from private lenders to pay production expenses. This informal credit has a very high interest rate, averaging 3.42 percent per month, and cost USD60.80 per ha in 2007.

The total expenditure for cassava production in Kamrieng in 2007 was USD464.80 per ha, of which 26 percent went for land (imputed), 19 percent for land preparation, 18 percent for inputs, 19 percent for labour and 13 percent for loans. The imputed cost of family inputs at market price represented 36 percent of total production costs, while the cost of purchased inputs accounted for the majority of input costs in 2007. Table 2.2 sets out the costs in more detail.

Eastern Cambodia

Table 2.3 summarises the cost of cassava production in Memut district in 2007. The grand total was USD329.10 per ha, significantly lower than in Kamrieng. Land costs were the largest expenditure at USD131.78 per ha, followed by labour at USD113.62 per ha in 2007. Input costs constituted the third biggest expense at USD46.32 per ha, followed by land preparation at USD22.54 and loan interest at USD7.58 per ha in the same year.

Table 2.3: Cost of cassava production in Memut district, Kompong Cham, 2007

Itemised costs	Unit	Imputed family inputs			Purchased inputs			Total
		Quantity	*Unit price*	*Value*	*Quantity*	*Unit price*	*Value*	***Value USD***
A. Cost of land	USD	-	-	**117.25**	-	-	**14.53**	**131.78**
B. Cost of land preparation	USD	-	-	0	-	-	**22.54**	**22.54**
- 1st plough	USD	-	-	0	-	-	14.38	**14.38**
- 2nd plough	USD	-	-	0	-	-	8.16	**8.16**
C. Cost of inputs	USD	-	-	**22.82**	-	-	**23.5**	**46.32**
- Plants	-	-	-	22.82	-	-	15.21	**38.03**
- Fertiliser	kg	-	-	0	82	0.0072	0.59	**0.59**
- Herbicide	can	-	-	0	3	3.25	8.29	**8.29**
D. Labour cost	person-day	30	-	**64.92**	22.4	-	**48.7**	**113.62**
- Land preparation	person-day	8	2.13	16.12	3	2.13	5.94	**22.06**
- Planting	person-day	7	2.17	14.5	6	2.17	13.1	**27.6**
- Weeding	person-day	16	2.18	34.3	14	2.18	29.66	**63.96**
E. Cost of loan	% per month	-	-	0	-	5.43%	**7.58**	**7.58**
F. Other costs	USD	-	-	0	-	-	**7.22**	**7.22**
Grand total	USD	**-**	**-**	**205.0**	**-**	**-**	**124.1**	**329.1**

Source: Author's calculation based on data from CDRI's cassava farmer survey 2008

Farmers in Memut use herbicide much less than those in Kamrieng; thus, the cost on this item is significantly lower (USD8.29 vs USD46.16 per ha). Only 8 percent of farmers in the east, compared to 78 percent in the west, borrowed from private moneylenders to finance cassava production, making the total cost of loans lower.

Imputed family inputs were about 62 percent of total production costs in 2007. This was the reverse of the expenditure pattern in Kamrieng and thus one of the major differences between the two areas.

3.1.4. Challenges and opportunities

Challenges

Although cassava is an increasingly attractive cash crop for farmers, it faces several challenges. The most important difficulty farmers complain of is the rise in labour cost and prices of agricultural inputs and services brought about by high inflation. There is a shortage of labour, especially in the west, where many people opt to migrate to work in Thailand. This increasing expenditure forces a majority of farmers, especially in the west, to borrow from private moneylenders at high interest rates to finance production. The high cost of credit considerably reduces farmers' post-harvest profits.

Another challenge is lack of support for introducing more productive seed varieties. There are neither extension services to help farmers address technical issues nor sufficient information about cassava prices in regional and national markets. In most circumstances, farmers are price takers and traders are price setters. As a result, farm gate prices are lower and farmers' margins smaller. Other constraints on farmers include great dependence on rainfall, a shortage of land preparation service providers, unpredictable closure of border gates and limited access to microfinance at reasonable interest rates.

Opportunities

Several opportunities are emerging for cassava farmers. First, productivity could be raised further if good seed varieties were introduced and critical production problems such as limited understanding of herbicide use and rising prices of agricultural inputs were better addressed.

Second, extension services could boost cassava productivity. Extension service is currently non-existent; farmers cultivate cassava based on knowledge learned from an older generation and from one another. Dissemination of better cultivation practices could be done relatively easily by the government and NGOs. This would be very useful to increase productivity and quality.

Third, there is considerable idle land that could used to expand the cultivated area, as observed by the study team. New areas are more fertile, promising higher yields.

Lastly, closer cooperation among GMS countries in cassava production and trade would be good for Cambodian farmers. For instance, it would be beneficial to deepen cooperation with Thailand and Vietnam, the region's largest cassava exporters, on selection of varieties and better cultivation.

3.2. Rubber

3.2.1. Overview

Rubber has long been a major commercial crop and export earner for Cambodia and, as a labour-intensive crop, has the potential to contribute to poverty alleviation through rural employment. The gross value added of rubber in 2006 was estimated at USD103.61 million, or about 5 percent of agricultural sector production (MAFF 2008).

Rubber production started in Cambodia in 1910 on 150 hectares owned by a Frenchman named Bouillard, with a low yield of around 200 kg per ha. Large-scale rubber planting was started in 1921 by big French companies. Both production and productivity have increased since then, reaching their peak in the mid-1960s with 50,000 ha of cultivated land and a yield of almost 1.5 tonnes per ha. The prolonged civil war hampered expansion, and, with little care or investment, productivity went down to less than one tonne per hectare. The yield has gradually increased since late 1990s, in part due to removal of old trees and planting of young trees.

The main rubber producing provinces in Cambodia are Kompong Cham, Kratie, Kompong Thom and Ratanakiri. According to MAFF (2007), rubber is grown on about 70,000 hectares, of which 44,850 are owned by the state or private companies, while 25,150 hectares are smallholder plantations. Cambodia had seven state-owned plantations covering about 80 percent of total plantation areas. However, the government's policy of privatising rubber plantations through divestment has increased the area owned by private companies and smallholders.[3] According to the General Directorate of Rubber Plantations of Ministry of Agriculture, Forestry and Fisheries, as of November 2008, six of the state-owned rubber plantations (Peam Cheang, Krek, Memut, Snuol, Chamkar Ondoung and Boeng Ket) had been privatised.

Rubber plantations under smallholders have increased rapidly largely due to the government policy of providing parts of state-owned plantations to farmers employed by the government. With financial support from the Agence Francaise de Development, smallholder rubber production projects have been developed in Kompong Cham, the province with the largest share of total rubber production. The project started in 1999 with 349 participating farmers and more than 887 hectares. In 2007, smallholder plantations increased to about 10,000 hectares. However, according to the General Directorate of Rubber Plantations of MAFF, smallholder plantation in and outside the project totalled 30,000 hectares in 2007.

Table 2.4: Household ownership of rubber land

Description		Ponhea Krek	Memot
Land size (ha)	Minimum	0.8	0.7
	Maximum	12.0	8.0
	Standard deviation	3.2	2.6
	Average	3.5	2.1
No. of plots	1	9	10
	2	7	7
	3	3	1
	≥ 4	1	1

Source: CDRI's rubber farmer survey 2008

[3] A sub-decree on creating a national permanent commission for coordinating the privatisation and promotion of rubber plantations was issued in September 1994.

Most rubber smallholders have plantations of one or two plots, averaging 2.8 ha in size. Households in Ponhea Kraek district have more land than those in Memut (Table 2.4). The survey revealed that farmers obtained their land in four different ways: distribution by the state (22 percent); clearing forest (6 percent); purchase from others (39 percent); and from parents and relatives (33 percent). At the time of the survey, 14 percent of the farmers had land titles, 38 percent had papers or receipts issued by different authorities, 6 percent were applying for land title and 42 percent had no document at all.

3.2.2. Cultivation practices

Life cycle and land use

Rubber plants take six to seven years to start yielding. Tapping starts in the fifth to seventh year after planting and continues for 25 to 30 years. After 30 years, a decline in latex makes further tapping uneconomic. The trees are then removed and replaced with new seedlings (Mead 2001). The older the tree, the more concentrated is the latex produced. The time comes when the rubber tree is so old that the latex is too concentrated to flow.

In order to sustain long-term productivity and efficiency of land use, a planting arrangement known as the hedgerow avenue planting pattern was introduced to allow high light penetration throughout the economic life of the trees. A row spacing of 18 to 25 metres maintains a density of 400 to 500 trees per ha and provides a better long-term environment for increasing crop diversity. This method seems to affect slightly the growth and yield of the inter-row (IRRDB 2001).

At an early stage when rubber trees do not have so many leaves, allowing sunlight to penetrate, farmers plant short-term cash crops between the trees. In some cases when rubber farmers cannot afford to grow subsidiary crops, they allow villagers to do so. In exchange, villagers pay land rent of around USD50 per hectare per year. They have only oral agreements that usually depend on trust, mutual interest and sympathy of plantation owners for poor landless families. The crop most commonly grown on rubber land in 2007 was cassava. This was expected to happen again in 2008 due to the good prospects for cassava.

The cultivation of other crops in rubber plantations cannot be extended to more than three to four years before the trees start to shade most of the area. Although revenue from non-rubber cultivation is small, it helps offset ongoing expenditures. According to focus group discussions with farmers, when food prices increased, that attracted more people to use of young rubber land to grow cash crops.

Farm inputs

Several rubber varieties were planted in the study sites. Introduced to Cambodia long ago, GT1 is the most popular variety, followed by PBM. About half of rubber smallholders buy seedlings from companies, while the other half cannot afford to do so and thus depend on using a mixture of different seeds collected from other farms. This practice costs less but provides a lower yield.

In general, family workers are used for production, from land preparation to planting and tapping. Hiring labourers for harvesting is also practised, especially by households that have an insufficient family workforce. Farmers use chemical fertilisers more than organic fertilisers, and fertiliser is often applied when seedlings are planted and again a year before tapping.

Table 2.5: Varieties of rubber used

	GT1	PB260	RA 4	RA 5	PBM	*	Total
No. of plots	29	1	1	1	3	34	69
Percent	42.0	1.4	1.4	1.4	4.3	49.3	100

*Note: * Type could not be specified by farmers because they mixed different types of seeds. Usually they are poor farmers who cannot afford to buy pure seeds from a company.*
Source: CDRI rubber farmer survey, 2008

The main equipment for tapping is bowls or cups, a few large containers of 30 litres and special knives or chisels, used to incise the bark to open the resin canals without damaging the cambium. Most of those employed for tapping are paid monthly and only a few paid daily. In addition to their pay, hired workers can also collect rubber left over in the cups.

Tapping

Weather in the plantation changes every two to three months, affecting the trees' latex concentration and yield. When there is little rainfall, the bark is hard and holds only a small amount of water. This results in a high concentration of latex, which slows down the flow. When there is more rain, the bark becomes soft and the concentration of latex decreases, the latex flows longer and thus yields increase. When the rain subsides and cold winds arrive, the latex coagulates more slowly, causing it to flow longer. At the end of the rainy season, the soil starts to dry and the rubber leaves start to shed, causing more sunlight to reach the ground and the temperature in the plantation to rise. Such weather conditions cause latex to flow more slowly and thus reduce the yield.

The temperature affects the yield because latex does not flow when the temperature is high. In high temperature regions, low concentration trees are less affected than high concentration trees. Workers should tap in early morning, when the soil is cool, to obtain more latex. In general, trees can produce more latex in regions where there is a long cold season and short dry season.

Usually, farmers collect only once from one cut. When the price of rubber increases, farmers collect twice from two cuts. However, the survey found that only 30 percent of farmers made double collection in response to a rise in the rubber price. In general, rubber trees are tapped every two to three days, but a good price attracts farmers to tap more often. During the survey, when the rubber price was high, the majority (64 percent) tapped at an interval of two to three days, while the rest tried to tap daily.

3.2.3. Production costs

Rubber requires several years of continuous investment without financial returns until tapping starts. Financial returns before tapping are mainly from cash crop production or rent of the land to cash crop farmers. These returns are not included in the study's cost calculations but can be by allowing USD50 per ha per year. An important phenomenon of recent years was the rapid increase in land prices. Most rubber lands, especially those connected to main roads, were valued at around USD20,000 per ha, while the rest were valued at USD5000–15,000 per ha.

The main inputs in rubber production are land, labour and capital. The labour cost is increasing, reaching USD2–2.5 per person per day, about a third higher than a few years ago. This is due to increasing employment opportunities for villagers both inside and outside the studied areas. In early 2008, when it was time for the cassava harvest, high competition for labour pushed the cost higher. High inflation also contributed to a consistent demand for higher wages.

Labour is the main cost item; it varies from the first year to the tapping period. It is used intensively for land preparation and planting as well as tapping. According to the farmer survey, the cost of labour accounts for about 70 percent of total production costs.

A shortage of skilled tapers is considered a serious problem and could result in significant losses due to untapped blocks. Use of unskilled tapers results in damage to the cambium and high bark consumption rates. These cause poor bark renewal. When poorly renewed bark is tapped, there is a decline in yield.

Traditionally, the sap is collected in latex cups. Latex can be sold on the day of collection from the cups. In plantations that are far from markets, farmers coagulate the sap and wait for buyers to come to collect it. The polylump method reduces the frequency of collection to about once a week, depending on the amount of latex harvested in each area. Labour costs could be reduced and productivity increased by employing proper methods of latex collection combined with larger task sizes, appropriate use of latex stimulants and use of rain guarding devices.

Buying seeds is the highest cost in year one. Input material costs would have been higher if all rubber farmers had to buy seedlings from companies. According to the survey, the total cost of rubber is USD439 per ha in year one and gradually decreases to USD209 in year six. The cost for year seven during which harvesting will start increases to USD580. Total production cost is estimated at USD1714 per hectare from years one to six, before the trees produce latex.

Table 2.6: Cost of rubber production in Memut and Ponhea Kraek, 2007 (USD per ha)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Land preparation	245	152	121	85	115	42	46
Caring	49	36	81	72	74	71	87
Harvesting	-	-	-	-	-	-	379
Input materials	132	74	74	116	49	95	63
Others	13	15	-	-	-	-	5
Total	439	277	277	273	238	209	580

Note: Rent or cost of land is not included in calculation
Source: CDRI's rubber farmer survey 2008

With the widespread adoption of high-yielding trees and more effective methods of yield stimulation, a much larger duration of latex flow is expected, especially in low frequency tapping areas. In some areas, double collection should be carried out due to longer latex flow. Especially before cutting down the trees, farmers will apply chemicals to accelerate production. Some plantation owners want to practise double collection and yield stimulation when they can receive good prices. They realise that this method can exhaust their trees faster.

3.2.4. Potential and policies

Cambodia's economic integration has been deepened since its entry into ASEAN in 1999 and its commitments under other regional trade agreements and the global trading system. As of July 2008, Cambodia had concluded three FTAs and was negotiating five more (ADB 2008). Its first was AFTA, implemented after ASEAN membership in 1999. Later FTAs have been or are being negotiated by ASEAN with China, South Korea, Japan, India, Australia and New Zealand.

These agreements give Cambodia preferential access to major markets for its rubber exports. China, for example, is one of the largest markets for rubber. Lower tariffs on rubber products under the ASEAN-China FTA will stimulate greater export from Cambodia and thus increase domestic rubber production. Cambodia should improve the quality of rubber processing to meet the demands of China's market and provide competitive prices.

3.2.5. Constraints and opportunities

According to Burger and Smith (2001), the economies of key buyers and sellers in the natural rubber market were severely affected by the Asian financial crisis. The crisis caused turbulence in the natural rubber market until 2000. Until recent rises, farmers were discouraged by low rubber prices. Rubber plantations need long investments, and since Cambodian farmers are price takers, smallholders especially are vulnerable to price fluctuations.

Even though Cambodia is open to trade and foreign direct investment, some businesses (both domestic and foreign) have reported being at a disadvantage vis-à-vis rivals who engage in acts of corruption or tax evasion, or take advantage of Cambodia's poorly enforced regulations. This situation could result in some large firms taking control of the rubber industry.

According to the theory of demand and supply, a higher yield should enable Cambodia to offer agricultural commodities at lower prices. However, this is not the case because Cambodia's trade openness and facilitation have linked domestic prices to regional and international prices, especially in early 2008, when prices skyrocketed. A high price of fuel also makes difficult synthetic rubber production. And because the prices of all agricultural commodities remain relatively high together with the demand for rubber for tire production, the future looks bright for rubber producers for at least a few more years.

Supporting services or interventions from ministries have so far not been provided. Research and extension activities are more efficient and effective with the involvement of the private sector, resulting in changes in farming techniques. Marketing has been less problematic due to the high demand for agricultural commodities, improvement of infrastructure and trade facilitation.

Cambodian agriculture faces both the potential to increase production and the opportunity to expand sales. The backbone of rural development and poverty reduction, it unfortunately experienced fluctuations in the past due to floods, droughts, disease and insects. However, climate conditions in recent years have been more favourable. Provinces such as Kompong Speu, Svay Rieng, Prey Veng and Kompong Thom, which usually experience drought in the middle or at the end of the rainy season, would be better off growing rubber rather than crops.

There is little or no discrimination against foreign investors either at the time of investment or afterwards. Cambodia's 1994 Law on Investment established an open and liberal regime that allows Cambodian and foreign citizens freely to enter and exit all sectors of the economy. Full foreign ownership is permitted in most sectors, except for land; Article 44 of the Constitution provides that only Cambodian citizens and legal entities have the right to own land. The country's liberal investment policy should attract more foreign investment in the future.

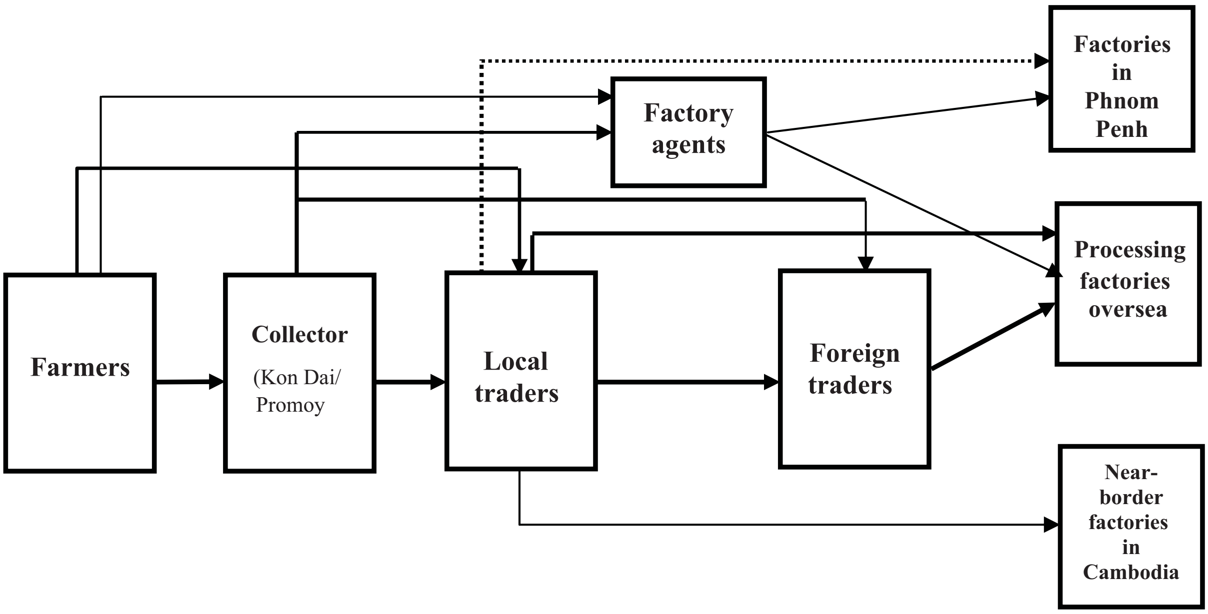
4. Trade

4.1. Cassava

4.1.1. Marketing chains

The cassava trade in Cambodia involves farmers, collectors, traders, factory agents and processing factories. As illustrated in Figure 2.4, the cassava marketing chain has many layers, with the collectors and traders serving as the main intermediaries between farmers and processing factories. Foreign traders also play a key role, purchasing large amounts of cassava for sale to foreign processing factories. Because the research team encountered some difficulties in gaining access to local processing factories and foreign traders, the following analysis focuses on farmers, collectors and traders.

Figure 2.4: Cassava trade flowchart



Farmers

Cassava farmers have few options in selling their outputs. Their decision is based on factors such as anticipated revenue, associated costs and availability of resources. Sale practices vary between the western and eastern parts of the country and are summarised below. Figures cited are from the 2007 survey.

Practices in the west

Most farmers sell raw cassava to traders (Option 1). The traders pay all associated costs, including harvesting and transport. At an average price of USD33.75 per tonne and output of 24.01 tonnes per ha, farmers' revenue from this option was USD810.34 per ha.

Another option (2) is to take raw cassava to the storehouse of factory agents. Under Option 2, the costs of harvesting and transport are the farmer's responsibility. At an average price of USD42.50 per tonne and average output of 24.01 tonnes per ha, farmers' revenue from this sale option was USD1020.43 per ha. Given a shortage of harvesting labour and increasing cost of transport, farmers are not so attracted by this option.

The last practice, Option 3, involves farmers selling dried cassava to traders. Farmers pay for harvesting, while transport is the traders' responsibility. At an average price of USD90.83 per tonne and average output of 24.01 tonne per ha and approximately 55 kg of dried cassava from 100 kg of raw cassava, farmers' revenue from this option was USD1199.46 per ha.

Table 2.7: Gross revenue from cassava sales in Kamrieng district, Battambang, 2007 (USD)

	Option 1 (raw cassava)	**Option 2** (raw cassava)	**Option 3** (dry cassava)
Price	33.75	42.40	90.83
Average Output	24.01	24.01	24.01
Gross revenue per ha	810.30	1020.43	1199.39

Source: author's calculation based on data from cassava farmer survey, 2008

Practices in the east

One interesting difference between the west and the east is that sales in the eastern region are not based on the exact weight of cassava but on an offered lump sum per ha. Traders visit the farm to estimate the output and offer a total payment (Option 1). The costs of harvesting and transport are the traders' responsibility. About 31 percent of farmers in the east sold their output this way at an average payment of USD667.47 per ha.

About 48 percent of farmers in the east choose to sell raw cassava to traders (Option 2). In this case, farmers bear the cost of harvesting, while transport costs are borne by the traders. At an average price of USD58.28 per tonne and average output of 13.28 tonne per ha, farmer's revenue from this option was USD773.96 per ha.

The sale of dried cassava to a trader, with the farmers shouldering the harvesting and transport costs, is Option 3. About 20 percent of farmers sold their output this way, at an average price of USD149.10 per tonne. At an average output of 13.28 tonne per ha and approximately 50 kg of dried cassava from 100 kg of raw cassava, revenue from this option was USD990.03 per ha.

Almost all farmers have no prior sales contract with traders or factory agents. Traders try to lower the farm gate price as much as possible, and farmers, being price takers, are at a disadvantage in negotiations. About 86 percent of farmers in the west thought that the price they got was fair, while 14 percent believed it was below the market price. Of farmers in the east, 43 percent thought they sold based on market price, while 38 percent thought they received less than the market price.

Table 2.8: Gross revenue from cassava sales in Kompong Cham, 2007 (USD)

	Option 1 (lump sum)	**Option 2** (raw cassava)	**Option 3** (dry cassava)
Price	-	58.28	149.10
Average Output	-	13.28	13.28
Gross revenue per ha	667.47	773.96	990.03

Source: Author's calculation based on data from cassava farmer survey 2008

Collectors

Collectors are the major agents in the cassava marketing chain. They are independent agents of traders and receive commissions based on the amount of cassava purchased. According to the collector survey, a collector in Kamrieng who represents Thai traders gets a commission of USD1.25 per tonne. Some collectors work for local traders who later sell to Thai traders on either a commission or margin basis. These collectors get USD0.50 to USD0.75 per tonne.

Local traders

Few wealthy local people in the study sites are in the cassava trading business. It is a fairly lucrative business but requires financial resources, facilities (e.g. storehouse), good communications and the confidence of farmers. Local traders sometimes act as collectors for foreign traders and receive a commission of USD1.25 per tonne. In some circumstances, local traders compete with foreign traders in buying cassava from farmers for resale to foreign traders.

Traders in the west bought raw cassava at an average price of USD32.50 per tonne and sold it to Thai traders at USD41.25 on average. After they paid harvesting costs of about USD5 per tonne (the Thai traders paid for the transport), the local traders' margin was USD3.75 per tonne. They bought dried cassava at an average USD90 per tonne and sold at an average USD105. With harvesting and loading costs around USD6.50 per tonne, local traders gained USD8.50 per tonne. Table 2.9 summarises trading options and margins. Traders' decisions depended on communications and connections with foreign traders, availability of labour and financial reserves.

Table 2.9: Margin of local traders in Kamrieng district, Battambang 2007 (USD per tonne)

	Option1	*Option 2* (raw cassava)	*Option 3* (dried cassava)
Farm gate price	32.50	32.50	90
Harvesting costs	0	5	6.5
Sale price	32.50	41.25	105
Margin	**1.25 (commission fee)**	**3.75**	**8.5**

Source: Author's calculation based on data from cassava farmer survey 2008

4.1.2. Costs and margins

Margins vary according to how cassava is sold as well as whether imputed family inputs are included in the cost of production. Since there are three options by which farmers can opt to sell, the margin analysis is disaggregated into three cases and in each case a distinction is made between two scenarios. Under Scenario 1, production cost includes imputed family inputs; under Scenario 2, production cost excludes family inputs. Figures are based on the 2007 survey.

Farmers' margins in the west

Table 2.10 shows the margins of farmers in Kamrieng district under the three different sales options. Option 1, the most common practice in the region, generated revenue of USD810.30 per ha. Given that harvesting and transport costs are the trader's responsibility, the average margin for farmers under this option was USD512.60 per ha if family inputs and labour are not considered in the cost calculation, and USD345.50 per ha if imputed family inputs are included.

Under Scenario 2, the revenues from Option 2 and option 3 were greater but partly offset by the harvesting and transport costs. If family inputs and labour were not imputed in production cost, farmers had a margin of USD529.69 per ha from Option 3 and USD521.2 per ha from Option

2. Table 2.10 also suggests that the margins vary only slightly among the three options and the differences are not significant enough for farmers to give up the current common sales practice, which is the most convenient for them in terms of time consumed.

Table 2.10: Margin from cassava production in Kamrieng, Battambang, 2007 (USD)

	Option 1		Option 2		Option 3	
	Scenario 1	*Scenario 2*	*Scenario 1*	*Scenario 2*	*Scenario 1*	*Scenario 2*
A. Gross revenue	810.30	810.30	1020.43	1020.43	1199.39	1199.39
B. Total cost	464.80	297.70	666.33	499.23	836.80	669.70
- Production cost	464.80	297.70	464.80	297.70	464.80	297.70
- Harvesting cost	0	0	160	160	372	372
- Transportation cost, if any	0	0	41.53	41.53	0	0
C. Margin	**345.50**	**512.60**	**354.10**	**521.20**	**362.59**	**529.69**

Source: Author's calculation based on data from cassava farmer survey 2008

This confirms the qualitative information from in-depth interviews with farmers that the majority prefer Option 1 because other options involve them in many other activities including harvesting, cutting roots and drying and collecting cassava chips. The difference in margin is not big enough for them to try other options. If family inputs are imputed in production cost (Scenario 1), the margin variations among options are again not significant.

Farmers' margins in the east

In Memut district, Table 2.11 shows that if family inputs and labour are not included in the cost calculation (Scenario 2), the margin was USD542.37 per ha for Option 1, USD620.48 for Option 2 and USD779.47 for Option 3. These results suggest that the differences are significant. However, not all farmers are able to choose Option 3. Only a small group of wealthier farmers who own small trucks can obtain this bigger margin from cassava sale, and these farmers also acts as middlemen between farmers and foreign traders.

If imputed family inputs are included in the production cost (Scenario 1), the margin dropped to USD337.37 per ha for Option 1, USD399.74 for Option 2 and USD550.86 for Option 3. As in Scenario 2, the difference between Option 3 and the other options is significant.

Table 2.11: Margin from cassava production in Memut, Kompong Cham, 2007 (USD)

	Option 1		Option 2		Option 3	
	Scenario 1	*Scenario 2*	*Scenario 1*	*Scenario 2*	*Scenario 1*	*Scenario 2*
A. Gross revenue	666.47	666.47	774	774	990.03	990.03
B. Total cost	329.1	124.1	374.26	153.52	439.17	210.56
- Production cost	329.1	124.1	329.1	124.1	329.1	124.1
- Harvesting cost	0	0	45.16	29.42	67.74	44.13
- Transportation cost, if any	0	0	0	0	42.33	42.33
C. Margin	**337.37**	**542.37**	**399.74**	**620.48**	**550.86**	**779.47**

Source: Author's calculation based on data from cassava farmer survey 2008

4.1.3. Challenges and opportunities

Challenges

Constraints in cassava market chains are several. First is the lack of market information, especially among farmers. The price of cassava keeps increasing, and this is known by foreign traders, who are mostly price setters. Given the farmers' limited knowledge of prices, farmgate prices are usually pushed far below current market prices.

The second constraint is poor infrastructure. Roads connecting main cassava production centres to main urban areas and border checkpoints are very poor. This makes transport and transaction costs high. Bad roads also hinder processing factories in urban areas from competing with foreign traders in purchasing cassava because they have the disadvantage of a higher cost of access to the place of production. Consequently, farmers have little choice of whom to sell to and little power in setting the price.

Third, the value added along cassava value chains is very limited. Most cassava in the study sites is exported to Thailand and Vietnam, where it is processed for export to third countries. There is a limited number of processing factories in main cities or near production centres, and the cost of processing, including materials, fuel and electricity, is very high. Unlike the garment industry, cassava trade and processing have received minimal support. In its absence, cassava does not generate significant value added.

The fourth problem is border issues. Traders complain about high fees for cross-border trade. In Kamrieng district, for example, traders pay USD100-150 to both Cambodian and Thai officers for transporting cassava across the border. The fee impacts directly on traders' margins and indirectly on farmers' margins. A related issue is unpredictable border closures, which occasionally happen on the border with Thailand. It is even worse if temporary closure takes place during the harvesting period because it makes farm gate prices decline. From our in-depth interview with village chiefs, farmers, especially those who need money urgently to repay loans, are badly affected by border closures.

Opportunities

The first emerging opportunity is the continual increase in international price of cassava, which has risen over the last seven years at an average rate of 12 percent per year. According to FAO's International Commodity Prices,[4] the fob Bangkok price of tapioca (hard pellets) was USD113.25 per tonne in 2007, up from USD78.04 in 2004 and USD55 in 2000. The fob Bangkok price of tapioca starch was USD250.50 per tonne in 2007 compared to USD157.42 per tonne in 2000. Given the increasing global and regional demand for cassava, its price is likely to rise further.

A second emerging opportunity is export development and market diversification. Cassava is among the 19 priority exports included in the DTIS 2007. Although its current export is limited, cassava is considered to have high export potential due to high world market demand and good domestic supply capacity. Cambodia's cassava exports receive tariff preferences from ASEAN, the EU and China through either free trade agreements or the Generalised System of Preferences.

The third opportunity is expansion of value-added. Since cassava has many uses and can be processed into a variety of products, the industry could be localised to attract investment into

[4] http://www.fao.org/es/esc/prices/PricesServlet.jsp?lang=en

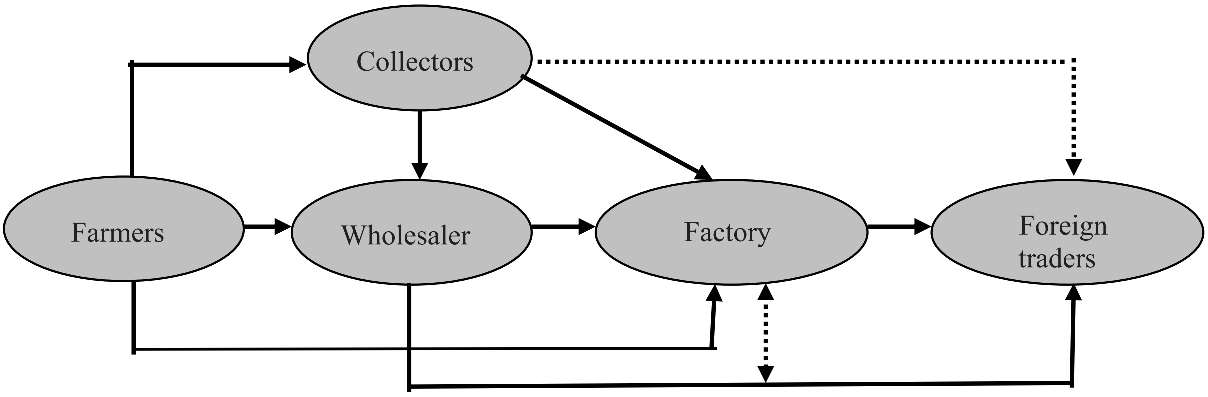
food processing, medicine, bio-fuels, animal feed and liquor (Ministry of Commerce 2007). Growth of these ago-industries would have big implications for cassava production and farmers' livelihoods.

4.2. Rubber

4.2.1. Marketing chains

Significant players from farm to export are shown in Figure 2.5 Rubber farmers close to the factory sell their product in the form of latex, while those far from the factory convert latex into a solid form before selling: farmers simply pour latex into a hollow space in the ground and keep it for a few days before buyers come to collect it.

Figure 2.5: Flow chart of rubber products in Cambodia



Farmers at present have more choices of buyers for their produce. This is a result of the free market economy, which allows many traders and enterprises to buy products. According to the survey, 63 percent of farmers sell to wholesalers. Thirty percent (mainly those whose farms are close to the factory) sell directly to a factory. Another 7 percent sell to different collectors.

Table 2.12: Rubber markets for farmers

Buyers	Percent
Processors or factory	30
Collectors	7
Wholesalers	63

Source: CDRI's rubber farmers survey in 2007

Wholesalers buy latex from smallholders for sale or transport to the factory for processing and export. Small collectors buy latex from farmers and sell it to wholesalers or factories in their areas. However, some collectors buy rubber for sale to Vietnam, although this is illegal. They transport rubber on motorbikes that can carry up to 300 kg. One wholesaler can buy between 10 and 20 tonnes a day, but the volume can be reduced to around 10 tonnes when small collectors are active.

Cambodia exports an unrecorded amount of rice and other agricultural products to Thailand and Vietnam. Natural rubber is no exception. In 2004, Cambodia recorded USD39 million of rubber exports, while an estimated USD76 million went unrecorded (US Commercial Services). While the gap has been reduced in recent years, it remains high. According to the study's estimates, the unrecorded amount now is equal to the recorded amount.

4.2.2. Processing

So far, rubber is produced in Cambodia only for export, due to a lack of capacity and investment in processing. Only semi-processed (dry) rubber, not latex, is allowed to be exported and this leaves rubber smallholders little choice but to sell their collected latex to state-owned or private enterprises for processing and export. All state-owned enterprises have rubber processing factories. There is also local processing of rubber trees into furniture. However, most rubber trees are exported to Vietnam to be made into furniture.

Cambodia produces and exports mostly TSR5 and TSR5L, which represented about 80 percent of total export volume in 2005 (EIC 2007). However, the share of these two types is only about 5 percent of total world demand. To capture more markets in the future, Cambodia should consider producing other types (e.g. TSR10 and TSR20) that are in high world demand for tire production.

4.2.3. Costs and margins

According to the farmer survey, rubber farmers can sell their latex at around USD1750 per tonne of dry rubber content at the farm gate. Intermediaries or wholesalers buy latex and transport it to storage. Collection of latex from farm, transport, drying and storage cost about USD125 per tonne of dry rubber content.

Processing into dry rubber (rubber blocks) costs about USD100 per tonne. The cost was higher several years ago at USD125 per tonne. The lower cost is a result of competition among factories and the availability of cheaper electricity from Vietnam.

Officially, only semi-processed rubber blocks are allowed to be exported. However, illegal raw solid rubber exports to Vietnam continue, and it was estimated that 500 kg of solid rubber were sold to Vietnam daily during the harvesting season.

The sale price in 2005 was at USD1391 per tonne, up from USD1175 per tonne in the previous year. The price increased to USD2330 per tonne during the time of the survey. Exported rubber is subject to export duty at a rate of 10 percent. Usually, exporters use big trucks to transport rubber blocks to Vietnam. The transport cost on paved road is estimated at USD3-4 per tonne over 10 km.

4.2.4. Constraints and opportunities

The demand for rubber was high in 2007 and 2008. According to the interviews with traders, the strong demand is due to high demand from China. Rubber from large Cambodian companies is exported to China or Malaysia through Vietnam. Rubber from small companies is bought by Vietnamese companies for export to China.

5. Policy Recommendations and conclusions

5.1. Cassava

In the DTIS 2007, cassava is identified as having high export potential and considerable impact on human development. But there are severe limitations and challenges that constrain Cambodia from fully achieving the potential of cassava. These are summarised as follows:

Absence of a clear policy and institutional framework: While Cambodia has built basic structure for development, there is a lack of a clear policy framework for agriculture and rural development (RGC 2001, 2006). Investment strategies have not been developed for resource- and technology-based production systems, including agro-industries. There is neither a solid legal framework nor clear regulatory guidelines to govern the allocation, protection and management of resources. Furthermore, the interpretation and enforcement of regulations are not consistent and predictable, and export procedures are complicated and troublesome (World Bank 2004). While cassava exports need to comply with importing countries' hygiene requirements, obtaining certification is time-consuming, costly and difficult for enterprises. This is primarily because of limited capacity and facilities of the responsible supporting institutions.

Institutional and financial constraints: There are serious gaps and overlaps in the mandates of institutions supporting agriculture and rural development. Public institutions also confront a shortage of technical skills, financial resources to implement agricultural development plans and facilities for agricultural research and development.

Inadequate extension services: Mechanisms for delivering agricultural support services such as extension programmes are either not in place or are inadequate (RGC 2001, 2006). It is widely recognised that agricultural extension services are very weak, and a fully functioning system for support services—and, more importantly, spreading technology—to the rural population has yet to be established. Technical information is mainly conveyed through informal channels, which include neighbouring farmers, non-government organisations, agricultural technicians and distributors of farm inputs. Farmers have very limited access to improved technologies because extension services are unsupported by R&D. State institutions are unable to deliver on a timely basis essential services and functions in support of productive, intensive and diversified farming.

Absence of an efficient marketing system: Agricultural market mechanisms (both domestic and international) do not function well (Hing and Nou 2006). Farmers have less bargaining power than intermediaries, and their products are priced much lower than they would be if market competition existed. At present, there is no national marketing institution. Only the Market Information Service under MAFF, which receives assistance from the Food and Agriculture Organisation, is undertaking marketing development.

Poor infrastructure: A lack of basic infrastructure such as irrigation systems, roads and transport is a major impediment to increasing farm productivity, facilitating trade flows and providing easier access to production centres. This results in higher transaction costs, unequal access to processing factories and foreign traders and greater informal cross-border trade at lower value-added.

The government has recognised these challenges, as clearly articulated in various socio-economic development plans and trade strategies. Its policies have proposed clear priorities and strategies aimed at developing and promoting agriculture in the context of regional and global trading systems. Priority agendas include development of a comprehensive strategy for agriculture, increasing public investment in the sector, encouraging and facilitating private involvement in agriculture and agro-processing, expanding extension services and improving basic infrastructure. Priorities for agricultural export development are improving market access and maximising benefits from preferential trade, better trade facilitation and building up a regulatory framework and institutional capacity to implement trade policy.

Experience suggests that the government had very good and fairly comprehensive policies pinpointing critical problems, but paid little attention to implementation. Although the government has made good progress on many priority actions and reform programmes, the outcome would be much better if they were implemented more effectively. This is an appropriate time for the government to pay serious attention to the efficiency and effectiveness of policy implementation. Three major elements are raised for the government to consider.

Strong leadership: This is a critical element of successful regulation enforcement and reform programmes.

Clear institutional framework: There should be clear guidelines on the mandates and responsibilities of institutions in supporting and coordinating the implementation of policies.

Sufficient financial and human resources: Resource mobilisation needs to be strengthened. This can be done through either increasing government funding or seeking more development assistance from donors.

In conclusion, cassava has good prospects for production expansion and exports, which will in turn help raise farmers' incomes and improve the country's human development. The crop's potential can be fully achieved only with concise and comprehensive policies that address the major constraints and challenges and with strong leadership and capable institutions that implement the strategies more efficiently and effectively.

5.2. Rubber

The rubber industry is identified in DTIS 2007 as having high export potential. Domestic supply conditions are good, with the following strengths and opportunities: comparable quality of raw rubber; high potential for expansion of planted areas; potential future development of value added; and trends toward full privatisation of state-owned enterprises (MOC 2007). Notwithstanding the priority actions suggested in DTIS 2007, several recommendations are raised here to address critical problems and challenges for rubber farmers and exporters.

One major problem that this study, together with other relevant publications such as EIC (2007) and MOC (2007), has identified is productivity. The average yield of rubber in Cambodia is low compared to major rubber producing countries in the region. This is largely attributable to the existence of rubber trees over 25 years old and use of low-yield seed. The latter often happens with smallholders. According to the study, about half of rubber smallholders could not afford to buy commercial seeds but used a mixture of different types collected from other farms. This costs less but provides lower yields.

Two possible policies could address the problem of low productivity. One is to provide high-yield rubber varieties to smallholders. That could be done through government or donor assistance or provision of low-interest credit for rubber farmers who lack resources. A second policy is research and development in rubber varieties and cultivation. The government needs to enhance research through strong funding support for the Rubber Research Institute of Cambodia and to promote the application of new rubber types in both smallholder and private estates.

Another critical issue is marketing chains and export costs. The study suggests that although farmers have more choices in selling their latex, they are essentially price takers. Farm gate prices are usually squeezed by collectors and traders. Mirroring the priority action suggested in DTIS 2007, this study also recommends the creation and strengthening of a professional farmers' organisation. Assistance at an early stage is needed to help the organisation to become an independent and self-supporting institution. A farmers' organisation could better address issues relating to the market and marketing information as well as cultivation and management.

Rubber exporters also face challenges that need policy emphasis. First, the quality of latex varies, that collected from smallholders in particular being of lower quality. Second, rubber processing has not been fully operational. Third, the cost of exporting remains high and therefore competitiveness low. Transport costs, customs clearance and logistics efficiency remain critical challenges. Albeit improved, the performance of Cambodia's rubber sector tends to remain poorer than that of major producing countries in the region. Fourth, a considerable proportion of the Cambodian rubber export price goes to hidden expenses, domestic sales tax and export tax, regardless of customs efficiency and logistics competence. Natural rubber is exported through Sihanoukville and the Vietnamese border. Hidden costs incurred through both channels and represent about 5 percent of the total fob value. (Kakada et al. 2008,19-20).

Enhancing the quality of processed rubber must be a priority. Recent admission of the Association of Rubber Development of Cambodia to the International Rubber Association is a good starting point for quality improvement and facilitation of rubber trade. But much remains to be done for the Cambodian Rubber Research Institute to gain international accreditation.

Reducing export cost must be included in the priority policy agenda to promote rubber exports. Cambodia's rubber competitiveness is low compared to Vietnam and Thailand. High export cost is one of the major contributors to weak performance. There has been notable achievement in the government's efforts on trade facilitation. Yet critical issues such as eliminating hidden costs, improving logistics and enhancing transport cooperation with neighbouring countries should be priority actions for promoting exports in general and for raising rubber competitiveness and realising rubber export potential in particular.

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Appendices

Questionnaire for Farmers Survey

Cassava Commodity

This survey is primarily designed to understand the cost structure of growing cassava in Cambodia. The destined samples are cassava farmers categorized as both small-scale farmers and big-scale farmers. All information collected in this survey is strictly confidential and will be used for statistical purposes only.

Ordinal Number of Questionnaire ....

Code of Village

Village's name .... commune .... district .... province ....

Interview Record

Interviewee's name: ....

Interviewer's name: ....

Signature: .... Date of interview: 2007

Time started:............. Time completed the interview:................ Total interview time: .... mins

Remarks:...

Quality Control Record

Survey Team Leader's Name: .... Signature: ....

Date: .... / .... / 2007

Remarks:...

Questions that Survey Team Leader ordered call back: ....

Supervision by CDRI Researcher

CDRI Researcher checking the questionnaire: .... Date: ...…../…… 2007

Questions that were clarified: ....

Questions that need call back: ....

I. Household Information

1.1 Sex of household head: 1. Male 2. Female

1.2 Age of household head: …………….years old

1.3 Education of household head: …………… years

1.4 Members of household aged under 14: …………….. persons

1.5 Members of household aged over 14 (including household head): …………….. persons

1.6 Membership in Farmer Association: 1. Yes 2. No

1.7 What would you rank your household well-being by this community setting? 1. Poor 2. Non-poor

II. Cassava Production and Costs

2.1 When do you grow cassava? Month:……………………

2.2 When do you harvest cassava? Month:……………………

	Plot 1 (A)	Plot 2 (B)	Plot 3 (C)	Plot 4 (D)
2.3. Cultivation areas (on household own land)	…………….ha	…………….ha	…………….ha	…………….ha
2.4. Cultivation areas (on rental land)	…………….ha	…………….ha	…………….ha	…………….ha

2.5. How do you grow cassava (growing technique)?

1. Growing cassava alone
2. Growing mixed with other crops 3. Growing in the interval of rubber trees

Costs and Expenditures	**Quantity (A)**	**Unit Cost (B)**	**Total Cost (C) = (A) x (B)**
Land Cost			
2.6 Household own land cost (converted)	...................ha	.... riel/ha	...........riels
2.7 Cost of land rental	...................ha	.... riel/ha	............riels
Land Preparation Cost			
2.8 Cost of land preparation (hire other to plough including his/her tractor and labour)	...................ha	.... riel/ha	............riels
2.9 Cost of land preparation (own labour but rent tractor plus gasoline cost)	...................ha	.... riel/ha	............riels
Cost of inputs			
2.10 Cost of seed or plant	.........seed/plant	..…… riels/plant	............riels
2.11 Cost of chemical fertiliser	……..….....Kg	……....... riels/ Kg	…………......riels
2.12 Cost of natural fertiliser	……..…........... Kg	…….…... riels/ Kg	…….............riels
2.13 Cost of pesticide	……..…......can	.... riels/can	…….............riels
2.14 Cost of herbicide	……..........can	…......... riels/can	…….............riels
Labour Cost			
2.15 Cost of labour hired for planting	…..person-day*	…........... riels/day	……….............riels
2.16 Cost of family labour working for planting (converted)	……...... person-day	……………......... riels/day	…………............ riels

2.17 Cost of labour hired for weeding	……....... person-day	………........... riels/day	………............. riels
2.18 Cost of family labour working for weeding (converted)	……....... person-day	………........... riels/day	………............. riels
2.19 Cost of labour hired for harvesting	……....... person-day	………........... riels/day	………............. riels
2.20 Cost of family labour working for harvesting (converted)	.......person-day	…........... riels/day	……….............riels
Other costs			
2.21 Interests if borrow money from others for cassava production			……….............riels
2.22 Other expenses if any (specify)……………………………..			……….............riels

* *(Number of adult multiply by total days equal person-day)*

III. Post-harvest sales

	Plot 1 (A)	Plot 2 (B)	Plot 3 (C)	Plot 4 (D)
3.1 Cultivation area	…………….ha	…………….ha	…………….ha	…………….ha
3.2 Yield/output	…………. tonne	…………. tonne	…………. tonne	…………. tonne

3.3 Quantity of sales: …………………… tonne

3.4 Sale price: ……………………………….. riel/tonne

If farmer sell cassava in lum sum, at what price they sell:

	Plot 1 (A)	Plot 2 (B)	Plot 3 (C)	Plot 4 (D)
3.5 Sale price per plot	…………riel/ plot	………riel/ plot	………riel/plot	………riel/plot

3.6. How is the sale price determined?
1. It is determined by farmers based on market price (no bargain)
2. It is determined by traders (no bargain)
3. It is determined by either farmers or traders, but bargainable.

3.7 What do you think about the price you sold?
1. Fair price (market price)
2. Below market price
3. Above market price
4. Not sure

3.8 To whom you usually sell your cassava: ***(Please note the contact address of the purchaser)***
1. Domestic collector
2. Foreign collector (come to collect)
3. Exporter
4. Wholesaler/processing factory
5. Farmer association
6. Other (specify)………………………………

3.9 Do you have prior sale contract with any of above traders?
1. Yes
2. No

3.10 What is the mode of delivery?
1. Traders come to pick up at their cost *(If the answer is No.1, pls go to Q14)*
2. Farmers transport at their cost

3.11 If answer No.2, how long is it transported: ……………………. km

3.12 If answer No.2, at what quantity: ……………………. tonne

3.13 If answer No.2, how much is total transportation cost: ……………………. riel

3.14 Do you know information price of cassava?
1. No I don't *(If the answer is No.1, pls go to Q4.1)*
2. Yes I do, but little bit
3. Yes I know quite well

3.15 If yes, how do you get that information?
1. Through farmers in same village/commune
2. Through farmer association
3. Through traders
4. Through information disseminated by relevant government offices
5. Other (specify)……………………………………………………..

IV. Farmers' Difficulties/Challenges

4.1 What you find income from growing cassava compared to other cash crops i.e. soybean, maize?
1. Much better
2. Slightly better
3. About the same
4. Slightly worse
5. Much worse

4.2 What are the <u>THREE</u> major constraints/difficulties in cassava production?
1. Lack of knowledge in production techniques
2. Unfertile/sandy land
3. Higher land prices, which make hard to expand cultivation areas
4. Higher price of inputs (fertiliser, seed, pesticide, gasoline, renting tractor,…)
5. Higher fees for labour
6. No support from provincial/district agricultural department
7. Other (specify)……………………………………………….

4.3 What are the <u>THREE</u> major constraints/difficulties after harvest?
1. Lack of knowledge about pricing
2. High price fluctuation
3. Not so many traders/collectors that make the price not competitive
4. Loss from failure to satisfy to quality desire
5. Less profit margin
6. Other (specify)……………………………………………….

4.4 What would you recommend to improve cassava production and income?
…………………………………………………………………………………………….....
…………………………………………………………………………………………….
……………………………………………………………………………………………

Questionnaire for Trader Survey

Cassava Commodity

Definition: *Traders here refer to those that either buy cassava from farmers or buy cassava from collector for sales or exports. They include collector, wholesaler, and exporter.*

Ordinal Number of Questionnaire ....

Code of Village

Village's name .... commune .... district .... province ....

Interview Record

Interviewee's name: ....
Interviewer's name: ....
Signature: .... Date of interview: 2007
Time started: .... Time completed the interview:................ Total interview time: .... mins
Remarks:...

Quality Control Record

Survey Team Leader's Name: .... Signature: ....

Date: .... / .... / 2007

Remarks: ....

Questions that Survey Team Leader ordered call back: ....

Supervision by CDRI Researcher

CDRI Researcher checking the questionnaire: ....Date: ...…..…./………2007

Questions that were clarified: ....

Questions that need call back: ....

I. Trader Information

1.1 Sex of trader: 1. Male 2. Female

1.2 Age of trader: …………….years old

1.3 Education of trader: …………… years

1.4 How long have you been in this business? .... years

1.5 Where do you live?

1. This village/commune 2. Nearby village/commune
3. Village/commune next to border 4. Town
5. Neighbouring country 6. Other (specify)……………………………..

II. Purchase and Sales

2.1 Are you a sole/exclusive collector/trader of cassava in this village/commune?

1. Yes (if yes, go to Q2.3) 2. No

2.2 If not, how competitive is this business?

1. Very competitive 2. Moderately competitive
3. Less competitive 4. Not competitive

2.3. From whom did you buy cassava?

1. Farmer 2. Farmer association 3. Collector
4. Wholesaler 5. Other (specify)………………………………

2.4. At what price: ………………………………… moeun riel/tonne

2.5. Why do they sell cassava to you instead of other traders?

1. Because I offer them a better price 2. Because we had a prior sale contract
3. Because I offer them a credit 4. Because they have no choice but sell to me
5. Because I am their long-time business partner
6. Other (specify) …………………………………..

2.6 To whom do you sell cassava?

1. Domestic collector 4. Exporter
2. Foreign collector 5. Processing factory
3. Wholesaler 6. Other (specify)………………………………..

2.7. At what price: ………………………………… moeun riel/tonne

III. Cost of transaction and business climate

Transaction Cost (From purchasing to resale)	When Purchase (A)	When Sale (B)
3.1 Transportation cost	………………..meon riel	………………..meon riel
3.2 Loading cost	………………..meon riel	………………..meon riel
3.3 Storage cost	………………..meon riel	………………..meon riel
3.4 Commission	………………..meon riel	………………..meon riel
3.5 Export tax (applicable for exporter)	………………..meon riel	…..……..meon riel/cont.
3.6. Other official payment	………………..meon riel	………………..meon riel
3.7 Informal fee	………………..meon riel	………………..meon riel
3.8 Other (specify)………………………	………………..meon riel	………………..meon riel

3.9 What are <u>THREE</u> major good things about this business?

1. Strong demands 4. Easy to store, maintain and fulfil product standard requirement
2. Easy to collect and supply 5. Not so many traders in this business
3. Relatively high profit margin 6. Other (specify) ……………………………………………..

3.10 What are THREE major bad things about this business?

1. Too many collectors/traders
2. Price is so fluctuated
3. Farmers don't respect sale contract
4. High transaction costs
   (incl. Transportation, informal fee,...)
5. Difficulty in getting information about pricing and market
6. Demand is so fluctuated
7. Other (specify)…………………………………………..

3.11 What would you recommend to improve cassava trading?

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

THANKS !

Questionnaire for Farmers

Rubber Commodity

CONFIDENTIAL

All information collected in this survey is strictly confidential and will be used for statistical purposes only.

Ordinal Number of Questionnaire ....

Code of Village

Village's name .... commune .... district .... province ....

Interview Record

Interviewee's name: ....

Interviewee ethnicity: 1. Khmer 2. Cham 3. Laotien 4. Vietnamese 5. Other....................

Interviewer's name: ....

Signature: .... Date of interview: 2007

Time started: .... Time completed the interview: .... Total interview time: .... mins

Remarks: ....

Quality Control Record

Survey Team Leader's Name: .... Signature: ....
Date: .... / .... / 2007

Remarks: ....

Questions that Survey Team Leader ordered call back: ....

Supervision by CDRI Researcher
CDRI Researcher checking the questionnaire: .... Date: ...…...…/………… 2007
Questions that were clarified: ....
Questions that need call back: ....

I. General information

1.1. How many people are in the household? .... (total)
1.2. How many household members are below 15 years old? ....
1.3. How many household members are from 15 to 54 years? ....
1.4. How many household members are above 54 years old? ....
1.5. How many household members work for their rubber plantation?

Household member		Occupation (work for their rubber plantation)	
Labour (number)	Non-labour (number)		

1.5. Do you own the rubber plantation? 1. Yes (continue to 1.6) 2. No (stop asking)

1.6. When do you start growing rubber? ....(year)

1.7. How many plots of rubber do you have? ....plots

1.8. Complete the table with size, age, production of each plot

Plot	Size (ha)	Age of rubber tree (years)	Production (tonnes)	Remarks
Plot 1				
Plot 2				
Plot 3				
Plot 4				
Plot 5				
Total				

II. Cost components

2.1. Production costs (***Riels or Dollars***)

Year of Rubber Trees	**Plot 1**		**Plot 2**		**Plot 3**		**Plot 4**		**Plot 5**	
	P.I*	F.I**	P.I	F.I	P.I	F.I	P.I	F.I	P.I	F.I
1. Land cost										
2.Land preparation										
3. Transplanting										
4. Seedlings										
5. Fertiliser										
6. Pesticide										
7.										
8.										
9.										
10.										

11.										
12.										
13. Others (specify ...)										
Total from 1 - 13										

Note: ****P.I: Purchased Input***
*****F.I: Family Input (converted by market price)***

Year of Rubber Trees	**Plot 1**		**Plot 2**		**Plot 3**		**Plot 4**		**Plot 5**	
	P.I*	F.I**	P.I	F.I	P.I	F.I	P.I	F.I	P.I	F.I
1. Land cost										
2.Land preparation										
3. Transplanting										
4. Seedlings										
5. Fertiliser										
6. Pesticide										
7.										
8.										
9.										
10.										
11.										
12.										
13. Others (specify...)										
Total from 1 - 13										

2.2 Harvesting costs

2.2.1 How many people work for your plantation?.. persons
2.2.2 Do you hire them or only your household members?
1. Hire (go to 2.2.3) 2. Only household members (go to 2.2.6)
2.2.3 How many people do you hire?.. persons
2.2.4 If you hire them, how much do you have to pay for 1 worker per day? .... riels or $/day
2.2.5 How many day do you hire them? .... days
2.2.6 How far is the distance from farm gate to the next buyer?.. k.m
2.2.7 How much is your loading cost and unloading cost?
1. Loading cost.................................riels or $/t
2. Unloading cost..............................riels or $/t
2.2.8 How much is your transporting cost for 100km?...riels or $/t
2.2.9 Other (specify if any) ....riels or $

III. Income components

3.1 How many output of rubber do you get per year? ....t/year/ha
1. Latex ....t
2. Dry-latex ....t
3.2 How many hectares do you have for growing rubber? ....ha
3.3 What is your selling price currently? ....$/kg

IV. Marketing information

4.1 To whom do you sell your products? at where?
1. Collectors..
2. Wholesalers..
3. Processors..
4. Thai traders...
5. Vietnamese traders..................................

4.2 Who do you sell your products to? and where do they live? inside your village or commune?
Buyers: ....
Places : ....

4.3 What are the most challenges or difficulties in your business? ***(Rank from 1 to 5, 1: the most difficult, 2: the second difficult, 3: the third difficult, 4: the fourth difficult, 5: the fifth difficult)***

1- Low selling price ....
2- Price instability...
3- Lack of market information about price..
4- Lack of capital to circulate..
5- High unofficial payment..
6- Poor road quality (transportation)...
7- Low demand...
8- Lack of planting skills (technology)...
9- Lack of equipment..
10- Lack of support from the government..
11- Others (specify)..

4.4 What strategic response do you have to improve your business?
....
....
....

Agricultural Trade in the Greater Mekong Subregion: The Case of Rubber in Laos

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Agricultural Trade in the Greater Mekong Subregion: The Case of Rubber in Laos

1. Introduction

Laos is a landlocked country, covering an area of 236,800 km2. The country is predominantly mountainous, with 80 percent of its land surface consisting of hills and mountains rising 100 to 3000 m above the Mekong River plains. These alluvial plains range in elevation up to about 200 m above sea level. The remaining 20 percent of Laos' land area consists of the lowland plains of the Mekong and its main tributaries, and adjacent flat-to-undulating plains. In the mountainous areas to the north and east, only the narrow river valleys and the plain of Jars are suitable for intensive agriculture. Laos is located in Southeast Asia, bordered by Vietnam to the east, Cambodia to the south, Thailand to the west and south, and Myanmar and China to the north. Increasingly it is being recognised that "landlocked" can be re-interpreted as "landlinked", changing the emphasis from "regional exclusion" to "regional inclusion". The country remains a predominantly rural economy, with about 83 percent of the population living in the rural areas and some 66 percent relying on subsistence agriculture (Linkham et al. 2005).

Map 3.1: Map of Laos

1.1. Significance of agriculture

Laos is among the countries whose economic systems are mainly based on agriculture. Indeed, agriculture is vital to the Lao economy especially in output contribution, employment and poverty reduction. The agriculture sector has the highest share of GDP. In 2007, the country's real GDP growth was estimated at nearly 8 percent, with agriculture accounting for about 40 percent of the total nominal output and posting a nominal growth of 6 percent from the preceding year. The sector employs 75 percent to 80 percent of the Lao labour force (IMF 2008: ADB 2008). The significance of agriculture particularly in poverty reduction efforts is recognised by the government and articulated in key national plans. According to the National Socio-Economic Development Plan (NSEDP) 2006-10, more than three-quarters of the Lao population live in rural areas, and a large majority of them depend on agriculture for their livelihoods. The Plan emphasises that increased agricultural productivity and improved market access are critical for achieving further significant reductions in poverty over the medium term.

Among Laos' agricultural subsectors, rice production is the single most important activity. Rice contributes the most to agricultural output followed by livestock and other commercial crops. Other major crops include maize, peanuts, soybeans and mungbeans. Agriculture is not a major export earner for the country, however. Traditional exports include wood, wood products, garments and hydroelectricity. Agriculture's share of exports is very small, and most agricultural output has been for domestic consumption and national trade. This is despite Laos' comparative advantages in the production of rice, maize, peanuts, soybeans, mungbeans, vegetables, livestock (pigs, live cattle and buffalo), coffee, sugar cane, fruit and plantation wood. Examination of the tariffs on agricultural items produced and exported by Laos indicates that some products on Laos' Temporary Exclusion List (TEL) are on the Inclusion Lists (ILs) of other ASEAN countries (Linkham et. al. 2005).

1.2. Significance of the forestry sector

In the 1900s, the forestry sector grew faster than the rest of the economy, reflecting an increase in log extraction from 300,000 m3 in 1990 to 734,000 m3 in 1998. However, the government reduced the annual harvest to 260,000 m3 in 2000/01, 200,000 m3 in 2001/02, and then to 150,000 m3 in 2004/05, while promoting downstream processing. Tree plantation development, although strongly promoted by the government, is still in its early stage. With favourable national conditions, it is expected to play a much larger role in the future.

The forestry sector contributed 3.2 percent of GDP and 25 percent of total national export value in 2001 and made a substantial contribution to the national budget. In 2001/02, log royalties constituted 15 percent of total fiscal revenues. Log sales have also been an important revenue source for many provinces.

The forestry sector is very important to employment generation in the country. Although exact estimates are not available, the sector provides several thousand jobs in log extraction, transportation and processing, with the rural population and the poor among those benefiting most. In turn, secondary employment creation in the wood processing industry, including furniture, provides some 22,000 jobs constituting one–quarter of the national total of 93,400 in the manufacturing sector.

In conserving Laos' natural resources, forests play an important role in watershed health by providing certain benefits. Forests conserve soil and protect against erosion and sedimentation, mitigate floods and droughts, and improve the reliability and quality of water supplies, power generation, irrigation, navigation and fish production. Also of importance are the designated national biodiversity conservation areas and initiatives that support sustainable use of existing forests and the rare and threatened plant and animal species they contain.

1.3. National agriculture and forestry sector strategy

To enhance GDP growth, the NSEDP 2001-05 focused on rural and agricultural development programmes and targets. It particularly stressed the major adjustments needed for improving yields and farming systems, transferring and disseminating appropriate technologies, and upgrading processing and marketing infrastructure (Linkham et al. 2005). The NSEDP 2006-10 recognises the centrality of the agriculture sector in the economy especially in poverty reduction efforts. As its overall goal, it seeks to set off greater economic progress by primarily developing the agriculture sector with a focus on eliminating slash-and-burn practices.

Slash and burn shifting cultivation is still widely practiced in the north of the country. In view of this, the government has adopted national policy aimed at eliminating all upland rice production under slash-and-burn cultivation systems, substantially reducing the area under upland rice. Permanent, more ecologically stable systems, with land management by villages and individual households are being introduced. The main priorities are to sustain the pace of the current momentum along the Mekong corridor while expanding the development process to higher slopes. Research to develop appropriate technologies for particular farming systems and mobilisation of an effective extension system are key components of the government's strategy for supporting upland farmers during the transition period (Linkham et al. 2005).

The government's development goals and the activities to achieve them are aimed at reducing poverty. The NSEDP 2001-05 is targeted at halving poverty by 2005. Smallholders need investment in upland agriculture, particularly in farming system diversification, livestock and agroforestry or non-timber products. Agricultural diversification can help poor farmers achieve food self-sufficiency, secure their sources of income and finally help them escape from poverty. To achieve these goals, macroeconomic policies aim to promote economic growth through improved infrastructure facilities and market access. This includes intensifying regional and international cooperation in promoting natural resource sustainability. As integration with the world economy increases, ASEAN needs to better integrate newer members into the regional economy. Laos, as a member of ASEAN, stands to share the benefits of the larger market (Linkham et al. 2005).

Following is a summary of the four goals of the strategic plan for the agriculture and forestry sector:

- Goal 1: Food production
  - Increase agriculture and forestry GDP growth rate to 3 to 3.4 percent annually
  - Maintain the level of food production at 400-500 kg per capita per year, equivalent to 3.2 to 3.3 million tonnes of paddy rice by 2010
  - Increase the quantity of food in the 47 poorest districts to the national level (350 kg per capita per annum)
  - Increase production of meat, eggs, fish and fresh milk by 5 percent annually; average consumption demand of 40-50 kg per capita per year

- Goal 2: Commodity production
  - Supply raw materials and agricultural and forestry products to processing industries and the service sector
  - Increase export share of agricultural and forestry products to one-third (approximately USD1 billion) of the total export value of commercial and services sectors (USD3.48 billion) by 2010
- Goal 3: Stop slash-and-burn cultivation
  - End slash-and-burn practices by 2010
  - Focus on the 47 poorest districts; link to rural development, poverty reduction and environmental protection.
- Goal 4: Sustainable forest management and balance between exploitation, utilisation, and protection/conservation
  - Increase forest cover from current 41.5 percent (9 million ha) to 53 percent (12 million ha) of total land area by 2010

1.4. Agricultural trade policies

Laos has taken initial actions in the move to comply with AFTA accession. Initially, the tariff cuts proposed by Laos were of a too long duration as most agricultural commodities were excluded from tariff reductions. The reduction of tariffs on goods trade across ASEAN will enable member countries to develop competitive advantages in the manufacture of certain products. Tariff reductions in early ASEAN trade agreements will help to acclimatise businesses and producers to increased competition.

Laos' traditional exports are agricultural commodities, logs and sawn timber, wood and wood products, livestock and hydroelectricity. Since 1999/2000, cash crops, particularly coffee, have become important export products. With new foreign investment in the 1990s, which helped the expansion of export-oriented manufacturing (e.g. garments), Lao exports have become more diversified. Likewise, trade liberation in Laos and its trading partners has encouraged non-traditional exports. Besides, significant informal cross-border trade has been going on for a long time between Laos and neighbouring countries, which cannot be prevented because of difficult terrain, poor infrastructure and poor law enforcement capacity (GOL 2001; Linkham et al. 2005).

Laos' top trading partner is Thailand. In 2007, about 36 percent of the country's total exports went to Thailand while 71 percent of total imports were of Thai products. Other major trading partners are Vietnam and China. Vietnam accounted for 11 percent of total Lao exports and 5 percent of its imports in 2007 (ADB 2008). Laos' main imports are of consumption goods (fuel, gas, and electrical appliances), investment goods (machinery and equipment) and intermediate goods (raw materials for garment industry). Despite efforts to develop and diversify its export products, Laos has significant trade deficit, though this deficit has considerably decreased in recent years. The balance of trade balance was -USD142 million in 2007 compared with -USD349 million in 2004 (ADB 2008).

1.5. Border trade policy

The government considers border trade one of the most important factors for the country's economic development. Two border zones have been designated as focal points for border trade development. The first is in Dansavanh village in Savannakhet province, which borders Vietnam and is located along Route 9, Southeast Asia's east-west corridor. The second is the Boten trade zone in Luang Namtha province, which shares a border with Yunan province of China and is located along Route 2, the north-west corridor between China and Thailand. The purpose of the policy is to attract FDI and to promote commercial production for export as well as to create jobs and generate income, which will contribute to the socio-economic development of the country.

In 2001, the Ministry of Commerce issued Instruction No. 0948 on Small Export Border Businesses. The purpose of the instruction is to promote small-scale commercial production for export and border trade management as well as to promote job creation and income generation. The instruction distinguishes two kinds of border points: those in remote areas and those in non-remote areas. Border points in remote areas obviously benefit those areas that have previously had no or difficult access to domestic markets. For these border points, under the list of goods permitted, members of "border trade clusters" can export and import all kinds of products necessary for production and consumption. At border points in non-remote areas, members of "border trade clusters" can export all their products and import inputs necessary for their production.

2. Methodology

2.1. Study site

The northern provinces of Luang Namtha and Oudomxay were chosen for the case study on rubber production. They were selected based on a review of the literature, data gap analysis and feedback from the first GMS-DAN meeting in Vietnam.

2.2. Hypothesis and research questions

The research hypothesis is that the development of the rubber industry is beneficial to Laos and other GMS countries. To explore the hypothesis, we set the following research questions:

- What are the characteristics of and major trends in Lao rubber production and border trade with other GMS countries?
- What are the costs associated with rubber production in Lao PDR and how do these compare with those in other countries?
- What are the determinants of farm-gate prices?
- What are the transaction costs in trading the commodities, and how do these compare across the Mekong region?
- What are the major marketing costs associated with moving agricultural commodities from farm gate to export/overseas markets?

2.3. Data collection

The task of collecting data for purposes of this study was governed by several imperatives. The team needed to review available literature on related topics. It was necessary to collect qualitative and quantitative data through interviews with farmers, district and provincial officials, extension workers, traders/investors and factory owners from the Lao and China side. The team also needed to collect secondary data from the Lao Provincial Agriculture and Forestry Office (PAFO), District Agriculture and Forestry Extension Office (DAFEO), trade offices in the districts and provinces and other relevant institutes.

The activities were undertaken in four stages. First, there was the introductory stage where the project was presented to decision makers at district and provincial level in Luang Namtha and Oudomxay. This part mainly entailed visits to provincial and districts offices where NAFRI researchers explained the aim of the study, explored opportunities for cooperation in data collection, and heard the concerns raised by officials for consideration in the design of the project proposal. The next stage consisted of data collection in and around the villages, which involved field visits and group discussions with selected participants. The third stage involved study trips to China and Vietnam where activities included field visits to farms, trade companies and factories, and meetings with stakeholders in the rubber trade. The last stage dealt with data compilation and report writing. A dissemination workshop was held to share the key findings of the research to and to collect feedback from district, provincial and national officials and other stakeholders.

3. Rubber

Laos has been caught up in a rubber plantation boom. Strong market demand for latex and the presence of many private investors from China, Vietnam and Thailand have triggered a sudden increase in rubber plantations, especially in the northern and southern provinces. Government support for the domestic rubber industry also facilitated the growth of Lao rubber production and trade. Following the implementation of NSEDP 2001-05, the large-scale plantation production of industrial crops such as rubber for local use or export has been increasing. As a result, extensive rubber tree plantations have been established in the provinces of Luang Namtha, Oudomsay, Bokeo, Khammouane, Champasak, Saravane, Sekong and Attapeu.

Rubber as a farm crop presents an interesting opportunity for smallholders. The great potential for intercropping on short rotation is what makes it more attractive over other plantation crops with a long gestation period. Because saplings can be grown with intercrops and within longer-term agroforestry systems (AFS), rubber as part of an integrated farming system is considered an ideal option for reducing poverty and stabilising shifting cultivation in the uplands

Smallholders are increasingly engaging in rubber growing, yet technical and market information for improved economic returns are lacking. Among the basic information needed are intercropping options, varietal selection of planting materials, ecological growth requirements, improved tapping, processing and marketing systems, as well as environmental and social impacts of the tree crop.

The demand for natural and synthetic rubber in the global market has been increasing since the early 1990s, largely driven by the booming Chinese economy. Estimations predict that this demand will continue to grow, and that, world demand by 2020 will be 50 percent higher than in 2003. With its growing economy, China's consumption of natural rubber is estimated to rise from 18 percent to 30 percent of total world production (Burger and Smit 2004).

This presents an opportunity for Laos, which borders China and has a suitable climate for rubber plantation, to increase production of natural rubber. At the same time, the transition from predominantly subsistence agriculture to commercial-scale production poses challenges, both ecological and social.

Although demand for rubber has been rising for several years, this does not necessarily mean that prices will continue to increase. Fluctuation in the world market price for natural rubber introduces uncertainty and because rubber trees do not produce latex until after five to eight years (depending on climate and variety), investment is associated with considerable financial risk. Apart from the uncertain market price, there is also the risk of adverse climatic conditions and pests destroying rubber trees. Yet, unlike other commodities, rubber seems to offer long-term economic returns and flexibility in its market for both latex and timber. However, there is also a question of where these revenues end up. Contracts between foreign investors and farmers are often vague or non-existent, and thus pose a major concern for farmers since it is unclear who will benefit from the profits of rubber planting. Some rural farmers are also illiterate and the notion of a contract and its sanctity are still not well understood by investors or farmers in Laos. Further, the lack of jurisdiction means that legal contracts are not enforceable.

Information on rubber is scarce and scattered. There is no systematic information on rubber across Laos including on the location of rubber plantations, ownership of plantations, arrangements between growers and processors, and production expansion plans. This presents a serious obstacle to assessing the social and ecological impacts of rubber plantations.

In addition to the lack of general information on rubber cultivation in Laos, information on the quality of the seedlings being introduced and where they are planted is also very important. The earliest that poor seedling quality can be detected is six months after planting. But it could be several years, or even 6-7 years when tapping begins, before the quality of the seedlings becomes obvious. Not having a standard for seedlings poses a major financial risk for farmers especially if there is nothing in the contract that stipulates compensating for financial loss due to poor seedlings.

Many rubber farmers in Laos practice intercropping, mainly with rice, maize and pineapple, during the first three years, then rubber is primarily grown as a monocrop. However, studies indicate that long-term intercropping in rubber plantations has potential to yield higher farm incomes than monoculture rubber plantations. Intercropping is particularly important for generating farm income while waiting for young trees to mature for tapping. Other benefits of intercropping are reduction of soil erosion, increased income and food security, and diversification of local products and rural skills (Linkham et al. 2008; Cheo n.d.).

To gain an understanding of the implications (land, technical, socio-economic and regional aspects) of rubber plantation in Laos, and to provide recommendations on how to encourage the adoption of sustainable land use in upland systems for raising farm incomes, there is a need to review the current status of rubber plantation in Laos and other GMS countries across the ecological, socio-economic and policy dimensions of biophysical systems.

Table 3.1: Rubber plantation areas in Laos (ha)

Region	Current	Planned area by 2010
	1,926	10,000
Central	1926	10,000
Southern	18,588	50,000
Northern	10,064	120,000
Total	30,578	180,000

Source: FRC 2006

3.1. Production

3.1.1. Rubber production in northern areas

The first rubber plantation in northern Laos was established in 1994 in Luang Namtha province. The objective of that project was to solve the problems of the upland farmers and thus address the three goals of the Lao government: to eliminate or reduce significantly slash-and-burn agriculture, to quickly reduce opium cultivation, and to reduce poverty. At the fifth conference of the provincial committee party, the expansion of rubber planted areas was pinpointed as a solution for the poverty of people living in the uplands. The objective was to increase plantation areas from about 10,000 ha in 2006 to 20,000 ha by 2010.

In 2000, three companies from China (Yunnan Local Product Import-Export Co. Ltd., Rubber Company Bejing Jinxianglian Co. Ltd. and Foreign Economic Commerce Co. Ltd. Sip Song Panna) decided to invest in rubber production in Luang Namtha. In 2001, the Lao Foreign Economic Commerce Division executed Project Agreement No. 002 with Yunnan province of China after approving its investment proposal. After that, three companies cooperated to establish a company named Sino-Laos Rubber Co. Ltd. and set up a rubber-processing factory in Luang Namtha. The factory can produce 6000 tonnes of rubber per year. The company also established rubber nurseries in the three districts of Na Lae, Namtha and Meuang Sing and stocked them with new clones from Yunnan including Yuyan 77-2 and Yuyan 77-4. In total, 2,020,000 rubber seedlings were distributed: Na Lae district received 220,000 seedlings, Namtha district 1,500,000 seedlings and Meuang Sing, 300,000.

In 2003, Sino-Laos Rubber Co. Ltd. planted rubber trees on 59 ha in Oudomxay province. By 2004, plantation areas had increased to 100 ha. There were two rubber nurseries, one in Hour district with 50,000 seedlings supplied by Jianfeng Company and the other in Beang district with 1,000,000 seedlings provided by Sino-Laos Rubber Co. Ltd (Oudomxay). All the rubber seedlings were imported from Yunnan, China, and included clones Yuyan 77-2, Yuyan 77-4 and RRIM 600 (Sino-Laos Rubber Co. Ltd. et al. (2004).

In 2004, Sino-Laos Rubber Co. Ltd. established a rubber nursery in Bokeo province, providing 3000 rubber seedlings. The total planted area of this nursery is 701 ha.

Sino-Lao rubber factory, Luang Namtha province

Table 3.2: Planting arrangements

Arrangements	Farmers' input	Benefits for farmers
Smallholder (self-financed, sometimes with credit from government)	Land Labour Capital	All profit from latex and timber goes to farmer (farmers seek markets individually)
Contract farming (promoted in the north)	Land Labour	Profits from latex and timber sales are shared among farmers and investors (investors purchase products)

Table 3.3: Problems and concerns

Arrangements	Problems and concerns
Smallholder	Checking quality of inputs (i.e. varieties) Management of plantation (i.e. pest, frost) Processing of latex Marketing
Contract farming	Uncertainty of household labour supply Uncertain profit share and contract arrangements Lack of confidence/commitment of local farmers to contract farming

3.1.2. Rubber production in central areas

In 1990, Ketphfoudoi Group Company planted 80 ha of rubber trees in Khammuane province. Seedlings were imported from Thailand and Vietnam at a price of KAP7000 per seedling. The latex collected is exported to Thailand.

In 1996, a GTZ project involved planting 114 ha of rubber trees in Xangthong district, Vientiane, the capital of Laos. The seedlings were imported from Thailand, and the resin collected from the rubber trees is exported to Thailand.

In 2004, Sino-Laos Rubber Co. Ltd brought 200,000 seedlings (rubber clones Yuyan 77-2 and Yuyan 77-4) to a nursery in Vientiane province. In 2006, the province executed an agreement with Lao-Thai Hua Rubber Co. Ltd granting a land concession of 100 ha for rubber plantation (Sino-Laos Rubber Co. Ltd. et al. 2004).

3.1.3. Rubber production in southern areas

Rubber tree plantations have been established in Laos since the 1930s. The first site was in Bachiang district, Champassak province, about 9 to13 km from Pakse town on the road to Bolaven plateau. The plantation followed a four-plot design, and each plot was about 0.5 ha. The local name for rubber trees is *cao-su.* The villagers around these plantations previously tapped the resin (latex) just for fun and used it to trap small animals, insects and birds. So far, little attention has been paid to these trees because they are considered less significant than other local tree species (Ketphanh et al. n.d.).

In 1991, the Development of Agriculture, Forestry and Industry (DAFI) planted about 1800 rubber trees for resin production. In the same year, an area of 13 ha was planted with rubber trees under a state programme. In 2006, Cao Su Dak Lak Company from Vietnam invested in rubber plantation in Champassak province, particularly in Bachieng district. Rubber plantation in the south is also widespread in Salvan, Sekong and Attapeu provinces. The rubber clones were imported from Vietnam (RRIV-4) and Thailand (RRIM 600) (Ketphanh et al. n.d.).

3.2. Cultivation practices

3.2.1. General characteristics of shifting cultivation

Shifting cultivation consists of cutting the natural vegetation, leaving it to dry and then burning it for temporary cropping of the land. The burning of vegetation cover and soil organic matter accelerates decomposition and releases useful nutrients for crop production. Burning also kills weeds and pests. Another important principle of shifting cultivation is the regeneration of soil fertility through plant regrowth after harvest. To rebuild the soil fertility after growing crops on a shifting cultivation plot, farmers abandon that plot and allow the natural vegetation to grow back for a number of years. This is the “fallow period”. In the meantime, they grow crops on other new plots. In principle, the longer the fallow, the better the crop (Gansberghe n.d.).

There is significant diversity in the shifting cultivation systems in Laos. Diversity factors include soil category, topography, altitude, rainfall, natural vegetation type, land tenure system, level of integration into the market economy, dietary habits, ethnic beliefs and traditions, local technical knowledge, level of conversion from shifting agriculture to sedentary agriculture and level of crop-livestock integration. What this diversity means is that most of these systems function under location-specific management and therefore require location-specific alternatives for those willing to modify their systems (Gansberghe n.d.).

Two types of shifting cultivation systems can be distinguished in Laos, namely rotational and pioneering. The first is the most common type, and involves established swiddeners keeping their villages in the same place but shifting their cultivated plots according to a crop/fallow cycle. Under the second system, swiddeners move their whole village settlements from one site to another after several years, mainly because the nearby forest has become exhausted (Gansberghe n.d.).

The wet season is the main cropping period for shifting cultivators. A shifting cultivation plot is generally cultivated for one year without any tillage. Sometimes the same plots are planted for two or three consecutive years, in which case tillage operations are generally carried out before sowing. Upland rice is the main crop grown by Lao shifting cultivators. Several other crops such as cassava, maize, cotton, yam, cucurbits, chillies, sesame, Job's tears and sweet potato are grown in smaller quantities. Shifting cultivators practice mixed or multiple cropping, and agricultural diversity tends to be higher in shifting cultivation systems than on the sedentary farms of the lowlands (Gansberghe n.d.).

The Lao government has included in its national objectives the complete elimination of slash-and-burn cultivation. This has been the major reason for the decline and other changes in shifting cultivation areas throughout Laos. However, other factors also influence swidden systems and practices such as population increase, growing market opportunities, and changes of attitude among shifting cultivators. Although many Lao farmers have already adopted sedentary agricultural systems, many others cannot completely convert their systems because of various constraints including limited availability of flat land, limited family labour, limited technical know-how for growing wetland rice, cultural practices revolving around the rice cycle, and limited knowledge of crop science (Gansberghe n.d.).

3.2.2. Principles of transition from shifting cultivation to cash production

Shifting cultivators in the uplands of Southeast Asia have progressively taken up cash crops over the past century. The transition from subsistence production to production for the market can be seen in two stages. The first stage is when farmers use the larger proportion of their resources to produce for their own consumption, but use their spare land and labour to produce for markets. The second stage occurs when farmers allocate most of their resources to supplying the markets and rely on purchasing commodities and services, with subsistence farming as a spare-time activity. In other words, farmers change from being part-time to fulltime producers for the market. The shift is accelerated by the improvement of infrastructure – especially transport and communications – and the availability of markets (Myint and Fisk cited in Manivong et al. 2009).

The transition to commercial production can also be classified into four stages – "pure subsistence in isolation, subsistence with supplementary cash production, cash orientation with supplementary subsistence, and 'complete specialization for the market" (Myint and Fisk cited in Manivong et al. 2009). The first stage occurs when farmers' consumption is entirely reliant on their own production, and the final stage is when farmers produce entirely for the market and rely on the market for all the commodities and services they need. The two stages in between involve a combination of subsistence and commercial production and correspond to Myint and Fisk's (cited in Manivong et al. 2009) two stages. Farmers may produce mainly for their household consumption, but undertake supplementary production to get access to goods and services not available from their own resources. Alternatively, they may mainly produce to supply the markets to earn cash income, but still produce a substantial part of their basic food and other requirements. In reality, there is rarely such a situation as pure subsistence or pure monetary production. Farmers normally practice stage two or stage three. For instance, although farmers may only focus on subsistence production, they tend to cultivate cash crops as well to get more income if they have spare land and labour. On the other hand, despite focusing on cash production, they still produce subsistence output because this will help reduce the risks associated with market demand (Myint and Fisk cited in Manivong et al. 2009).

3.3. Production costs

Overall, rubber trees can live up to 100 years, but they are no longer economically viable after about 30 to 40 years. Rubber trees provide latex between years 7 and 25. After that, the yield of latex decreases significantly. Therefore, the investment is calculated for 25 years and separated into three periods: year 1, years 2-6 and years 7-25.

Table 3.4: Prices of tub-lump rubber in Luang Namtha province, 2002-07

Year	Average (kip/kg)
2002	4300
2003	4500
2004	5500
2005	6500
2006	10,370
2007	10,625

Source: Interview with Rubber Management and Development Unit, PAFO Luang Namtha

3.3.1. Investment in rubber plantation in year 1

Table 3.5 shows the estimation of investment in rubber plantation in year 1, including the costs of land clearing and preparation, planting materials and maintenance costs.

Table 3.5:Estimation of investment in rubber plantation in year 1

Items	Unit	Quantity	Price (kip)	Total (kip)
Land clearing	ha	1	1,000,000	1,000,000
Land preparation	ha	1	1,500,000	1,500,000
Rubber seedling	seedling	500	5000	2,500,000
Labour for planting	seedling	500	500	250,000
Barbed wire	roll	16	150,000	2,400,000
Posts	post	300	5000	1,500,000
Fencing	ha	1	700,000	700,000
Nails	kg	2	10,000	20,000
Organic fertiliser	kg	500	1200	600,000
Pesticide	litre	2	15,000	30,000
Chemical fertiliser	kg	120	4000	480,000
Maintenance	year	1	1,000,000	1,000,000
Total			11,980,000	

Source: Interview with Rubber management and Development Unit, PAFO Luang Namtha Province, 2006

Smallholder farmers usually have family labour of 2 to 3 persons per household and therefore tend to invest only in pesticide, rubber seedlings, and chemical and organic fertilisers.

3.3.2. Investment in Rubber Plantation in Years 2-6

The investment from year 2 to year 6 is all about maintenance of the rubber plantation. The estimation of the investment is summed and then divided by 5 to calculate the annual figures.

Table 3.6: Estimation of investment in rubber plantation in years 2-6

Items	Unit	Quantity	Prices (kip)	Total (kip)
Costs for maintenance	year	5	1,000,000	5,000,000
Organic fertiliser	kg	5000	1200	6,000,000
Chemical fertiliser	kg	925	4000	3,700,000
Pesticide	litre	10	15,000	150,000
Fungicide	kg	150	10,000	1,500,000
Total				**16,350,000**

Source: Interview with Rubber Management and Development Unit, Luang Namtha Province, 2006

3.3.3. Investment in rubber plantation in years 7-25

Expenditure during years 7-25 is higher than during the first six years as it includes the costs of tapping. Inputs consist of tapping materials, chemical and organic fertilisers, and pesticides.

Table 3.7: Estimation of investment in rubber plantation in years 7-25

Items	Unit	Quantity	Prices (kip)	Total (kip)
Costs for maintenance	year	19	1,000,000	19,000,000
Organic fertiliser	kg	10,000	1200	12,000,000
Chemical fertiliser	kg	6500	4000	26,000,000
Pesticide	litre	368	15,000	5,520,000
Costs for tapping	day	2280	30,000	68,400,000
Fungicide	kg	570	10,000	5,700,000
Bowl/cup	piece	3000	2000	6,000,000
Tapping knife	piece	18	30,000	540,000
Iron wire	piece	3000	100	300,000
Knife sharpening stone	set	6	25,000	150,000
Total		**143,610,000**		

Source: Field interview 2008

3.3.4. Total rubber investment per hectare

1. Estimated rubber investment in Luang Namtha province during the period of 25 years is 171,940,000 kip/ha; however, rubber trees provide latex for only 19 years.
2. Latex production yields 1500 kg/year/ha (3 kg/year/tree x 500 tree = 1500 kg/year)
3. Income is 1500 kg/year x 10,500 kip/kg = 15,750,000 kip/year (19 years x 15,750,000 kip = 299,250,000 kip)
4. Income from intercropping is around 1,800,000 kip/year x 4 years = 7,200,000 kip (127,310,000 kip + 7,200,000 kip = 134,510,000 kip)
5. Net profit is (299,250,000 kip + 7,200,000 kip = 306,450,000 kip) 306,450,000 kip - 171,940,000 kip = 134,510,000 kip/25 years

3.4. Productivity (case of Baan Hat Nyao village)

3.4.1. Background

Baan Hat Nyao is a small village at the edge of the provincial town in Luang Namtha province. At the time of the survey in 2008, there were 122 households in the village with 146 families. Of the village population of 964, just under half were females. Socio-economically, about 25 percent of the households were well-off, more than 50 percent were mid-level and 18 percent were less well-off (see Table 3.10). Very few households were in poverty. By definition, those in poverty would be the less well-off households, those who are destitute. This would constitute some families with little available labour such as a widow with small children, an elderly couple or a person who lives alone or is sick (Alton et al. 2005).

Table 3.8: Village Demographics

Tot HHs	Males	Females	Total Pop	Well-off HHs	Mid-level HHs	Less well-off HHs
122	500	464	964	32	70	20

Source: Field survey 2008

3.4.2. History

The village was established in 1975. Most of the early families came from Pak Tha district of Oudomxay (now Bokeo) province and had settled in Luang Namtha in 1973 but up in the mountains. Later, other Hmong families came in from Xieng Khwang province. In 1975, they moved down to Hat Nyao village in search of paddy rice land. From 1975 to 1980, more than 160 died as people adjusted to living at a lower elevation in the lowlands. Because of the scarcity of potential paddy land, many households returned to the nearby mountains to practice shifting cultivation. During this period, the size of the village declined to a mere 17 households (Alton et al. 2005).

In the late 1980s, various Hmong communities were encouraged to resettle in Hat Nyao village, and the population began to expand. These incomers included Hmong refugees from China, who had relatives in Hat Nyao village and requested permission to resettle there; they made the move in January 1994. While living in Chinese agricultural collectives, they had learned how to cultivate (Alton et al. 2005).

As the village population started to burgeon with newcomers and others, with limited hope for paddy rice land, they explored various other alternatives to enhance their livelihoods. They went to Sip Song Panna in China to explore various alternatives, including fruit tree and vegetable cultivation, livestock rearing, aquaculture and rubber tree cultivation. With the newcomers' experience with rubber trees they decided that rubber production was the most promising of the alternatives (Alton et al. 2005).

3.4.3. Rubber production in the village

Families and the leadership in Hat Nyao saw rubber tree cultivation as compatible with their existing livelihood systems including opium poppy cultivation. They felt that with its labour requirements for latex production, rubber tree cultivation would be compatible with their work ethic and community organisation. In addition, with the encouragement of the provincial government, rubber was promoted as an alternative to shifting cultivation and opium poppy cultivation (Alton et al. 2005).

Land was allocated in 1997. Of the 4604 ha allocated to the village, 700 ha were classified as conservation forest, 1300 ha as protection forest, 1700 as agricultural land, 700 ha as forest plantation land, 200 ha as grazing land, and 4 ha for the village settlement. Since then, village households have grown upland rice, corn, cassava, chilies, vegetables and rubber trees under a short-fallow shifting cultivation system, resulting in very low yields due to low soil fertility and weed competition (Alton et al. 2005).

It is difficult to determine how much of the village's agricultural land is used for upland rice cultivation under shifting cultivation. Village leaders tend to understate this activity because of the perceived non-compliance with government policy on eradicating shifting cultivation. However, at least around 900 ha of the designated village agricultural land is used for subsistence rice and other food crops (Alton et al. 2005).

By 1996, about 154,000 rubber trees (342 ha) had been planted on fallow land. The frost of December 1999 killed around 34,000 trees (75.5 ha), leaving 120,000 trees (267 ha) alive. Tapping began in 2002. In 2003 and 2004, another 170 ha were planted, bringing the total plantation area to about 437 ha. These rubber tree stands were planted on the 1700 ha of designated agricultural land. Another 200 ha were planted, in 2005 and a further 100 ha in 2006. In 2008, the rubber planted area covered about 834 ha, of which 334 ha were being tapped and the remaining 500 ha were expected to be ready for tapping between 2013 and 2015. On average, there were 470 rubber trees per ha (Alton et al. 2005).

Table 3.9: Rubber trees planted in Hat Nyao

Year	Planted area (ha)	No. of HHs
1994	94.30	60
1995	249.70	93
1996	342.00	102
2003	437	105
2004	(170 more trees planted)	
2005	200 more trees planted	84
2006	100 more trees planted	92
2008	843 (334 ha ready for tapping)	122

Source: Alton, et al. (2005)

Most of the labour for rubber tree cultivation is provided by the households that own the land, although there is some hiring of labour at peak periods. Less well-off households supply virtually all the labour required. Households that can afford it will at least hire labourers for clearing the land, terracing and planting of seedlings, and annual weeding. Family labour is usually used to care for the nursery stock and young saplings and for all tapping work because these tasks require delicate handling and skilled labour (Alton et al. 2005).

The hired labourers come from neighbouring villages, usually other ethnic communities, e.g. Khmu, Akh, and Yao. The wage rate in 2005 was KAP25,000-30,000/day for light work and KAP30,000-35,000/day for heavy work. At the time of survey, there did not appear to be any hired labour shortages. In 1994-96 all rubber-producing households received subsidised loans to help cover the cost of seedlings and some fencing (barbed wire). Each producing household received between KAP1 and 3 million of credit to plant rubber trees. The initial funds were provided by the Provincial Agriculture and Forestry Office (PAFO), which extended credit to the value of KAP12,873,340 at an interest rate of 2 percent over a 15-year term. Then in 1995, the provincial government through the Agricultural Promotion Bank (APB) provided a further KAP10 million but at an interest rate of 7 percent over the same term (Alton et al. 2005).

Table 3.10: Baan Hat Nyao loans for rubber tree cultivation, 1994-95

Year	HHs	Approx Area (ha)	Loan (kip)
1994	60	94.30	12,873,340
1995	93	249.70	10,000,000

Source: Alton et al. (2005)

3.4.4. Preferment of income

A study by Alton et al. (2005) estimated rubber yields based on the actual yields attained by six village households in the first three years of tapping (2002-04). The projected yield estimates for Hat Nyao village in years 11-30 were adjusted based on the production data of the Rubber Research Institute of Thailand (RRIT) and calculated using an average of 105 tapping days per year. Note that the estimated production data (maximum peak yield of 1694 kg/ha.) taken from RRIT estimates for northern Thailand did not account for the limiting factor of the environmental stress caused by the high (650-700 m) elevation (Alton et al. 2005).

Rubber sales in 2004 were limited to tub/cup lumps priced at LAK5.5/kg (USD0.69/kg) on average. For future projections, the conservative price of LAK5.0/kg (USD0.63/kg) was used in the study. Raw rubber sheets and liquid latex had better net returns, but lack of information prohibited reliable projections (Alton et al. 2005).

It is conventional to include the sale of rubber timber at the end of the production cycle. While there was a market for rubber wood in Sip Song Panna, China, there was no domestic market at the time of study. Timber sales from 70 m^3/ha can amount to KAP25,350,000 (USD2450) and branch wood sales (for charcoal) from 130 m^3 can amount to KAP13,390,000 (USD1300). The study estimated that 140 labourers per day would be required to harvest this volume of wood (Alton et al. 2005).

Tapping in Hat Nyao village

Table 3.11: Revenues from selected crops

Crops	Yield (kg/ha)	Farm gate price (kip/kg)	Revenue/ha (KAP)	Revenue/ha (USD)
Upland rice	1500	1000	1,500,000	146
Maize	3000	700	2,100,000	204
Soybean	800	2500	2,000,000	195
Sesame	700	5000	3,500,000	340
Rubber*	**1300**	**6500**	**8,450,000**	**822**

*Note: *This does not include investment during the first 7 years. Average income from rubber over 30 years is estimated at approximately USD645/year.*

In the scenario where 25 percent of the recommended amount of fertiliser is applied, the returns to HH labour can reach KAP123,476 (USD11.99), and the returns to all labour, KAP111 (USD10.84). Both of these were almost five times that of the wage rate at the time of study. The returns to capital on the other hand were valued at approximately KAP6.65

per kip invested without HH labour and KAP2.73 per kip invested with all labour. With a discount rate of 20 percent, the net present value (NPV) of the income stream was estimated at KAP6.3, the internal rate of return (IRR) at 8.63 percent and the benefit-cost ratio (B/C) at 1.86. The NPV and IRR are quite low; however, looking at the sparsity of alternatives for farmers in Luang Namtha, the investment is still probably worthwhile. At a B/C ratio of 1.86, the enterprise would be considered feasible (Alton et al. 2005).

3.5. Trade in rubber

Demand for rubber is high and the market for rubber is expanding; further increases in demand are envisaged over the next 10 years. However, unstable supplies and volatile market prices give rise to "boom and bust" cycles. Therefore, smallholders need to have coping mechanisms to deal with price fluctuations and the inevitable price crashes. Government support, i.e. price support, is vital to tide farmers over periods of declining rubber prices (NAFRI et al. 2006). Prices of rubber in Laos, especially in Luang Namtha province, have increased. Rubber products in the form of tub-lumps were exported to China in 2002-07.

3.5.1. Marketing chains

Rubber is different from other commercial crops and needs a high degree of organisation and institutional support at all levels. At the national level, this could include a national strategy integrating technical issues, extension, credit, transport and marketing. Most rubber-producing countries have a national coordinating committee, which works closely with all sectors related to the rubber industry. At the local level, smallholder groups need to be organised and/or supported by government in order to strengthen rubber cultivation, tapping, processing and marketing (NAFRI et al. 2006).

3.5.2. Costs and margins

The cost of transporting tub lumps from Hat Nyao to the border is calculated as follows:

- Labour cost for transferring tub lumps from the farm to the truck is around KAP20,000 per tonne
- Transport cost from the farm to the border is around KAP150,000 per tonne; intermediaries have to pay income tax (35 percent) of around KAP3,950,000 per tonne
- Tub lump price in Hat Nyao (farm gate price) is around 5 yuan per kg and the border gate price is around 14 yuan per kg (1 yuan = 1250 kip). The cost of transporting 1 tonne of tub lumps from farm gate to the border is around KAP4,120,000, but selling this 1 tonne of tub lumps at the border gate earns a profit of around KAP11,250,000.

Given the higher returns, many intermediaries (Lao and Chinese) prefer to buy tub lumps direct from farmers and sell them at the border rather than producing rubber themselves. To illustrate this, a trader buys tub lumps at the farm gate for around KAP6250 /kg and sells them at the border for KAP17,500/kg. Due to high transport and other associated costs, farmers have no choice but to sell their produce to intermediaries.

3.5.3. Exports and processing

Laos has no rubber processing industry. Rubber is sold in the form of tub lumps, which consist of coagulated rubber poured into a washtub, small plastic garbage can, or a pit dug into the ground lined with a plastic bag. These lumps are stored inside if there is space and, if not, then outside. Tub lumps are easily contaminated with sand, dirt and small stones. Reportedly, the weight of tub lumps declines after more than a month in storage (Alton et al. 2005).

Beginning in June, the Collection and Sales Unit (CSU) goes to Sip Song Panna in China, usually to Mengla county, to seek the best prices for their rubber. They visit various factories to obtain bids. When the team was in the village in late November, it took them three days to find the best offer of KAP5.3/kg. Then about two days later, two trucks came to transport the tub lumps to the factory. Households brought their tub lumps to the village collection point in pushcarts, small carts pulled by motorcycles, and a couple of households used pick-up trucks. The tub lumps were weighed and recorded by the CSU. The fees payable to the Rubber Growers' Association Fund (RGAF) are calculated as a percentage of sales. This fee is deducted from the final payment made to the households. The CSU reported that the Chinese merchants always complain of depressed prices when they know that world prices are stable or increasing. Village households have no idea what the world rubber prices are. In 2005, prices for low quality lump rubber ranged from LAK5.2/kg to LAK 5.7/kg (Alton et al. 2005).

Lao farmers are very much "price takers" of whatever the Chinese traders offer. Traders tell the farmers that world prices are declining and other stories in order to lower prices. Market information on world prices of rubber or even prices in China is virtually non-existent. A regular mechanism for announcing price information, such as regular radio broadcasts, is needed to notify farmers about current world and regional prices for the various forms of rubber (Alton et al. 2005).

Lao farmers access only the Chinese market. Of course, this is the final market for most rubber in the region. However, once Route NR3 from Botène to Baan Huay Sai, Bokeo, is open and as increased rubber production in northern Thailand prompts the establishment of more rubber processing factories, new marketing opportunities will be opened for Lao farmers. Thus, alternatives to selling to the Chinese should be considered. In addition, farmers should consider producing different types of rubber such as raw rubber sheets, raw liquid latex and smoked rubber sheets (Alton et al. 2005).

From the experience of Baan Hat Nyao, it is clear that rubber growers' associations are crucial to success. Its own Village Rubber Growers' Association (VRGA) has helped farmers in organising production and marketing. However, the exact formation of these associations will be different for each village and ethnic community given their differing organisations, cultures, customary rules and regulations. Village associations could eventually become cooperatives, similar to those beginning to emerge in the Isaan region of Thailand (Alton et al. 2005).

3.6. Potential and policies

3.6.1. Village initiatives

The Village Development Committee (VDC) of Baan Hat Nyao prepared a production plan, which included the allocation of the land designated for rubber tree cultivation among households according to their available labour. The structure of the village with its four units (nuay) was used to set production units. The VDC gave each of the four production units the responsibility for clearing land, planting seedlings, managing cultivation (including regular weeding of the intercrops in immature rubber trees) and then monitoring. It then created a fifth unit for the group of households who had land outside the village. These production units also fenced the perimeter of the rubber tree field.

The province, in the first year (1994), arranged for low interest loans through the Lao National Bank (LNB) and received about KAP12 million. Individual household loans ranged from KAP1-3 million with an interest rate of 2 percent per annum and a 15-year payback period. The 60 households mostly used their loans to cover the costs of land clearance, seedlings, planting and fencing. Then in the second year (1995), the province negotiated another loan of about KAP10 million; however, the funds were not received until January 1996. Administered by the APB, the interest rate on loans was set at 7 percent over a 15-year term (Alton et al. 2005).

The seedlings from China were delivered in small amounts of 3-5000 seedlings. They were then distributed to interested households, sometimes no more than 50 seedlings per household. Each village unit was responsible for cultivation and management techniques.

Regulations concerning production were drawn up, and households signed an agreement to abide by these rules when embarking on the cultivation of rubber. If they failed to act upon infractions of these regulations, they would be fined, or if they continued to ignore warnings, they could even lose their land. A series of resolutions was issued to address certain concerns as they arose (Alton et al. 2005).

In 2001, the first experimental tapping was done by 6 -7 households, but more intensive tapping began in 2002. In 2004, rubber lumps sold for an average of about LAK5.5/kg. They were of low quality with a fair amount of dirt and small stones incorporated due to poor storage techniques (Alton et al. 2005).

In 2003, the village created a Village Rubber Welfare Fund (VRWF). A fee was levied to cover the administrative costs of the VRGA and compensate members for their work, and contributions were made to the village development fund (VDF). At first, this amounted to about 8 percent, of which 40 percent went to the VDF and 60 percent on VRGA administrative costs. This was revised in the 2004 season. It was agreed to levy a fee of LAK0.25/kg rubber lumps sold (i.e. about 4 percent of the value). Of the fees collected, 60 percent was earmarked for the VDF for people to borrow or use for community activities. Then the remaining 40 percent was used for the administration of the Collection and Sales Unit (CSU), including wages (Alton et al. 2005).

3.6.2. Government strategies

Laos is one of the poorest and least developed countries in East Asia. It has some of the worst social indicators among countries in the region. Income per capita is low at aboutUSD500 per annum in 2006, and poverty headcount ratio estimated at 33 percent in 2003 is high (Alton et al. 2005). Poverty incidence in rural areas is much higher than in urban areas; overall, the central parts of the country are generally better off than the southern and northern regions (Ketphanh et al. n.d.).

Government has identified agricultural development as a key strategy to eradicating poverty and advancing economic growth. Rubber tree cultivation is one alternative that can be promoted to this end. In support of this action, the Ministry of Agriculture and Forestry (MAF) has drafted the strategy for research on trees and non-timber forest products (NTFP) varieties including rubber trees. The government also has given foreign and local investors the opportunity to invest in rubber tree plantation (Alton et al. 2005).

The NSEDP 2006-10 has identified several ways of developing the Lao rubber industry, specific targets being the expansion of cultivation areas and increasing the volume of rubber exports.

Notable among these are attracting greater private sector investment in agriculture and rural infrastructure construction projects, development of the domestic rubber processing industry, and establishment of credit mechanisms that are more accessible to rural communities.

3.6.3. Rubber research and development policy

The international workshop on rubber development, held in Laos in May 2006,1 highlighted four imperatives where research and extension could play a significant role:

- The need to appropriately locate where rubber can be best planted along the landscape continuum, taking into account the required agro-ecological conditions and social parameters
- The need to develop a range of rubber-based mixed farming and AFS in order to spread out the risk from the "boom and bust" cycle of the crop
- The need to ensure quality control over planting materials through improved germplasm selection and production
- The need to improve local skills in latex tapping, processing, product storage and marketing.

The Rubber R&D Policy Thrust was one of the proposed strategies that resulted from the conference. Its overall aim was to rationalise the entry of rubber into mainstream research as part of the national strategy for economic development and rural reconstruction in the country. Its specific objectives were as follows:

1. Stir up initial interaction and dialogue among researchers, research managers, project planners and implementers within NAFRI and NAFES on how rubber research and extension should be situated in the overall R&D thrusts of both agencies;
2. Present rubber R&D domains for policy consideration;
3. Outline NAFRI and NAFES proposed future strategic directions or activities towards strengthening rubber R&D in Laos.

In formulating the Rubber R&D Policy Thrust, the framework depicted in Figure 3.1 below served as a guide to keep tight the flow and structure of the lines of action, i.e., looking from the macro national development perspective and down to what can be done at the agency or institute level.

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[1] This three-day Workshop on Rubber Development in Laos (Exploring Improved Systems for Smallholder Production) was organised by NAFRI in partnership with NAFES and NUOL, with funding support from SDC, SIDA and GTZ. It was attended by more than 200 participants from Laos and the region. Its overall goal was to impart to Lao policymakers and agricultural officials at national and provincial levels lessons about rubber development from the experiences of other countries in Southeast Asia and South Asia (see NAFRI, NAFES and NUOL 2006).

Figure 3.1: Rubber R&D policy framework

National Development Goal
This is an official motherhood statement based on Laos' national development plan, projecting a desired future scenario for the country towards economic progress and rural reconstruction.

↓

Rubber R&D Strategic Directions
These are the development areas where government's investment and logistic support should be directed most in order to make rubber a viable and profitable industry for national development.

↓

Activities/Plans
Specific activities towards achieving the R&D strategic directions with temporal (short-medium-long term), as well as geographical (area-based) dimensions. It may include both immediately attainable and prospective targets or outcomes.

Source: FRC (2006)

3.7. Constraints and opportunities

The following summarises some of the constraints on rubber plantation in Laos (Linkham et. al. 2008):

- Lack of knowledge on improved varieties and variety selection
- Lack of access to adequate and reliable information at the right time
- Lack of knowledge about suitable varieties for specific areas
- Lack of funds to expand planted areas
- Protest and conflict over land use regulations
- Conflict between permanent residents and migrants
- Insufficient water and electricity in villages
- Lack of knowledge about latex storage and processing techniques
- Low bargaining power of farmers
- No trade agreement between the Lao and Chinese governments
- Large concession areas over community-owned land affect land use planning and land allocation
- Weak research capacity and lack of expertise (rubber is a new crop for Laos).

Other problems and constraints beset the country's agricultural trade in general (Linkham et al. 2005); these include:

- Narrow export base dependent on low value-added agricultural exports
- Predominance of informal cross-border trade masks actual trade performance and prospects for growth, and represents loss in tax revenues
- Lack of competitiveness products in foreign markets due to low quality standards

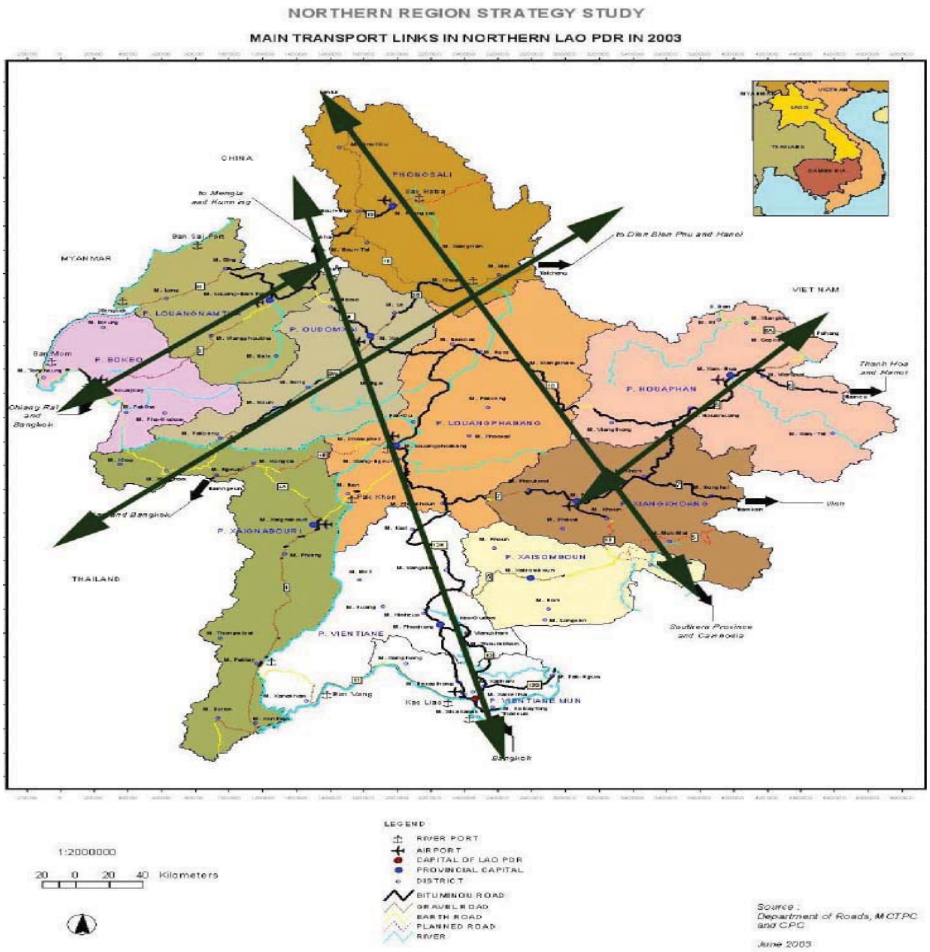
- Lack of trade promotion and export-linked incentives
- Ineffective law enforcement because of underdeveloped legal framework.

On a positive note, several opportunities can boost the rubber industry in particular and agricultural production and trade in general, including:

- Strategic location of Laos, particularly its position in the northern part of the GMS
- Rising incomes of the growing middle classes in China, Thailand and Vietnam
- Commitment of the government to poverty reduction through economic growth (including export promotion) while ensuring food security for the people.

The Lao government is seeking to diversify traditional farming practices and encourage adoption of more stable production systems, and therefore needs to identify solutions or alternatives for maintaining and improving household incomes in upland areas. The country has become more outward looking as it seeks to gain from the exploitation of its comparative advantages.

Map 3.2: Medium-term export opportunities



Note: Emerging trade routes:
Route 1: Kunming – Ho Chi Minh
Route 2: Hanoi – Bangkok
Route 3: North-South Economic Corridor: Kunming – Northern Thailand
Route 9: Xiengkung – Houphanh – Vietnam
Route 13: Kunming – Vientiane – Bangkok

4. Policy recommendations and conclusion

4.1 Policy implications of the research

Primary findings from this research provide useful and timely information to central and provincial authorities on the following:

- Smallholders are open to economic abuse by foreign and local rubber investors or traders due to their lack of experience in bargaining and contract farming, and their poor knowledge of rubber management. This constitutes a source of financial leakage from the country.
- Local banks play a vital role in providing fairer loans to smallholders, protecting them to some extent from exploitation by foreign companies. Without this support, smallholders would be even poorer than before rather than better off.
- Rubber monoculture, specifically its cumulative impacts, poses risks to the host areas, especially indigenous communities, environmental services and the National Eco-Tourism Pilot Project Areas. Rubber plantations on the steep slopes in the mountainous areas of the north expose communities to a high risk of land/mudslides during heavy rain. Moreover, rapid expansion of large-scale rubber plantation could adversely affect the health of natural forests and their biodiversity.
- Informal cross-border trade makes it difficult to determine the costs and benefits, and the future prospects, of rubber plantation. More research is required to be able to analayse the costs and benefits in detail.
- Non-readiness of the sector hinders the sustainable development of rubber production and its contribution to poverty alleviation and environmental sustainability. Research on appropriate rubber technology transfer is still at an early stage. The public trade sector has not provided the right market information to smallholders or extended training on market negotiation. Legislation to protect the rights and benefits of smallholders is lagging.
- Women play important roles in rubber production, generating family income from their jobs in the rubber industry in addition to ensuring their families' food security and well-being.

4.2. Policy considerations

Many regional experts (see NAFRI et al. 2006) point out that many considerations need to be taken into account when promoting rubber:

- Expansion of rubber needs to be carefully planned, taking into account appropriate agro-ecological conditions and market access. Such planning can increase the profitability and productivity of rubber while reducing negative environmental impact.
- A range of rubber-based, mixed farming and AFS should be considered to help spread the risk from the boom-bust cycle of rubber, ensure food security, and ensure environmental services (water, soil, biodiversity).
- Investors should be provided with guidelines and standardised contracts as the current investment policies and guidelines are unclear. In addition, there is no monitoring of how contracts are implemented. Contract schemes and concessions require strong

supervision, the absence of which jeopardises potential returns to the national economy and places farmers in economically unjust situations.

- Financing and credit are very important aspects of the package that needs to be provided to smallholders. Credit mechanisms need to be integrated into the rubber development plans from the outset.
- Alternative options and models for rubber development must be defined so that they reflect the diverse situations in Laos and respect the livelihoods and cultures of indigenous communities.
- Existing land use plans must be respected to ensure that rubber is not being planted in conservation forests, village forests, or areas not appropriate for rubber cultivation.
- Concrete guidelines and standards must be adopted to ensure that contract agreements are transparent and that contracts are economically, environmentally and socially beneficial.
- Policies related to rubber development must be enforced and their implementation monitored.
- National Agriculture and Forestry Research Center (NAFReC) and Provincial Agriculture and Forestry Extension Services (PAFES) should consider conducting a survey of the rubber research and extension needs of the northern, central and southern provinces.
- Smallholders, and research and extension providers, should consider a range of options, particularly AFS, for planting rubber.
- Poor farmers should be encouraged to adopt mixed farming systems through policy incentives and rewards for both smallholder and private investors.
- Implementation of an adaptive research-extension programme for smallholder rubber development should be prioritised.

4.3. Strategic options

To develop the growing of rubber and other crops in the area in a sustainable manner that contributes to poverty alleviation, halts opium cultivation, stabilises slash-and-burn shifting cultivation and secures environmental services, the following strategic options must be taken into account:

- Female and male farmers need to be trained in all aspects of rubber tree cultivation, including establishment, maintenance, tapping, processing, marketing, timber sales and negotiation. In processing, they should be made aware of the opportunities, costs and returns from selling other forms of rubber and expand higher value-added activities and skills, such as clean cup lumps, raw rubber sheets, raw liquid latex and smoked rubber sheets. There also needs to be training on how to set up a rubber growers' association, which could then become a cooperative.
- There is a need for the Agricultural Promotion Bank (APB) to establish clear policies and appropriate measures to enable farmers, such as rubber smallholders, to secure loans with a low interest rate and realistic period of grace.

- Technology transfer through the interaction of researchers, extension workers and smallholders is vital. There is a feed forward of field level realities related to cultivation, harvest and sales – the opportunities, problems, and constraints – from local community issues and needs to the extension system to technology transfer among researchers and local smallholders. The proposed experimental station in Luang Namtha province in northern Laos, or in any NAFRI networks representing the central and southern parts of the country, should constantly feed field information concerning opportunities, problems and constraints into the technology transfer research programme. Technology transfer could rely on expertise from China, Thailand, Vietnam or Indonesia, such as on intercropping, high yielding varieties, and the prevention of adverse environmental effects (i.e. mudslides and deterioration of soil structure).
- Benefit-cost analysis and environmental impact assessment of large-scale rubber plantation projects should be carried out before foreign and local investors are granted land concession areas.
- A network mechanism providing information and timely advice regarding price movements in world rubber markets and other related matters has to be set up in order to minimise financial leakages, fraud, waste and abuse in the rubber sector.
- Legislation that ensures the rights and profits of rubber smallholders, including security of land tenure, must be promulgated.
- Women's involvement in rubber production must be promoted and their capacity developed.
- More cost-benefit and cost-effectiveness analyses on rubber plantation development must be undertaken.

4.4 Other recommendations

Other recommendations that could be considered are as follows:

- Create a Rubber Technical Working Group (RTWG) at NAFRI to study and develop the summary outline of activities into action plans with timeframe and funding requirements
- Conduct a rubber multi-stakeholder consultative workshop with NAFRI, NAFES, GTZ and NUOL as the key institutions to review and refine the contents of the expanded document
- Form a special group at NAFRI to distill and translate the improved document into policy measures
- Present the proposed Rubber R&D policy measures to MAF
- With WTO accession, ensure preferential treatment for Lao rubber under Special and Differential Treatment (SDT)
- Ensure preferential treatment for Lao rubber within ASEAN
- Strengthen Laos' market position in China
- Encourage investment in production capacity

- Diversify production from natural rubber to value-added rubber products
- Expand the provincial fund programme across the country
- Improve smallholder access to finance (microfinance, ODA and government budget)
- Establish the Rubber Association under the Lao National Chamber of Commerce and Industry (LNCCI)
- Improve access to market information by, for instance, establishing a market information centre in the Provincial Trade and Industry Office.

4.5. Conclusion

An understanding of the rubber situation in Yunnan is vital as it has direct bearing on how the rubber system is driven in Luang Namtha. Every factor related to rubber, from technical advice, labour, seed supply, bud wood, equipment and other inputs to markets, comes from or is found in China. In addition, both small and large-scale rubber contracts are the result of Chinese businesses seeking lucrative opportunities in Laos. Therefore, although the Chinese market will continue to drive demand for rubber, Laos will need to closely follow the production of rubber in China and assess trends in rubber production systems (Linkham et al. 2008).

It may be that China views Laos as a strategic, albeit small, producer of rubber with abundant land resources, cheap labour and a favourable climate. Yet Laos' productive capacity pales in comparison to that of Thailand and Vietnam; technically, Laos has yet to attain even the most elementary level of knowledge about rubber (Linkham et al. 2008).

Rubber production seems to be good for long-term income generation because rubber is a priority product for Laos; it can be a stable income source for both the farmers and the national economy. The success of rubber production in Baan Hat Nyao is particularly encouraging together with the interest of investors in the country's rubber industry and the support of government in promoting the industry and attracting foreign investments. The proximity of the country to the Chinese, Thai and Vietnamese markets also presents massive opportunity for the expansion of the domestic rubber industry. The important thing is to put in place an effective policy on land-use planning and rubber investment that can facilitate the achievement of equitable economic growth and environmental sustainability (Linkham et al. 2008).

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Annexes

Annex 1: Existing and planned (2010) rubber plantations in Laos

Province	Rubber planted area (ha)	Plan for rubber planting (ha)	Investors
Phongsaly	13	14.000	-
Luang Namtha	8,770	20.000	SINO-LAOS RUBBER CO. LTD (China)
Bokeo	701	15.000	SINO-LAOS RUBBER CO. LTD (China)
Oudomxay	4,530	20.000	SINO-LAOS RUBBER CO. LTD (China)
Xayaboury	66	50.000	JPBPG (China)
Luang Prabang	2,467	2.000	-
Vientiane province	100	10.000	JPBPG (China)
Vientiane capital city	130	-	-
Bolikhamxay	1,026	-	-
Khammuane	1,447	-	-
Savannakhet	243	-	-
Salavan	1,418.8	19.840	Cao Su Dak Lak Company (Vietnam)
Champasak	6,719	13.000	Cao Su Dak Lak Company (Vietnam)
Sekong	100	10.000	Cao Su Dak Lak Company (Vietnam)
Attapeu	500	10.000	Cao Su Dak Lak Company (Vietnam)
Total	***28,230 ha***	***183.840 ha***	

Source: FRC (2007)

Annex 2: Introduction of rubber clones from China

Institute	Clone	Type	Yield (kg/tree/year)
CATAS	Reyan 7-33-97	High yielding/wind resistant	4.56
CATAS	Reyan 93-114	Cold resistant	-
	Haiken 1	High yielding/wind resistant	-
	Wenchang 217	High yielding/wind resistant	3.60
	Wenchang 11	High yielding/wind resistant	3.63
	Dafeng 95	High yielding/wind resistant	5.20
	Haiken 2	High yielding/wind resistant	5.89
Yunnan	Yuyan 77-4	High yielding/cold resistant	2.65
Yunnan	Yuyan 77-2	High yielding/cold resistant	3.46
Yunnan	Yuyan 277-5	High yielding/cold resistant	6.40

Source: CATAS (2006)

Agriculture Trade Study within the Greater Mekong Subregion: Thailand Case Study

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Agriculture Trade Study within the Greater Mekong Subregion: Thailand Case Study

1. Introduction

Poverty alleviation is one of the major goals of all countries in the Greater Mekong Subregion (GMS). This goal could be achieved through agricultural trade, which is crucial to poverty reduction and rural development. Although trade in the subregion has shown an increasing trend over the years as a result of trade and development cooperation among members, GMS countries remain at different stages of development. While Thailand, China and Vietnam have large commercial agricultural sectors, agriculture in Cambodia and Laos is still characterised by subsistence and semi-subsistence farming. Thus, there is huge potential for the further expansion of agricultural trade in the subregion. To achieve that goal, appropriate policies need to be implemented.

Cassava and rubber are emerging as important commercial crops to supply industry due to the growing domestic and international demand for raw materials. Both crops can generate higher farm incomes which, in turn, help to alleviate rural poverty. As a regional leader in cassava and rubber production and trade, Thailand is expected to be a key player in efforts to realise this potential.

This study is one of a series of studies conducted in other four GMS countries: Cambodia, China, Laos and Vietnam. It is part of a collaborative project intending to increase the efficiency of agricultural trade in the GMS and hence contribute to rural development and poverty reduction. The study provides insights into the production and marketing of cassava and rubber in Thailand.

The report is organised as follows: Section 2 describes the research design, sampling strategy, data collection and data analysis. Section 3 covers production trends, production costs and productivity and discusses the constraints on and opportunities for production. Sections 4 and 5 focus on trade and marketing aspects of cassava and rubber. The final section concludes and proposes policy recommendations to increase the efficiency of agricultural trade in the region.

2. Methodology

The study used a combination of quantitative and qualitative methods to examine how best to promote agricultural trade in the subregion. The study used both primary and secondary data. Primary data was gathered through field survey by interviewing various stakeholders along the rubber and cassava production and trade chains. Secondary data was collected from desk review of the literature and information obtained from government and non-government sources. While secondary data was used in the development of the research design and provided important information, the main findings of the study were derived from primary data collected through the survey.

The field survey was conducted in December 2007 for rubber and January 2008 for cassava. The surveyed site for each commodity was selected based on production figures obtained from the Office of Agricultural Economics (OAE), Department of Agriculture, Ministry of Agriculture and Cooperatives (MOAC). As the largest production areas, Nakhon Ratchasima province was selected for the study on cassava, and Surat Thani province was selected for that on rubber.

For cassava, 60 farmers from Pak Chong, Dan Kun Tod and Mueng districts (20 farmers from each district) in Nakhon Ratchasima were randomly selected for interviews using structured questionnaires. For rubber, 40 farmers from Kirirut Nikom and Don Sak districts (20 farmers from each district) in Surat Thani were randomly selected for interviews. The questionnaires collected information on farmers' characteristics, production practices, production costs, income, and farmers' perspectives of commodity production and trade. The study also included interviews with traders, processors and exporters at different stages along the marketing chains by using rapid marketing appraisal method.[1] Data analysis used both descriptive and statistical methods.

3. Production

3.1. Cassava

3.1.1. Production

Cassava was first introduced in southern Thailand as an intercrop on young rubber plantations. At that time, cassava was processed into starch and sago exclusively for domestic consumption. Once the rubber trees had matured enough to produce latex, there was insufficient sunlight to continue growing cassava and the crop was eventually phased out in southern Thailand. Later on, cassava was introduced in the eastern central plains from where the present cassava boom originated. After World War II, Japan demanded large amounts of raw materials and started to import cassava starch from Thailand. Eastern Thailand with its sandy soils and poor irrigation held much promise for growing cassava. However, the cassava planted area expanded and shifted from the central plain to the northeast along with growing demand from Europe for cassava products. About 55.2 percent of the cassava planted area lies in the northeast of the country, 30.2 percent on the central plain and 14.6 percent in the north.

Cassava is one of Thailand's major crops, in addition to rice, rubber, sugarcane, maize and palm oil. In 2007, with nearly 1.2 million hectares, Thailand produced about 26.4 million tonnes of fresh cassava valued at about USD857 million at farm gate prices. Despite periods of decline, the total harvested and production areas under cassava have increased over the last four decades (Figure 4.1). This growing trend can be divided into three periods:

1) 1961-1989: Thailand experienced a high annual growth rate of 9.9 percent, largely due to growing demand from export markets for dried cassava chips and pellets used for animal feed in West Europe. In 1989, the harvested area reached its peak of 1.6 million hectares with total cassava production of 24 million tonnes.

2) 1990-1998: The harvested area started to decline and production gradually declined in response to the reduction in harvested area. It was the EU Common Agricultural Policy (CAP) that drove this trend.[2]

3) 1999-present: in response to CAP, a national agricultural policy was implemented aiming to reduce planting and increase yields. As a result, the decline in the harvested area steadied at around 1000 hectares before increasing again in response to higher demand for cassava chips from China.

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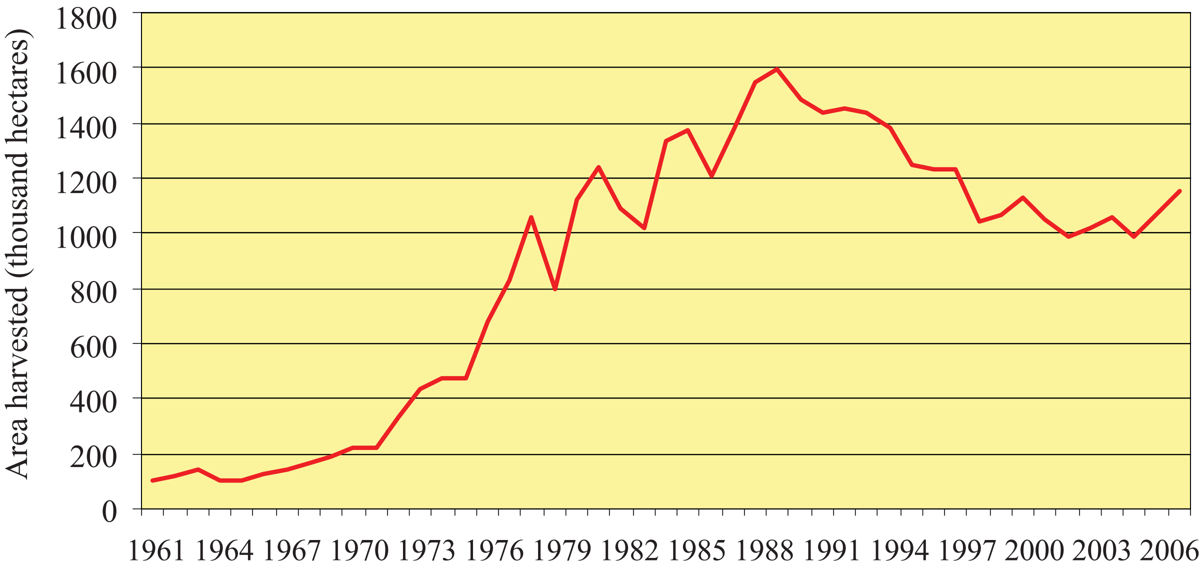
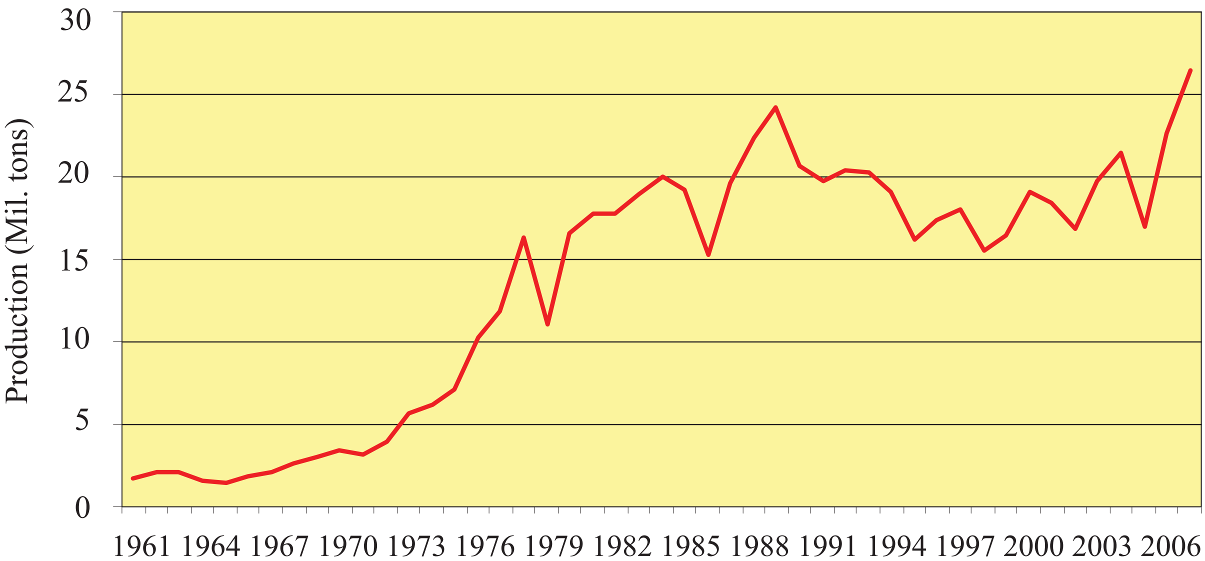
1 Rapid appraisal is a less structured data collection method aimed at supplying needed information in a timely and cost-effective manner (Kumar 1993).

2 The 1992 EU Common Agricultural Policy (CAP) reform cut agricultural subsidies, resulting in lower cereal prices in the region.

The high production growth rate during 1961-1989 was due to expansion of the planting area rather than increases in yield (Table 4.1). The cassava variety grown in Thailand at that time was a local variety the average yield of which was quite low at about 14 tonnes per hectare. Therefore, expansion of the planting area was the only way to increase production. In 1990-98, Thailand struggled to find new export markets to replace the EU, and cassava harvested areas and production declined. Fortunately, this decline was later compensated by a growth in starch production and increasing demand for cassava chips in China (Howeler 2006).

Figure 4.1: Cassava harvested area and production in Thailand, 1961-2007





Source: Office of Agricultural Economics, Department of Agriculture and Cooperatives

Total cassava production in 2007 regained its 1989 level but with only two-thirds of the 1989 harvested area. Noticeably, the growth rate of production was much higher than the expansion in harvested area, implying increasing productivity. The growth in yield over the last ten years was mainly due to the adoption of new high-yielding varieties and improved cultivation practices (Howeler 2006).

Table 4.1: Average annual growth rate (percent) in cassava harvested area, production and yield, 1961-2007

	1961-1989	1990-1998	1999-2007
Area harvested	10.4	-4.3	0.9
Production	9.9	-3.4	6.1
Yield	-5.5	0.9	5.0

Source: Author's calculation based on data from the Office of Agricultural Economics

In Thailand, cassava has made the transition from a staple food crop to a secondary product and a raw industrial material, while rice has remained a staple food crop. After harvesting, cassava roots must be processed to lengthen their otherwise short shelf life. Cassava roots can be processed into various products: the most common are cassava chips, pellets, starch and sago. Chips and pellets are mainly used as animal feed, while starch is used in food and paper industries. For many years, cassava pellets dominated domestic production due to high demand from the EU. Until recently, starch was likewise a dominant product as Thailand used about 50 percent of its annual cassava crop to produce cassava starch (Table 4.2). Almost half of the starch production is destined for domestic use, and the rest is for export. Cassava chips still play a significant role in cassava production, with about 80 percent of production exported and the rest used in the domestic animal feed industry. Cassava pellets are produced primarily for export because cassava chips are a cheaper source of raw materials for the animal feed industry.

Table 4.2: Estimated production and use of cassava roots (thousand tonnes), 2003/04

	Fresh root equivalent		Dry product				
		%	Total	Export		Domestic	
Fresh root production	22,748	100	-	-		-	
Chips	6,959	30	3,132	2,470	(79%)	662	(21%)
Pellets	5,811	26	2,557	2,557		0	
Starch	9,978	44	2,744	1,630	(59%)	1,114	(41%)

Source: Wattananonta 2006

3.1.2. Cultivation practices

The majority of cassava farms in Thailand are small-scale. There are no large-scale plantations because land accumulation is prohibited.[3] Data from the 2008 survey shows that the cassava planted area per farm ranges from 0.5 to 56 hectares. The average cassava planted area is 7.6 hectares, although the most common farm size is 1.6 hectares. Half of the farmers own their farmland. In addition, some farmers rent land to grow cassava. The average family size is 4.8 persons per household, and about 2 members or about 40 percent of family members (94 percent of whom are of working age) are engaged in cassava farming activities. Ninety percent of cassava growing households are in debt, mostly having borrowed money to invest in

[3] According to the Land Reform Act of 1975, the Agriculture Land Reform Office is empowered to confiscate any private land over 3.2 hectares which the owner is not using for agricultural purposes (Suehiro 1981).

agriculture. The main source of credit for farmers is the Bank for Agriculture and Agricultural Cooperatives (BAAC). Some processors give loans to farmers in the form of stakes or fertilisers at the beginning of the crop season. Farmers are expected to pay off their loans at harvest time by selling fresh roots back to the processors.

Majority of the cassava planted areas are in the drought-prone northeast where most areas have no irrigation; therefore, cassava crops are generally rainfed. Production practices are partially mechanised; ploughing and row preparation are done by machine, either owned or rented by the farmer, to save labour time and cost. Draught animals are not used at all but transplanting is still done by hand. Cassava is raised by planting stem cuttings. These cuttings are taken from stems at least 10 months old and 2.5-3.5 cm thick. Spacing between rows is about 80-100 cm, as recommended by local MOAC officials, but some farmers might set rows closer together. Spacing between plants is about 60-100 cm, depending on local conditions. Thus, the number of plants per hectare varies from 10,000 to 20,000. Based on the study findings, all the surveyed farms grow high-yielding varieties (HYV). The most common HYVs grown are Huaybong 60, Kasetsart and Rayong 72. Weeding is done by hand and herbicides are applied simultaneously. There was no evidence of pesticide use on cassava: unlike in other parts of the world, pests and diseases do not seriously affect the cassava crop. Currently, cassava is fertilised to maintain soil fertility. Ninety three percent of the farmers surveyed apply fertilisers, either chemical or organic. Fertilisers are applied 2-3 times during the crop cycle at an average rate of 312.5 kg per hectare per application. There are no general recommendations to ensure that the right balance of NPK (nitrogen, phosphorous, and potassium) is used. Farmers rely on their experience in the field or advice from officials, fertiliser traders and neighbours.

Cassava can be planted throughout the year. However, most crops are planted early in the rainy season (April to May) and only a few are planted late in the season (October). In order to obtain the highest starch content, cassava should be harvested at 10-12 months old. Therefore, most farmers harvest their crops between December and February. Before the tubers are harvested, the stems are cut off to be grown on or they are sold. The stems are bundled and can be stored for up to 3 months. Harvesting is done by using a tractor to loosen the tubers from the soil. Once exposed, the tubers are pulled out manually. The tubers are cut by machete, loaded onto trucks and transported to the processors; one worker can handle up to 1 tonne of tubers per day.

3.1.3. Production costs

Production costs are divided into fixed costs and variable costs. Fixed costs consist of land rent, depreciation and interest; variable costs consist of materials and labour. In our survey of 60 households, the average production cost for one hectare in the crop year 2006/07 was USD458.9 (Table 4.3). With an average yield of 20.8 tonnes per hectare and average fresh root price of USD46.7 per tonne, the average gross income was USD969.5 per hectare. This puts the estimated profit per farmer at USD510.6 per hectare per year. However, if opportunity cost were taken into account, the total production cost would be USD578.6 per hectare. The additional cost is attributable to family owned inputs such as land and labour.

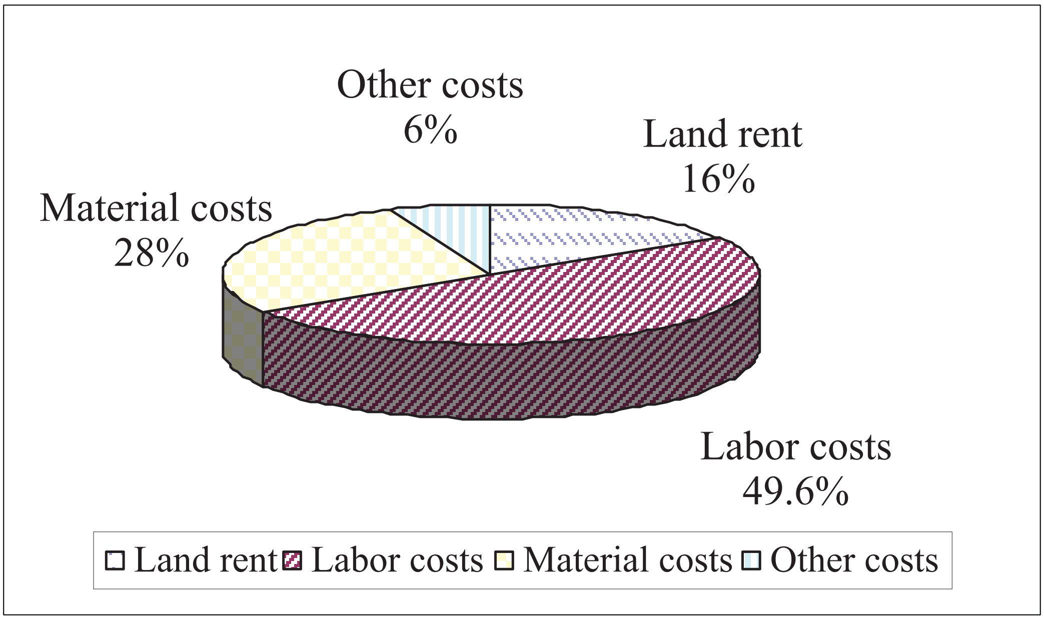
Table 4.3: Production cost of cassava, 2006/07

	Production cost (USD/ha)		
	Purchased input	Family input	Total
Land rent	46.2	48.9	95.1
Labour cost			
Land preparation	79.7	20.6	100.4
Labour for transplanting	29.7	3.2	33.0
Labour for crop husbandry*	44.8	14.6	59.4
Labour for harvesting	93.8	0.4	94.3
Seedlings	27.8	31.9	59.7
Fertiliser	78.0	0.1	78.1
Pesticide	23.1	0.0	23.1
Others (interest, depreciation)**	35.7	0.0	35.7
Total cost	458.9	119.7	578.6
Yield (tonnes/ha)	20.8	-	20.8
Average price (USD/tonne)	46.7	-	46.7
Gross revenue at farm gate (USD/ha)	969.5	-	969.5
Profit	510.6	-	390.9
Production costs (USD/tonne)	22.1	-	27.8

*Note: USD=34.51 baht in 2007; *weeding, and applying fertiliser and pesticide.*
*Source: Author's calculation based on data from the TDRI survey 2008;** estimated by Office of Agricultural Economics.*

Like most agricultural products, cassava production is labour-intensive. In 2007, labour costs accounted for about 47.6 percent of the total production costs, followed by material costs at 28 percent and land rent at 16 percent (Figure 4.2).

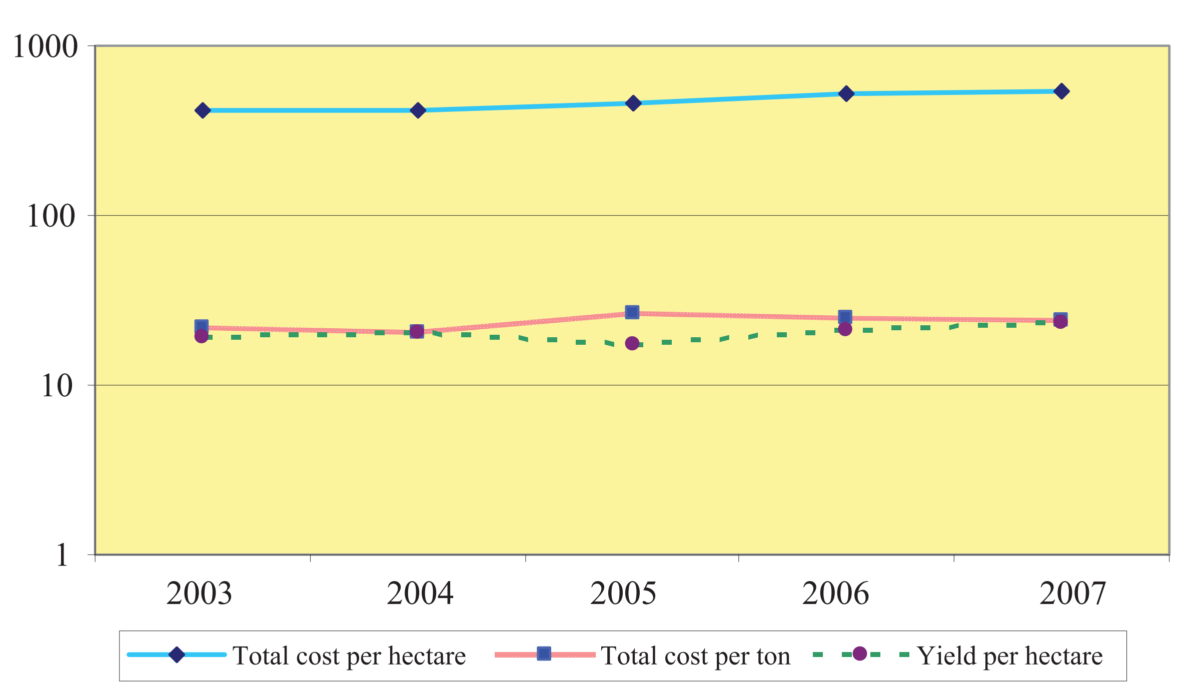
Figure 4.2: Proportion of total production costs, 2007



Source: Author's calculation based on data from the TDRI survey 2008

According to the OAE, average cassava production costs have been steadily increasing over the years (Figure 4.3). In spite of the increase in production costs per hectare, production cost per tonne has decreased. This means that farmers can produce more cassava at the same cost, implying increased efficiency in cassava production.

Figure 4.3: Cassava production costs per tonne and per hectare, and yield per hectare, 2003-07



Note: Graph is plotted on a logarithmic scale for ease of comparison; costs calculated at fixed exchange rate of 1USD=THB34.51.
Source: Author's calculation based on data from the Office of Agricultural Economics

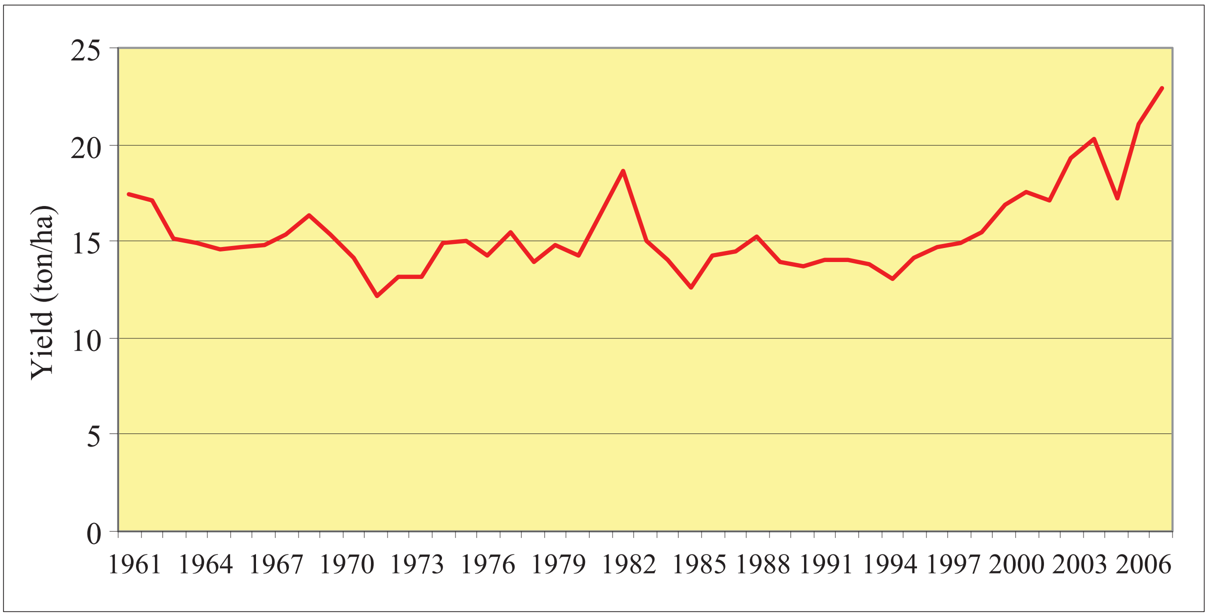
3.1.4. Productivity

Agricultural productivity is simply the yield or production per harvested area. According to the OAE, the average productivity of cassava was 22.92 tonnes per hectare in 2007. Cassava productivity has fluctuated but increased gradually over the years. In the last decade, the upward trend has been more obvious (Figure 4.4). Yield has increased from about 14 tonnes/ha in 1995 to 23 tonnes/ha in 2007, a 50 percent increase. Productivity fell in 2005, however. This was largely due to the unusually short rainy season that year resulting in a severe drought in the northeast, the largest cassava planting area in the country.

Besides yield, cassava productivity can be calculated by measuring the dry matter content (DMC) of the root. The DMC in fresh cassava root is determined by several factors:

- Cassava variety: high yield varieties (HYV) give a higher DMC than the local variety.
- Harvesting age: DMC of the root is highest when the cassava plant is about 10-12 months old.
- Harvesting season: DMC is higher during the dry season (November-April), and lower in the rainy season (May-October).
- Agronomic conditions: fertiliser slightly reduces DMC but increases yield.

Figure 4.4: Cassava productivity in Thailand, 1961-2007



Source: Office of Agricultural Economics, Department of Agriculture and Cooperatives

Productivity of processed cassava products depends on the quality of inputs and the starch content in the roots. For example, higher starch content reduces the drying time for making cassava chips and increases product yield. Normally, 1 tonne of fresh roots produces 450 kg of chips, 440 kg of hard pellets or 250-300 kg of starch. The technology used in cassava processing has not changed much over time. Although higher technology is available, it is very costly relative to product yield and quality. To ensure the quality of roots, some processors, usually starch factories, measure starch content at selling points.

3.1.5. Potential and policies

Both domestic and international demands for Thai cassava products are increasing. In the last few years, cassava trade volume in the world market has been positively affected by sharp increases in oil prices forcing many countries to take action to promote alternative sources of fuel. In China, several factories are using cassava for bioethanol production. Among the common raw materials for commercial ethanol production, cassava-ethanol has relatively high potential in China because cassava uses less land and is cheaper than maize and sugarcane. With the rapid growth of its alcohol and ethanol industries, it is projected that China's demand for dried cassava will reach 11-11.5 million tonnes by 2010, with an annual increase of 12-15 percent. The estimated gap between the demand and supply of dried cassava in China is as much as 7-7.5 million tonnes. Limited domestic production and high demand resulted in China importing large amounts of dried cassava and starch between 2001 and 2007 at average annual rates of 27 percent and 36 percent, respectively. In 2007, China imported from Thailand 2.6 million tonnes of dried cassava at a value of USD316 million, and 0.25 million tonnes of cassava starch at a value of USD70 million (Table 4.4). Recent implementation of the Early Harvest Programme (EHP) under the ASEAN-China Free Trade Agreement (FTA) also favours the import of cassava from Thailand.

Domestic demand for Thai cassava is only about 25 percent of total production but increasing as a result of several factors. First, to compensate for the decline in cassava pellet exports to the EU, the domestic use of cassava for animal feed in Thailand has been encouraged. Implementation, however, was very limited until the Animal Nutrition Research and Development Center (ANRDC) of Kasetsart University and the Thai Tapioca Development Institute (TTDI) decided to promote cassava as an animal feed though seminars, workshops, television and other media (Kanto and Juttopornpong 2002). Many domestic cassava processors now produce prime quality or clean cassava, a substantial portion of which is used for animal feed.

Table 4.4: Thailand's cassava export to China by type (thousand tonnes, USD million), 1999-2007

		Dried chips	Pellets	Flour	Starch	Cassava waste	Dextrin and other modified starches
Year	HS code	0714100906	0714100204	1106200	1108140	230310	350510
2001	Quantity	1,006.7	684.5	0.2	37.9	0.0	42.1
	Value	58.7	37.1	0.2	8.7	0.0	19.0
2002	Quantity	1,328.8	143.9	1.3	16.0	0.0	68.4
	Value	92.4	10.1	0.6	6.4	0.0	27.7
2003	Quantity	1,809.4	22.4	5.3	24.0	0.0	83.2
	Value	128.4	1.4	0.8	7.3	0.0	32.2
2004	Quantity	2,787.1	0.0	4.6	129.2	0.0	103.5
	Value	213.3	0.0	1.4	23.6	0.0	43.1
2005	Quantity	2,763.3	0.0	10.6	152.6	104.3	99.9
	Value	295.6	0.0	2.0	34.6	6.5	42.2
2006	Quantity	3,810.6	0.0	7.0	267.0	77.4	84.1
	Value	415.3	0.0	2.2	58.8	4.6	39.7
2007	Quantity	2,627.8	75.9	8.8	246.6	15.8	96.2
	Value	315.9	8.3	2.6	69.7	1.2	50.5

Source: Customs Department of Thailand

Second, around half of the present starch (both native and modified starch) production,[4] is used in domestic food and non-food industries, while the rest is exported. Cassava starch is used in a wide range of products in various industries such as paper, food and textiles. These industries are expected to expand due to the recent Japan-Thailand FTA, known as the Japan-Thailand Economic Partnership Agreement (JTEPA). Higher domestic demand for starch is also expected due to the expansion of linkage industries.

Lastly, with high crude oil prices, cassava has emerged as a commercially viable feedstock for ethanol production. In 2000, Thailand was one of the first countries in Asia to launch a package of energy efficiency proposals to reduce its dependency on imported energy. The development of renewable energy has been integrated into energy planning strategies for the long run (Suksri et al. 2007). Liquid biofuels, especially bioethanol and biodiesel, are the main renewable energy targets in Thailand. Bioethanol will be combined with regular gasoline to form "E10", also known as "gasohol".[5] In Thailand, bioethanol is mainly produced from molasses and cassava. Gasohol usage is promoted through managed price difference; the price of gasohol is artificially set at USD0.06 per litre lower than that of regular gasoline to induce a higher demand. The difference is formed by an exemption tax on ethanol. A special funding

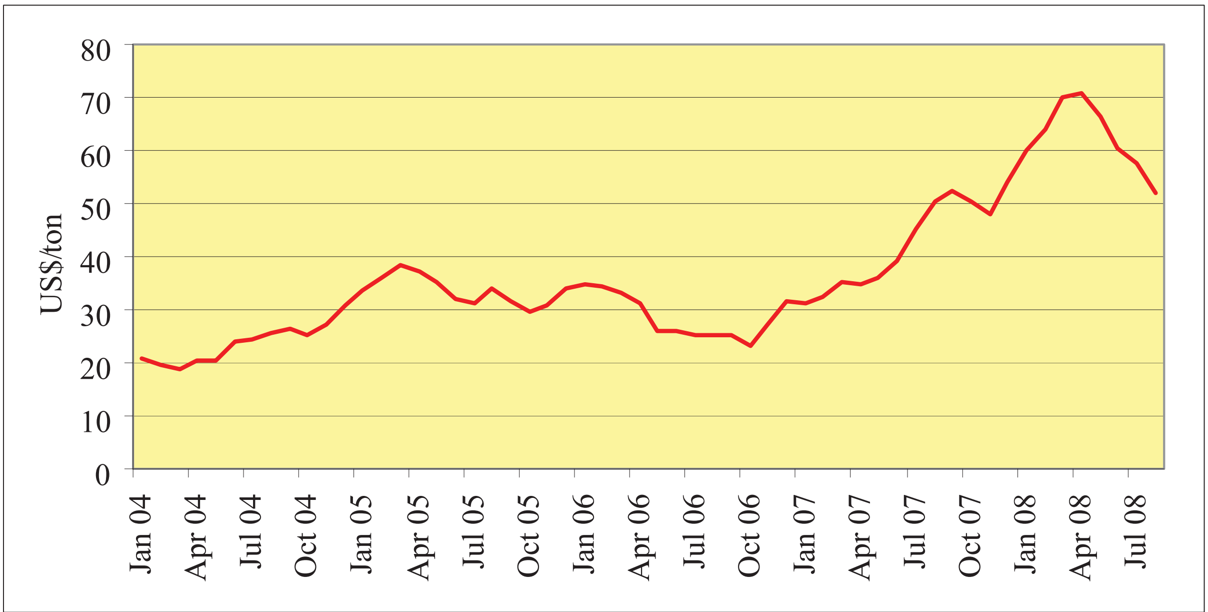
4 Cassava starch can be roughly categorised into native and modified. Native starch is just regular starch but modified starch is starch altered by physical or chemical treatment to give special properties for specific purposes.

5 Ethanol fuel mixture has an "E" number, which describes the percentage of ethanol in the mixture; E10 is a fuel mixture of 10% ethanol and 90% gasoline.

rate for oil fund[6] is also set on gasohol, which is less than half of that collected from regular gasoline. The MOAC estimates that ethanol consumption will increase as regular gasoline consumption increases from 0.3 million litres per day in 2005 and 1 million litres per day in 2007 to 3 million litres per day in 2011. As a result, the demand for cassava is expected to keep rising. Nonetheless, the potential increase in usage of cassava roots as raw material for ethanol has raised some concerns about how that might compete with and possibly reduce the supply of cassava to domestic flour and pellet producers (Bangkok Post 2008). With the government's full support, at least 25 ethanol-producing plants are scheduled to open in the next few years. The total expected ethanol output of about 7.8 million litres a day will require a supply of about 15 million tonnes of fresh cassava per year.

Thailand is the largest cassava producer in Asia and the largest cassava exporter in the world. Cassava is and will continue to be an economically important crop in the future. Recognising the importance of cassava, the Thai government has put in place various interventions to support cassava farmers. Most farmers harvest cassava at the beginning of the harvesting season. Resultant of the glut on the market during harvest, the price is usually low. To encourage farmers to harvest cassava in a timelier manner, a price insurance scheme helps to both prevent oversupply at the beginning of the season and smooth farm incomes. Under the cassava price insurance scheme, the price was USD39 per tonne in April 2007. The price intervention policy has worked fairly well in smoothing fluctuations in cassava prices. The average farm price during the 2007/08 crop year rose significantly from USD30 per tonne in early 2007 to USD70 per tonne in April 2008, the highest price yet (Figure 4.5). High price and strong demand encouraged farmers to expand the planting area of cassava in the next crop year by reducing that for maize and sugarcane. The OAE expects cassava production to reach 30 million tonnes in 2009.

Figure 4.5: Monthly average farm price of cassava, 2004-08



Source: Office of Agricultural Economics, Department of Agriculture and Cooperatives

6 The Thai government collects the Oil Fund and uses it to maintain domestic detail price levels by subsidising the difference between actual cost and actual selling price.

3.1.6. Constraints and opportunities

The study identified the following constraints and opportunities:

Constraints

- **Production cost.** Increases in land rent, wages and input costs especially chemical fertilisers add to production costs.
- **Poor market information.** Farmers are not in a position to negotiate the price. They generally take the price traders or processors offer, a problem commonly experienced in all agricultural subsectors.
- **Threat to soil quality.** Farmers grow cassava continuously on the same land without adequate fertilisation. Moreover, most cassava farmers have not adopted soil conservation practices. This could affect farm productivity.
- **Lack of marketing management and planning.** Most of the farmers surveyed do not have a marketing plan for selling cassava. The majority of cassava is harvested between December and February, causing oversupply on the market and driving the price down. In addition, the short shelf life of harvested cassava means that farmers' crops are undervalued.
- **Poor crop husbandry.** Cassava is a drought resistant crop that needs minimal care. Thus, farmers pay little attention to nurturing the plants. This can affect the quality of cassava roots. Proper care would improve the quality of the crop, adding value and increasing farm incomes.
- **Low-technology drying yards.** Processing is mainly dependent on sunshine and is therefore subject to the risk of uncertain weather.
- **Inconsistency of policy on ethanol and cassava production.** Forty-five ethanol plants in Thailand have permission to manufacture ethanol, 30 of which plan to use cassava. Eleven of the 45 plants are already operating but only one factory uses cassava while the others use molasses or sugarcane. This is due to the recent rapid rise in the price of cassava. Farm cassava prices were USD60-75 per tonne in early 2008, pushing the cost of producing 1 litre of ethanol to approximately USD0.64, far above the government-set price of USD0.52 per litre. Because of the high price of cassava, cassava-ethanol plants temporarily stopped running during the first quarter of 2008.

Opportunities

- **Wide use of HYVs.** HYVs are widely accepted by farmers. All cassava planting areas now use HVYs developed by Rayong Field Crops Research and Kasetsart University. This should raise farm productivity and yields.
- **Expansion in forward linkage industries.** The domestic market for cassava products continues to grow. The demand for cassava chips is going up, influenced the government's promotion of cassava chips as feed in the livestock industry, while the demand for starch is rising in response to the expansion of forward industries producing sweeteners, seasonings, textiles and paper.
- **China's economic expansion.** China has built its economic strength by investing in manufacturing industries and facilitating foreign trade. This required more raw materials

for industry. Cassava products from Thailand have high potential in China's market as versatile raw inputs.

- **ASEAN-China FTA.** China's elimination under the 2003 ASEAN-China FTA of the tariff on imports of cassava from Thailand has stimulated trade in cassava between Thailand and China.[7] In terms of value, cassava chip exports to China almost doubled between 2003 and 2004. Similarly, cassava starch exports increased from 24 thousand tonnes in 2003 to 129 thousand tonnes in 2004, and the export value increased threefold over the same period (Table 4.4). China is now the largest export market for Thai cassava.
- **Price incentive.** The price of cassava reached its highest level in history in 2008. The planted area is expected to expand in 2009 as prices continue to rise. Further, increased domestic and international demand for cassava will buoy the higher prices. Planting areas of other crops have increasingly been converted to grow cassava. In addition, more workers from other sectors have moved to the agricultural sector.

3.2. Rubber

3.2.1. Production

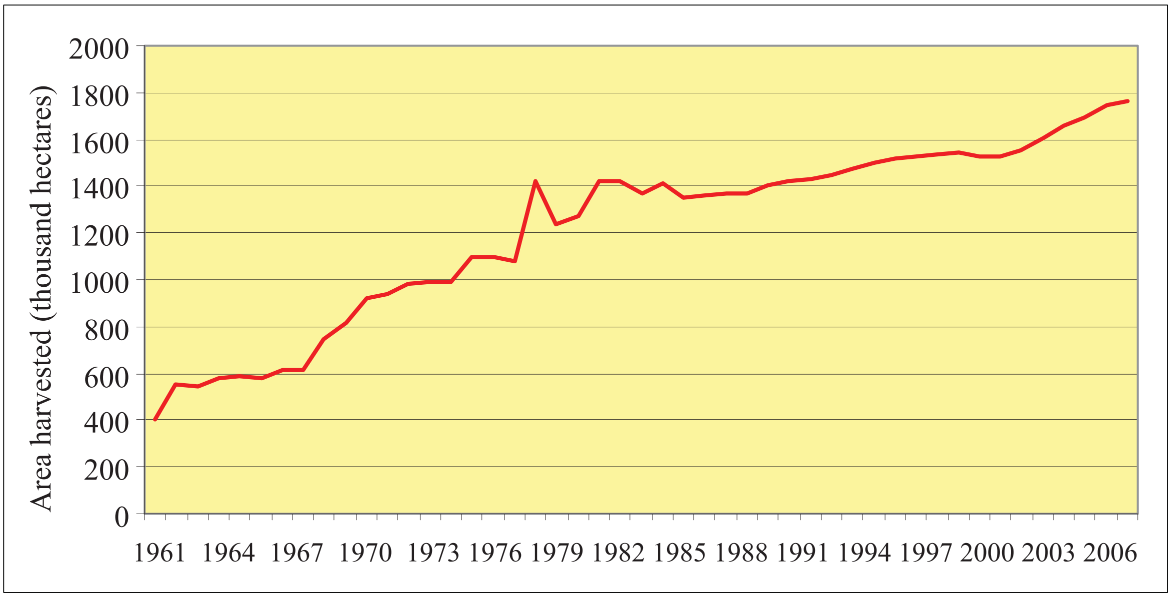
Rubber trees first came to south Thailand in the early 1900s, shortly followed by the establishment of rubber tree-breeding programmes. In 1908, rubber plantations expanded to east Thailand. At that time, integrated plantation was practiced where local rubber trees were grown along with other fruit trees. Realising the potential of rubber, the Office of Rubber Replanting Aid Fund (ORRAF) under the MOAC was established in 1960 to promote rubber planting. The rubber plantation pattern began to change from integrated plantation, which gives low productivity, to a rubber monoculture system utilising HYVs (Sayamol et al. 2007). Rubber became the major economic crop for farmers in south and east Thailand and rubber planting began to spread to other parts of the country. The planted area in south Thailand have about 72.4 percent of the total rubber plantation area, the northeast accounts for 13.9 percent, the central plain for 11.1 percent, and the north only 2.6 percent .

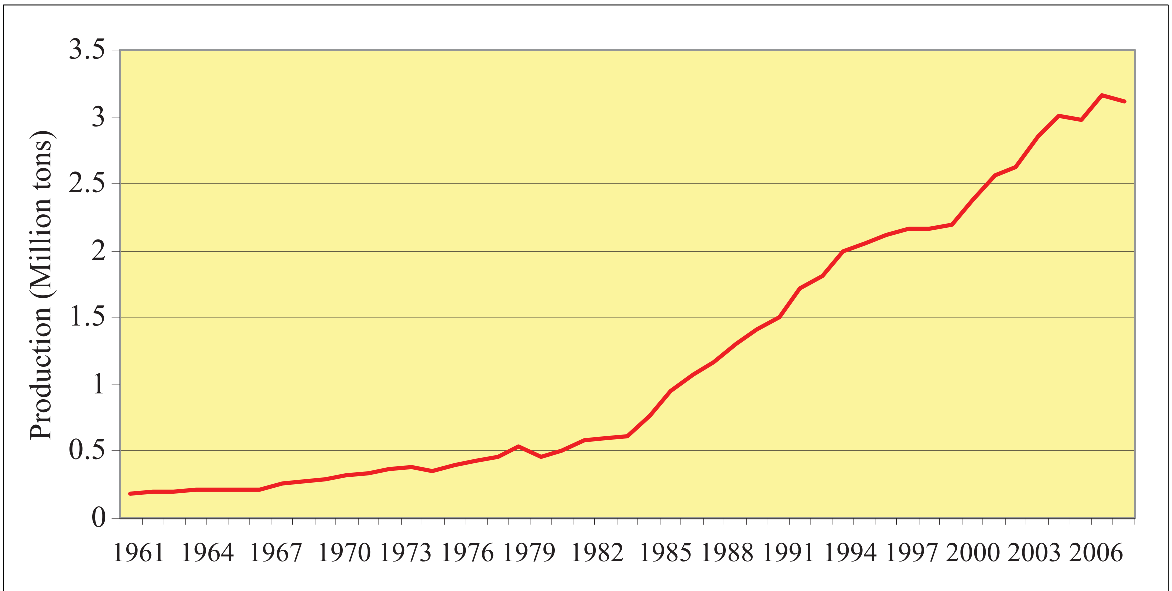
National production of rubber amounts to about 3 million tonnes a year with a harvested area of 1.8 million hectares. Total production value is about USD6 billion at farm gate prices. The aggregate area for rubber increased steadily with some minor setbacks in 1980/81. Rubber production during the last two decades has grown at an average rate of 5.5 percent (Figure 4.6).

Thailand became the world's largest exporter of natural rubber in 1991, overtaking Malaysia and Indonesia, and due to ORRAF's replanting programme, it has stayed in top position ever since. Major export markets are China, Japan, Malaysia and the United States. Most of the rubber produced is exported; only about 10 percent of production is used for domestic consumption (Table 4.5).

[7] Thailand and China have agreed to accelerate the tariff elimination under Early Harvest Program for vegetables and fruits (HS 07-08) on October 2003. Cassava products in HS 07 (cassava chips and pellets) are subject to zero tariff, but starch products (HS 11) are still subject to 10 % tariff.

Figure 4.6: Rubber area harvested and production quantity in Thailand, 1961-2007





Source: Office of Agricultural Economics, Department of Agriculture and Cooperatives

Table 4.5: Natural rubber production in Thailand (thousand tonnes), 1999-2007

Year	Production	Export	Domestic use	Stock	Import
1999	2,154.56	1,886.34	226.92	250.85	-
2000	2,346.49	2,166.15	242.55	188.64	-
2001	2,319.55	2,042.08	253.11	213.00	-
2002	2,615.10	2,354.42	278.36	196.68	1.35
2003	2,876.01	2,573.45	298.70	202.24	1.70
2004	2,984.29	2,637.10	318.65	232.56	1.77
2005	2,937.16	2,632.40	334.65	204.26	1.59
2006	3,136.99	2,771.67	320.89	249.90	1.20
2007	3,056.01	2,703.76	373.66	230.39	1.91

Source: Rubber Research Institute of Thailand

Rubber is processed into primary products such as rubber sheets, block rubber, crepe rubber and concentrated latex, which provide raw materials for the manufacture of downstream products such as vehicle tyres, rubber gloves, rubber bands and elastic rubber. Ribbed smoked sheet (RSS) was a dominant product in the country for many years, accounting for over 50 percent of the country's natural rubber production in 1999 (Table 4.6). The country has continued to produce about 1 million tonnes of RSS annually, but the production of higher-quality block rubber and concentrated latex has doubled in the last 10 years. In 2007, production of block rubber surpassed that of RSS, making block rubber the leading primary product. There are many grades of block rubber in Thailand, but STR 20 (standard Thai rubber) is the most common.

Table 4.6: Natural rubber production by type (thousand tonnes), 1999-2007

Year	Ribbed smoke sheet	Block rubber	Concentrated latex	Compound rubber	Others	Total
1999	1,141.90	624.80	300.64	8.25	78.97	2,154.56
2000	1,055.90	868.20	350.98	9.70	61.71	2,346.49
2001	951.02	869.83	440.71	5.79	52.20	2,319.55
2002	1,111.42	940.40	470.80	6.98	85.50	2,615.10
2003	1,225.17	1,029.60	494.68	37.10	89.46	2,876.01
2004	1,104.18	1,134.03	590.89	86.54	68.65	2,984.29
2005	1,005.70	1,240.27	585.30	36.72	69.18	2,937.16
2006	1,028.93	1,192.06	697.98	138.16	79.87	3,136.99
2007	957.34	1,218.33	663.93	151.44	64.98	3,056.01

Source: Rubber Research Institute of Thailand

3.2.2. Cultivation practices

Rubber trees are perennial tropical plants. In general, plantation trees live for around 32 years, immature period of 7 years and a productive period of 25-30 years. Smallholdings account for 93 percent of all rubber plantations in Thailand (Somboonsuke et al. 2007). In 2007, at the time of the survey, the average size of farmers-owned rubber planted area was 3 hectares (in a range of 0.5 to 15.7 hectares). Each farmer owned, on average, about two plots of 2.1 hectares. The average family size was 3.9 persons per household. Of the household members engaged in farming activities, 68 percent were of working age. Seventy two percent of the farm households engaged in rubber planting were in debt. BAAC was the main source of credit for rubber farmers.

New rubber plantations are located in cleared forest or matured rubber estates. Rubber trees require good drainage and deep, rich soils. The planting pattern depends on the topography. Rectangular planting in lines is suitable on flat land, while planting on undulating land should be done in rows across the slope along contour lines (Albarracin et al. 2006). Land preparation is mechanised, but transplanting is manual. Polyclonal seeds, budded stumps, and poly-bagged plants are used for planting. Poly-bagged planting, available on local rubber tree-breeding farms, has become popular because it is easier, saves time and provides earlier yield. From the survey, the most common HYV used by farmers was RRIM 600, which is extensively promoted by ORRAF. A planting hole is generally 50cm x 50cm x 50cm, spacing between rows is about 6-8 metres, and spacing between plants is 2.5-3 metres depending on land conditions. The planting density is around 375 to 470 plants per hectare. Some plantations intercrop rubber saplings with bananas, vegetables or mangosteens. Weeding is recommended, especially in the first year of planting. Weeding is done by hand or machine, or by applying herbicide, or a combination of these. Fertiliser is applied once or twice a year during the rainy season.

The Department of Agricultural Extension recommends that rubber trees are ready for harvesting once the trunk attains a girth of 50 cm at a height of 150 cm above ground level, usually in year seven. Tapping is preferably performed in the early morning because the trunk produces more latex at that time (Rayong 2003). The recommended tapping system involves one-half spiral cut every other day. However, most of the farmers surveyed use one-third spiral cut every 3 days followed by 1 day's rest. This is because a one-half spiral is difficult to perform. Moreover, alternate daily tapping generates less income. Labourers come from the immediate locality; their pay is calculated as a percentage of sales, usually 40-50 percent depending on negotiation with the owner, regardless of the official minimum wage rate.

3.2.3. Production costs

Production costs of rubber can be divided into two stages—.years 1-6, and years 7-35. The first stage involves the costs incurred while the rubber saplings are becoming established and are not ready to produce latex. Usually lasting for 6 years, it might only take 5 years in some regions depending on soil and weather conditions. The major cost items in year 1 are land preparation and seedling and the main costs incurred in years 2 to 6 are associated with crop husbandry (weeding, applying herbicides, pesticides and fertilisers). Based on data for 2006/07 gathered from the survey, the production cost of young rubber is USD288.1 per year per hectare on average, excluding family inputs (Table 4.7). There is no land rent, since most of the farmers surveyed own their land.

Table 4.7: Production cost of rubber, 2006/07

	Production cost (USD/ha)		
	Purchased input	Family input	Total
Years 1-6			
Land rent (per year)	0.0	78.2	78.2
Land preparation			
Land clearance	316.9	0.0	316.9
Ploughing	104.0	0.0	104.0
Seedlings	246.0	0.0	246.0
Labour cost			
Labour for transplanting	6.2	54.7	60.9
Labour for caring (per year)*	55.6	57.1	112.7
Fertiliser (per year)	103.7	0.0	103.7
Pesticide (per year)	16.7	0.0	16.7
Total cost per year (for 1-6 year)	288.1	144.5	432.6
Year 7-25			
Year 7-35	42.5	39.3	81.8
Labour for caring (per year)	842.9	0.0	842.9
Labour for harvesting (per year)**	163.9	0.0	163.9
Fertiliser (per year)	17.5	0.0	17.5
Pesticide (per year)	120.0	0.0	120.0
Tapping equipment	139.4	0.0	139.4
Others (interest, depreciation)**	1,326.1	39.3	1,365.4
Total cost	1.7	-	1.7
Yield (tonnes/ha)	774.3	-	797.3
Production cost (USD/tonne)			

*Note: 1USD=THD34.51 in 2006/07; *labour includes weeding, fertilising, pesticide.*

*Source: Author's calculation based on data from the TDRI survey 2007; ** estimation by Office of Agricultural Economics.*

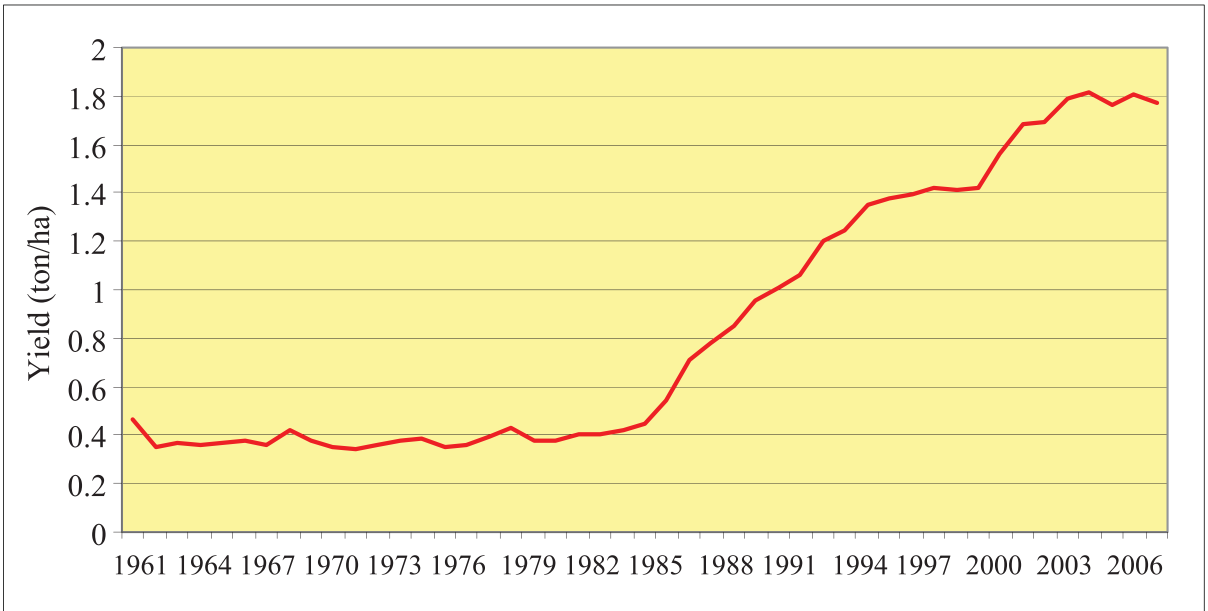
Costs in the second stage are those incurred from when the rubber tree begins producing latex, usually in year 7. The productive life of a rubber tree is 18-35 years, depending on tapping methods. Again, based on the 2006/07 data gathered from the survey, average production cost is about USD1326 a year. The major cost is labour, particularly labour for harvesting. With a yield of 1.7 tonnes per hectare, the production cost is about USD774.3 per tonne. Interestingly, the cost of production during this period mostly entails the cost of purchased inputs. Moreover, the production cost varies from time to time as a result of variation in the harvesting cost. The wage of rubber tappers is associated with the revenue from latex sales, ranging from 40 to 50 percent of revenue, depending on location and tappers' skill.

Generally, rubber farmers have three options after harvesting: selling fresh latex, processing field latex into air-dried rubber sheets (ADS) before selling, and selling rubber residues or cup lumps. Compared with fresh latex, the production of ADS and cup lumps involves additional costs. To produce air-dried rubber, the farmers incur an additional processing cost of USD156 per tonne; in producing cup lumps, farmers incur additional cost of the chemicals used in the process.

3.2.4. Productivity

According to OAE, in 2007 the national average yield of natural rubber was 1.77 tonnes per hectare. Overall, the productivity of natural rubber has significantly increased over the years (Figure 4.7). Yield during the 1960s was quite stable at about 0.4 tonnes/ha. In the early 1980s, yield started to rise at very high growth rates. This was a result of the promotion of HYVs and proper farming practices by ORRAF, and the suitable climate in south and east Thailand.

Figure 4.7: Rubber productivity in Thailand, 1961-2007



Source: Office of Agricultural Economics, Department of Agriculture and Cooperatives

3.2.5. Potential and policies

Rubber is an important component of many products in the manufacturing sector. Natural rubber production in Thailand represents about one-third of world production. Thailand is the world's largest rubber exporter; about 90 percent of domestic production is exported. The International Rubber Study Group (IRSG) forecasts a 4.4 percent annual growth rate in world rubber consumption between 2007 and 2009. The rise in global rubber consumption is a consequence of economic expansion in emerging markets such as China and the rising price of crude oil. The rise in the crude oil price increases the production cost of synthetic rubber, a substitute for natural rubber in the tyre industry. Thus, the demand for natural rubber in the tyre industry goes up to compensate for the reduction in the demand for synthetic rubber.

Like other raw material markets, the natural rubber market is influenced by the growing demand from China., China can produce only 600,000 tonnes of natural rubber, which is not sufficient to meet its exceptionally high demand (Table 4.8). In 2007, China's natural rubber import volume increased to 1.55 million tonnes, almost double that of the year 2000. Since 2003, China has surpassed the United States as the largest rubber importer (Table 4.9) and has been the world's largest consumer of rubber ever since. This resulted from the rapid growth of the automobile industry and road construction in China. Imported natural rubber is mainly used to supply the automobile industry and newly-built roads linking provinces in China.

Table 4.8: World rubber production by major countries (thousand tonnes)

	2000	2001	2002	2003	2004	2005	2006	2007
Thailand	2346.4	2319.6	2615.1	2876.0	2984.3	2937.2	3137.0	3063.0
Indonesia	1501.1	1607.3	1630.0	1792.2	2066.2	2271.0	2637.0	2,797.0
Malaysia	927.6	882.1	889.8	985.6	1168.7	1126.0	1283.6	1201.0
China	445.0	478.0	527.0	565.0	573.0	510.0	533.0	600.0
Vietnam	291.0	312.6	331.4	363.5	419.0	468.6	553.5	602.0
India	629.0	631.5	640.8	707.1	742.6	771.5	853.3	811.0
Others	589.9	1,018.5	723.3	758.3	794.2	797.7	678.6	413.8
Total	**6764.0**	**7332.0**	**7337.0**	**8033.0**	**8756.0**	**8892.0**	**9686.0**	**9893.0**

Source: International Rubber Study Group, 2008

Table 4.9: World rubber import by major countries (thousand tonnes)

	2000	2001	2002	2003	2004	2005	2006	2007
United States	1191.6	972.1	1110.3	1077.0	1143.6	1159.2	1003.1	1018.4
Japan	801.5	713.3	771.8	791.8	800.7	848.6	885.9	849.0
China	820.4	943.3	914.7	1149.6	1205.9	1329.2	1505.6	1547.0
South Korea	330.8	330.3	323.4	332.6	351.7	369.8	363.6	377.3
Germany	250.1	245.3	242.6	260.3	242.3	263.0	269.2	268.3
Others	2035.6	1996.7	1959.2	2088.7	2233.8	2284.2	2324.6	2437.0
Total	**5430.0**	**5201.0**	**5322.0**	**5700.0**	**5978.0**	**6254.0**	**6352.0**	**6497.0**

Source: International Rubber Study Group, 2008

Similar to the trends in production, the structure of natural rubber export from Thailand to China has changed in recent years. In 2003, Chinese imports of block rubber (or technical specified natural rubber[8]) dominated that of smoked sheet rubber (Table 4.10). Many tyre manufacturers in China prefer block rubber because it is cheaper than RSS. Moreover, RSS is produced by farmers and graded visually by traders; thus the quality of RSS is inconsistent. By contrast, block rubber is manufactured in factories and graded according to its properties. Block rubber can be made with specified properties for a particular usage.

[8] Technical specified natural rubber or block rubber was introduced in Thailand in 1968; it is known as standard Thai rubber (STR). STR is available in five grades: STR-5L, STR5, STR10, STR20 and STR20CV. Only two grades, STR5L and STR20, are traded in significant volumes.

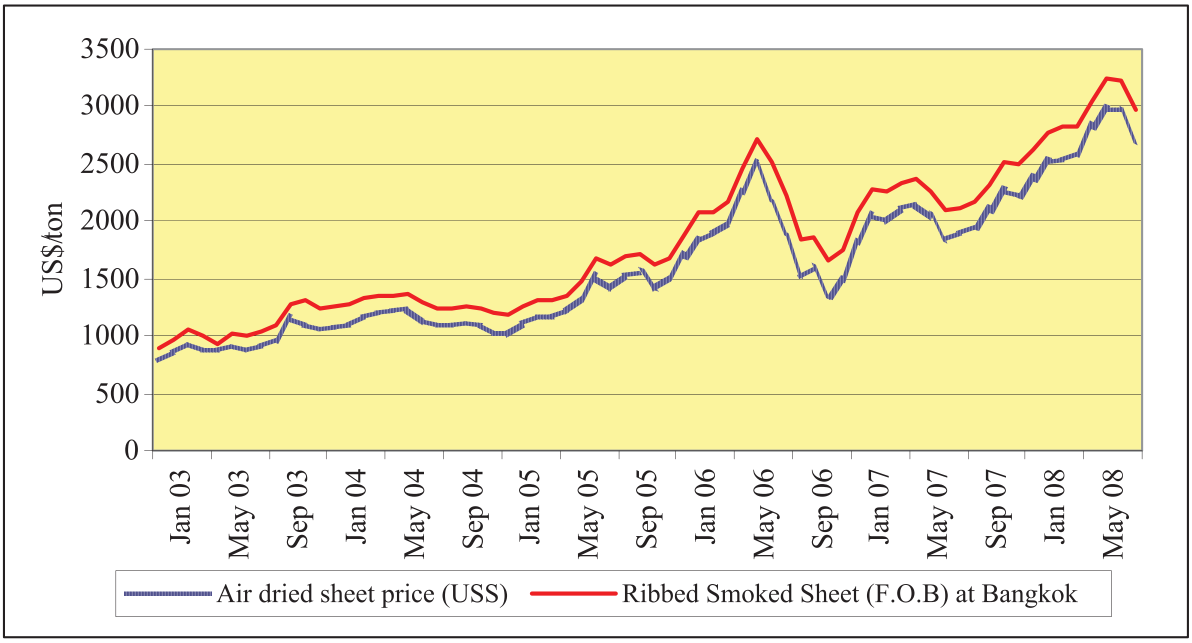
Table 4.10: Thailand's rubber export to China by type (thousand tonnes, USD million)

		Rubber concentrated latex	Smoked sheet grade 3	Block rubber (TSNR)
Year	HS code	4001100	4001210	4001292
2001	Quantity	63.6	252.0	172.5
	Value	30.2	137.5	93.8
2002	Quantity	55.7	272.5	168.1
	Value	31.4	192.4	118.3
2003	Quantity	99.7	312.4	294.5
	Value	79.1	312.2	287.2
2004	Quantity	124.1	224.3	281.9
	Value	111.8	278.7	342.1
2005	Quantity	123.8	173.3	301.8
	Value	130.3	243.2	406.1
2006	Quantity	191.3	221.5	311.4
	Value	260.3	438.4	607.8
2007	Quantity	145.1	156.7	312.1
	Value	219.8	334.6	660.8

Source: The Customs Department of Thailand

China expects domestic rubber production to reach 780,000 tonnes by 2010, but it does not have sufficient suitable land to grow enough rubber to meet this demand. Therefore, China has adopted policies that encourage investment in rubber plantations in neighbouring countries such as Laos and Myanmar. The area of rubber plantations under Chinese investment amounts to around 1333 hectares and is expected to expand in the near future. However, it will be at least 6 years until these plantations can start producing latex. In the short run, therefore, Thailand will very likely continue to play an important role in serving the huge demand of China.

Figure 4.8: Average monthly price of rubber, 2003-08



Source: Office of the Rubber Replanting Aid Fund

As noted earlier, only 10 percent of Thailand's total rubber production is used for domestic consumption. Most of the rubber production is used in the manufacture of products such as tyres and inner tubes for cars and motorcycles, latex gloves and rubber bands. Thailand's rubber product industry has largely grown in response to rising international and domestic demand. The price of rubber in local and international markets has increased steadily despite some temporary downturns (Figure 4.8).

ORRAF has encouraged farmers to grow rubber, promoting recommended varieties and agronomic practices to increase productivity. Rubber plantation owners are provided USD2000 per hectare to finance the replacing of local varieties with HYVs. The replanting fund is collected from rubber exporters at the rate of USD40 per tonne of rubber exports.

Recently, the government launched a 3-year rubber planting promotion project, from 2004 to 2006, known as the One Million Rai Project. The project aims to establish new rubber plantations of 48,000 hectares in the north and 112,000 hectares in the northeast. The government provides farmers with 563 seedlings per hectare and arranges affordable loans at zero interest rate for the first seven years. It is expected that the new plantations will start producing rubber latex in 2010, with production possibly totaling 200,000 tonnes per year. This is expected to meet the estimated rise in world demand for rubber, at 300,000-400,000 tonnes per year (Daily News 2007).

3.2.6. Constraints and opportunities

The survey identified the following constraints and opportunities:

Constraints

- **Lack of skilled tappers.** Inappropriate tapping methods could lower productivity and damage rubber trees. High demand for skilled labour drives up wages, resulting in higher production costs.
- **High cost of other factors of production.** Higher fertiliser prices result in higher production costs. Fertilisers, HYVs and chemicals are in short supply.

Opportunities

- **Area expansion in the north and northeast.** The government project to promote rubber planting in the north and northeast is expected to increase rubber production to serve growing demand for rubber from China. Farmers in the north and northeast would also benefit from selling rubber products as an alternative crop.
- **Timber production.** Rubber wood from old rubber trees is becoming increasingly significant as a source of extra farm income. Around 80 percent of Thai rubber wood is exported, mainly to China and Vietnam; the rest is used in Thai furniture factories (Albarracin 2006).

4. Trade

4.1. Cassava

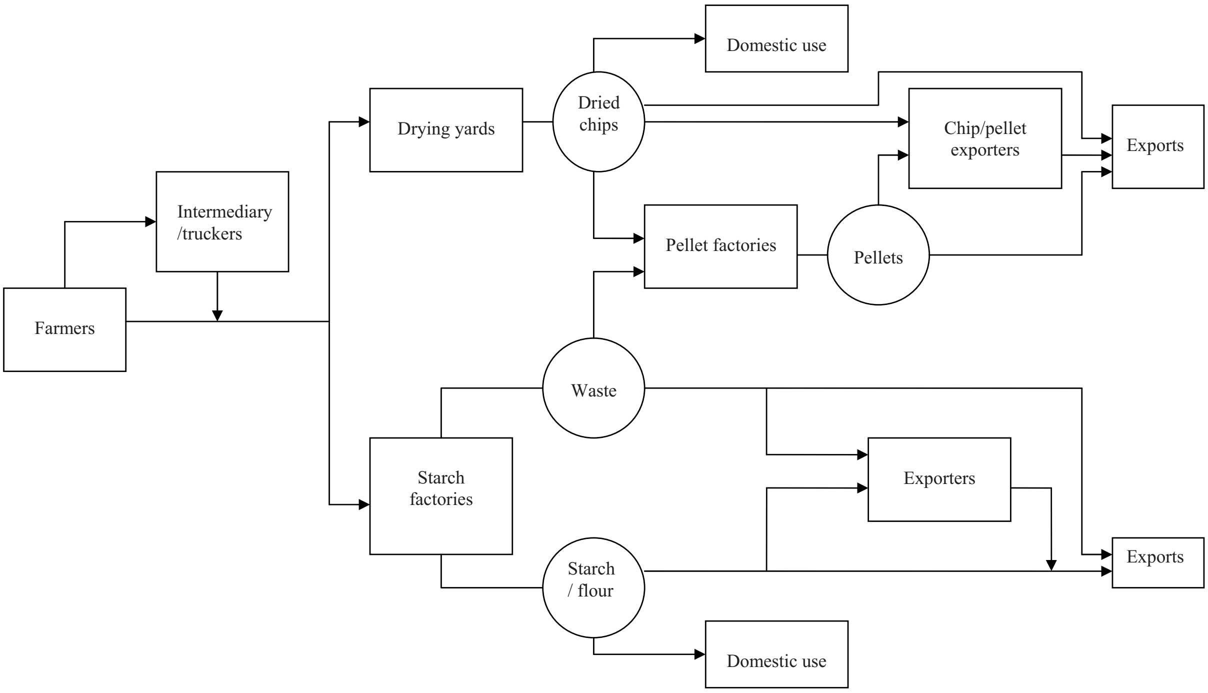
4.1.1. Marketing chains

Figure 4.9 depicts the structure of the cassava market chain in Thailand. The following explains the roles of each player along the chain and the relationships between them

Farmers

Farmers sell all of their fresh cassava either directly to cassava processors or indirectly through local intermediaries or truckers. Fresh roots are perishable and are therefore sold and delivered to factories on the day of harvesting. Farm trucks or six-wheeled trucks transport fresh roots from farm to factory. The trucks can deliver up to 10 tonnes per trip. The distance from farm to factory is normally less than 50 km. Unless they sell their produce to an intermediary, famers pay the cost of transport. In some cases, the processor might cover transport costs to provide an incentive for farmers to sell their produce when market supply is low.

Figure 4.9: Cassava marketing channel



Source: TDRI survey 2008

Intermediaries/truckers

Intermediaries collect cassava roots from farmers and deliver roots to processing factories in the locality or in other provinces. In the past, farmers usually used intermediaries to deliver fresh roots to the factories. As a result of improved transport and infrastructure, farmers can now choose to deliver fresh roots to the factories themselves, in which case they get the full factory gate price without deductions from intermediaries Some truckers also operate as intermediaries. offering both transport and harvesting services to farmers who do not have the time or tools to harvest their crops themselves. The truckers pay farmers a lump sum amount per harvested area.

Processors

The cassava factories can be categorised, by finished product: chips, pellets and starch.

Chipping factories, also known as drying yards, are typically small-scale located near cassava farming areas. The factories use simple equipment such as choppers, tractors and trucks. The trucks carrying fresh roots are weighed upon arrival at the drying yard. The fresh roots are then offloaded and the truck is weighed again to calculate the weight of the roots. The roots are transferred to the choppers by tractor. Then, the chopped roots are moved to a cement floor where they are spread out manually by rake to dry. Drying normally takes 2-3 days in sunny weather (it takes longer if it rains). During drying, chips are turned frequently by a special tractor to ensure consistent drying. Cassava chips normally lose approximately 50-60 percent of their weight during drying. Therefore, it takes about 2.00-2.50 kg of fresh roots to produce 1 kg of chips, depending on starch content. Cassava chips are either exported (directly or through exporters) or sold to pellet factories for further processing. Ten-wheeled trucks are used to deliver cassava chips to exporters or seaports. Transport cost depends on distance and product weight.

The production of cassava pellets causes less air pollution than that of cassava chips which creates more dust. Main inputs are cassava chips and some cassava waste from starch factories. The price of cassava chips price is set in relation to the export price of cassava pellets in Bangkok. Cassava pellets are transported in the same as cassava chips.

Starch factories are usually medium- to large-scale enterprises. Farmers deliver fresh roots to nearby factories, or ones offering the best price, by farm trucks or six-wheeled trucks. The roots are weighed in the same way as in chipping factories, and then checked for quality by measuring the starch content. The price will be reduced if the starch content is below the level agreed. Some starch factories compensate farmers or truckers for transport costs. The starch production process, from root to starch, only takes 45-60 minutes. The flour is packed in various size sacks according to the customer's order. Domestic distribution from factories to customers relies on ten-wheeled trucks. Starch for export is packed into 20-foot containers (from an international carrier) for overland freight by train[9] or trailer to Bangkok and Laem Chabang ports where they are loaded onto cargo ships. The process must not exceed five days, according to the requirement by carriers. Transport cost depends on distance and product weight.

Exporters

Most starch factories are also exporters in their own right. The exporters discussed in this section mostly refer to chip/pellet exporters or traders. Exporters are located mostly in the central region close to the seaport. Exporters mainly collect cassava chips/pellets from the factories and store the products in warehouses. To save on transport costs, exporters stockpile products until they have enough for a bulk load, which is usually 1500 tonnes. Bulk carriers that operate over inland waterways then transport the products to port. Transport cost depends on distance and product weight.

4.1.2. Costs and margins

Information on costs and margins was gathered from various stakeholders along the marketing chain. Note that some information was not available at the time of survey; therefore, some of the figures stated below are approximate real values. Since most of the farmers surveyed deliver fresh roots directly to processors, for simplicity, the study assumed that there are no intermediaries in the marketing chain. This section discusses costs and margins for cassava chips and cassava starch, Thailand's major export products. The transport costs provided in the tables are the costs of a single trip. The distance from factory to farm ranges from 0-50 km. The average distance from factory to exporter (Nakhon Ratchasima to Bangkok) is 260 km.

[9] Only for some factories in Nakhon Ratchasima.

Cassava chips

Table 4.11 shows the marketing costs and margins of cassava chips, from farmer to port of shipment. Based on data gathered from the survey, on average, farmers bear production costs of USD50.70 to produce the fresh root equivalent of 1 tonne of chips. A farmer selling fresh roots to a drying yard at USD129.90 per tonne incurs a margin of USD79.21, divided into transport cost (USD12.67) and profit (USD66.54). Drying yards sell chips for USD151.18 per tonne, giving a margin of USD21.27. The margin for drying yards can be divided into labour cost, fuel cost, transport cost, profit and others. The export price (FOB) of cassava chips is USD170, leaving a margin of USD18.82 for the exporters. Overall, the marketing costs for the whole chain consist of transport, labour, fuel and handling. These costs vary from one agent to another along the marketing chain. For example, the transport cost for farmers is USD12.67 per tonne compared to USD9.05 per tonne for drying yards.

Notably, the cost of producing the fresh root equivalent of 1 tonne of cassava chips is only about 30 percent of the export price. That leaves a marketing margin of about 70 percent along the whole chain. It was also observed that farmers have the largest margin and receive the highest profit compared to the drying yards and the exporters.

Table 4.11: Marketing costs and margins for cassava chips (USD/tonne)

Description	Total	Percentage
Production costs	**50.69**	**29.82**
Farmer margin	**79.21**	**46.59**
Transport cost	12.67	7.46
Profit	66.54	39.14
Average farm price at office	**129.90**	**76.41**
Drying yard margin	**21.27**	**12.51**
Labour	3.02	1.78
Fuel/electricity	2.41	1.42
Transport cost	9.05	5.33
Others	0.81	0.48
Profit	5.97	3.51
Domestic price	**151.18**	**88.93**
Exporter margin	**18.82**	**11.07**
Handling and export fee	11.53	6.78
Profit	7.30	4.29
Export price (FOB)	**170.00**	**100.00**

Source: Author's calculation based on data from the TDRI survey 2008

Table 4.12: Marketing margins for cassava chips (USD/tonne)

Margins	Total	Percentage*
Transport cost	21.73	12.78
Labour	3.02	1.78
Fuel/electricity	2.41	1.42
Handling and export fee	11.53	6.78
Others	0.81	0.48
Profit	79.81	46.95
Gross margin	**119.31**	**70.18**
Net margin	**39.50**	**23.23**

*Note: * percentage of export price.*

Source: Author's calculation based on data from the TDRI survey 2008

Table 4.12 provides a summary of marketing margins for cassava chips. The gross marketing costs for cassava chips account for 70.18 percent of the export price (FOB). The net marketing margin[10] is USD39.50, which is 23.23 percent of the export price. Of all the marketing costs, transport cost is the highest, followed by handling and export fees.

Cassava starch domestic consumption

Table 4.13 presents the survey data on the marketing costs and margins of cassava starch along the marketing chain from farmer to domestic consumer, and Table 4.14 gives a summary of marketing margins. To produce the fresh root equivalent of 1 tonne of starch, farmers spend USD98.97 on production. The factory price is set at USD253.62. Therefore, the farmers get a margin of USD154.65, which is more than half of the factory price. Farmers receive profit of USD129.90, about 50 percent of the selling price. The cost of producing the fresh root equivalent of 1 tonne of starch is about 28 percent of the domestic price, leaving the rest for marketing costs. The starch factory sells starch domestically at USD353.05 per tonne, giving a margin of USD99.43. The starch factory's margin consists of labour cost, fuel cost, transport cost, profit and others. Fuel and electricity costs of USD27.16 are the highest, followed by transport cost.

Table 4.13: Marketing costs and margins for domestic cassava starch (USD/tonne)

Description	Total	Percentage
Production costs	**98.97**	**28.03**
Farmer margin	**154.65**	**43.80**
Transport cost	24.74	7.01
Profit	129.90	36.79
Average farm price at office	**253.62**	**71.84**
Starch factory margin	**99.43**	**28.16**
Labour	10.56	2.99
Fuel/electricity	27.16	7.69
Transport cost	12.07	3.42
Others	38.93	11.03
Profit	10.71	3.03
Domestic price	**353.05**	**100.00**

Source: Author's calculation based on data from the TDRI survey 2008

Table 4.14: Marketing margins of farmer for domestic cassava starch (USD/tonne)

Margin	**Total**	**Percentage***
Transport cost	36.81	10.43
Labour	10.56	2.99
Fuel/electricity	27.16	7.69
Handling and export fee	0.00	0.00
Others	38.93	11.03
Profit	140.62	39.83
Gross margin	**254.07**	**71.97**
Net margin	**113.46**	**32.14**

Note: percentage of export price.*
Source: Author's calculation based on data from the TDRI survey 2008

[10] The gross marketing margin is the difference between the final price and the cost. The net marketing margin is the gross marketing margin, from which is deducted all the profits for each agent along the chain. The net marketing margin reflects the true marketing costs along the chain.

The gross marketing margin for domestic cassava starch is USD254.07, which accounts for 71.97 percent of the domestic price. After the deduction of net profits of USD140.62, the net marketing margin is USD113.46 or 32.14 percent of the domestic price. The farmer margin is almost double that of the starch factory. Overall, transport is the highest cost, followed by fuel/electricity and labour.

Cassava starch for export

Train freight or road haulage is used to transport cassava starch to the port warehouse. Table 4.15 shows the marketing costs and margins of transporting cassava starch from farmer to port by train, and Table 4.16 summarises the marketing margins. Table 4.17 shows the marketing costs and margins of transporting cassava starch from farmer to port by truck, and Table 4.18 gives a summary.

The farmer margin for exported cassava starch is the same as that for domestic consumption, but the starch factory margin is slightly different. The starch factory margin also includes a handling and export fee and has a slightly different transport cost. The transport cost of train freight is slightly lower than that for truck haulage. The train freight cost for the starch factory is USD13.58, while that for truck haulage is USD18. The total margin of the starch factory is the same whether truck or train freight is used. Therefore, the choice of transport only affects factory profit other things held equal.

Table 4.15: Marketing costs and margins for export cassava starch by train (USD/tonne)

Description	Total	Percentage
Production costs	**98.97**	**26.82**
Farmer margin	**154.65**	**41.91**
Transport cost	24.74	6.71
Profit	129.90	35.20
Average farm price at office	**253.62**	**68.73**
Starch factory margin	**115.38**	**31.27**
Labour	10.56	2.86
Fuel/lectricity	27.16	7.36
Transport cost	13.58	3.68
Others	38.93	10.55
Handling and export fee	4.83	1.31
Profit	20.33	5.51
Export price (FOB)	**369.00**	**100.00**

Source: Author's calculation based on data from the TDRI survey 2008

Table 4.16: Marketing margins for export cassava starch by train (USD/tonne)

Margin	Total	Percentage
Transportation cost	38.32	10.39
Labour	10.56	2.86
Fuel/electricity	27.16	7.36
Handling and export fee	4.83	1.31
Others	38.93	10.55
Profit	150.23	40.71
Gross margin	**270.03**	**73.18**
Net margin	**119.79**	**32.46**

Source: Author's calculation based on data from the TDRI survey 2008

Table 4.17: Marketing costs and margins for export cassava starch by truck (USD/tonne)

Description	Total	Percentage
Production costs	**98.97**	**26.82**
Farmer margin	**154.65**	**41.91**
Transport cost	24.74	6.71
Profit	129.90	35.20
Average farm price at office	**253.62**	**68.73**
Starch factory margin	**115.38**	**31.27**
Labour	10.56	2.86
Fuel/electricity	27.16	7.36
Transport cost	18.11	4.91
Others	38.93	10.55
Handling and export fee	4.83	1.31
Profit	15.80	4.28
Export price (FOB)	**369.00**	**100.00**

Source: Author's calculation based on data from the TDRI survey 2008

Table 4.18: Marketing margins for export cassava starch by truck (USD/tonne)

Margin	Total	Percentage
Transport cost	42.85	11.61
Labour	10.56	2.86
Fuel/electricity	27.16	7.36
Handling and export fee	4.83	1.31
Others	38.93	10.55
Profit	145.70	39.49
Gross margin	**270.03**	**73.18**
Net margin	**124.32**	**33.69**

Source: Author's calculation based on data from the TDRI survey 2008

As a result, the net marketing cost of cassava starch using train freight is 32.46 percent of the export price while that using truck haulage is 33.69 percent. The net marketing cost of cassava starch using train freight is slightly higher due to the difference in costs between the two modes of transport. This implies that rail freight is the better mode of transport compared to road haulage. In Thailand, most products are transported by road, followed by inland and coastal waterways (Table 4.19). Train transport is least used in Thailand, although it is the most efficient way of transporting products in many countries. Transport costs are still the highest in the marketing margin for exported cassava starch.

Table 4.19: Domestic transport by mode of transport (tonnes), 2003-06

Transport mode	Year			
	2003	2004	2005	2006
Road	440,018.5	435,147.4	430,275.0	427,581.2
Train	10,521.2	12,883.3	11,760.1	11,578.5
Inland waterway	29,024.3	29,134.6	29,568.6	31,073.6
Coastal waterway	22,942.0	27,766.9	28,322.2	29,980.7

Source: Thailand Ministry of Transport

4.1.3. Constraints and opportunities

The following constraints and opportunities were identified during the survey.

Constraints

- **Road transport.** Cassava is mainly transported by road haulage, which is more costly than alternatives such as rail freight or waterway shipment. However, an efficient rail transport system is not yet developed.
- **Weight loss during transport.** Weight loss during transport is inevitable. Cassava chips can be carried in closed containers to prevent weight loss during transport but the cost is relatively high and not worth the shipment value.

Opportunities

- **Many buyers.** According to the Thai Tapioca Development Institute, there are over 800 drying yards, 68 starch factories and 63 pellet factories nationwide. Competition for cassava roots by so many buyers can raise the farm gate price.
- **Good road conditions.** The road network in Thailand is in good condition, especially compared with those in neighbouring countries. This results in fast and convenient transport, eases trade between farmers and processors, and reduces marketing margins.
- **Small number of traders along the marketing chain.** Fewer traders along the marketing chain diminish the marketing margins usually caused by intermediaries thereby, increasing farm revenues.

4.2. Rubber

4.2.1. Marketing chains

The structure of the rubber marketing chain in Thailand is depicted in Figure 4.10. Following is a description of the roles of each participant along the marketing chain and the relationships and transactions between participants.

Farmers

Farmers sell their produce in the form of air-dried sheets (or raw sheets), fresh latex, cup lumps and scrap rubber, depending on their expertise. Most farmers sell raw sheets because there is a price incentive. However, cup lumps have become more popular in some areas because they are easier and quicker to make and in higher demand from industry. Air-dried sheet is categorised in five grades according to quality, grade one being the best. In Thailand, the majority of sales are of grade three sheets because the high-grade sheets require extra care in the production process, and the price for the low-grade sheets is unattractive. The farmers sell direct to local traders, cooperatives or central rubber markets, depending on production quantity and market accessibility.

Rubber cooperatives

Established by the Department of Agriculture of MOAC, rubber cooperatives assist members (farmers) in buying rubber at a fair price by helping to resolve under-pricing by intermediaries. They also provide knowledge to members on how to increase the value-added of rubber products. The objective of rubber cooperatives is to raise farm incomes. Members transport fresh latex to the cooperatives by motorcycle or pick-up truck. The products are then auctioned at central rubber markets or sold directly to processors. There are about 700 cooperatives nationwide, each with 100 members. However, farmers prefer selling their products to traders or central rubber markets because of the strict rules and delayed payment by cooperatives.

Traders

There are many levels of traders. Local traders are bigger buyers who collect rubber from farmers, community traders and auction points, then sell the rubber on to processors. Community traders are travelling traders and village traders scattered around the production areas.[11] They collect rubber from farmers and sell it to local traders or at central rubber markets. In some cases, community traders sell directly to processors. In this part of the chain, trade volume is small.

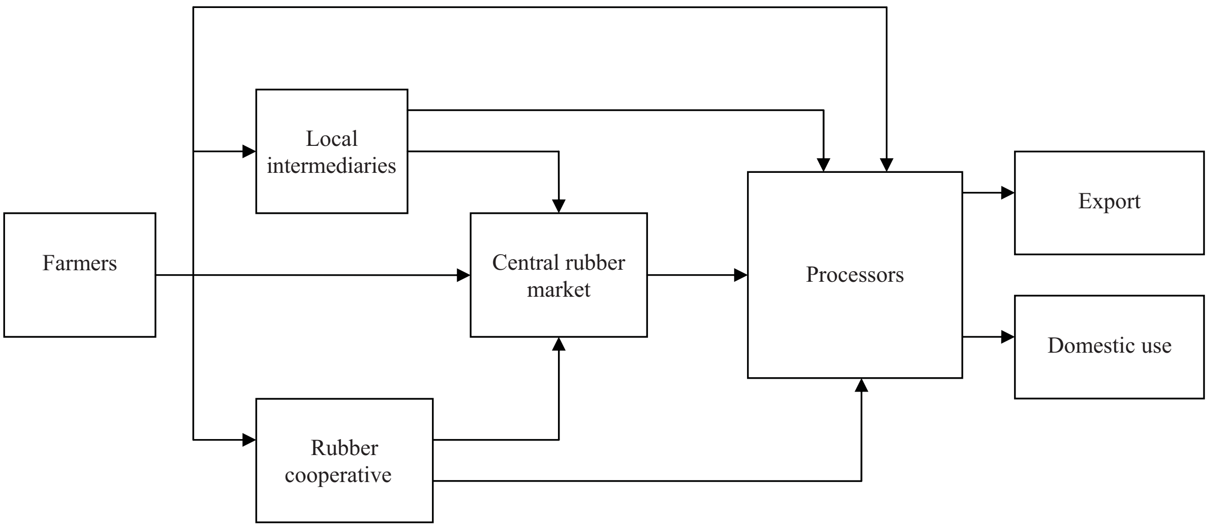
Central rubber markets

Rubber central markets are established and developed by the Rubber Research Institute of Thailand (RRIT). There are three central markets in the south, in the provinces of Songkla, Surat Thani and Nakhon Sri Thammarat. Rubber trading in central rubber markets is restricted to rubber sheets, and rubber is sold by price bidding. The central rubber markets also provide marketing information such as rubber prices.

Processors and exporters

Processors obtain raw rubber from local traders, large-scale rubber farmers and central rubber markets and process it into primary products. Primary products are RSS, block rubber (known as technical specified rubber), concentrated latex, skim block and crepe. Ninety-four percent of materials are purchased locally through local traders. The rest is purchased from central rubber markets.

Figure 4.10: Rubber marketing chain



Source: TDRI survey 2007

[11] A travelling trader is a trader operating door-to-door at farm level, usually using motorised vehicles to transport goods. A village trader has specific location for trade, buys products from travelling traders and farmers, and then sells the products to provincial traders or factories.

Majority of rubber products are exported in primary forms such as STR, block rubber, RSS, skim block, ADS and concentrated latex. Figure 4.11 illustrates the transport routes and methods of transport (truck, train and ship) from factory to port in the south of the country. In other regions, trucks are the main mode of transport used to get goods to the port, either Bangkok or on the Eastern seaboard.

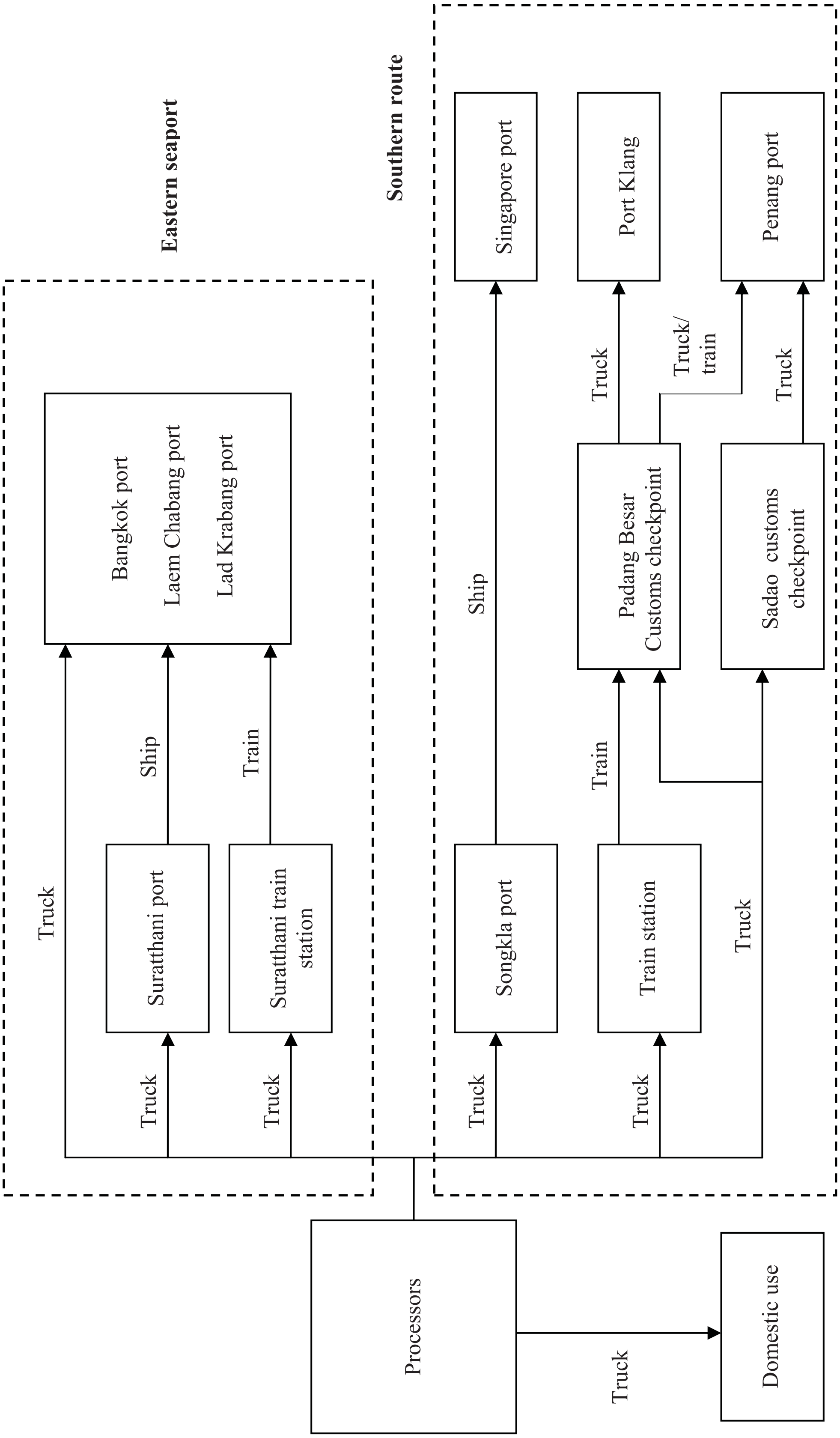
Exports to China, a major export destination, go through the sea ports of Bangkok, Laem Chabang, Lad Krabang and Songkla. Customs checkpoints are at Padang Besar and Sadao. The pathway chosen by exporters depends on the location of the factories and cost of transport. Exporters generally select the quickest, easiest and cheapest way to ship products.

Most factories in the far south of the country prefer to use southern seaports and checkpoints, thus minimising transport costs. Processing factories transport their products to Songkla port and customs checkpoints by truck, trailer or train. From there, the containers are carried by feeder ships to Singapore port where they are loaded onto bigger vessels heading to the export destination. At Padang Besar customs checkpoint, containers arrive by truck, trailer or train; from there they are transported by train to Penang port. At Sadao customs checkpoint, containers arrive by truck or trailer; then trucks take them to Penang port.

Factories in the near south of the country transport their products through the southern route or via Bangkok port and the eastern seaports, depending on transport costs or the route specified by the customer. Products arrive at Bangkok port and the eastern seaports by truck, trailer, train or ship where they are loaded into containers and transported to export destinations by ship.

Factories in the upper southern part of Thailand can choose to transport their products either through the southern route or through the Bangkok port and the Eastern sea ports. The choice depends on the cost of transportation or specific routes as in the order of customers. The products are transported to the Bangkok port and the Eastern sea ports either by trucks, trailers, trains or ships. Upon arrival at the ports, the products will be loaded to containers and transported to export destinations by vessels.

Figure 4.11: Transport routes and methods of rubber export in south Thailand



Source: TDRI survey 2007

4.2.2 Costs and margins

The information on costs and margins was gathered from various stakeholders along the marketing chain. Some information was not obtainable; therefore, the figures given below are approximate real values. Data on costs and profits, for example, was difficult to obtain due to firms' secrecy. Block rubber production in Thailand uses air-dried sheets (USS) and cup lumps as raw materials. The ratio of USS and cup lumps determines the quality of block rubber. For the purposes of this study, the proportion is assumed to be 25 percent USS and 75 percent cup lumps. This proportion was used to calculate production costs and average farm price.[12] Two marketing channels—Penang port and Bangkok port—are compared. The distance between farm and buying point ranges from 2-56 km. For Penang port, the transport cost was calculated by setting the distance equal to 232 km (the official distance from Nakhon Si Thammarat to Padang Besar). For Bangkok port, the transport cost was calculated by setting the distance equal to 650 km (the official distance from Surat Thani to Bangkok).

Block rubber

Block rubber from south Thailand is exported through several ports. The study selected Bangkok port and Penang port because they are the two leading ports for rubber export. Table 4.20 shows the marketing costs of block rubber via Penang, and Table 4.21 presents a summary of the marketing margins. Similarly, the marketing costs of block rubber via Bangkok port are given in Table 4.22, followed by a summary of the marketing margins in Table 4.23. It costs farmers USD845.35 to produce the rubber latex equivalent of 1 tonne of block rubber. Farmers sell to intermediaries at the average price of USD1698.48 for the rubber product equivalent to 1 tonne of block rubber. That gives a farmer margin of USD853.12 and farmer profit of USD839.54. Intermediaries incur transport costs of USD21.12 and labour costs of USD6.04. With the selling price to the factory at USD2248.42, intermediaries achieve gross profit of USD522.78. Intermediaries' gross profit is remarkably large at this stage because there are multiple levels of intermediaries along the block rubber marketing chain, from farmer to factory.

Table 4.20: Marketing costs and margins for block rubber to Penang port (USD/tonne)

Description	Total	Percentage
Production costs	**845.35**	**33.63**
Farmer margin	**853.12**	**33.94**
Transport cost	13.58	0.54
Profit	839.54	33.40
Average farm price	**1698.48**	**67.57**
Intermediary margin	**549.94**	**21.88**
Labour	6.04	0.24
Transport cost	21.12	0.84
Profit and others	522.78	20.80
Average farm price at office	**2248.42**	**89.45**
Processor margin	**265.16**	**10.55**
Labour	15.09	0.60
Fuel	27.16	1.08
Transport cost	17.35	0.69
CESS	42.25	1.68
Profit and thers	163.32	6.50
Export price (FOB) to Penang	**2513.58**	**100.00**

Source: Author's calculation based on data from the TDRI survey 2007

[12] At the time of survey, USS farm price was USD 2314.7 per tonne and cup lump price was USD2226.3.78 per tonne. With the proportion of 25:75, the average farm gate price for block rubber is USD1698.48 per tonne.

Table 4.21: Marketing margins for block rubber to Penang port (USD/tonne)

Costs and margins	Total	Percentage
Transport cost	52.05	2.07
Labour	21.12	0.84
Fuel	27.16	1.08
CESS	42.25	1.68
Others	1525.65	60.70
Gross margin	**1668.23**	**66.37**

Source: Author's calculation based on data from the TDRI survey 2007

Rubber factories both produce and export primary rubber products. This study compares the costs and margins of two export routes. For the Penang port route, the export price (FOB) of block rubber is USD2513.58 per tonne. That leaves a factory margin of USD265.16. The transport cost is USD17.35. For the Bangkok port route, the export price (FOB) of block rubber is USD2521.12 per tonne, a little higher than that for the Penang port route. The factory margin is USD272.71, and the transport cost is USD25.65.

Table 4.22: Marketing costs and margins for block rubber to Bangkok port (USD/tonne)

Description	Total	Percentage
Production costs	**845.35**	**33.53**
Farmer margin	**853.12**	**33.84**
Transport cost	13.58	0.54
Profit	839.54	33.30
Average farm price	**1698.48**	**67.37**
Intermediary margin	**549.94**	**21.81**
Labour	6.04	0.24
Transport cost	21.12	0.84
Profit and others	522.78	20.74
Average farm price at office	**2248.42**	**89.18**
Processor margin	**272.71**	**10.82**
Labour	15.09	0.60
Fuel	27.16	1.08
Transport cost	25.65	1.02
CESS	42.25	1.68
Profit and others	162.57	6.45
Export price (FOB) at Bangkok	**2521.12**	**100.00**

Source: Author's calculation based on data from the TDRI survey 2007

The factory margin for exporting produce via Bangkok port is higher than that for Penang port. This is due to the higher export price attained at Bangkok port. However, when transport costs are taken into account, holding other things equal, the profit margin from exporting via Penang port is slightly higher than that via Bangkok. The marketing costs via Bangkok port are higher due to the longer distances involved. In addition, the main mode of transport in the Bangkok route is truck/trailer, while the Penang route uses lower-cost train freight. Transport accounts for the highest proportion of costs in the marketing margins for both block rubber routes.

Table 4.23: Marketing margins for block rubber to Bangkok port (USD/tonne)

Costs and margins	Total	Percentage
Transport cost	60.35	2.39
Labour	21.12	0.84
Fuel	27.16	1.08
CESS	42.25	1.68
Others	1524.89	60.48
Gross margin	**1675.77**	**66.47**

Source: Author's calculation based on data from the TDRI survey 2007

4.2.3 Constraints and opportunities

The following constraints and opportunities were identified during the survey.

Constraints

- **Tax incidence and shift of tax burden.** Rubber exporters are charged a fee, which pays for the government programme to help farmers replant their plantations with HYVs; the fee is set at approximately USD40 per tonne of rubber exported. However, the tax burden is often passed on to traders and then ultimately falls upon farmers, resulting in lower farm prices.
- **Poor cooperation among farmers.** Rubber farmers sell their products independently. They do not organise themselves into groups, which would strengthen their bargaining power with buyers and enable them to achieve higher prices for rubber.
- **Multiple levels of traders.** Rubber products are traded and transported by multiple traders before they reach the factories, especially in less accessible areas. Traders at each level collect their own marketing margin. Resultant of higher marketing margins along the chain, farmers in these areas achieve lower than average farm prices.
- **Logistics management.** First, information about logistics services is not fully integrated across the supply chain, leading to higher transaction costs. Second, the railway system relies on outdated rolling stock and is inefficient and unreliable, affecting transport costs and customer confidence. Third, Thailand's seaports are under-used. Rubber products from south Thailand are mostly transported via train to seaports in Malaysia and Singapore because the freight cost from Songkla port to China (USD400 per 20-foot container) is double that from Penang port to China (Prachachat 2008). The higher cost is due to the shortage of containers at Songkla port.

Opportunities

- **Advantage of air-dried sheets.** ADS has a long shelf life and does not deteriorate during storage. This enables farmers to maximise profits by extending or postponing the sale of products until the price is right. Moreover, producing ADS creates value-added for rubber.

5. Conclusions and policy recommendations

5.1. Conclusions

The study has provided insights into the production and marketing of cassava and rubber. Thailand is a major world producer and exporter of cassava and rubber. Domestic and international demand for cassava and rubber are increasing. In particular, demand from China, a major importer of both products, has significantly increased in response to rising oil prices and China's economic expansion, especially in the automotive industry.

Constraints on cassava production and marketing are production costs, poor market information, soil deterioration, lack of marketing management and planning, low quality products, low technology and ambiguous government policy on ethanol production and road transport. Lack of skilled labour and high production costs are the main constraints on rubber production while tax, poor cooperation among farmers, multiple traders and high logistics costs are the problems in rubber marketing.

5.2. Review of existing policies

Agriculture has maintained its importance in the Thai economy, employing 40 percent of the workforce. Cassava and rubber are among Thailand's top products in terms of production value. There is no doubt that their present success is due to government policy.

5.2.1. Cassava

Production policies

The centrepiece of a government programme to improve cassava productivity was the introduction of high-yielding cassava varieties, developed from crosses between local and Latin American germplasm. The programme first released Rayong 1 in 1975 and many important varieties later on. Since then, improved cassava varieties have been adopted in nearly all of the country's cassava planting areas, producing over 20 tonnes of fresh roots per hectare.

The government supports farmers through supplying inputs at either no cost or reduced prices. The BAAC also provides low-interest loans for farmers to invest in cassava production.

Government has tried to register cassava farmers in order to keep track of their numbers, set up a system to efficiently manage cassava production, and help reduce price fluctuations. However, farmers often alter the crops that they grow in accordance with crop prices. This was the main cause of policy failure. The policy was later cancelled.

The government has also been promoting cassava-ethanol production by offering tax incentives. Recently established by MOAC, the Cassava Development Committee aims to promote cassava production. The committee is responsible for cassava development such as determining the measures for product development and processing and providing consultation on product development.

Marketing and price policies

The price of cassava products has fluctuated depending on seasonality and volatility in world demand. This in turn has affected the price of fresh roots and farm revenues. When there is a glut of cassava on the market, farmers are likely to achieve low farm gate prices causing incomes to drop. The government has put in place several measures to stabilise the price and help smooth farm incomes. The mortgage scheme for cassava, for instance, helps to absorb excess supply, especially at the beginning of the season.

5.2.2. Rubber

Production policies

Rubber production has been promoted through several policies. Suitable zones have been designated for rubber plantation and farmers registered accordingly. In addition, government encourages progress through research and development of rubber varieties and cultivation practices. Central rubber markets, established as auction points to serve farmers and private firms, sometimes implement government-led market interventions such as the mortgage scheme.

Finance policies

The Rubber Plantation Project was developed to support farmers financially. The project aims to provide access to credit for rubber farmers who cannot mobilise the resources required to shift production to plantations and to enter the market. Rubber farmers who elected to grow rubber on National Forest Reserve farms were granted a certificate that can be used as collateral against a loan. Moreover, ORRAF provides a welfare fund of USD2000 to rubber farmers who wish to replace local varieties with new HYVs.

Marketing and price policies

Similar to all agricultural products, rubber prices are volatile. Thailand, Malaysia and Indonesia, the world's largest rubber producers, formed the International Tripartite Rubber Organization (ITRO), the main objective of which is to create a price floor and improve remuneration for farmers in the three countries.

5.3. Implications for new policies

Based on the findings of this study, there is high potential for trade in cassava and rubber among GMS countries. However, several constraints have to be overcome. Future policy could consider the following:

5.3.1. Production and marketing

- Prior government measures and policies have emphasised the development of primary products. The fact that Thailand exports 90 percent of its rubber and 75 percent of its cassava production as raw materials leaves the country overly reliant on foreign markets. Changes in foreign policies could adversely affect domestic production and prices. Although the price in recent years has been increasing, there is no guarantee that the price will not fall again as has frequently happened in the past. Government should promote the development of domestic linkage industries for both cassava and rubber to induce demand and create added-value for the final products. Further, there should be a governmental body tasked to monitor and support the development of downstream industries.
- Searching for new international markets would expand trade and reduce the risk of relying on just a few major markets. Bilateral agreements could attract new markets for the cassava and rubber industries.

- Farmers often harvest cassava at the same time, early in the harvesting season or when the price is attractive. Some form of coordination among farmers, such as joint farm planning, would help to avoid excess supply.
- Rising fertiliser prices make production more costly. This calls for the promotion of organic fertilisers, which are cheaper and help to replenish soil quality and retain soil moisture..
- Adequate irrigation systems would prevent production losses during times of drought and water shortage, especially for rainfed cassava planting.

5.3.2. Regional cooperation

- Exchange or sharing of expertise among GMS countries should be encouraged to improve production efficiencies. For example, Vietnam has expertise in rubber tapping while Thailand has vast experience in small farm management.
- Foreign direct investment and associated technology transfer should be encouraged, perhaps in the form of International Joint Ventures, for example.
- Agreement on product standards or a mutual recognition agreement (MRA) would improve product quality, reduce obstacles caused by non-tariff measures and facilitate trade among countries.

5.3.3. Logistics

- The integration of logistics services, especially information systems, across marketing and production chains would reduce freight charges and transit time.
- Cassava and rubber products are mostly exported through the eastern seaports and Bangkok port. Instead of depending on ports in Singapore and Malaysia, seaports on the south coast should be developed so that they can handle the large volume of export trade.
- Developing the inland waterways on the northern trade route to China would support rubber production regions in the north and cassava production areas in the northeast.

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Agricultural Trade in the Greater Mekong Subregion: Case Studies of Cassava and Rubber in Vietnam

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1. Introduction

Vietnam is an integral part of ASEAN and of the GMS, which encompasses Thailand, Vietnam, Cambodia, Laos and China. Vietnam is a transitional country in which many economic processes are shifting and under reform. The country during the last two decades has undergone economic "renovation", achieving substantial economic growth before the recent slowdown. Although the pace of industrialisation has speeded up, agriculture remains the primary source of livelihood for the majority of the population.

Vietnam has made big strides in economic growth and poverty reduction, but the economy is still facing many difficulties. Agricultural productivity and rural development lag behind the pace of economic development. The poor are concentrated in the rural areas, and the average income gap between rural and urban areas is widening. An intuitive question is why is it that the country's export value in general and agricultural export revenue in particular have been increasing fast but the benefits do not seem to accrue to the farmers? The first answer is that farmers are just part of the value chain and thus receive only a part of the overall benefit. There are many other stakeholders across agricultural value chains, and each one achieves a different level of benefits. Pro-farmer agricultural value chains should be promoted at both national and regional levels.

The main objective of this Vietnam country study is to increase agricultural trade efficiencies "in a manner that contributes to improvements in rural development and poverty reduction". Scaling up pro-farmer value chains would create incentives for farmers to improve agricultural production. The specific research questions are:

- What are the production costs at different stages of the value chain?
- What are the determinants of farm gate prices?
- What are the transaction costs associated with trading commodities?
- What are the main marketing costs associated with moving agricultural commodities from farm gate to export/overseas market?

The answers to the above questions could provide inputs for a broader comparative analysis among the five GMS countries. In Vietnam, promoting international trade in general and trade with GMS countries in particular is of special concern. It seems that there is huge trade potential that has not been tapped. The lack of production and market information among GMS countries seems to be a major cause of that gap.

The study selected cassava and rubber for in-depth analysis. Cassava was chosen because the crop is a good substitute for rice – the staple food in Vietnam as well as in almost all other GMS countries – and has been used to stave off hunger in the off-farm season. The crop is also an important source of livestock feed in many parts of the country, especially in the mountainous areas. In addition, it is an important input in the starch processing industry, and is a profitable cash crop for some farmers. In the GMS, cassava is a major crop, and tracking its development in ways that make for meaningful comparisons among different countries in the region is critical for improving regional agricultural trade. Studying the value chains of cassava across the GMS could help reveal each country's comparative advantage in cassava production and trade.

Rubber was selected because of its re-emergence in recent years. With production partly driven by increases in natural rubber prices on the world market, rubber producers have been successful in increasing the country's agricultural exports. The majority of Vietnam's rubber exports go to China, and rubber is considered a crop for alleviating poverty in many provinces of Vietnam. The crop has become a good source of employment and income for rural people and a source of foreign exchange for the country, especially in southeast Vietnam (Ho Chi Minh City, Tay Ninh, Binh Duong, Binh Phuoc, Dong Nai, Ba Ria Vung Tau, Ninh Thuan and Binh Thuan). Since 1995, rubber has been Vietnam's third or second largest agricultural export commodity after rice and coffee, and its export value has more than doubled during the last decade. For the first nine months of 2008, the export value of rubber reached USD1.25 billion (MARD website). Rubber is also a very important agricultural crop in Thailand (the largest rubber producer in the world) and Laos.

2. Methodology

Following the value chain approach, the study traces cassava and rubber from production to final consumption. Exploring the value chain entails looking at the complex range of activities of various actors (primary producers, processors, traders, service providers) along the chain starting from the production of raw materials to the linkages with enterprises engaged in trading, assembling and processing (ADB 2007). At this initial stage of our study, farm gate costs and margins are analysed to assess the benefits accruing to farmers.

In tracing the products, the study examines the relationships between actors across the product chains, what binds them together, what information is shared and how the relationships are evolving (ADB 2007). For the same product, there may be many different value chains tracing different pathways. The key issue is to select a representative value chain for analysis.

At the most basic level, a value chain is depicted by "mapping" the links between the economic actors involved in the production, distribution, marketing and sales of a particular product. In this way, the cost structure, margins and other factors in the value chain are presented (see Figures 5.1 and 5.2). The details representing each stakeholder in each section of the map are often collected via direct or focus group interviews, participatory rural appraisal, secondary data or a combination of these tools. The linkages between stakeholders across the value chain are important for the analysis. In these linkages, the interactions between various stakeholders are described and evaluated.

Value chain analysis is an efficient tool for identifying the distribution of benefits among the actors in the chain. The benefits accruing to each actor are determined through an analysis of margins and profits, and those who benefit the most and the least can be identified. Further, the impact of policy on the distribution of benefits in the value chain can be analysed. Each item of cost or benefit may be affected differently by different policy options. The effects of improvements on or "upgrading" of different aspects (such as quality, product design) on the benefits received by each actor can also be evaluated. In addition, value chain analysis also reveals the structure of relationships and coordination mechanisms among actors, i.e. the governance aspect of the value chain. Recommendations for pro-poor policies can be drawn from the results of the analysis. In principle, value chain analysis does not require a large number of observations for each stakeholder: more important is the representativeness of the data collected.

In this study, the value chains of cassava and rubber in Vietnam are examined. The cassava value chain in Vietnam is very complex because cassava outputs come in many different forms. In general, four main activities are included in the chain: production of cassava roots, processing, trading of cassava roots and starch, and end-use of starch and processing by-products. The main actors involved in the cassava value chain in Vietnam are producers, traders, processors, waged employees, end-users and related institutions. These actors differ by region in terms of numbers, scale, activities, importance, income, scope of business and development orientation. These differences result in variations in costs, benefits, margins, market governance and linkages among actors in different regions (ADB and DFID 2005). In this research, the primary data for cassava was collected from 60 production households in Truong Dong commune (Hoa Thanh district) and Tan Phong commune (Tan Bien district) of Tay Ninh province, 10 collector households in the same communes and 6 cassava primary processing units of which 2 are in Hoa Hiep (Tan Bien district) and 4 in Truong Dong (Hoa Thanh district). As for the last actors in the value chain, data was collected from 3 processing and exporting enterprises in Phuoc Vinh commune (Chau Thanh district), and Thanh Bac and Thanh Binh communes (Tan Bien district). In addition to the primary data collected in the study sites, secondary data was also gathered for the analysis of cassava production and trade. The survey was undertaken to collect information on the 2007 season.

Secondary data for rubber was obtained from various sources including from two state rubber companies, Phuoc Hoa and Dau Tieng in Binh Duong province. Primary data was collected from a group survey of 5 smallholders and interview survey of 5 rubber sap collectors, both undertaken in 2008 by the Faculty of Economics of the University of Agriculture and Forestry, Ho Chi Minh City. Although the sample sizes were small, they were representative of their groups.

3. Production

3.1. Cassava

3.1.1. Production

Vietnam is the 12th largest cassava producer in the world. Cassava is an important food crop, especially in the remote and mountainous areas of Vietnam. Cassava products were originally grown for food and animal feed. With the development of processing industry in the last decade, large amounts of cassava are now destined for use as raw material in starch processing, food processing, paper, pharmaceutical and biofuel industries.

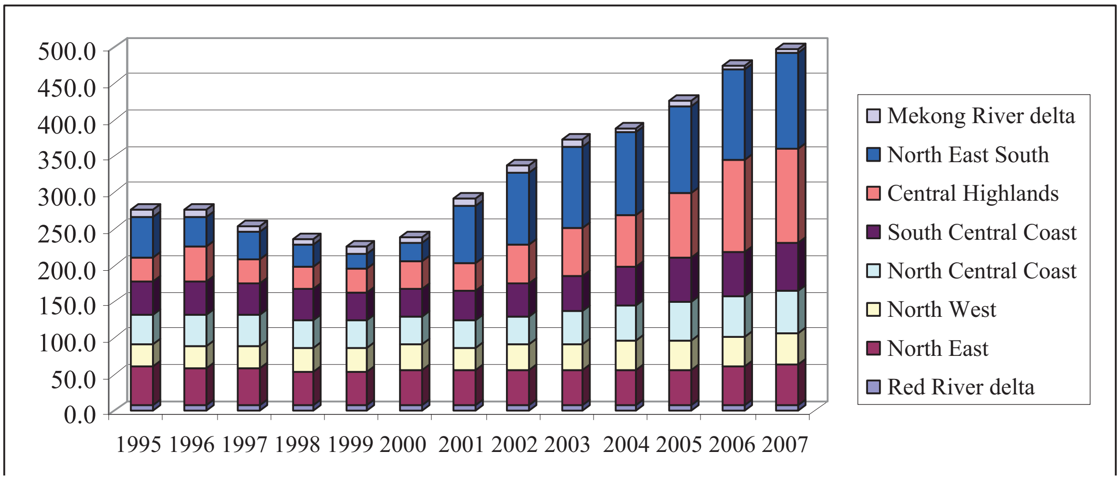
Cassava is cultivated in almost all provinces of the country, but the size of the planted areas varies between regions and provinces. Mountainous provinces in the North, the Central Coastal region, Central Highlands and South East are the main regions of cassava cultivation whereas the Red River Delta and Mekong River Delta have very few cassava planted areas, accounting for less than 7 percent of the total in 1995 and 3 percent in 2007 (GSO 2008).

Cassava production development over the last twelve years can be divided into two periods: from 1995 to 2000, and from 2001 to 2007.

In the period 1995 to 2000, the cassava cultivated areas in most of the provinces declined. In 1995, the whole country had 277.4 thousand hectares of planted cassava; Gia Lai had the largest area (15.8 thousand hectares), followed by Quang Nam, Tay Ninh, Thanh Hoa, Son La, Dong Nai and Nghe An. By 2000, this area had decreased by 14.3 percent, equivalent to

39.8 thousand hectares. Annual growth rate of the total cassava area in 1995-2000 was -3.05 percent. The northeast region experienced the biggest decline in the proportion of cassava uncultivated areas (-56.3 percent or -15.25 percent of the annual growth rate). This level was nearly four times higher than the average for the whole country. It was a direct result of the huge decline in the cassava planted areas in Tay Ninh province (up to -94.5 percent) and Binh Phuoc province (-83.6 percent), and a smaller but still significant decline of -19 percent in the south central coast region.

Figure 5.1: Cassava planted area, 1995-2007



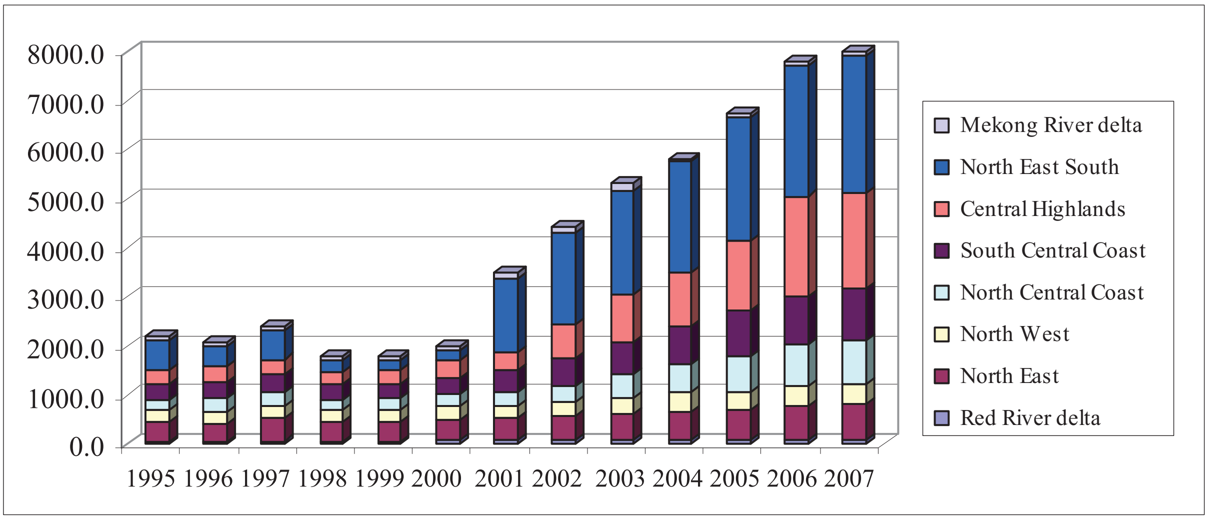
Source: Calculated from GSO statistical data

There has clearly been an upward trend in cassava production in 2001-2007. Demand for cassava as a raw material in starch processing, food processing, paper, and biofuel industries has steadily increased, pushing up the price of fresh cassava roots and starch. Thus, cassava is no longer regarded as a pure food crop, but as an industrial crop with high comparativeness.

In 2007, the total area of planted cassava was 70 percent higher (9.25 percent of the annual growth rate) than that in 2001. There are big disparities in the growth levels between different regions and provinces, however. The Central Highlands had the highest growth rate of 246.4 percent or 23.01 percent per year on average. In contrast, the other regions experienced slower average annual growth of less than 9 percent. The gap between the largest and the smallest growth rates was very big, approximately 15 times; while the Central Highlands regained an annual growth rate as high as 23.01 percent, the North East lagged far behind with an annual growth rate of 2.53 percent. The rapid expansion in cassava area in the Central Highlands can be explained by the high price of cassava products in recent years, the region's richly fertile soils (favoured by industrial plants including cassava plants), and the establishment of five processing factories in the vicinity. The actual cassava areas of some provinces have exceeded their planned areas. For example, in 2007, the actual area of cassava in Dak Lak province exceeded planned areas by 13,040 ha. Similarly, the planned area for cassava production in Phu Yen province is 9500 ha by 2010; however, the cultivated area had already reached 13,200 ha by 2008, nearly 4000 ha or about 42 percent more than planned (Khanh Phuong 2008).

As a consequence of the decline in cassava planted areas in 1995-2000, the total volume of cassava production decreased from 2211.5 thousand tonnes in 1995 to 1986.3 thousand tonnes in 2000, reflecting a negative annual growth rate of 2.13 percent over the period. Particularly affected were the North East South region (-18.65 percent) and Red River Delta (-3.04 percent).

Figure 5.2: Cassava production 1995-2007



Source: Calculated from GSO statistical data

In the period 2001-2007, due to the increase in planted areas and the higher yields of high yielding varieties (HYVs), cassava production rose sharply. Total cassava output in 2007 had reached 7984.9 thousand tonnes from only 3509.2 thousand tonnes in 2001. Total output growth was 127.5 percent over 7 years, or 14.69 percent per annum on average. There were changes in the ranking of regions. The North Central Coast region jumped to fourth place from the sixth, while the South Central Coast region went down from the second to the third. By province, there was little change in the top ranking: Tay Ninh retained the lead, followed by Gia Lai, Binh Phuoc and Kon Tum. However, Dak Lak, Binh Thuan, Nghe An and Yen Bai provinces quickly rose to the high ranks. Close to the bottom rank in 2001 with production of only 50 thousand tonnes, by 2007 Dak Lak province was producing about 400 thousand tonnes.

Table 5.1: Average annual growth rate (percent) in cassava harvested areas, production and yield in Vietnam, 1995-2007

	1995-2000	2001-2007	1995-2007
Area harvested	**-3.05**	**9.25**	**4.98**
Production	**-2.13**	**14.69**	**11.29**
Yield	**0.95**	**4.98**	**6.01**

Source: Calculated from GSO statistical data

3.1.2. Cultivation practices

Cultivation practices vary between regions and provinces, depending on local characteristics such as topography, soils, climate and traditional customs. Take land preparation, for example. Most cassava fields in the mountainous regions are ploughed once before harvesting, while fields in the delta regions are ploughed twice. However, just about half of cassava areas are harrowed. Land preparation is usually done by hand or by draught animal (Kim 2008).

Cassava is a rainfed crop, so planting is usually done at the beginning of the rainy season. However, in a few provinces the planting time is at the end of the rainy season (Kim 2008)

Farmers mainly use their own stems in planting cassava. In some cases, stems are stored to develop stakes. Stakes require more complex preservation as their viability depends on the age of the plant at harvest and the planting time of the next crop.

There are two main methods of planting cassava: horizontal and vertical. Horizontal planting is the most popular method, accounting for 68 percent of the total cassava planted area in the South and 76 percent of that in the North (Kim 2008). Horizontal planting is suitable for poor or thin soils while vertical planting is commonly used in some wet soils. A combination of these methods is used mainly in the Central Coastal regions and the Central Highlands.

The planting density of cassava is mainly determined by soil conditions. The thicker the soil, the wider the row and plant spacing. Conversely, the poorer the soil, the tighter the spacing. The standard spacing in monoculture is 50-100 cm, though cassava crop is often planted as an intercrop. Intercropping can generate more farm income and helps improve soil fertility. Cassava – peanut intercropping generates the highest profit, about 3 times higher than that from monoculture (ADB 2008). It also results in about 0.75 times less dry soil loss than that experienced in monoculture. Other crops such as maize, peanuts, black beans and mung beans could be intercropped with cassava. However, intercropping is still not popular in Vietnam. As a proportion of the total cassava planted area, intercropped cassava accounts only for 10 percent in the North and 30-40 percent in the South (Kim 2008).

Cassava is a tolerant crop. It can be grown on poor soils and is barely affected by diseases and insect infestations. However, to be highly productive, it does require regular and timely applications of good quality fertiliser. Farmers, especially those with limited resources, normally apply low-quality chemical fertilisers to their cassava crops.

Age at harvest is a determinant of cassava productivity and quality. If cassava is harvested too early, then the starch content will be low, leading to low yield. Crops harvested at 10-12 months old yield the highest starch content.

New high-yielding varieties such as KM94, KM 140, KM 98-5, KM98-1, KM98-7 and SM937-26 have been adopted nationwide. About 75 percent of the total cassava cultivated area is under HYVs (Kim 2008).

3.1.3. Production costs

To estimate cassava production costs, Tay Ninh province, the largest cassava production area in Vietnam, was surveyed. A field survey was carried out in Hoa Thanh and Tan Bien districts, and farmers/cassava producers, collectors, processors and exporters were interviewed. Truong Dong commune in Hoa Thanh district and Tan Phong commune in Tan Bien district were selected for the household survey. Sixty households, evenly distributed among the districts and communes, were selected for interview.

Cassava does not need many inputs. Overall expenditure for each ha of cultivated cassava in 2007 was VND9557,000 or USD597, of which the largest proportion (as much as VND4376,000 or nearly 50 percent of total production costs) was for chemical fertilisers. Before the introduction of HYVs, farmers rarely used fertiliser for cassava production.

Under Vietnam's Land Law, farmers are allocated farm land by the State and are awarded land use certificates for that land as well as rights to its use such as transfer, exchange, lease, collateral, inheritance and investment. As Table 5.2 shows, farmers do not pay any land rent.

Table 5.2: Estimated cost, revenue and profit margins for cassava production in Tay Ninh province, 2007

Items	Amount per ha		Amount per tonne of fresh cassava root		Percentage of total cost
	VND (thousand)	USD	VND (thousand)	USD	
Total cost	9557.65	597.35	358.56	22.41	100.00
Land rental	0.00	0.00	0.00	0.00	0.00
Land preparation	712.64	44.54	26.74	1.67	7.46
Purchased	621.28	38.83	23.31	1.46	6.50
Self-supplied	91.36	5.71	3.43	0.21	0.96
Cassava stem	549.04	34.31	20.60	1.28	5.74
Purchased	26.92	1.68	1.01	0.06	0.28
Self-supplied	522.12	32.63	19.59	1.22	5.46
Labour cost	2777.06	173.57	104.18	6.51	29.06
- For transplanting	436.31	27.27	16.37	1.02	4.57
Purchased	392.59	24.54	14.73	0.92	4.11
Self-supplied	43.72	2.73	1.64	0.10	0.46
- For weeding	490.50	30.66	18.40	1.15	5.13
Purchased	425.75	26.61	15.97	1.00	4.45
Self-supplied	64.75	4.05	2.43	0.15	0.68
- For harvesting	1354.39	84.65	50.81	3.18	14.17
Purchased	1354.39	84.65	50.81	3.18	14.17
Self-supplied	0.00	0.00	0.00	0.00	0.00
Manure	977.89	61.11	36.68	2.29	10.23
Purchased	973.03	60.81	36.50	2.28	10.18
Self-supplied	4.86	0.30	0.18	0.01	0.05
Chemical fertilisers	4376.19	273.51	164.17	10.26	45.79
Pesticide	4.60	0.29	0.17	0.01	0.05
Irrigation fee	140.17	8.76	5.26	0.33	1.47
Others	20.06	1.25	0.75	0.05	0.21
Purchased	20.06	1.25	0.75	0.05	0.21
Revenue (selling price)	23,212.84	1450.80	870.84	54.43	
Profit margin	13,655.19	853.45	512.28	32.02	142.87

Source: Authors' estimation from the survey in 2008.

Labour takes the second biggest share of cassava production cost, accounting for nearly 30 percent of the total, and of which the cost of labour for harvesting was the largest (almost half of the total). Labour cost for harvesting does not enhance cassava yield; therefore,,reducing harvesting costs would generate more profit from cassava production.

Despite the high production cost, each ha of cassava generates farm profit of more than USD853 or a 143 percent profit margin compared to production cost.

Table 5.3: Estimated cost, revenue and profit margins for traditional cassava production in Tay Ninh province, 2007

Items	Amount per ha		Amount per tonnes of fresh cassava root		Percentage of total cost
	VND (thousand)	USD	VND (thousand)	USD	
Total cost	13488.57	843.04	429.18	26.82	100.00
Land rental	0.00	0.00	0.00	0.00	0.00
Land preparation	600.00	37.50	19.09	1.19	4.45
Purchased	0.00	0.00	0.00	0.00	0.00
Self-supplied	600.00	37.50	19.09	1.19	4.45
Cassava stem	300.00	18.75	9.55	0.60	2.22
Purchased	0.00	0.00	0.00	0.00	0.00
Self-supplied	300.00	18.75	9.55	0.60	2.22
Labour cost	4791.43	299.46	152.45	9.53	35.52
- For transplanting	480.00	30.00	15.28	0.95	3.56
Purchased	428.57	26.79	13.64	0.85	3.18
Self-supplied	51.43	3.21	1.64	0.10	0.38
- For weeding	2042.86	127.67	65.00	4.06	15.14
Purchased	1871.43	116.96	59.55	3.72	13.87
Self-supplied	171.43	10.71	5.45	0.34	1.27
- For harvesting	2268.57	141.79	72.18	4.51	16.82
Purchased	2268.57	141.79	72.18	4.51	16.82
Self-supplied	0.00	0.00	0.00	0.00	0.00
Manure	1191.43	74.46	37.91	2.37	8.83
Purchased	1191.43	74.46	37.91	2.37	8.83
Self-supplied	0.00	0.00	0.00	0.00	0.00
Chemical fertiliser	6525.71	407.86	207.64	12.98	48.38
Pesticide	0.00	0.00	0.00	0.00	0.00
Irrigation fee	80.00	5.00	2.55	0.16	0.59
Others	0.00	0.00	0.00	0.00	0.00
Revenue (selling price)	29628.57	1851.79	942.73	58.92	
Profit margin	16140.00	1008.75	513.55	32.10	119.66

Source: Authors' estimations from the survey data.

Farmers grow both traditional varieties and HYVs but tend to grow more HYVs. Although traditional cassava roots fetch a better market price than do HYV cassava roots, growing traditional cassava needs more inputs such as labour and fertiliser, resulting in less profit. Among the 60 interviewed households, only three were still growing traditional cassava. Total cost of traditional cassava production per ha was VND4023,000 or USD251 higher than that of HYV cassava production. The labour cost for traditional varieties was VND4,791,000 and that for HYVs was VND2,729,000.

One ha of traditional cassava can generate farmer profit of VND16140,000 or USD1000. Based on the total production cost, the profit margin reached 119 percent.

Table 5.4: Estimated cost, revenue and profit margins for HYV cassava production in Tay Ninh province, 2007

Items	Amount per ha		Amount per tonne of fresh cassava root		Percentage of total cost
	VND (thousand)	USD	VND (thousand)	USD	
Total cost	9465.20	591.57	356.59	22.29	100.00
Land rental	0.00	0.00	0.00	0.00	0.00
Land preparation	715.30	44.71	26.95	1.69	7.56
Purchased	635.90	39.74	23.96	1.50	6.72
Self-supplied	79.40	4.96	2.99	0.19	0.84
Cassava stem	554.90	34.68	20.91	1.30	5.86
Purchased	27.55	1.72	1.04	0.06	0.29
Self-supplied	527.35	32.96	19.87	1.24	5.57
Labour cost	2729.69	170.61	102.84	6.43	28.84
- For transplanting	435.29	27.20	16.40	1.02	4.60
Purchased	391.75	24.48	14.76	0.92	4.14
Self-supplied	43.54	2.72	1.64	0.10	0.46
- For weeding	453.99	28.37	17.10	1.07	4.80
Purchased	391.75	24.48	14.76	0.92	4.14
Self-supplied	62.24	3.89	2.34	0.15	0.66
- For harvesting	1332.89	83.31	50.22	3.14	14.08
Purchased	1332.89	83.31	50.22	3.14	14.08
Self-supplied	0.00	0.00	0.00	0.00	0.00
Manure	972.86	60.80	36.65	2.29	10.28
Purchased	967.89	60.49	36.46	2.28	10.23
Self-supplied	4.97	0.31	0.19	0.01	0.05
Chemical fertiliser	4325.64	270.35	162.96	10.19	45.70
Pesticide	4.70	0.29	0.18	0.01	0.05
Irrigation fee	141.58	8.85	5.33	0.33	1.50
Others	20.53	1.28	0.77	0.05	0.22
Purchased	20.53	1.28	0.77	0.05	0.22
Revenue (selling price)	2,3061.95	1441.37	868.84	54.30	
Profit margin	13596.76	849.80	512.24	32.02	143.65

Source: Authors' estimations from the survey data.

As Table 5.4 shows, HYVs generated profit of VND13,596,000 or USD849 for each cultivated ha, lower than that of traditional cassava. This is because (i) traditional cassava tends to be grown on smaller plots and farmers therefore have more labour and more money to invest in fertiliser, and (ii) the market price of traditional cassava is much higher than that of HYVs. Setting the profit margin against the total production cost, the ratio for growing HYVs was 143.65 percent, much higher than the ratio of 119.66 percent for growing traditional cassava.

Table 5.5: Estimated cost, revenue and profit margin for cassava production on farms of less than 1 ha in Tay Ninh province, 2007

Items	Amount per ha		Amount per tonnes of fresh cassava root		Percentage of total cost
	VND (thousand)	USD	VND (thousand)	USD	
Total cost	10,585.55	661.60	370.35	23.15	100.00
Land rental	0.00	0.00	0.00	0.00	0.00
Land preparation	977.27	61.14	34.23	2.14	9.25
Purchased	865.44	54.09	30.28	1.89	8.18
Self-supplied	112.83	7.05	3.95	0.25	1.07
Cassava stem	838.23	52.39	29.32	1.83	7.92
Purchased	63.50	3.97	2.22	0.14	0.60
Self-supplied	774.73	48.42	27.10	1.69	7.32
Labour cost	2809.22	175.58	98.28	6.14	26.54
- For transplanting	482.62	30.17	16.89	1.05	4.56
Purchased	390.37	24.40	13.66	0.85	3.69
Self-supplied	92.25	5.77	3.23	0.20	0.87
- For weeding	1186.90	74.19	41.52	2.60	11.21
Purchased	990.98	61.94	34.67	2.17	9.36
Self-supplied	195.92	12.25	6.85	0.43	1.85
- For harvesting	1139.71	71.23	39.87	2.49	10.77
Purchased	1139.71	71.23	39.87	2.49	10.77
Self-supplied	0.00	0.00	0.00	0.00	0.00
Manure	918.79	57.42	32.15	2.00	8.68
Purchased	894.06	55.88	31.28	1.95	8.45
Self-supplied	24.73	1.55	0.87	0.05	0.23
Chemical fertiliser	4857.86	303.62	169.96	10.62	45.89
Pesticide	23.40	1.46	0.82	0.05	0.22
Irrigation fee	103.61	6.48	3.62	0.23	0.98
Others	56.15	3.51	1.96	0.12	0.53
Purchased	56.15	3.51	1.96	0.12	0.53
Revenue (selling price)	23,212.84	1450.80	870.84	54.43	235.14
Profit margin	12,627.29	789.21	500.49	31.28	135.14

Source: Authors' estimations from the survey data.

A comparison of production costs by farm size reveals economies of scale. Expenditure on cassava cultivation for farms of less than 1 ha is VND1279,000, higher than that for farms of over 1 ha. The cost of producing 1 tonne of fresh cassava roots for farms of over 1 ha is VND15,000, lower than that for farms of less than 1 ha. Consequently, the profit margins per ha were VND13,906,000 for farms of more than 1 ha and VND12,672,000 for farms of less than 1 ha.

Table 5.6: Estimated cost, revenue and profit margins for cassava production on farms of over 1 ha in Tay Ninh province, 2007

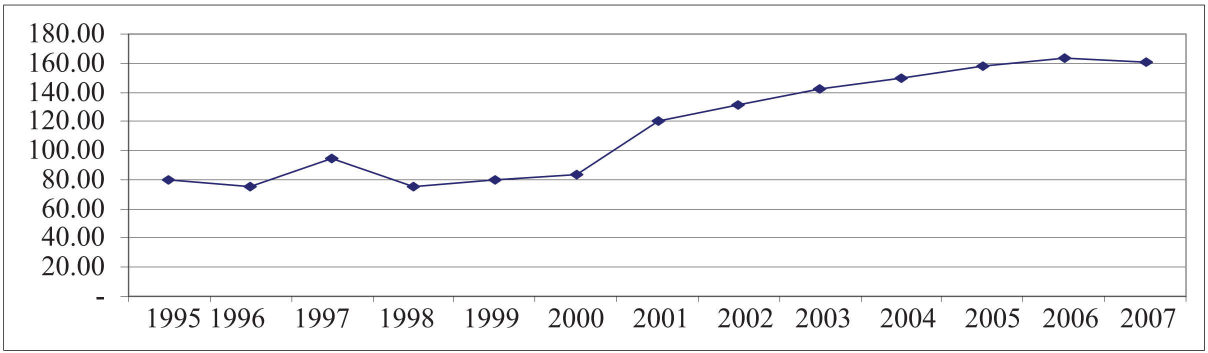
Items	Amount per ha		Amount per tonne of fresh cassava root		Percentage of total cost (%)
	VND (thousand)	USD	VND (thousand)	USD	
Total cost	9306.38	581.65	355.41	22.21	100.00
Land rental	0.00	0.00	0.00	0.00	0.00
Land preparation	647.71	40.48	24.74	1.55	6.96
Purchased	561.60	35.10	21.45	1.34	6.03
Self-supplied	86.11	5.38	3.29	0.21	0.93
Cassava stem	478.35	29.89	18.27	1.14	5.14
Purchased	17.97	1.12	0.69	0.04	0.19
Self-supplied	460.38	28.77	17.58	1.10	4.95
Labour cost	2769.20	173.07	105.76	6.61	29.76
- For transplanting	425.00	26.56	16.23	1.02	4.56
Purchased	393.14	24.57	15.01	0.94	4.22
Self-supplied	31.86	1.99	1.22	0.08	0.34
- For weeding	320.16	20.01	12.22	0.77	3.44
Purchased	287.58	17.97	10.98	0.69	3.09
Self-supplied	32.68	2.04	1.25	0.08	0.35
- For harvesting	1406.86	87.93	53.73	3.36	15.12
Purchased	1406.86	87.93	53.73	3.36	15.12
Self-supplied	0.00	0.00	0.00	0.00	0.00
Manure	992.33	62.02	37.90	2.37	10.66
Purchased	992.33	62.02	37.90	2.37	10.66
Self-supplied	0.00	0.00	0.00	0.00	0.00
Chemical fertiliser	4258.45	266.15	162.63	10.16	45.76
Pesticide	0.00	0.00	0.00	0.00	0.00
Irrigation fee	149.10	9.32	5.69	0.36	1.60
Others	11.24	0.70	0.43	0.03	0.12
Purchased	11.24	0.70	0.43	0.03	0.12
Revenue (selling price)	23 212.84	1450.80	870.84	54.43	
Profit margin	13 906.46	869.15	515.43	32.21	145.02

Source: Authors' estimations from the survey data.

3.1.4. Productivity

Cassava yield increased slightly in 1995-2000, from 79.72 quintals/ha in 1995 to 83.6 quintals/ha in 2000, or only just 0.95 quintals/ha of annual growth level. It was offset by the contraction in the cassava planted area, leading to a considerable decrease in cassava output from 2211.5 thousand tonnes in 1995 to 1986.3 thousand tonnes in 2000, equivalent to -10.2 percent over the whole period.

Figure 5.3: Cassava yield, 1995-2007



Source: Calculated from GSO statistical data

In contrast to the previous period, in 2001-2007 cassava yield gradually climbed back up along with the expansion in the cultivated area, at a growth rate of 101.53 percent over the whole period or an average of 6.01 percent a year. This increase was mainly due to the adoption of new high yielding varieties; however, the rates of increase varied between different regions and provinces. The North Central Coast region showed the highest growth rate at 8.86 percent per year on average. Meanwhile the Northwest region had the lowest growth rate of yield of only 3.07 percent. These trends were driven by cassava yield changes in just some of the provinces in those regions. Nghe An province, in the North Central Coast region, achieved the highest annual yield growth of 22.73 percent whereas Binh Phuoc and Binh Duong provinces in the North East South region had the lowest rates of 0.32 percent and 0.24 percent, respectively.

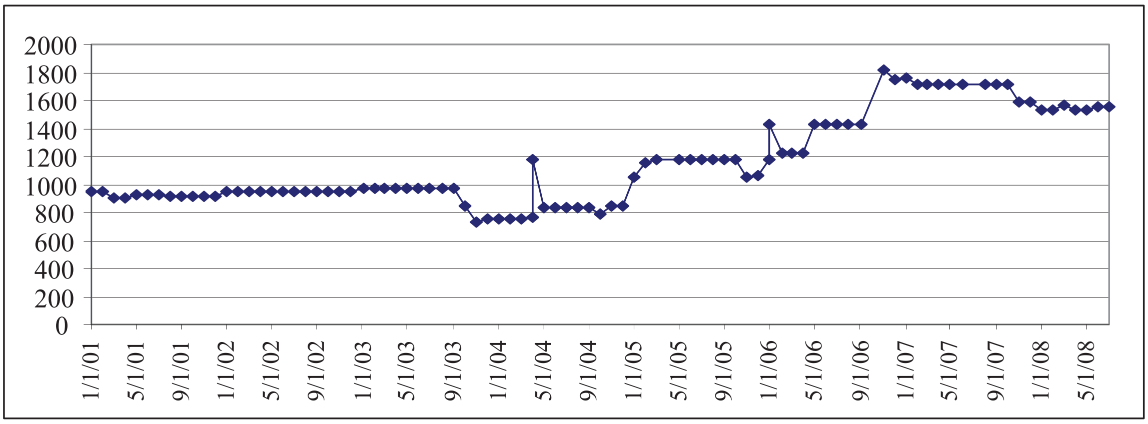
3.1.5. Potential and policy

Developments in the global cassava sector indicate the high potential of cassava production in the near future. Demand for cassava as an industrial raw material is going up. Cassava production and consumption are estimated to increase. Total demand for cassava is expected to increase annually by 1.4 percent until 2010 (FAO 2003). Furthermore, net cassava exports were forecasted to rise by 2.5 percent over the same period. Estimates indicate that total cassava utilisation will go up by 1.7 percent per annum during 1993-2020 (Hershey and Howeler 2001). Along with this increase, the price of fresh cassava roots is also expected to rise.

In Vietnam, cassava has been regarded as a cash crop for the poor in the remote and mountainous areas. For example, on average, a farmer might earn a net return of approximately VND10 million per hectare per annum in Yen Bai province (Van Thong 2008). In some areas, the profit earned from 1 hectare of cassava production is about VND14-5 million per year or even more. As a result, cassava is an attractive crop especially for poor farmers. Furthermore, cassava is highly adaptable to different types of soil, even poor or unfertile soils. Cassava production will expand if it continues to provide more benefits to farmers. An advantage of cassava production development is that many large and modern starch processing factories are operating or being constructed, with a processing capacity of 5360 thousand tonnes of cassava fresh roots per year. Thus, there is further room for improvement in cassava production, which currently satisfies only 75 percent of processing capacity.

The production potential and opportunities could lead to a cassava boom in Vietnam in the near future.

Figure 5.4: Monthly price of fresh cassava (VND/kg), Jan 2001 to Jul 2008



Source: Calculated from GSO statistical data

3.1.6. Constraints and opportunities

Some farmers have been using new high-yielding cassava varieties and applying new cultivation techniques such as intercropping, though large numbers of farmers are still using traditional production techniques. Many producers have been slow to adopt new varieties and improved technologies. The more development there is, the more danger the bad habits pose. Low yield, soil erosion and soil fertility deterioration are direct negative impacts of these bad practices. In addition, starch processing generates serious environmental pollution, especially by small firms which usually lack the technologies and equipment for treating liquid and solid waste. Another limitation is that cassava areas in many provinces have exceeded the planned and established land areas for production. This poses a particular problem, as the progress in development that has been achieved has not been under control, leading to imbalances in socio-economic development. In addition, the prices of cassava products often fluctuate and are highly dependent on the world market, making it difficult to forecast prices. Further, there is a considerable gap between the demand and supply of cassava in Vietnam. The most serious constraint on the sector is the shortage of cassava raw materials. Shortage of raw materials has meant that many processing factories have been operating at 60 percent of their capacity, which is an inefficient use of resources for the industry in particular and the whole country in general. Another problem is that farmers cannot readily access processing factories mainly because of high transport and delivery costs, disciplinary quality controls and cumbersome administrative procedures. Thus, they must sell products through intermediaries at a price that is much lower than that if they sold directly to large processors.

HYVs such as KM60, KM94 and KM98 have been introduced in the last decade, and are increasingly being adopted by farmers. In addition, farmers are shifting crop production to cassava because it is more profitable. Cassava market prices have been very attractive in recent years and exceeded farmer's expectations. For example, in late 2008, the price of fresh cassava roots in Tay Ninh province was as high as 1300VND/kg (equivalent to USD81 per tonne), allowing farmers to earn VND12 to 15 million profit per cassava growing area. Domestic demand for cassava is high as most cassava processing factories are short of raw material.. Some cassava processing factories commit to a floor price for cassava, strengthening the linkage between them and farmers. Demand in the international market has also increased, especially from China. As a WTO member, Vietnam's foreign trade policy is facilitated; therefore, it would be easier for Vietnam's trade in cassava and cassava products to expand on the international market.

3.2. Rubber

3.2.1. Production

Natural rubber has been grown in Vietnam since 1897. Most of the rubber has been planted in the southern part of Vietnam, especially in the South East and Central Highland regions. Natural rubber has come to play an important role in Vietnamese agriculture, providing jobs and incomes for rural people and foreign exchange for the country.

Vietnam is the fourth largest rubber producer in the world, just behind Indonesia, Thailand and Malaysia. In 1995-2007, with an annual growth rate of 5.2 percent, Vietnam had the fastest growing areas planted to rubber trees while the annual growth rate of areas planted to rubber in the world was only 1.8 percent.

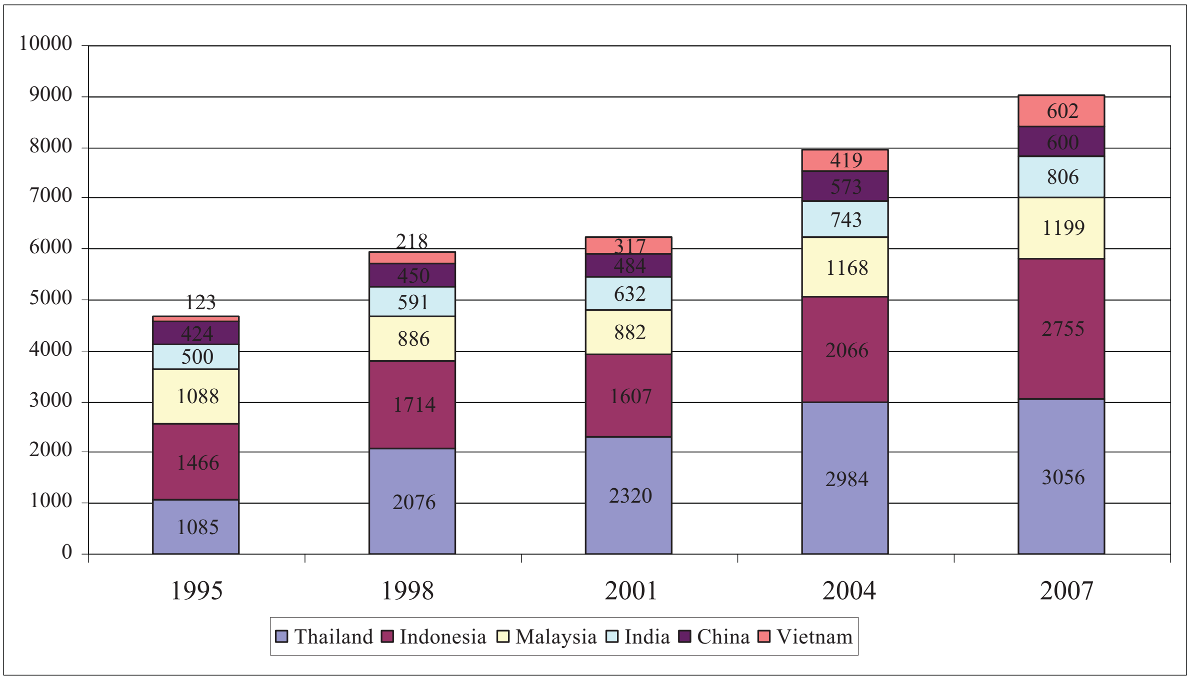
Table 5.7: Vietnam in world natural rubber production (thousand hectares)

Country	1995	2000	2005	2007	Annual growth rate (%)
The world	7212	7565	8167	8944	1.8
Thailand	1496	1524	1692	1763	1.4
Indonesia	2261	2400	2660	3175	2.9
Malaysia	1475	1300	1237	1400	-0.4
India	356	400	450	450	2.0
China	396	421	465	475	1.5
Vietnam	**278**	**412**	**483**	**512**	**5.2**
Others	950	1107	1180	1169	1.7

Source: FAO STAST 2008

Six countries account for 90 percent of total natural rubber production in the world. Vietnam ranks fourth in revenue and fifth in production.

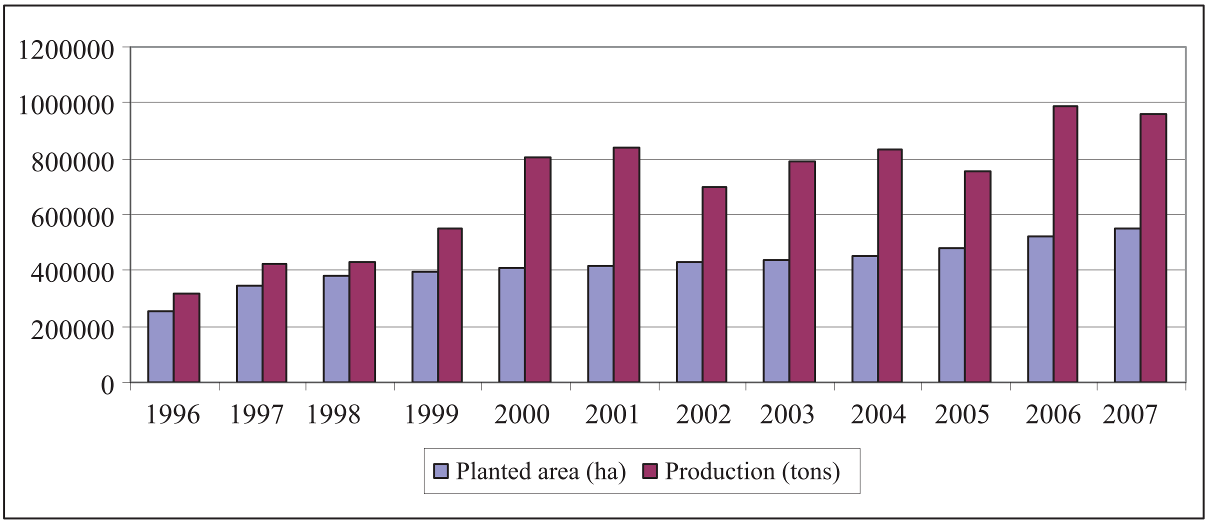
Figure 5.5: Production in the top six rubber producing countries (thousand tonnes), 1995-2007



Source: ANRPC

Following the rapid expansion in the last decade of the area planted to rubber, Vietnam had the highest annual growth rate of natural rubber production in the world at 14.1 percent in 1995-2007.

Figure 5.6: Natural rubber production in Vietnam, 1996-2007

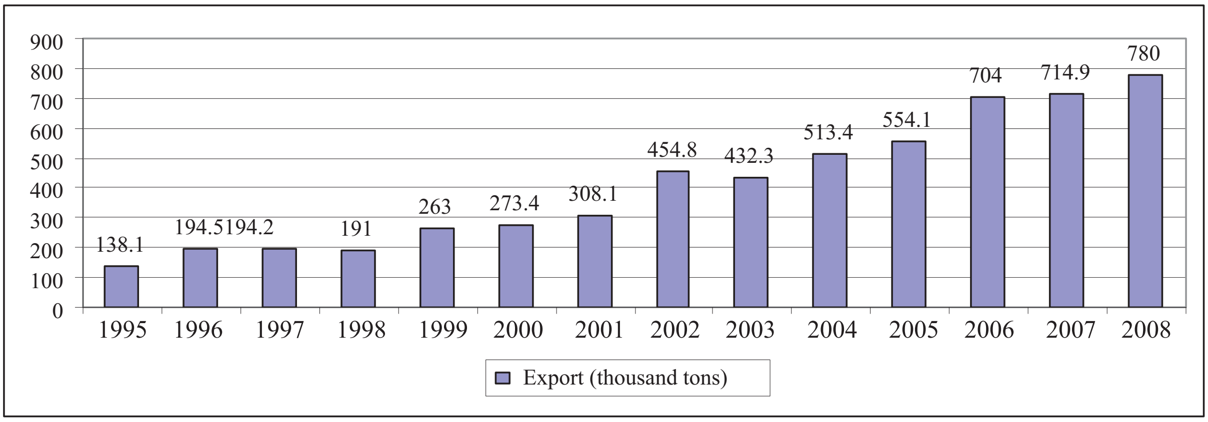


Source: Calculated from MARD data

The area planted to rubber trees continuously increased during 1996-2007 at an annual growth rate of 14.5 percent. The total rubber tree area in 2007 was double that in 1996. Most of the rubber trees are concentrated in the South East region, which in 2007 accounted for 371,000 ha or 67.5 percent of the total rubber tree area.

The annual growth rate of rubber production in 1996-2007 was 15.3 percent. Total rubber production in 2007 was 4.6 times higher than that in 1996.

Figure 5.7: Vietnam natural rubber export (thousand tonnes), 1995-2008



Source: Calculated from GSO data and vinanet.com.vn

The export volume of natural rubber continuously increased through from 1995 to 2008 at an annual growth rate of 14.7 percent. Rubber export value reached about USD1.8 billion in 2008.

3.2.2. Cultivation practices

In Vietnam, rubber is mainly produced by state farms. State farms account for around 70 percent and smallholders for about 30 percent of total production. Smallholder rubber plantations have developed in recent years. State farms receive support in the form of land, credit and technology; management is a problem, however. On a positive note, state farms, processors and exporters belong to one company; thus, they have the advantage of being able to cooperate from production to export. State farms also achieve economies of scale, more than 10,000 ha. Farm holders have incentives to work, but face the problems of limited land and difficult access to credit and technology such as high-yielding varieties.

Smallholder plantations started to emerge when the government allowed private farms to occupy larger land areas, particularly with the issuance of the Land Law in 1993. Smallholders have suffered some problems. They grow rubber trees based mainly on their own experience or learning from their neighbours and relatives. They do not have enough information to help them select the good varieties, and mainly get varieties from local people or by themselves. Because the lifetime of rubber is long (about 25 years), it is very difficult for them to change the variety once planted. Fertiliser is also a problem for smallholders; they mainly use chemical and rarely apply organic fertilisers. Smallholders usually tap the trees once every two days and for 9 months a year.

3.2.3. Production cost

Rubber is a perennial tree, and it takes 5 years for a tree to mature for tapping. Rubber trees can be tapped for 20 years. Therefore, the initial investment is depreciated over the whole rubber tree production cycle. The average cost and profit margins of rubber production can be estimated as shown in Table 5.8.

On average, the initial investment in rubber trees is estimated at around VND30 million per ha (USD1870). Over 20 years of tapping, this amount depreciates by USD93.8 a year. No income is expected from young trees in the first five years of planting; therefore, farmers must generate income from other crops instead.

The cost of planting seedlings is VND1,461,960 per ha or USD0.69 per tonne of rubber sap. The cost of chemical fertilisers is VND16,704,000 per ha or USD7.9 per tonne, accounting for the biggest proportion (55.76 percent) of the total cost of the initial investment.

The cost of maintenance and harvesting is estimated at VND646,800,000 per ha or USD307.12 per tonne for the whole production cycle of 20 years. This accounts for nearly 96 percent of total production costs. The cost of labour for harvesting is VND563,760,000 per ha or USD267.69 per tonne, accounting for the largest share (83.31 percent) of the total cost of rubber production for the entire 20-year period. Chemical fertilisers, at VND43,200,000 per ha or USD20.5 per tonne for the whole production cycle, constitute 6.38 percent of total production costs. Manure accounts for 2.72 percent and bowls for collecting rubber sap take 2.16 percent of the total production cost.

In sum, the total rubber production cost is VND676,757,160 per ha or USD321.3 per tonne of rubber sap for the whole production cycle. When the average price per kg of average quality rubber sap is VND9940, the margin per ha of rubber trees is VND631,595,340 or USD299.9 per tonne of rubber sap. Thus, the average profit of small farm households is about 93.35 percent of the total production cost. This is a good profit for rubber farmers.

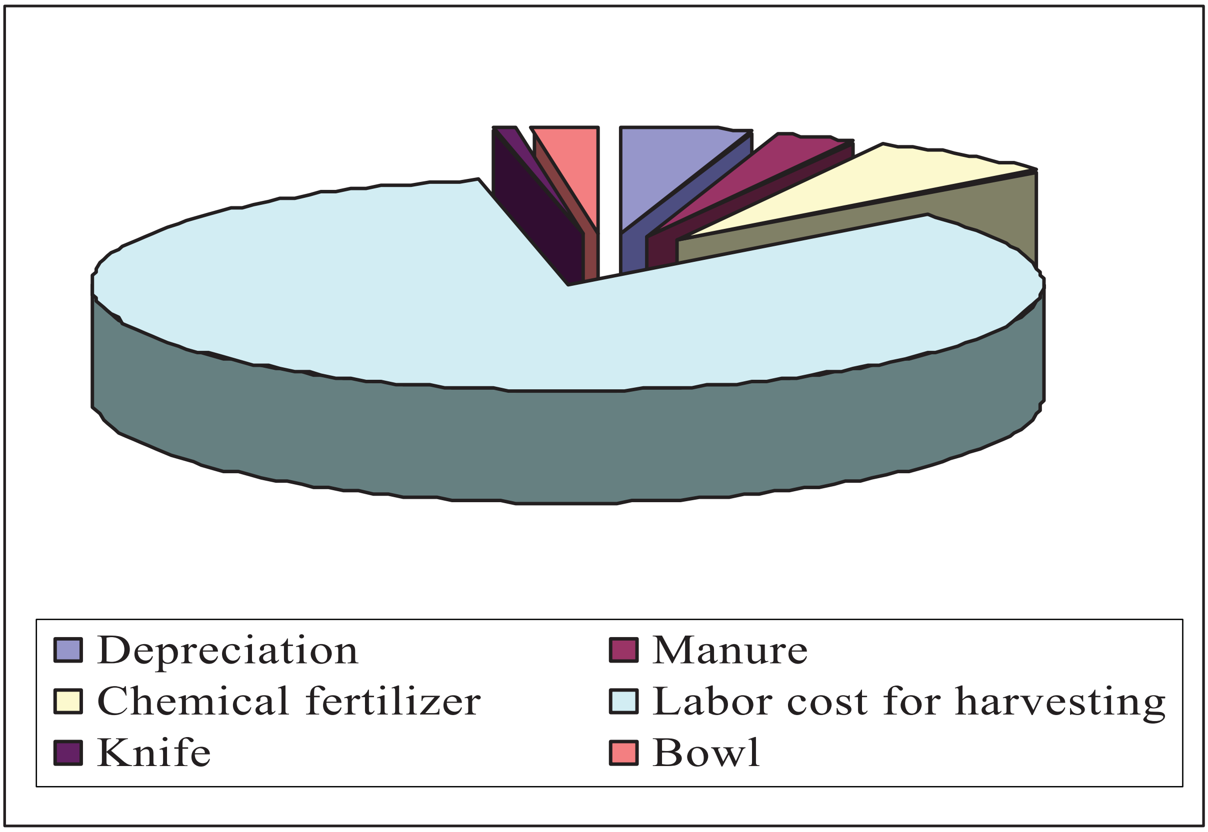
Table 5.8: Estimated cost, revenue and profit margin for rubber sap production in Phu Giao district, 2007/08

			Amount/ha (VND)	Amount/tonne (VND)	Amount/tonne (USD)
Initial investment			29,957,160	226,948.18	14.18
	Cost for the first year		8291,560	62,814.85	3.93
		Land preparation	2660,000	20,151.52	1.26
		Seeding	1461,960	11,075.45	0.69
		Manure	176,000	1333.33	0.08
		Chemical fertiliser	1,920,000	14,545.45	0.91
		Planting labour cost	475,200	3600.00	0.23
		Weeding	598,400	4533.33	0.28
		Other cost	1,000,000	7575.76	0.47
	Cost for the second year		5,416,400	41,033.33	2.56
		Chemical fertiliser	3,696,000	28,000.00	1.75
		Other chemical	20,000	151.52	0.01
		Weeding	374,400	2836.36	0.18
		Weed killer	446,000	3378.79	0.21
		Plough fallow land	880,000	6666.67	0.42
	Cost for the third, fourth and fifth years		16,249,200	123,100.00	7.69
		Chemical fertiliser	11,088,000	84,000.00	5.25
		Other chemical	60,000	454.55	0.03
		Weeding	1123,200	8509.09	0.53
		Weed killer	1338,000	10,136.36	0.63
		Plough fallow land	2640,000	20,000.00	1.25
Operations cost for harvesting			646,800,000	4,913,960.11	307.12
		Manure	18,400,000	139,791.07	8.74
		Chemical fertiliser	43,200,000	328,205.13	20.51
		Labour for harvesting	563,760,000	4,283,076.92	267.69
		Knife	6800,000	51,661.92	3.23
		Bowl	14,640,000	111,225.07	6.95
Total cost			676,757,160	5,140,908.3	321.31
Revenue			1,308,352,500	9,940,000.00	621.25
Margin			631,595,340	4799,091.7	299.94

Source: Calculated from survey data.

The total depreciation cost of the initial investment in rubber plantation accounts for 4.4 percent of total production cos,t while harvesting cost accounts for 95.6 percent. Labour cost for harvesting accounts for a huge 83.3 percent of total production cost. Harvesting rubber is labour-intensive, from cutting the trunk to collecting rubber sap. It is not easy for rubber producers to reduce labour costs. Farmers balance this cost by hiring more labour when the market price of rubber sap increases and hiring less labour or even stopping tapping when the market price decreases.

Figure 5.8: Structure of rubber sap production cost

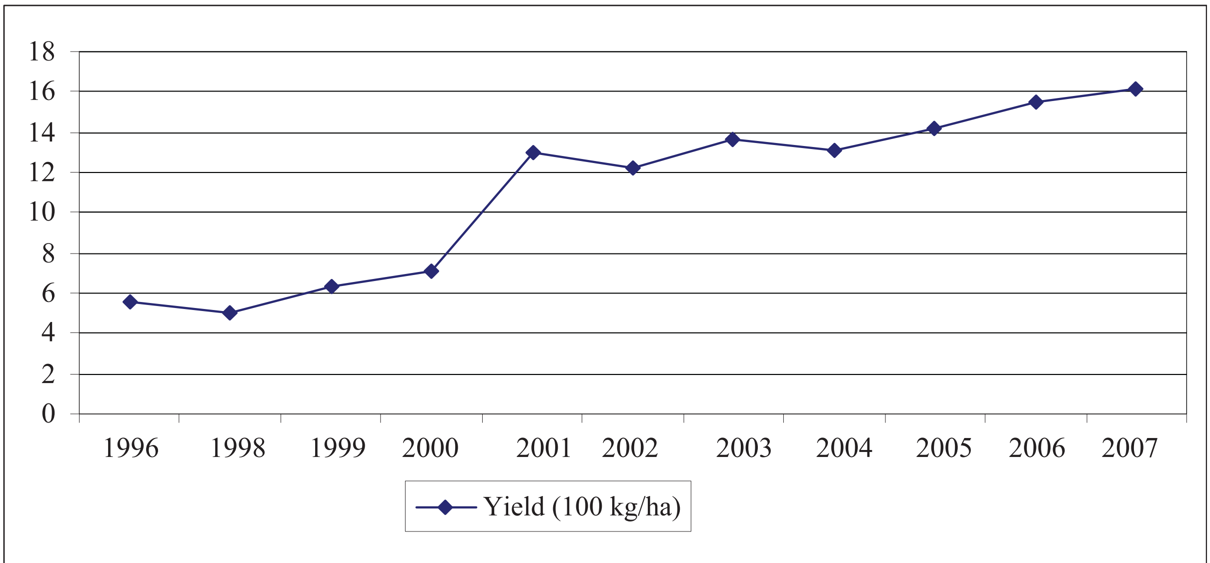


Source: Calculated from survey data

3.2.4. Productivity

The productivity of rubber in Vietnam is high. In general, harvesting starts in year 6 and finishes in year 26. Productivity is highest during years 15-19.

Figure 5.9: Rubber productivity in Vietnam, 1996-2007



Source: Calculated from GSO data

The average productivity of natural rubber in Vietnam during 1996-2007 increased remarkably, especially after 2001. In 2007, natural rubber productivity reached 16.1 quintals per ha, triple than that in 1996. At that time, the South East region had both the biggest concentration of rubber tree planted areas and the highest level of rubber productivity (17.1 quintals per ha).

3.2.5. Potential and policies

Rubber tree plantation shows huge potential. In terms of economic efficiency, natural rubber production is superior to that of other crops. For instance, in comparison with other cash crops in the Central Highlands, rubber trees ranked the second best in profit and cost ratio, next to cashews. In terms of return per ha of crop cultivation, rubber trees also ranked second, next to coffee. In terms of investment, rubber production needs relatively low inputs while bringing in high profit rates.

Vietnam's natural rubber has good competitiveness as its domestic resource cost (DRC) is only around 0.48. In addition, the demand for natural rubber on the international market is high. Around 64 percent of Vietnam's natural rubber is exported to China. Therefore, export companies can benefit from the advantage of lower transport costs.

Rubber tree production in particular and the rubber industry in general can benefit from government policy. The development plan for the rubber industry was approved by the prime minister on 5 February 1996. This plan is the legal framework for the rubber industry in Vietnam. In addition, Decision No. 2855 QD/BNN-KHCN dated 17 September 2008 recognised the rubber tree as a multi-purpose tree thereby allowing rubber trees to be planted on forestry land. Recently, rubber planting was expanded to the North Mountainous area and Vietnam has even been able to invest in rubber tree plantations in Laos.

3.2.6. Constraints and opportunities

Land for rubber plantations in Vietnam is now limited. It has become increasingly difficult for Vietnam to expand its rubber producing areas. Growing rubber trees on sloping land is both costly and risky.

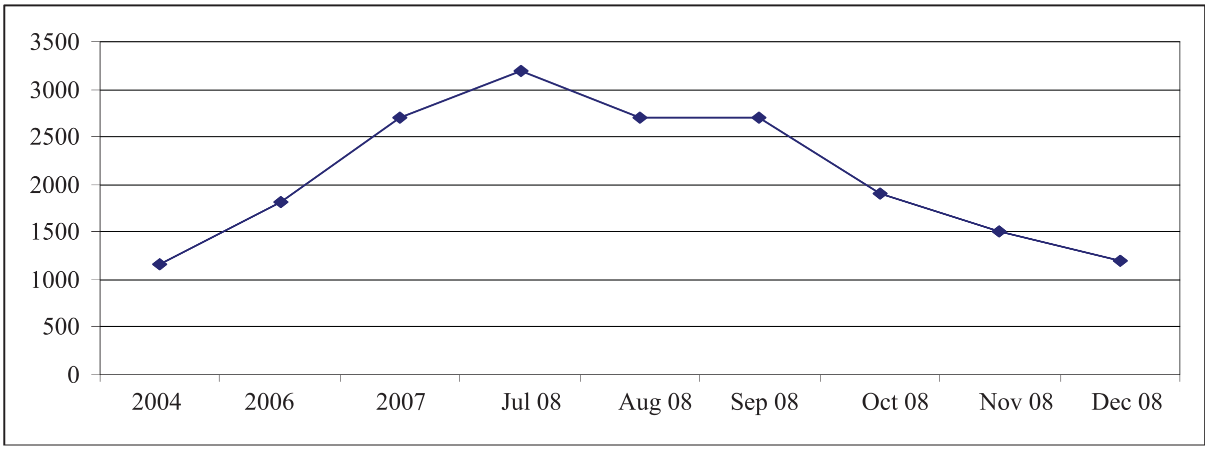
Rubber in Vietnam is mainly produced by state farms. State farms have comparative advantages in economies of scale, credit, technology and human resources, but similar to most other state companies, their working incentives are very limited. Besides that, state farms are facing a management problem. Weak business management often leads to low effectiveness, economic inefficiency and loss of competitiveness. While smallholders have great working incentives, they too suffer from such problems as limited technology and land, dependence on state processing companies, and being more vulnerable to fluctuations in prices and demand on world markets.

Rubber production is labour intensive and the cost of labour accounts for the largest part of total production cost. The labour cost for harvesting specifically accounts for 83 percent of the total cost. The higher demand for labour in the harvesting season would increase the cost, consequently affecting rubber growers' benefit.

Rubber prices on the international market are volatile. For instance, from July to December 2008, the export price of Vietnamese natural rubber decreased sharply from USD3200/tonne to USD1200/tonne

In terms of opportunities, smallholders have room to improve their rubber productivity and quality. In addition, the development of new techniques for tapping trees for latex would promote intensive farming and increase economic efficiency of the rubber industry. Local and international markets for final products have huge demand that Vietnam can supply.

Figure 5.10: Export price of Vietnam's natural rubber (USD per tonne)



Source: Calculated from data of the Vietnam Customs Office

4. Trade in cassava

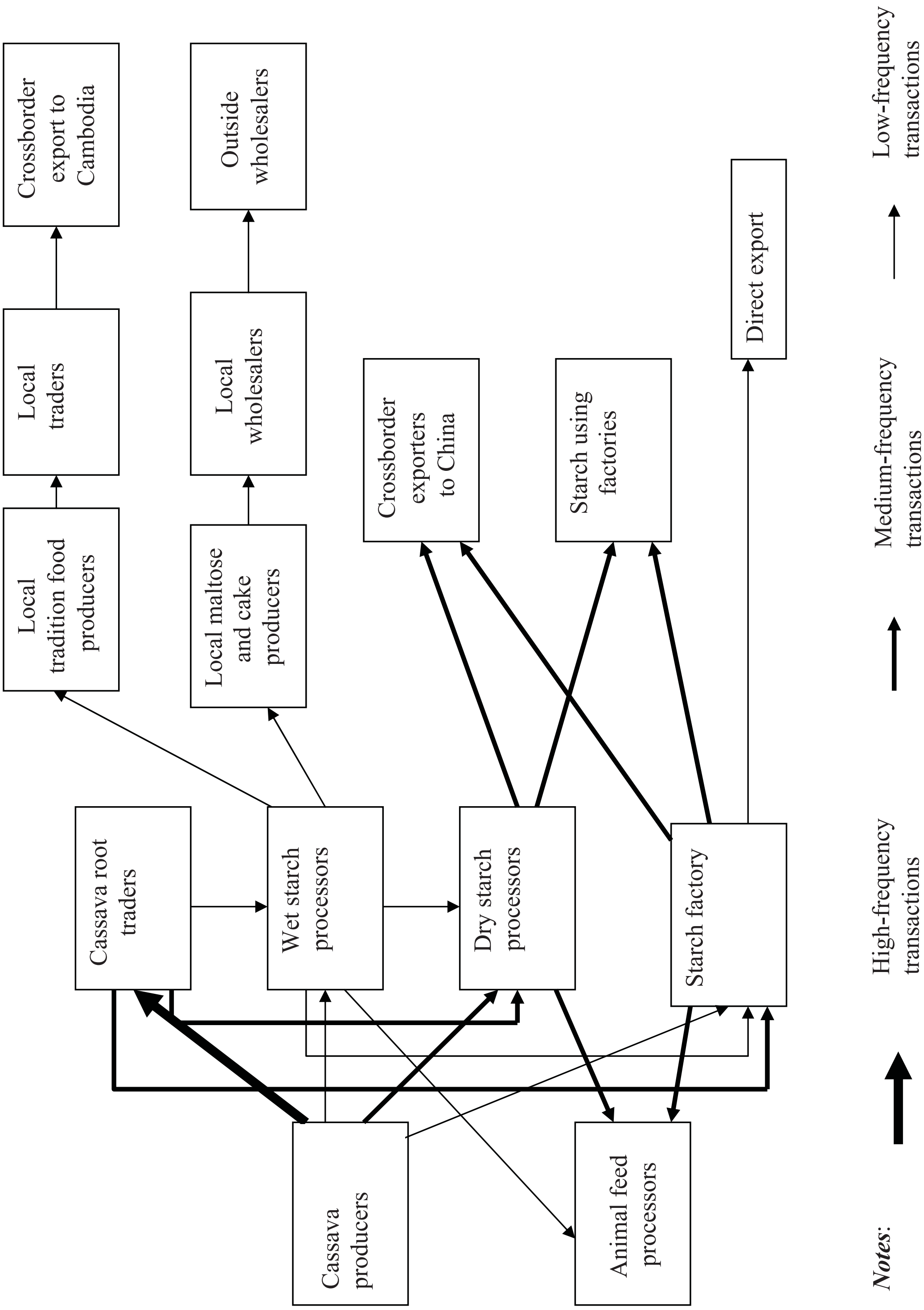
4.1. Marketing chains

A typical marketing chain for cassava in Tay Ninh province is presented in Figure 5.11. This marketing chain is quite complicated. Farmers sell the bulk of cassava to cassava root traders. The product then goes to wet starch processors. The wet starch processors either sell cassava starch to animal feed processors, dry starch processors or starch factories. This is not the only way that cassava is sold however. Some cassava farmers sell their products direct to wet starch processors or even starch factories. Similarly, cassava root traders sometimes sell a considerable amount of cassava roots directly to starch factories.

Another channel that wet starch processors often follow is to sell their products to local traditional food producers or local maltose and cake producers. From there, the local traditional food producers sell their products to local traders and crossborder exporters to Cambodia, the end of one of the branches of this value chain. Local maltose and cake producers sell their products to local wholesalers and then outside wholesalers. This is the end of another branch of this value chain.

However, dry starch processors sell substantial amounts of cassava are sold to crossborder exporters to China, and this ends the third branch of the cassava marketing chain in Tay Ninh. Dry starch processors can also sell their products to starch-using factories for producing many other products. At this point, cassava is consumed domestically and is used as an ingredient in the manufacture of other products. This ends the fourth branch of the value chain. The last branch of the marketing chain ends when the starch factories export their products to the world market.

Figure 5.11: Cassava marketing chain in Tay Ninh province



This is also the usual situation in other provinces, though the level of complexity varies. The frequency of transactions in cassava trading is represented by the thickness of the arrows showing the corresponding relationships among actors. The quantity of cassava exported is perhaps not much compared to domestic consumption. Nevertheless, the international market does affect the domestic cassava price to some extent.

4.2. Costs and margins

4.2.1. Farm gate prices

The farm gate prices of cassava in Tay Ninh are discussed in the previous subsection on production costs. As Table 5.2 shows, the average cost per tonne of fresh cassava reached VND358,560 in the 2007 season. The farm gate price paid by cassava collectors in Truong Phong and Tan Phong communes was VND870,840 per tonne in the same season. Therefore, the profit margin for the farmers was VND512,280 per tonne (USD32.02), accounting for around 143 percent of the total costs of cassava production there. Although this percentage is relatively high, the profit value is not high compared to other crops. Another fact is that average household cassava output is not high, leading to moderate profit from cassava.

4.2.2 Intermediaries

The intermediaries or cassava collectors in the study areas were also interviewed about their trading costs and profit margins. Table 5.9 presents the findings.

Table 5.9: Estimated costs and margin for cassava collectors in Tay Ninh province, 2007

Cost Items	Average cost per tonne of fresh cassava		
	VND	USD	Percentage of total costs
Selling price	1,081,967.0	67.6	104.5
Material Inputs	870,838.9	54.4	84.1
Transport cost in input buying	85,680.7	5.4	8.3
Other costs	1,559.8	0.1	0.2
Managerial costs	0.0	-	0.0
Loss	0.0	-	0.0
Transport cost	76,191.7	4.8	7.4
Transport cost in selling	817.5	0.1	0.1
Total costs	1,035,088.5	64.7	100.0
Profit margin	46,878.5	2.9	4.5

Note: Exchange rate: VND 16,000:USD1
Source: Estimated based on the survey data in Tay Ninh province

As farmers mainly sell their products (cassava) to collectors, the farm gate price represents the input cost for the collectors, Illustrated in Table 5.9, input materials make up the major share of the total cost for collectors. For 1 tonne of fresh cassava, collectors paid around VND870,840 (USD54.4) to the farmers, and this cost accounted for 84.1 percent of the collectors' total cost per tonne of fresh cassava. The second largest cost for the collectors is transport associated with purchasing inputs. This cost accounts for 8.3 percent of the total cost (USD5.4 per tonne). The two other transport costs are general and those incurred when selling produce. These two items make up 7.5 percent of the total average cost for cassava collectors. Other costs including transaction costs are minor.

The collectors sell their products to primary processors and, according to the results in Table 5.9, the average selling price in 2007 was VND1,081,967 (or USD67.6) per tonne. The cassava collectors achieve a profit margin of VND6,878 (or USD2.9) per tonne. It seems at first that the collectors have a very slim profit margin (about 4.5 percent of total cost). However, the absolute profit value for each collector is not much less. This is because the collectors often buy much higher quantities of cassava and thus their profits are expected to be much higher than it seems.

4.2.3. Processing

Tracing further the marketing chain of cassava, the primary processors buy cassava from the collectors. It also means that the selling prices of collectors as seen in Table 5.9 are costs of input materials for the processors. The detailed information on costs and margins of primary processors are provided in Table 5.10.

Primary processors buy cassava from collectors. The selling prices attained by collectors (Table 5.9) represent the costs of input materials for the processors. Table 5.10 provides detailed information on costs and margins of primary processors.

Table 5.10: Average costs and profit margin of fresh cassava for primary processors in TEY Ninth province, 2007

Cost items	Average cost per ton of fresh cassava		
	VND	USD	Percent
Selling price (total product value)	1,479,681.2	92.5	
Average price	1,388,905.6	86.8	
Complementary products	90,775.6	5.7	
Material Inputs (cassava)	1,081,966.9	67.6	75.9
Labour	52,377.2	3.3	3.7
Electricity and water	37,959.2	2.4	2.7
Transport	60,786.9	3.8	4.3
Machine hire	38,974.0	2.4	2.7
Wrapping	37,085.0	2.3	2.6
Storage, management	2,411.4	0.2	0.2
Transaction	3,416.1	0.2	0.2
Losses	26,804.9	1.7	1.9
Transport	76,617.6	4.8	5.4
Depreciation	6,581.1	0.4	0.5
Other	0.0	0.0	-
Total cost	1,424,980.3	89.1	100.0
Average profit margin	54,700.9	3.4	3.8

Exchange rate: VND16,000:USD1
Source: Estimated based on survey data

The primary processors of cassava incur many kinds of costs, including transport, labour, electricity, water, machine hire, wrapping and depreciation.. Input materials accounted for 75.9 percent of the total cost while total transport costs took up 9.7 percent. Other considerable costs are labour, electricity, water and wrapping costs each accounting for around 2 to 4 percent. Minor costs are storage, management, transaction costs and losses.

The final outputs of cassava primary processors include two types of products: one type goes to exporters, and the other includes complementary products (subproducts). The value of the final products of processors is the total value of these two groups of products. The total value of 1 tonne of processed cassava products is VND1,479,681 (USD92.5), resulting in a profit margin of VND54,700 (USD3.4) per tonne. The margin at around 3.8 percent of total costs looks very thin. The absolute profit value for processors is not that small, however. This is because processors often buy and process huge quantities of cassava, so their profits are much higher than they might appear to be at first sight.

4.2.4. Exports

Exporters are the last stakeholder in the marketing chain. They buy products from primary processors; the selling prices for processors are also the input material costs for exporters. Table 5.11 presents the structure of costs and margins of cassava exporters in Tay Ninh province.

Table 5.11: Average costs and profit margin for exporters of cassava products in Tay Ninh province, 2007

Cost Items	Average cost per tonne of fresh cassava		
	VND	USD	Percent
Total revenue	1,544,625.0	96.5	
Total cost	1,451,769.1	90.7	100.0
Goods purchased	1,388,906.0	86.8	95.7
Transport	52,388.1	3.3	3.6
Transaction	10,475.0	0.7	0.7
Average profit margin	92,755.9	5.8	6.4

Note: Exchange rate: VND16000/USD1.
Source: Estimated based on the survey data in Tay Ninh province

For exporters, the cost of goods purchased is VND1,388,906 (USD86.8) per tonne, accounting for 95.7 percent of total costs. The second highest cost item is transport (3.6 percent), and transaction costs are minor (0.7 percent).

Exporters have a relatively good profit margin. For each tonne of cassava products, the exporters in Tay Ninh get an average profit of VND92,866 (USD5.8). The profit margin of 6.4 percent is relatively high. They often buy and sell large volumes of cassava products. Therefore, the absolute value of their profits is larger than that of other stakeholders in the chain.

4.3. Constraints and opportunities

As the demand for cassava and cassava-derived products is increasing, the opportunities for expansion of the cassava industry are good. Cassava is not only used as a food plant. It can also be used for producing starch, which is an input for many industries. Cassava can be grown in many provinces of Vietnam and does not require fertile land. Therefore, the crop has potential to expand. However, the problem is that the constraints must be properly addressed so that further development secures efficiency.

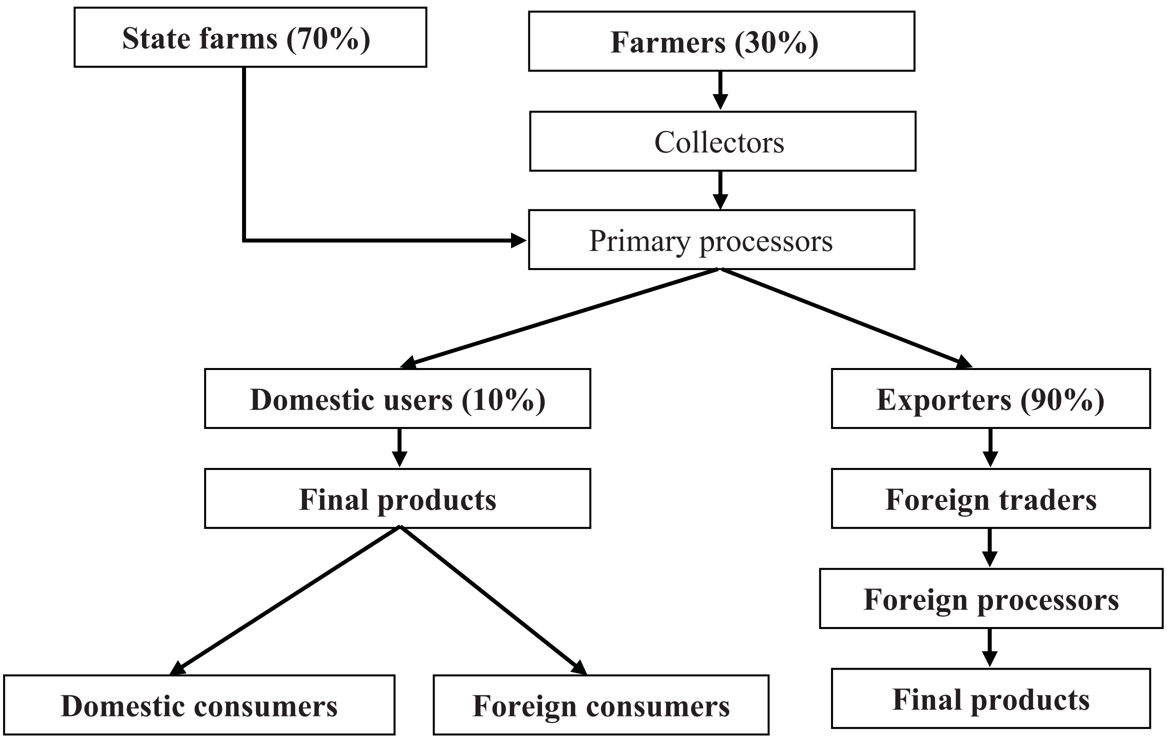
The constraints on cassava farmers were discussed in a previous subsection. This section looks at constraints further along the marketing chains. First, cassava is a low value product and both the world market and domestic market prices fluctuate substantially. This can substantially affect profit margins for different stakeholders in the marketing chain. Farmers and small processors are the most vulnerable to volatile prices. Second, the starch processing and starch-using industries can be sources of environmental pollution and this affects the sustainable development of the country. Third, exporters in the cassava marketing chain appear to be the largest beneficiaries and they are in a more advantageous condition compared to farmers and small processors.

5. Trade in rubber

5.1. Marketing channel

Figure 5.12 depicts the marketing channel for rubber. State farms produce 70 percent of Vietnam's rubber and smallholders produce the rest. The state farms belong to state rubber companies together with export processing factories and local end-product processors. State farms provide rubber sap to processing factories for processing and exports. Smallholders sell rubber sap to private collectors and the collectors sell rubber sap to the processing factories of state rubber companies. Ninety percent of primary rubber products are exported and the remaining 10 percent go to local end-product processors from where the final goods are sold in local or overseas markets. Thus, due to historical reasons, private plantations including small family plantations account for only a small share of total rubber production. It is difficult to increase that share quickly because of land limitation. That 90 percent of rubber is exported shows that Vietnam loses value-added. The lack of markets and technology may be reasons for that.

Figure 5.12: Rubber marketing channel



Source: Author compilation.

5.2. Costs and margins

5.2.1 Farm gate price

Farmers sell their rubber to collectors in the region daily. The market is almost in perfect competition. Farmers have a right to select the collector. The price is rather competitive. It is determined in two steps. First, collectors measure the degree of rubber by burning the latex and then weighing it. The price per degree is determined by the market, but the problem is the measurement of the degree. Since collectors know more than farmers do, cheating may happen in this activity. In general, farmers receive weekly payments.

Table 5.12: Farm gate prices, 2008

	Unit	Min	Average	Max
Price	Dong/degree	310	350	410
Degree	Degree/kg	24	29	32
Price	Dong/kg	7440	10150	13120

Source: Survey, 2008

5.2.2. Collectors

After collecting rubber sap from farmers, collectors add preservatives and then sell the latex to factories within a few hours. During the harvest season, each collector buys about 14,000 kg per day. Table 5.13 presents the costs, revenues and profit margin of rubber collectors.

Table 5.13: Estimated costs, revenue and profit margin for rubber sap collectors, 2007/08

		VND/tonne	Percentage of total cost
Depreciation of warehouse		2,962.96	0.03
	Family warehouse	1,111.11	0.01
	Rented warehouse	1,851.85	0.02
Depreciation of tools		451.85	0.00
	Heat scale	138.27	0.00
	Weigh scale	186.83	0.00
	Roast cooker	53.50	0.00
	Degree roast pipe	73.25	0.00
Labour		39,777.78	0.40
	Family labour	7,925.93	0.08
	Hired labour	31,851.85	0.32
Chemical preservatives		10,615.45	0.11
Other maintenance (bag)		772.88	0.01
Transport		52,833.33	0.53
Other (loading and unloading)		10,333.33	0.10
Total collection costs		117,747.59	1.17
Rubber sap purchase		9,940,000.00	98.83
Total cost		**10,057,747.59**	**100.00**
Revenue		**10,167,200.00**	**101.09**
Margin		**109,452.41**	**1.09**

Source: Calculated based on survey data

Costs during collection include rubber sap, warehouse depreciation, labour, chemical preservatives and fuel for transport. The cost of purchasing rubber sap accounts for almost 99 percent of the total; therefore, collectors' profit margin is as little as 1.09 percent of the total production cost. Despite the thin profit margin, the huge volume of rubber sap that collectors buy and sell every day means they earn higher profits than farmers.

5.2.3. Processing

Rubber is processed into different products. The major product is SVR3L, used in 56 percent of all processed rubber products. Rubber is mainly processed by state companies. Vietnam has 32 rubber processing factories with sufficient capacity to process all the rubber produced in Vietnam. The processing industry in Vietnam has high technological content. Seven processing companies in the South East have obtained Certificate ISO-9002. Table 5.14 shows the costs of processing for Phuoc Hoa Rubber Company. For 1 tonne of rubber, the company has to pay VND2,175,000 (USD135.2). Unlike the smallholder rubber producers who have to sell all their rubber sap to collectors who then sell it to state companies for processing, the state companies are in charge of all stages of production, from tree planting to tapping, processing and export. Therefore, it is not necessary to calculate the profit margin at each of these stages.

Table 5.14: Costs for rubber production, processing and marketing, Phuoc Hoa Rubber Company, 2007

Item			1000 VND/tonne	USD/tonne
Production			***18,537.00***	***1,151.37***
	Fertiliser		1857.00	115.34
		Chemical	1810.90	112.48
		Manure	46.6	2.86
	Other materials		238.90	14.84
	Labour		11,119.80	690.67
	Common		5321.3	330.52
		Depreciation	917.60	56.99
		Rubber trees	729.80	45.33
		Tax	517.00	32.11
		Other	3886.60	241.40
Processing			***2,176.5***	***135.19***
	Materials		600.80	37.32
		Energy	369.6	22.96
		Other materials	231.30	14.37
	Labour		699.90	43.47
	Common		875.70	54.39
Marketing			***2,800.30***	***173.90***
Total cost			23,513.80	1460.46
Selling price			34,506.30	2143.20
Margin			10,992.50	682.74

Source: Calculated based on unpublished report of Phuoc Hoa Rubber Company, 2007.

As Table 5.14 shows, the cost of processing 1 tonne of block rubber is USD35.2 or 9.26 percent of the total cost. In this company, materials including energy accounted for 27.6 percent of the total processing cost while labour took 32.2 percent and common costs 40.2 percent.

5.2.4. Exporting

The ten top countries that import Vietnamese rubber are China, Korea, Taiwan, Germany, USA, Russia, Belgium, Japan, Singapore and Malaysia. China is a very important market for Vietnamese rubber exports as about 60 percent of such exports go to China. Vietnamese rubber accounts for about 20 percent of China's rubber imports. Thailand is the leading rubber exporting to China Malaysia is a rubber exporting country, but it imports rubber from Vietnam for re-export; Malaysia has better access to export markets than has Vietnam.

Table 5.15: Vietnam rubber exports by destination

	1995	2000	2005
China	108.3	110.7	369.7
Korea	3.4	15.4	29.1
Taiwan	6.8	13.6	22.5
Germany	2.4	12.7	20.7
USA	0.2	2.4	19.2
Russia	0.9	20.6	19.2
Belgium	0.2	3.1	14.9
Japan	4.1	8.2	11.5
Singapore	6.9	34.4	2.9
Malaysia	4.8	7.8	5.9
Total export	**143.9**	**287.6**	**587.8**

Source: Nguyen Van Ngai, Nong Lam University

China is the most important market, especially for primary rubber, followed by South Korea, Taiwan and Germany (each with a 4 to 5 percent market share). As the international market for rubber becomes more promising, the Vietnamese government will set higher targets for increased rubber exports and market diversification. Although China remains Vietnam's biggest rubber importer, it is expected that it will not continue to be the only large destination for primary rubber exports.

Table 5.16: Vietnam‘s export of natural rubber by grade, 2007

Grade	Quantity (tonne)	Percent	Value (USD)	Percent
SVRL	7,929	1.1	17,443,111	1.2
SVR3L	308,580	42.9	641,247,988	45.8
SVRCV60	27,577	3.8	62,783,468	4.5
SVRCV50	5,713	0.8	12,883,281	0.9
SVR5	11,095	1.5	22,050,460	1.6
SVR10	116,388	16.2	223,978,055	16.0
SVR20	16,591	2.3	32,157,158	2.3
RSS3	15,705	2.2	32,995,222	2.4
RSS	7,828	1.1	15,537,115	1.1
LATEX	82,428	11.5	107,177,226	7.7
RUBBER COMPOUND	42,423	5.9	83,338,431	6.0
CSR L	17,861	2.5	37,553,017	2.7
CSR 5	2,539	0.4	5,354,978	0.4
CSR 10	23,152	3.2	46,469,902	3.3
OTHERS	33,589	4.7	59,030,588	4.2
	719,398	100	1,400,000,000	100.0

Source: VRA News Letter, 25 Jan 2008.

Vietnam produces more latex grades (TSR3L, TSRL, TSRCV and TSR5) than other producing countries. Table 5.16 shows the export volume and value of natural rubber by grade in 2007.

It is not easy to calculate the cost and revenue for the export stage only. This is because rubber companies are involved in activities along the chain from producing rubber sap to processing; therefore, it is not easy to deduce the cost for each stage of production, especially common costs.

5.3. Constraints and opportunities

Constraints

In Vietnam, rubber is mainly produced by state farms. State companies are facing restructuring and management problems. Rubber production carries very high common costs (up to 38.3 percent of the total). This both reduces firms' profit margins and lowers the competitiveness of Vietnamese rubber on international markets.

Main products are SVR3L and latex, and they are sold to local companies (10 percent) as intermediate inputs for tyre and medical equipment manufacturing, and to foreigners (90 percent) as exports. Vietnam loses value-added to foreign importers and processors.

Although Vietnam rubber is exported to 45 international destinations around the world, China is still the biggest importer of natural rubber from Vietnam. The heavy dependence on China, where market uncertainties and price volatility are extremely high, is a big threat for Vietnam's rubber industry

Rubber industry is labour intensive. Labour costs account for a large part of total production costs (especially in rubber sap production). Therefore, wage increases would have a negative impact on the margin and competitiveness of rubber production.

The major rubber product is SVR3, and constitutes 56 percent of all processed rubber products. However, there is very high world demand for SVR10 and SVR 20. Vietnam should process more of these products to meet this international demand.

Backward and undeveloped logistics lead to high export costs. In Vietnam, logistics cost are generally high, accounting for nearly 20 percent of GDP or 50 percent of total export value.

Opportunities

There are a number of opportunities for the rubber industry in Vietnam. As a WTO member, Vietnam can benefit from its Most Favoured Nation status in WTO member markets such as China and Taiwan, avoiding unfair price competition. With market expansion and diversification, Vietnamese rubber could access international markets more easily and get better prices. As a member of the ASEAN Protocol for Rubber, Vietnam can benefit from cooperation among members in exchanging education, expertise, information, and research and development on the rubber products industry. Local and international markets for final products have huge demands that Vietnam can supply. This is why rubber has became an answer to poverty reduction in many parts of the country; rubber production areas could be expanded to the northern region. The price and export volume of primary products could increase and this again would help improve farmers' incomes and Vietnam's exchange earnings.

6. Conclusions and policy recommendations

6.1. For cassava

As exporters have more advantages and the widest profit margin in the value chain, the way to help farmers and small processors is to create more favourable conditions such as low interest credit, agricultural extension services and better market access.

Collectors play an active role in the value chain when processors or exporters cannot or are not willing to buy cassava from farmers directly. It seems that this situation will persist at least in the medium term. Government could promote a contract scheme so that farmers and collectors can form a good "union" through formal contracts that secure benefits for both farmers and collectors.

Although cassava, especially new high-yielding varieties, is a profitable crop, the policy for expanding its cultivation area needs to be carefully analysed to protect soil from erosion, and its real economic efficiency needs to be examined in comparison with the efficiency of other crops.

The development of starch processing and starch-using industries should also be considered together with environmental concerns. Those businesses with relatively modern technologies should be encouraged and the polluting ones restructured.

Following are some considerations that could be adopted immediately:

- ✓ Identify an appropriate strategy for research and development of cassava in Vietnam; besides cassava area expansion, Vietnam should focus on suitable cassava cultivation technologies;
- ✓ Design feasible policies for research, investment and marketing in the cassava value chain to enhance productivity, reduce farmers' losses due to market shocks, and increase producers' income;
- ✓ Collect create and develop high yielding varieties of high quality to improve cassava productivity;
- ✓ Distribute cultivation techniques and encourage intercropping (cassava-peanut, cassava-bean) to increase farm incomes and reduce dry soil losses;
- ✓ Publicise widely and transparently the planned and established cassava zones to address the imbalance between planned and cultivated areas and for sustainable development of cassava production;
- ✓ Encourage cassava farmers to establish their own associations or cooperatives, and linking them through contracts with starch processing enterprises to attain the highest economic returns and lowest environmental cost for both parties;
- ✓ Regulate closely the opening or construction of new processing factories because processing capacity already exceeds cassava production.

6.2. For rubber

The natural rubber industry in Vietnam makes a significant contribution to the economy in providing foreign exchange and profit for producers, processors and exporters; creating jobs and incomes for rural people; and contributing revenue to the government budget. Although the industry faces some constraints, it also offers opportunities.

Following are some considerations that could be adopted immediately:

- ✓ State companies and government institutions must support smallholders by extending technology, credit and secure land tenure.

- ✓ Government should encourage companies to make final products from natural rubber not only for local markets but also for international markets.
- ✓ Companies should improve export strategies, increase export volume and negotiate better on export prices.
- ✓ Government should support enterprises in enhancing product quality, registering and protecting product brand names. Trade promotion programmes should be organised.
- ✓ Research and development should be invested in to move Vietnam's rubber industry from mainly producing primary raw rubber to more processing of final products in order to increase export value.

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Appendix

Questionaires

A. Private rubber farmers

Code: ………..

1. Household information

Labour

Number of family members::………….. Number of labours (age 16-60): ……...............

Main occupation::……………………… Number of farm workers: ....

Number of rubber farm workers; ………

Land

Total area: …………......ha Agricultural land: …………ha

Rubber land allocation by age of rubber tree and sources of land

Age of rubber tree	Area (ha)	Source of land (1=buying, 2= heritage, 3=renting)	Note

2. Farming

Planting and first year investment

Land preparation

By animal-power ☐ tractor ☐ Hired ☐ family ☐

If hired, how much does it cost: .... dong/ha

If family works, what is the cost in the region if you hire: ....dong/ha

Seed

Variety: ...., reason to choose this variety:..

Number of tree: ..../ha

Source of seed:

Buy ☐ family ☐

If buy, where:......................................., price: .... dong/tree

If family, do you know the price in the market: ....dong/tree

Fertilisers

Manure: What kind of manure: ....

Buy .... kg/ha, price: ....dong/kg

Family: .... kg/ha, what is the market price: ....dong/kg

Chemical fertiliser: What kind of fertiliser: ....
Amount .... kg/ha, price: ....dong/kg
Other chemicals:... Amount: ..../ha,
price: ....dong/..............

Plating Labour:
Number of hired labours: ....person days/ha, wage: ....dong/person day
Number of family labours: ....person days/ha

Watering
Source of water:...................................
Cost of watering: ....

Weeding
Number of hired labours: ....person days/ha, wage: ....dong/person day
Number of family labours: .... person days/ha

Other costs
....
....
Any problem of the first year investment:
....
....

Second year investment

Fertilisers:
Manure: What kind of manure: ....
Buy .... kg/ha, price: ....dong/kg
Family: .... kg/ha, what is the market price: ....dong/kg

Chemical fertilizer: What kind of fertilizer: ....
Amount .... kg/ha, price: ....dong/kg

Other chemicals:...
Amount: ..../ha, price: .... dong/...............

Watering:
Source of water:...................................
Cost of watering: ....

Weeding:
Number of hired labours: ....person days/ha, wage: ....dong/person day
Number of family labours: .... person days/ha

Other costs:
....
....

Any problem of the second year investment:
....
....

Is the third, fourth and fifth year investments the same with the second year? Y or N
If Y, what are the differences?
....

Harvesting years
From year .... to year ....

Fertilisers:
Manure: What kind of manure: ....
Buy .... kg/ha, price: ....dong/kg
Family: .... kg/ha, what is the market price: ....dong/kg

Chemical fertilizer: What kind of fertilizer: ....
Amount .... kg/ha, price: ....dong/kg

Other chemicals:...
Amount: ..../ha, price: .... dong/..............

Watering:
Source of water:...................................
Cost of watering: ....

Weeding:
Number of hired labourers: .... person days/......ha, wage: ....dong/person day
Number of family labourers: .... person days/......ha

Harvesting
Number of hired labourers: .... person days, wage: ....dong/person day
Number of family labourers: ....person days, what is market way? .... dong/day

Harvesting tools:
1..., number;........................., price..
2..., number;........................., price...
3..., number;........................., price...

Other costs:
....
Any problem of the harvesting year investment:
....
....

3. Production and Marketing

Harvesting; ......days/once; ....month/year
Amount of harvested rubber sap: Min:............................/day/.........ha
Average...................../day/.........ha
Max:........................./day/.........ha
Selling

Sell to private collector □ private processor □ state company □

Reasons to choose the seller:
1..
2...

Is there any contract: Y/N
If Y, explain:...
Price: Min ....dong/degree, Average .... dong/degree, Max .... dong/degree,

Any problem in selling the rubber sap:
1..
2..

Any suggestion to the government:
1...
2...

Name of interviewee: ...., Position in the family:.........................
Address: Village .... commune .... District ....
Phone (if available): .... Name of interviewer: ....

B. Private Rubber Collectors

Code:………..

1. Collector's information

Which year did you start this business:.................
Why did you choose the business: Tradition/good business/jobless/others (if other, explain ....
....)
Where are you living?..
Where are you from?...

2. Buying

How many farmers often sell rubber to you?............................
Do you have any contract with farmers? Y/N
If Y, explain...
....

What are your investments:
House: Your own / renting
If renting, how much is the rate: ....dong /............
If your own, how much do you estimate the rate if you rent: ....dong/.........

Other items
1. Item ...., price ...., buying year ....
2. Item ...., price ...., buying year ....
3. Item ...., price ...., buying year ....

Labour:

Number of hired labourers: .... persons, wage: ....dong/person month
other payments: Clothes ...., food ...., bonus ....
Number of family labourers: ....persons, what is the market wage if you hire ....

Buying rubber at the: farm gate/your house
If farm gate, how do you transport; by motorbike / cart / others
What is the transportation cost: ....
Amount of buying rubber sap: ....kg/day
Duration of the business: ....month/year
What is price in 2007: Min .... dong/degree,
Average.................. dong/degree, Max .... dong/degree,
How to measure the degree, explain ....
....
.What is degree in 2007: Min .... degree, Average .... degree,
Max....................... degree,
Competition level of buying rubber: very high / high / average / low / very low
How do you keep your customers? explain ....
....
Payment form: cash / bank account transfer / other (explain, ...)
How often payment: daily / weekly / monthly / other (explain, ...)

Any problem in buying the rubber sap:
1...
2...

Any suggestion to the government:
1...
2...

2. Storing or processing
How long have you keep rubber sap at your house: ....hours
Chemical used to store the rubber sap:..
Cost of chemical:...

Any other cost to store rubber before selling:
1...
2..
Any problem of storing rubber sap
....
....

3. Selling
Which company or person so you sell your rubber: ....
Where:..
How far is it from your house: .... km
How do you transport rubber to the buyer: by ....
Cost of transport;...
Any other cost to sell rubber
1...
2..

Selling Price in 2007: Min .... dong/degree,
Average .... dong/degree,
Max .... dong/degree,
How much is price difference between buying price and selling price: ....dong/degree
Payment form: cash / bank account transfer / other (explain, ...)
How often payment: daily / weekly / monthly / other (explain, ...)
Competition level of selling rubber: very high / high / average / low / very low

Any problem in selling the rubber sap:
1..
2..

Any suggestion to the government:
1..
2..

Do you intend to expand your business: Y/N
What is your future expectation?
1..
2..

Name of interviewee:.., Position in the family:......................
Address: Village .... commune ....District.....................................
Phone (if available):...
Name of interviewer:...

Type:

C. Households

Number:

		Code
Province		
District		
Commune		
Village/hamlet		
Interviewer		
Interviewee		

Type of the household: ________

1. State farm workers
2. Contracted farmers
3. Cooperative members
4. Farmers
5. Others

Household's land use

	Type of land	Unit	Areas
1.	Traditional cassava		
2.	HYV cassava		
3.	Wet rice		
4.	Fruits		
5.	Forestry		
6.	Others		

Cassava produced in 2007

		Unit	Traditional cassava	HYV cassava
1. Total output				
2. Household consumption				
3. Animal feeding				
4. Selling	1. Fresh root			
	2. Dried chip			
	3. Powder			
	4. Others (specify)			

Where the household sold a majority of cassava? ________

1. At home
2. Collecting center
3. Processing place
4. Local market
5. Central market
6. Others (specify)

Volume of cassava sold in 2007

Buyer	Fresh root		Dried chip		Powder	
	Amount (kg)	Price (VND/kg)	Amount (kg)	Price (VND/kg)	Amount (kg)	Price (VND/kg)
1. Small collectors						
2. Traders						
3. Small processors						
4. Big processing factory						
5. Others (specify)						

Have you signed a contract with buyers? __________1. Yes 2. No

If yes, the percentage of cassava was sold by above contracts: __________(%)

Buyer	Fresh root		Dried chip		Powder	
	Amount (kg)	Price (VND/kg)	Amount (kg)	Price (VND/kg)	Amount (kg)	Price (VND/kg)
1. Small collectors						
2. Traders						
3. Small processors						
4. Big processing factory						
5. Others (specify						

Households' income (in 2007)

Economic activities		Income (000 VND)
1. Agricultural activities	1. Growing cassava	
	2. Growing grain	
	3. Husbandry	
	4. Forestry	
	5. Cassava processing	
	6. Other crops	
2. Non-farm activities	1. Pension	
	2. Subsidy	
	3. Working for hire	
	4.Others	

9. Production costs of traditional cassava (season 2007)
Traditional cassava areas: …………………… m^2

Items	Unit	Purchased inputs			Family input (converted by market price)		Total costs
		Quantity	Unit	Total value	Quantity	Total value	
Rental land	1000 VND						
Land preparation	1000 VND						
Seed	pieces						
Labour costs							
Labour for planting	Pers-day						
Labour for weeding	Pers-day						
Labour for harvesting	Pers-day						
Manure	kg						
Fertiliser	kg						
Pesticide	little						
Irrigation fee	1000 VND						
Others (specify)							
Total costs							
Gross value at farm gate	1000 VND						
Value added	1000 VND						

10. Production costs of HYV cassava (season 2007)
HYV cassava areas: …………………… m^2

Items	Unit	Purchased inputs			Family input (converted by market price)		Total costs
		Quantity	Unit	Total value	Quantity	Total value	
Rental land	1000 VND						
Land preparation	1000 VND						
Seed	pieces						
Labour costs							
Labour for planting	pers-day						
Labour for weeding	Pers-day						
Labour for harvesting	Pers-day						
Manure	kg						
Fertiliser	kg						
Pesticide	little						
Irrigation fee	1000 VND						
Others (specify)							
Total costs							

Gross value at farm gate	1000 VND						
Value added	1000 VND						

11. Where to buy input materials for cassava production
(Circle appropriated)

1. Buyers who supply input in advance   2. Retailers   3. Local market
4. Central market   5. Others (specify)

12. Households' difficulties in cassava production and selling
Difficulties in cassava production

Difficulties in cassava selling

11. Household recommendation for cassava production and selling

Quest type:

D. Collectors

Sequential No:

		Code
Province		
District		
Commune		
Name of interview		
Name of business		
Address of business		
Name of respondent		
Position of respondent		
Telephone number		

A. Cassava Procurement

1. How much fresh cassava root did you buy last season 2006: ____________(tonnes)

2. What is average price for fresh cassava root? __________(VND/kg)

3. Volume of fresh cassava root procured by supplier and grades:

#	Suppliers	Traditional cassava		HYV cassava		Dried chip	
		Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)
1	Self-produced						
2	Cassava households						
3	Cooperatives						
4	Farms						
5	Farmer groups						
6	Traders						
7	Others						

4. Share of cassava root procured by location:

#	Suppliers	Percentage (%)
1	Farm gate	
2	At your business	
3	Market	
4	Other	

5. Normally, who decides the procurement price ?_____________

1. Sellers 2. Your business 3. Negotiation 4. Following price set by the government

6. Did you buy semi-processed cassava from processors last year?__________ 1. Yes 2.No

7. If yes, volume of semi-processed cassava have you bought from suppliers:

#	Suppliers	Cassava powder		Wet starch		Dried starch	
		Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)
1	Self-produced						
2	Cassava households						
3	Cooperatives						
4	Farms						
5	Farmer groups						
6	Traders						
7	Processors						
8	Others						

8. Normally, who decides the procurement price of semi-processed cassava ?___________

1. Sellers 2. Your business 3. Negotiation 4. Following price set by the government

9. Transportation cost: ....VND

10. Maintenance cost: ....VND

11. Other transaction costs: ....VND

B. Contracting Linkage

1. Have you ever signed contract to by cassava root with farmers? 1. Yes (→ B.3) 2. No
2. [If no (2) in B.1] Why? _____________________ |________|
    1. Too small business 2. Lower market prices 3. High price variability
    4. Afraid that farmers collapse contracts
    5. Nobody wants to sign contract with your business
    6. Other (specify) ____________
3. Who do you contract to buy cassava roots? |__________| |__________| |__________|
    1. Farmers 2. Cooperatives 3. Farms 4. Farmers groups 5. People's committee

4. What your supply cassava roots comes from contracts? _________________(kg)
5. How long have you contracted?_____________(year)
6. Generally, are your contracts written or verbal?
    1. Written contracts 2. Verbal contracts
7. Have you ever reneged on the terms of a contract? 1. Yes 2. No
8. Why? _____________________ |________|
    1. Market price was lower 2. Poor quality 3. Lack of consumer demand
    4. Cash flow problems 5. Insufficient storage space
    6. Others
9. Has a contractor with whom you have had dealings ever reneged on the terms of a contract with you? __________ 1. Yes 2. No

10. Why? _____________________ |________|
    1. Market price was higher 2. Cash flow problems 3. Post harvest spoilage
    4. Failure of cassava crops 5. Poor quality of cassava roots provided by contractors
    6. No ideas 7. Others
11. If so, what action did you take?
12. Do you sign a contract with individual farmers? 1. Yes 2. No
13. If no, why do not you contract with individual farmers? |________| |_______| |_______|
    1. They provide a small supply 2. Afraid that they collapse contracts
    3. Their product quality is not good/not consistent
    4. Too many suppliers, your business can be provided stably
    5.Others (specify)___________________
14. Under what circumstances might you be willing to do so?
    1. They are in a group 2. They are cooperatives
    3. They are guaranteed by People's committee 4.Others (specify)
15. If yes in B12, how many farmers did you contract last season? __________
16. What type of farmers do you contract? |_________| |_________|
    1. Small farmers 2. Commercial farmers 3. Farms 4. Others
17. Do you have any supports for contract farmers? ___________1. Yes 2. No
18. If yes in B.17, what kind of support do you bring to farmers?

#	Type of support	1. Yes	2.No
1	Provide loan for farmers		
2	Provide material plant on credit		
3	Provide fertiliser on credit		
4	Provide technical support		
5	Provide pesticide on credit		

6	Rental land		
7	Others (specify)		

19. Do your contractors sell their product to your competitors? ________
1. Yes __________________2. No __________________3. No ideas

C. Sale

1. How much fresh cassava root and processed cassava did your business sell in 2006? ______________________(tonnes)

Please tell me by grades

#	Grades	Selling quantity (kg)	Average price (VND/ kg)
1	Fresh root		
2	Dired chip		
3	Powder		
4	Wet starch		
5	Maltose		
6	Class-2 dried starch		
7	Class-1 dried starch		
8	Others		

2. How much other products did your business sell last year? ______________ (tonnes)

Please tell me by grades

#	Grades	Selling quantity (kg)	Average price (VND/kg)
1			
2			
3			
4			

3. Share of your sale in terms of raw material to different buyers ?

#	Buyers	Fresh root	Dried chip	Powder
1	Private traders			
2	Wholesalers			
3	Domestic retailers			
4	Exporters			
5	Starchy processing enterprises			
6	Enterprises use starches			
7	Others			
7	Total	100%	100%	100%

4. Share of your sale in terms of processed cassava to different buyers?

#	Buyers	Wet starch	Maltose	Class-2 dried starch	Class-1 dried starch
1	Private traders				
2	Wholesalers				
3	Domestic retailers				
4	Exporters				

5	Starchy processing enterprises				
6	Enterprises use starches				
7	Others				
7	Total	100%	100%	100%	100%

5. Do you sign raw material contracts with buyers ? __________ 1. Yes 2 No
6. If yes what is share of sale by contracts? __________(%)
7. Share of contracts for buyers?

#	Buyers	Fresh root	Dried chip	Powder
1	Private traders			
2	Wholesalers			
3	Domestic retailers			
4	Exporters			
5	Starch processing enterprises			
6	Starch using business			
7	Other			
7	Total	100%	100%	100%

8. Do you sign processed cassava contracts with buyers ? __________ 1. Yes 2 No
9. If yes what is share of sale by contracts? __________(%)
10. Share of contracts for buyers?

#	Buyers	Wet starch	Maltose	Class-2 dried starch	Class-1 dried starch
1	Private traders				
2	Wholesalers				
3	Domestic retailers				
4	Exporters				
5	Starchy processing enterprises				
6	Enterprises use starches				
7	Others				
7	Total	100%	100%	100%	100%

11. Transportation cost: VND
    Type of transportation
    Road conditions
    Fuel cost: VND
    Bridge and road fees: VND
    Informal expenditures: VND
12. Maintenance/storage expenditures: VND
13. Other transaction costs: VND
14. Volume of loss in maintenance: tonnes
15 Any problems with output sales?

#	Problems	1. Yes 2. No
1	Can not find buyers	
2	Low demand	
3	High price variation	

4	Poor quality	
5	No sale contracts	
6	Others	

16 What marketing difficulties have you encountered?

1. High transportation fee 2. Unstable demand 3. Police's check 4. Others____

17. What factors are constraints of further development of cassava business?
18. How to deal with these constraints?
19. What factors are constraints of poor farmers' involvement?

E. Processors

Quest type: [ ]

Sequential No: [ ]

		Code
PROVINCE		
DISTRICT		
COMMUNE		
INTERVIEWEE		
NAME OF BUSINESS		
ADDRESS OF		
NAME OF		
POSITION OF RESPONDENT		
TELEPHONE NUMBER		

A.1 Type of business: __________________

Not registered households
Registered households
Private enterprises
Cooperatives
Joint stock/limited
State companies
Others (specify) __________________

A. 2 When your business was established? __________ (Year)
What type of products do you process?

#	Products	1. Yes	2.No
1	Wet starch		
2	Maltose		

3	Class-2 dried starch		
4	Class-1 dried starch		
5	Noodle		
6	Cakes		
7	Others		

B. Agricultural and Cassava Production

B1. Did you have land for growing cassava last season ? _________ 1. Yes 2. No
B2. If yes, how many area of cassava did you have last season? _______________ (m^2)
B.3. What was your total production of cassava roots last season? ___________ (tonnes)
B.4 Did you grow other crops? _________ 1. Yes 2. No

C. Scale of Business

C1. How many hired workers do you have?___________ (If 0 then go to C6).
C2. How many household labourers do you have?_______________
C3. List number of hired labourers by working time

#	Type of labour	No. female	No. male	Average salary (VND/ month)
1	Temporary			
2	Fulltime			

C4. Do you have any problems with workers? 1. yes 2. No,
If yes; what are the main problems?______________
1. Low skilled labour 2. Can not mobilise in peak times
3. They require high wages 4. Others (specific)__________________________________

C5. What is processing capacity of your business (kg cassava roots per day)______________
C6. How much cassava roots do you normally process per year? ________________ (tonne)
C7. How many months do your processing normally run in 2007? ______________(month)

Section D. Input Procurement

D1. How many cassava roots did you buy for processing cassava last season? _________(kg)
D2. What is average price per cassava root? __________(VND/kg)
D3. Volume of cassava roots procured by suppliers and grades

#	Suppliers	Traditional cassava roots		Industrial cassava roots		Dried chips	
		Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)
1	Self-production						
2	Cassava households						
3	Cooperatives						
4	Farms						
5	Farmer groups						

6	Traders						
7	Others						

D4. Share of cassava root procured by location

#	Suppliers	Share (%)
1	Farm-gate	
2	Your business	
3	Market	
5	Others	

D5. Normally, who decide the procuring price ?_____________

1. Sellers 2. Your business 3. Negotiation 4. Following price set by government

D6. Did you buy semi-processed/processed cassava roots from other processors last year? ___________ 1. Yes 2.No

D7. If yes, how much semi-processed/processed cassava did you buy last year from the following suppliers?

#	Suppliers	Flour		Wet starch		Dried starch	
		Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)
1	Self production						
2	Cassava households						
3	Cooperatives						
4	Farms						
5	Farmer groups						
6	Traders						
7	Processors						
8	Others						

D8. Normally, who decide the procuring price of semi processed/processed cassava?_______

1. Sellers 2. Your business 3. Negotiation 4. Following price set by government

E. CONTRACT LINKAGES

E1. Has your business ever signed contracts with farmers for cassava roots? __________

1. Yes (→ E.3) 2. No

E2. [If No (2) in E.1] Why not? ____________________ |________|

1. Too small business 2. Lower market price 3. High price variability
4. Afraid that farmers collapse contracts
5. Nobody wants to sign contracts with your business 6. Others (specify)______

E3. Who do you contract to buy cassava roots? |__________| |__________| |__________|

1. Farmers 2. Cooperatives 3. Farms 4. Farmers groups
5. People's committee

E4. The quantity of your supply cassava roots comes from contracts? _______________(kg)

E5. How long have you contracted? _____________ (year)

E6. Generally, are your contracts written or verbal? __________

1. Written contracts 2. Verbal contracts

E7. Have you ever reneged on the terms of a contract? __________
1. Yes 2. No
E8. Why? ____________________ |________|
1. Market price was lower 2. Poor quality 3. Lack of consumer demand
4. Cash flow problems 5. Insufficient storage space 6. Others
E9. Has a contractor with whom you have had dealings ever reneged on the terms of a contract with you? __________ 1. Yes 2. No
E10. Why? ____________________ |________|
1. Market price was higher 2. Cash flow problems 3. Post harvest spoilage
4. Failure of cassava crops 5. Poor quality of cassava roots provided by contractors
6. No ideas 7. Others
E11. If so, what action did you take?
E12. Do you sign a contract with individual farmers 1. Yes 2. No
E13. If no, why do not you contract with individual farmers? |________| |______| |_______|
1. They provide small supply 2. Afraid that they collapse contracts
3. Their product quality is not good/not consistent
4. Too many suppliers, your business can be provided stably 5. Others (specify)_____
E14. Under what circumstances might you be willing to do so?
1. They are in a group 2. They are cooperatives
3. They are guaranteed by People's committee 4. Others (specify)
If yes in E11, how many farmers did you contract last season? __________
E15. What type of farmers do you contract? |_________| |_________|
1. Small farmers 2. Commercial farmers 3. Farms 4. Others
E16. Do you have any supports for contract farmers? ___________1. Yes 2. No
If yes in E16, what kind of support do you bring to farmers?

#	Type of support	1. Yes	2. No
1	Provide loan for farmers		
2	Provide material plant on credit		
3	Provide fertiliser on credit		
4	Provide technical support		
5	Provide pesticide on credit		
6	Hired land		

E17. Do your contractors sell their product to your competitors? ________
1. Yes _______ 2. No _________________3. No ideas

F. Costs of Production and Sale Price

F1. Could you tell me costs of production of wet starch in your business (000 VND/kg)

#	Items	Cost (000 VND/kg)
A	Cost of production	
1	Cassava roots	
2	Labour	
3	Water/electricity	
4	Transportation	
5	Rental machines	
6	Packaging	
7	Others	
B	Sale price	

F2. Could you tell me costs of production of maltose in your business (000 VND/kg)

#	Items	Cost (000VND/kg)
A	Cost of production	
1	Cassava roots	
2	Wet starch	
3	Labour	
4	Water/electricity	
5	Transportation	
6	Rental machines	
7	Packaging	
8	Others	
B	Sale price	

F3. Could you tell me cost of production of class-2 dry starch in your business (000 VND/kg)

#	Items	Cost (000 VND/kg)
A	Cost of production	
1	Cassava roots	
2	Wet starch	
3	Labour	
4	Water/electricity	
5	Transportation	
6	Rental machines	
7	Packaging	
8	Others	
B	Sale price	

F4. Could you tell me costs of production of class-1 dried starch in your business (000VND/kg)

#	Items	Cost (000 VND/kg)
A	Cost of production	
1	Cassava roots	
2	Wet starch	
3	Class-2 dried starch	
4	Labour	
5	Water/electricity	
6	Transportation	
7	Rental machines	
8	Packaging	
9	Others	
B	Sale price	

G. SALE

G1. How much processed cassava did your business sell last year? _______________ (tonnes)
Please tell me by grades

#	Grades	Selling quantity (kg)	Average price (VND/kg)
1	Wet starch		
2	Maltose		
3	Class-2 dried starch		
4	Class-1 dried starch		
5	Others		

G2. How much other products did your business sell last year? ______________ (tonnes)
Please tell me by grades

#	Grades	Selling quantity (kg)	Average price (d/kg)
1			
2			
3			
4			

G3. Share of your sale to different buyers?

#	Buyers	Wet starch	Maltose	Class-2 dried starch	Class-1 dried starch
1	Private traders				
2	Wholesalers				
3	Domestic retailers				
4	Exporters				
5	Starchy processing enterprises				
6	Enterprises use starches				
7	Total	100%	100%	100%	100%

G4. Do you sign a contract with buyers? __________ 1. Yes 2 No
G5. If yes, the percentage of your sale by above contracts? __________ (%)
G6. Share of contracts for buyers?

#	Buyers	Wet starch	Maltose	Class-2 dried starch	Class-1 dried starch
1	Private traders				
2	Wholesalers				
3	Domestic retailers				
4	Exporters				
5	Starchy processing enterprises				
6	Enterprises use starches				
7	Total	100%	100%	100%	100%

G7. Transportation cost: VND
Type of transportation
Road conditions
Fuel cost: VND
Bridge and road fees: VND
Informal expenditures: VND
G8. Maintenance/storage expenditures: VND
G9. Other transaction costs: VND
G10. Volume of loss in maintenance: tonnes
G11. Any problems with output sales?

#	Problems	1.Yes 2. No
1	Can not find the buyers	
2	Low demand	
3	High price variation	
4	Poor quality	
5	No sale contract	
6	Others	

G12. What marketing difficulties have you encountered?
1. High transportation fee 2. Unstable demand 3. Police's check 4. Others__________
G13. What factors are constraints of further development of cassava business?
G.14. How to deal with these constraints?
G15. What factors are constraints of poor farmers' involvement?

Section H. Processing Equipment

H1. What is the total current value of equipment for cassava process? ________ (000 VND)
H2. When did you buy it? ____________
H3. Which country is your equipment made?________________
H4. Equipment's price _____________ (VND)
H5. Did you have any technological upgrading your equipment? __________1.Yes 2.No
H6. If yes, why do you want to upgrade your equipment?
1. Too backward 2. Expanding business scale 3. High competition 4. Others (specify)__
H7. What is a level of modernisation of your equipment compared to other processors? ____
1. Modern 2. Normal 3. Out of date 4. No ideas

F. Exporters

Quest. type

Sequential No:

		Code
PROVINCE		
DISTRICT		
COMMUNE		
INTERVIEWEE		
NAME OF BUSINESS		
ADDRESS OF BUSINESS		
NAME OF RESPONDENT		
POSITION OF RESPONDENT		
TELEPHONE NUMBER		

A. Scale of Business
1. How many employees do you have?___________
2. List number of employees by type of working time:

#	Type of labour	No. female	No. male	Average salary (VND/ month)
1	Temporary			
2	Full-time			

1. Processing capacity (tonnes cassava root/day)_______________
2. Volume of cassava root processed in 2007? _________________(tons)
3. Number of operating months in 2007? _________________(months)
4. If the company performances under capacity, please tell me why? _____________________

B. Input Procurement

1. How many cassava roots did you buy for processing cassava in 2007? ____________(tons)
2. What is average price per cassava root? __________(VND/kg)
3. Volume of cassava roots procured by suppliers and grades

#	Suppliers	Traditional cassava roots		Industrial cassava roots		Dried chips	
		Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)
1	Self-production						
2	Cassava households						
3	Cooperatives						
4	Farms						
5	Farmer groups						
6	Traders						
7	Others						

4. Share of cassava root procured by location?

#	Suppliers	Share (%)
1	Farm-gate	
2	Your business	
3	Market	
5	Others	

5. Normally, who decide the procuring price?_____________
   1. Sellers 2. Your business 3. negotiation 4. Following price set by government
6. Did you buy semi-processed/processed cassava roots from other processors last year? ____
   1. Yes 2.No
7. If yes, how much semi-processed cassava did you buy last year from the following suppliers?

#	Suppliers	Flour		Wet starch		Dried starch	
		Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)	Volume (kg)	Price (VND/kg)
1	Self production						
2	Cassava households						
3	Cooperatives						
4	Farms						
5	Farmer groups						
6	Traders						
7	Others						

D8. Normally, who decide the procuring price of semi processed/processed cassava ?______
   1. Sellers 2. Your business 3. Negotiation 4. Following price set by government

C. Costs Of Production And Sale Price

1. Could you tell me cost of production of wet starch in your business (000/kg)

#	Items	Cost (000 VND/kg)
A	Cost of production	
1	Cassava roots	
2	Labour	
3	Water/electricity	
4	Transportation	
5	Rental machines	
6	Packaging	
7	Others	
B	Sale price	

2. Could you tell me cost of production of maltose in your business (000 VND/kg)

#	Items	Cost (000 VND/kg)
A	Cost of production	
1	Cassava roots	
2	Wet starch	
3	Labour	
4	Water/electricity	
5	Transportation	
6	Rental machines	
7	Packaging	
8	Others	
B	Sale price	

3. Could you tell me cost of production of class-2 dried starch in your business (000VND/kg)

#	Items	Cost (000 VND/kg)
A	Cost of production	
1	Cassava roots	
2	Wet starch	
3	Labour	
4	Water/electricity	
5	Transportation	
6	Rental machines	
7	Packaging	
8	Others	
B	Sale price	

4. Could you tell me cost of production of class-1 dried starch in your business (000VND/kg)

#	Items	Cost (000 VND/kg)
A	Cost of production	
1	Cassava roots	
2	Wet starch	
3	Class-2 dry starch	
4	Labour	
5	Water/electricity	
6	Transportation	
7	Rental machines	
8	Packaging	
9	Others	
B	Sale price	

Sale

1. How much processed cassava did your business sell last year? _______________ (tonnes)
Please tell me by grades

#	Grades	Selling quantity (kg)	Average price (VND/kg)
1	Wet starch		
2	Maltose		
3	Class-2 dried starch		
4	Class-1 dried starch		
5	Others		

2. How much other products did your business sell last year? _______________ (tonnes)
Please tell me by grades

#	Grades	Selling quantity (kg)	Average price (VND/kg)
1			
2			
3			
4			

3. Share of your sale to different buyers?

#	Buyers	Wet starch	Maltose	Class-2 dried starch	Class-1 dried starch
1	Private traders				
2	Wholesalers				
3	Domestic retailers				
4	Exporters				
5	Starchy processing enterprises				
6	Enterprises use starches				
7	Total	100%	100%	100%	100%

4. Do you sign a contract with any buyers? ___________1. Yes 2 No
5. If yes, what is your share of sale by contracts? ___________(%)

6. Share of sale for buyers?

#	Buyers	Wet starch	Maltose	Class-2 dried starch	Class-1 dried starch
1	Private traders				
2	Wholesalers				
3	Domestic retailers				
4	Exporters				
5	Starchy processing enterprises				
6	Enterprises use starches				
7	Total	100%	100%	100%	100%

E. EXPORT

1. Export value in comparison with total revenue:__________________%
2. Export markets: (name of the destinations)
3. Volume of cassava processed and revenue

Market	2006		2007	
	Volume	Value	Volume	Value
1. Export				
2. Domestic				
3. Total				

4. Transportation cost: VND
   Type of transportation
   Road conditions
   Fuel cost: VND
   Bridge and road fees: VND
   Informal expenditures: VND
5. Maintenance/storage expenditures: VND
6. Other transaction costs: VND
7. Volume of loss in maintenance: tonnes

Agricultural Trade in the Greater Mekong Subregion: The Case of Natural Rubber and Cassava in China

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Agricultural Trade in the Greater Mekong Subregion: The Case of Natural Rubber and Cassava in China

1. Introduction

1.1. Background

The Association of Southeast Asian Nations (ASEAN) countries are China's most important trade partners for agricultural products. The significance of China-ASEAN international trade in agricultural products keeps increasing, particularly with regard to the import of agricultural products into China. In 2006, the total value of China's agricultural imports from ASEAN countries reached 495 thousand yuan, 2.3 times more than that from the European Union. This made ASEAN countries the number one trade zone for China's import of agricultural products and raw materials.

Mutual trade in agricultural products developed rapidly as a result of the Early Harvest Programme (EHP), an initiative of the China-ASEAN Free Trade Agreement (FTA). From 2002 to 2006, total annual trade value increased by 20.9 percent, import value by 29.3 percent and export value by 18.6 percent. Trade deficit keeps increasing, and is considered the main factor contributing to the trade deficit in agricultural products. In 2006, China-ASEAN agricultural trade deficit was USD1.9 billion while China's agricultural trade deficit was only USD0.96 billion. The widening trade deficit indicates that ASEAN countries have begun to rely more on exports of domestically produced agricultural products to the Chinese market.

As well as being the main ASEAN countries exporting agricultural products to China, Thailand and Vietnam are also China's neighbours in the Greater Mekong Subregion (GMS). In 2006, Thailand was ranked the 8th biggest supplier of China's agricultural products, and Vietnam the 20th. The value of agricultural trade between China and the two other GMS countries, Laos and Cambodia, is comparatively small though it has increased annually. To meet the expanding domestic demand driven by its rapid economic rise, China mainly imports raw agricultural materials used in industry. Natural rubber and cassava are the two main agricultural products China imports from GMS countries.

In 2007, natural rubber imported from Thailand accounted for 33 percent and Vietnam for 3 percent of China's natural rubber imports. In 2006, China imported four times more technically specified natural rubber (TSNR) from Cambodia than in 2005, although less ribbed smoked sheet (RSS). Laos mainly exports RSS, and supplies 2 percent of China's RSS imports. Laos began to export TSNR to China in 2004.

Thailand accounted for 78 percent and Vietnam 19 percent of China's dried cassava imports in 2006. Cambodia does not export cassava to China but Laos began to export dried cassava in 2007.

To promote economic growth and poverty reduction, the GMS countries are continuing to increase agricultural trade in order to raise farm incomes and national revenues. The project "Agricultural Trade in the Greater Mekong Subregion: Case-studies of Rubber, Cassava and Cattle" is one of the continuing regional research series housed under the GMS Development Analysis Network (DAN), and co-ordinated by the Cambodian Development Resource Institute (CDRI). Based on the actual agricultural trade situation, the research topic for the country team from the ASEAN Regional and Industrial Development Research Centre, under the supervision of the Faculty of Management and Economics (FME), Kunming University of Science and Technology (KUST), focuses on natural rubber and cassava. As China is at the high end of the value chain, analysis highlights downstream demand and market share in the country.

Following this introduction (part 1) and the description of the methodology (part 2), parts 3 and 4 present China's production and consumption of and trade in natural rubber and cassava. The discussion about production centres on the limited domestic supply, while that on consumption focuses on demand and the development of downstream industries (e.g. tyres, cars, ethanol, fuel ethanol). Factors driving the development of downstream industries, along with demand forecasts, show huge potential demand for natural rubber and cassava in China. The report also looks at the varieties imported, value and quantities, as well as the main ports handling cassava and rubber imports. The mapped routes from ports to end-users illustrate the marketing chains from the products' arrival at a Chinese port. The subsections on costs and margins in parts 3 and 4 present the changes in import prices and the cost structure of imported products after arrival at domestic factories. The imported prices of natural rubber and cassava play a significant role in the pricing structure of final products in downstream industries that use natural rubber and cassava as raw materials. Based on a review of existing policies, part 5 puts forward some policy recommendations for the further development of regional agricultural trade and related industries.

1.2. Objectives

This report presents an overview of China's natural rubber and cassava production, consumption and trade with other GMS countries. The specific objectives are: (1) to understand the domestic production and consumption of natural rubber and cassava in China from the demand side; (2) to analyse the marketing chains and existing policies; (3) to identify the factors influencing regional trade; and (4) to provide policy recommendations for the future expansion of regional trade from the demand side.

2. Methodology

This study was based on existing literature and primary data. Data was collected through in-depth interviews with various stakeholders in different aspects of the trade in raw materials and the production of and trade in downstream products. The study used three different methods:

a) Desk research: review of the existing literature on natural rubber and cassava production, and the development of downstream industries.

b) Fieldwork interviews and surveys: these were conducted at natural rubber farms and processing factories in Yunnan and ethanol factories located in Hekou city; the aim was to collect and examine primary data and information on cost.

c) Semi-structured interviews: these were undertaken with natural rubber producers, rubber traders, cassava traders, tyre manufacturers and exporters, and ethanol factories located in Anhui and Yunnan provinces; the aim was to examine the marketing chains and cost information.

3. Natural rubber

3.1. Natural rubber production in China

3.1.1. Cultivated area, yield and productivity

The major production areas of natural rubber in China are in Hainan, Yunnan, Guangdong and Guangxi Autonomous Region, and the harvest periods are from May to July and October to December. The total cultivated area of China is the fifth largest in the world.

Table 6.1: Natural rubber production in China's main provinces

Province	2000			
	Cultivated area	Harvested area	Yield	Yield per hectare
	1000 hectares	1000 hectares	1000 tonnes	tonnnes/hectare
Hainan	369.80	271.70	280.90	1.034
Yunnan	210.25	109.10	171.60	1.573
Guangdong	38.72	35.58	26.20	0.736
Guangxi	6.10	4.42	1.40	0.317
China	628.23	423.00	483.10	1.142
	2005			
Hainan	395.13	292.54	230.80	0.789
Yunnan	298.97	139.59	240.30	1.721
Guangdong	34.58	27.98	24.80	0.886
Guangxi	4.53	2.72	0.70	0.257
China	740.83	471.62	511.00	1.083
	2006			
Hainan	402.15	296.97	247.50	0.833
Yunnan	334.10	165.10	264.20	1.600
Guangdong	35.37	29.21	25.40	0.870
Guangxi	4.53	2.99	0.80	0.268
China	776.15	494.28	537.90	1.088
	2007			
Hainan	656.50	457.40	280.60	0.613
Yunnan	594.80	269.28	286.60	1.064
Guangdong	54.90	44.40	24.80	0.559
Guangxi	6.30	4.20	0.80	0.190
China	1315.10	777.28	593.50	0.764

Source: Statistical data from the Ministry of Agriculture of China.

In 2007 China's total rubber cultivated area was 1315.10 thousand hectares, and annual production was 593.50 thousand tonnes. These figures represent increases of 109 percent and 22.9 percent, respectively, compared with the year 2000. Total production in 2007 ranked fifth in the world and accounted for 5.89 percent of global natural rubber production. Affected by typhoon Weida in 2004, natural rubber production in Hainan province dropped significantly in 2005 and resumed gradually in 2006 and 2007. However, due to the cold, snowy winter of 2007, production in 2008 was estimated to drop.

Table 6.2: Natural rubber production in China

Year	Cultivated area	Harvested area	Yield	Yield per hectare
	1000 hectares	1000 hectares	1000 tonnes	tonnes/hectare
1996	589.30	394.90	402.40	1.019
1997	607.90	407.20	451.90	1.110
1998	634.26	407.50	440.00	1.080
1999	630.90	417.60	489.60	1.172
2000	628.23	423.00	483.10	1.142
2001	627.72	423.00	477.50	1.129
2002	632.54	428.00	527.40	1.232
2003	660.86	436.00	565.00	1.296
2004	696.18	452.00	575.50	1.273
2005	740.83	471.62	511.00	1.083
2006	776.15	494.28	537.90	1.088
2007	1315.10	777.28	593.50	0.764

Source: Statistical annual report of the Ministry of Agriculture of China.

Table 6.2 shows that cultivated area and annual production maintained stable levels before 2003. The increased production was generated by expansion of the cultivated area since there was no significant improvement in yield per hectare during this period. The reduction in national production in 2005 was a result of a typhoon in Hainan province, even though cultivated and harvested areas had reached a historical peak. In fact, the natural environment in China is not suitable for rubber plantation. Frequent typhoons in Hainan destroy rubber trees, while winter frosts reduce the rubber yield in Yunnan province where the cultivation areas are located in mountainous areas 600 metres above sea level.

3.1.2. People engaged in natural rubber industry

More than 150 farmers and about 180,000 households are engaged in natural rubber cultivation. Among the 6 million people involved in the natural rubber industry in China, 1.5 million are engaged in rubber planting, about 600,000 in the natural rubber products industry, and another 4 million in related industries such as technology software and services, and transport equipment manufacturing.

3.1.3. Development of the private sector

In China, state-owned rubber farms have contributed to infrastructure improvements in local areas, while the private sector has been an important driver in the further development of the natural rubber industry. By the end of 2005, the privately-owned rubber-cultivated area in China was 300,000 hectares, representing 40.5 percent of the total rubber-cultivated area, and the yield accounted for 38.5 percent of the total. Driven by rising market prices, individual households have turned to natural rubber production. In addition, farmers are attracted by the characteristics of the natural rubber industry, such as low inputs, low maintenance, small market risk and long economic life. The private rubber industry has had more room for development in technology, production and cultivation size. As a result, it has played an important role in increasing farmers' income and improving their well-being, promoting rural development and guaranteeing social stability. Take Xishuangbanna prefecture as an example. It is the most important hub for rubber in Yunnan, accounting for 75 percent of the province's rubber production. In 2005, the rubber industry provided a net per capita income of 615 yuan for the prefecture's population of 280,000, which represented 27.8 percent of net farm income per capita. In 2006, it provided a netper capita income of 875 yuan, an increase of 43 percent on the previous year.

3.1.4. Natural rubber varieties in Chinese market

Natural rubber is classified into latex, RSS and TSNR or standard China rubber (SCR). RSS and TSNR have the highest consumption rates in the international market. Majority of natural rubber produced in China is TSNR or SCR, and China imports both RSS and TSNR from around the world. The domestically produced SCR5 is equivalent to the imported RSS3. Table 6.3 presents the grade, origin and use of the different natural rubber varieties mostly consumed in China's market.

Table 6.3: Grade, origin and use of natural rubber in China

		Main domestially produced varieties	Main domestically consumed varieties	Main imported varieties	Use
RSS	RSS1				Medical products, inner-tubes
	RSS2				Inner-tubes and other industrial products
	RSS3		√	√	Tyre tread, rubber pipes
	RSS4 RSS5				Low quality rubber products
TSNR or SR	SR5	√	√		High quality industrial products
	SR10 SR20	√	√	√	Tyres , conveyer belts
		√			Low quality rubber products

Source: China Rubber Industry Association

3.1.5. Constraints and opportunities

3.1.5.1. Constraints

To begin with, low-yield rubber farms constitute a large percentage of the aggregate. China currently has1.95 million mu (about 0.13 million hectares) of old rubber farms, which yield less than 50 kg per mu, and about 3 million mu (about 0.2 million hectares) of new rubber farms waiting to be tapped. The scientific and technological levels of the privately-run rubber farms are relatively low. Coupled with ageing rubber trees and underdeveloped tapping techniques, their production potential has not been fully realised.

Second, the rubber plantations are poorly distributed and the choice of rubber tree cultivars is limited. Take Hainan, the province with the biggest rubber cultivation area, as an example. The factors underlying the limited varieties cultivated include farmers' ignorance about new cultivars and the growth of rubber trees, insufficient knowledge about rubber tree planting, and the widespread practice of planting rubber trees in typhoon-prone eastern Hainan. Consequently, farmers are slow to adopt the superior and new varieties of rubber trees, and the country has to rely on imports of high-quality standard rubber. All these are the outstanding contradictions between the mix of natural rubber products and market demand in China.

Third, the overall benefit of the natural rubber industry is far from substantial; by-products of the industry include rubber, wood and seed oil. To date, little attention has been paid to the growth and preservation of rubber trees in China. For example, of the furniture exported from Malaysia, about 70-80 percent is made from natural rubber wood and the value of exported rubber wood furniture from Malaysia amounts to USD2 billion per year.

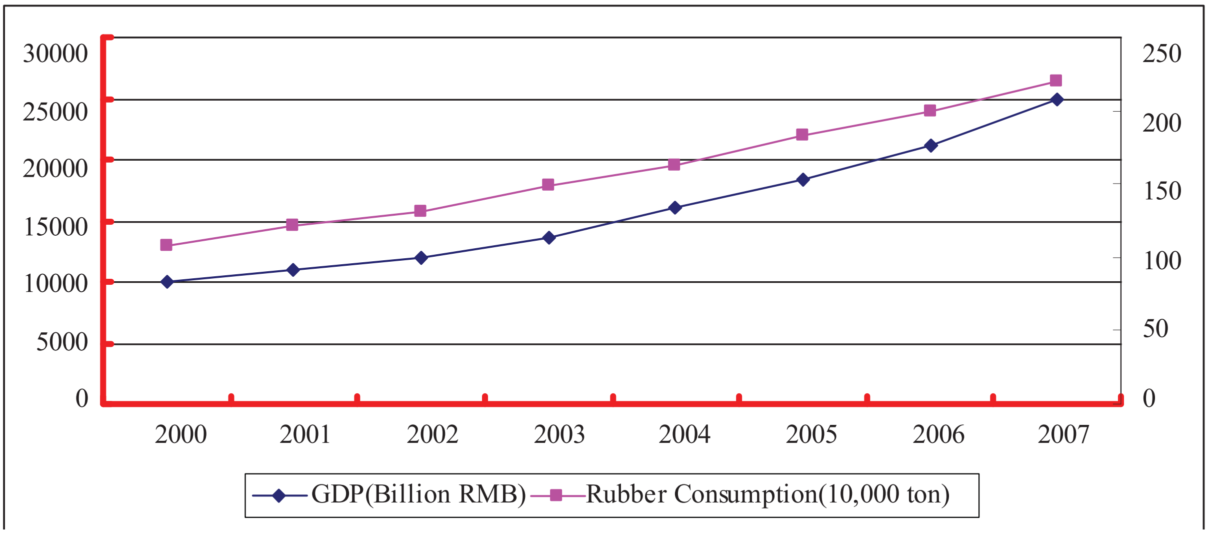
Finally, the capacity of China's rubber processing factories is limited and research and development (R&D) of related products is inadequate. The average capacity of the 324 factories controlled by state farms is only 1600 tonnes per year. In comparison, the annual rubber production of the main rubber-planting countries in Southeast Asia exceeds 10 thousand tonnes. The small scale operation of rubber processing factories in China results in higher production costs and poor quality.

3.1.5.2. Opportunities

As one of the world's strategic resources, natural rubber has a direct bearing on economic development, which is closely related to the rubber-consuming power of different regions and the world as a whole. Recent statistics show that there is a relationship between the GDP growth of China and its domestic consumption of natural rubber. In most cases, whenever aggregate GDP grows by 1 percent, China's domestic natural rubber consumption rate increases by 0.9 percent accordingly (see Figure 6.1).

The slowdown in the US economy will continue to have a knock-on effect on the global economy. However, China's economy is predicted to maintain a high growth rate, though it may slow down with further macroeconomic controls. China's annual economic growth rate is 2008 is projected to be more than 10 percent. Hence, total natural rubber consumption in China will still see a moderate increase.

Figure 6.1: Natural rubber consumption and GDP in China, 2001-07



Source: China Rubber Industry Association

3.2. Natural Rubber Consumption in China

3.2.1. Natural Rubber Consumption Analysis in China

In 2007, global natural rubber consumption reached 9.672 million tonnes. China took the greatest amount, consuming 22.7 percent or 2.19 million tonnes, followed by the United States (US) with 11.8 percent (1.145 million tonnes. Japan came third (See Table 6.4).

Table 6.4: Natural rubber consumption in the world, 200-07 (10,000 tonnes)

Countries	2000	2001	2002	2003	2004	2005	2006	2007
World	732.0	719.0	754.0	795.0	828.0	874.2	920.2	967.2
China	108.0	121.5	131.0	148.5	163.0	182.6	200.1	219.4
US	119.5	97.4	111.1	107.9	114.4	115.9	114.5	114.5
Japan	75.2	72.9	74.9	78.4	81.4	85.9	89.6	94.6
India	63.8	63.1	68.0	71.7	74.5	78.6	82.8	87.4
China's share of world consumption (%)	14.8	16.9	17.4	18.7	19.7	2 0.9	21.8	22.7

Source: International Rubber Study Group

With its huge population and rapid economic development, China is the biggest global consumer of natural rubber. By 1993, its demand for rubber had exceeded that of Japan and was second only to the US. But by 2001 China had knocked the US into second place (1.215 million tonnes versus 0.974 million tonnes). Despite only producing 7 percent of the world's natural rubber, China uses 20 percent of the world's total natural rubber and consumption is increasing at an average rate of 11 percent per year.

3.2.2. Self-sufficiency rate of natural rubber in China

Driven by increasing demand, China's rate of self-sufficiency in natural rubber declined from 44.7 percent in 2000 to 27.1 percent in 2007. Statistics also show that 72.9 percent of the domestically needed natural rubber was imported in 2007. According to the recent forecast by the China Rubber Industry Association, the consumption of natural rubber of China will reach 2.80 million tonnes in 2010, 3.5 million tonnes in 2015 and 4.5 million tonnes in 2020. The World Rubber Research Organisation estimates that China's domestic natural rubber consumption will represent a quarter to a third of world consumption in the next 10-15 years. However, there is little room to expand production in China because of the limited rubber cultivation area and the scale of planting; the potential production peak of natural rubber is only 800 thousand tonnes. Therefore, the gap between domestic supply and demand will continue to widen, and China will become more dependent on international natural rubber markets in the long run.

Table 6.5: Domestic natural rubber production and consumption in China, 2000-07

Year	2000	2001	2002	2003	2004	2005	2006	2007
Production (10,000 tonnes)	48.31	47.75	52.74	56.5	57.55	51.10	53.79	59.35
Consumption (10,000 tonnes)	108	121.5	131	148.5	163	182.6	200.1	219.4
Import dependence rate (%)	55.3	60.7	59.7	61.9	67.7	72.0	73.4	72.9
Self-sufficiency rate (%)	44.7	39.3	40.3	38.1	32.3	28.0	26.6	27.1

Source: production statistics are from the statistical annual report of the Ministry of Agriculture of China; consumption statistics are from the China Rubber Industry Association.

3.3. Demand analysis of natural rubber in China

3.3.1. Main rubber products and related natural rubber consumption, 2007

Among the consumption sectors of natural rubber (see Table 6.6) it is clear that tyre-making is the main driver of natural rubber consumption, with 68 percent of natural rubber going to this sector in 2007. Also, the rapid expansion of tyre production in China has significantly driven up the demand for natural rubber. After 2000, the rapid production of natural rubber in the country was accompanied by the robust development of the tyre-making industry. With a surging GDP, China experienced a huge increase in the purchase of private cars, which largely encouraged the production of rubber. Although trade barriers and anti-dumping charges have plagued China's tyre industry, the restructuring of domestic tyre enterprises is underway. The production and export of high value-added products such as radial tyres maintain a stable growth momentum.

Table 6.6: Percentage of natural rubber consumption in main rubber products in China, 2007

Rubber product categories	% of NR consumption	Factories' location
Tyres	68	North and east of China such as Shandong, Jiangsu, Zhejiang
Rubber products for industrial use, pipes	13	Countrywide
Rubber products for daily use, shoes	8	Countrywide
Latex products	8	Countrywide
Others	3	
Total	100	

Source: China Rubber Industry Association

China's tyre industry requires large quantities of TSNR or SCR, namely SCR10 and SCR20, which are made in China. The imported standard rubber from Malaysia (SCR20), Thailand (STR20) and Indonesia (SIR20) is largely used for radial tyre production, and the imported RSS3 from Thailand is mainly used to make tyre tread. The domestically produced SCR5 is equal to RSS3 in quality and performance, and could readily take its place.

3.3.2. Analysis of the development of the natural rubber downstream industry

Owing to China's sustained economic development, its tyre and rubber industries in 2007, after braving the difficulties caused by lower export tax rebates and the soaring price of raw materials like natural rubber, continued their rapid development and improved performance.

3.3.2.1. Tyre and rubber products manufacturing industry

As the main rubber product, tyres account for almost 70 percent of total natural rubber consumption. Table 6.7 shows that tyre production in recent years has maintained stable and rapid growth, especially radial tyre production with an annual increase of 20 percent, revealing the further upgrading of product structures in the tyre-making industry (see Tables 6.7 and 6.8). Table 6.9 shows that production of non-tyre rubber products has maintained a 7 percent increase in recent years.

Table 6.7: Tyre production in China, 2002-07 (10,000 pieces)

Products	2002	2003	2004	2005	2006	2007
Tyres	14,000	16,500	21,000	25,000	28,000	33,000
% change	13.8	17.9	27.3	19.0	12.0	17.9
Radial tyres	5,400	7,600	10,960	14,850	17,860	23,000
% change	27.1	40.7	44.2	35.5	20.2	28.8

Table 6.8: Motorcycle Tyre production and force-propelled vehicle tyres, 2002-07

Products	2002	2003	2004	2005	2006	2007
Motor car tyres	5,800	6,200	7,800	8,500	10,000	12,000
% change	16.1	6.9	25.8	9.0	17.6	20.0
Force-propelled vehicle tyres	44,392	38,581	41,210	41,165	47,500	52,000
% change	12.3	-13.1	6.8	0.0	15.4	9.5

Note: Force-propelled vehicle tyres above include the tyres of bicycles and handcarts, though mainly referring to bicycle tyres.

Table 6.9: Production of non-tyre rubber products in China, 2002-07

Products	2002	2003	2004	2005	2006	2007
Conveyer belt /10,000m^2	7,328	8,876	11,349	13,702	15,357	17,000
% change	1.1	21.1	27.9	20.7	12.1	10.7
V belt/ 10,000A m	65,410	76,347	78,351	86,600	91,623	99,000
% change	0.3	16.7	2.6	10.5	5.8	8.1
Rubber pipe/ 10,000m	23,048	33,522	35,057	37,827	51,181	55,000
% change	9.4	45.4	4.6	7.9	35.3	7.5
Rubber shoes/ 10,000 pairs	95,863	79,260	100,798	127,475	159,089	180,000
% change	18.7	-17.3	27.2	26.5	24.8	13.1

Source: Statistics of rubber shoes come from the State Statistics Bureau. Other statistics come from calculations made by the China Rubber Industry Association based on the statistics of its member enterprises.

3.3.2.2. Export of tyres and other rubber products

Tables 6.10 and 6.11 indicate the year-on-year increases in the export of tyres and rubber conveyer belts. In 2007, tyre exports accounted for 47.56 percent of total production, an increase of 30.8 percent from the previous year. In addition, in 2007, the export of conveyer belts increased by 12.4 percent and V belts by 32 percent.

Table 6.10: Volume of tyre export, 2002-07 (10,000 pieces)

Year	Export quantity	% of total production	% change from previous year
2002	3,523.2	25.17	33.69
2003	4,500.0	27.27	27.72
2004	6,875.2	32.74	52.78
2005	9,100.0	36.40	32.36
2006	12,000.0	42.86	31.90
2007	15,696.0	47.56	30.80

Table 6.11: Rubber Conveyer belt and V belt exports, 2002-07

Product	2002	2003	2004	2005	2006	2007
Conveyer belt 10,000 m^2	284	372	594	856	1199	1369
% change	-14.7	40.0	59.7	44.1	40.1	14.2
V belt/ 10,000 A m	4401	11230	12690	9646	11964	15790
% change	5.4	155.2	13.0	-24.2	24.0	32.0

Source: China Rubber Industry Association

3.3.3. Factors driving the development of China's rubber industry

3.3.3.1. Sustainable economic development of China

The sustainable economic development of China and the economic rise in western countries have contributed to the recent rapid and stable growth of China's rubber industry. The GDP growth rate of 11.4 percent in 2007 marked the fifth consecutive year that China's economic development maintained a more than 10 percent increase. Although further macrocontrol policies have been decided at the Economic Affairs Conference, China's economic development is forecast to maintain a high growth rate which will fuel the stable development of the rubber industry in China.

3.3.3.2. Development of the automobile industry

As the backbone of China's national economy, the automobile industry will continue to be upgraded and more focused on the private car market. More than 8.5 million cars were manufactured in 2007—a 15 percent increase from the previous year. Further market expansion in 2008 is likely to reach the production target of 10 million cars. It is estimated that China's automobile production in 2010 will exceed 12 million, making China one of the main automobile manufacturers in the world. While meeting domestic consumer demand, China's automobile manufacturers have also entered the international market. Since 2006, China has exported automobiles in large quantities, reaching 600,000 or 7 percent of total production in 2007. The number of owned automobiles in 2006 reached 39.1 million and is likely to increase to 53 million by 2010. The development of the automobile industry has created a huge market for tyres and other rubber products for cars.

Table 6.12: Automobile demand, production and ownership in China, 2005-10 (10,000)

	2005	2006	2007	2008*	2009*	2010*
Demand	560	637	691	750	827	914
Production	586	739	850	1000	1100	1200
Possession	3100	3490	3,910	4340	4830	5300

*Source: Production and Export of Automobile (1985-2007), China's National Statistic Bureau Statistics with * data estimated.*

3.3.3.3. Stable development of highway transportation

China will continue to prioritise road transport development, upgrading the road network, constructing a national expressway network, and improving national and provincial road networks. Five highways running from north to south and seven horizontal lines running from east to west were linked up in 2007 to form national highway networks 76 percent of which are expressways. The total extension of China's expressways has reached 53,000 km, ranking second in the world. The construction of more roads will significantly increase the demand for rubber products.

3.3.3.4. Stable development of related industries

Industries closely related to rubber production, such as coal, electricity, construction materials and machine-making, enjoy stable development and will continue to drive the demand for rubber pipes and other rubber products. China's coal production in 2007 reached a historical peak of 2.4 billion tonnes, a 9 percent increase compared with 2006. In the same year, crude steel reached 480 million tonnes, a 14 percent increase on the previous year; raw steel produced by furnaces, estimated to be 465 million tonnes, showed a 12.4 percent increase since 2006; and the volume of power generated amounted to 3.1849 trillion kilowatts (kW) per hour, an increase of 15.8 percent. By the end of 2007, the total installed capacity of power plants approached 7 billion kW and had increased several fold in 5 years, a unique achievement in China's modern history. It is predicted that these sectors will maintain sound growth momentum in 2008.

3.3.3.5. Investment from foreign and private sectors

Chinese private enterprises have increased their investment in China's tyre-making, which will accelerate the development of the rubber industry in the country. This is in addition to the business expansion of established foreign firms such as Michelin, Goodyear, Bridgestone, Coopertire and Pirelli.

3.3.3.6. Rubber products export growth potential

In recent years there have been more and more anti-dumping charges involving exported rubber products such as tyres made in China. What is worse, from 1 June 2007 China lowered its export rebates on tyres and other rubber products from 13 percent to 5 percent All these have cast a shadow over the export of rubber products. However, due to the structural upgrading of rubber products such as tyres, the quality of Chinese rubber products is approaching international standards and their competitiveness is improving. The export volumes of rubber products will stabilise at beneficial levels with the gradual reduction of trade friction.

3.3.4. Forecast of future demand for rubber products

The rubber industry in China faces more opportunities than challenges, and will offer more benefits than risks in the future. The industry will grow at a rate of 5-10 percent. Tyre-making will be a fast growing sector and its growth rate will be maintained at 10-15 percent.

The continuing demand for rubber will not fluctuate but will slow over time. Rubber consumption in 2008 will exceed 5.4 million tonnes, including 2.38 million tonnes of natural rubber and 3.02 million tonnes of synthetic rubber. It is predicted that by the year 2010, 6.45 million tonnes (2.80 million tonnes of natural and 3.65 million tonnes of synthetic) rubber will be consumed (see Table 6.13). The basic demand and supply of natural rubber will not fluctuate as long as no catastrophes befall the rubber planting countries in Southeast Asia in the period 2008-10.

Table 6.13: Predicted future rubber demand in China, 2006-10 (10,000 tonnes)

Products	2006	2007	2008*	2009*	2010*
Natural rubber	200	219	238	258	280
Synthetic rubber	240	270	302	330	365
Total	440	489	540	588	645

*Note: * Statistics are estimated.*
Source: Calculated based on the Statistics provided by China Rubber Industry Association.

3.4. Trade and marketing of natural rubber

3.4.1. General rubber import situation

3.4.1.1. Import values

Rubber product imports in China have risen in recent years, and the average annual growth rate of rubber product import value rose to 27 percent in 2007. The value of rubber product imports in 2007 was USD9589.32 million, a 13.5 percent rise from 2006. The import value of natural rubber reached USD3257.50 million, accounting for 34 percent of the total value of rubber product imports.

Table 6.14: Rubber product import to China from the world (USD million)

Year	Import Value (Millions of US Dollars)	% change
2000	1,905.79	29.74
2001	2,071.23	8.68
2002	2,467.60	19.14
2003	3,713.55	50.49
2004	4,734.46	27.49
2005	5,583.67	17.94
2006	8,448.76	51.31
2007	9,589.32	13.50

Source: Global Trade Atlas

3.4.1.2. Main importing sources

In 2007, the rubber products imported from Thailand represented 18.72 percent of total import value while that from Malaysia accounted for 14.88 percent and from Japan 12.40 percent. According to China Customs, 80 percent of the rubber products imported from Thailand were natural rubber (4001). China imported synthetic rubber (4002) and articles nesoi of unhardened vulcanised rubber (4016) from Japan, as well as rubber products from Vietnam, Laos and Cambodia. Although the import value from those countries represents a comparatively small share, the overall increase is clear as shown in (see Table 6.15).

Table 6.15: Import sources of rubber products for China

Partner country	**USD million**			**% Share**			% Change 2006/07
	2005	**2006**	**2007**	**2005**	**2006**	**2007**	
World	5583.7	8448.8	9589.3	100	100	100	13.50
Thailand	969.4	1675.3	1795.4	17.36	19.83	18.72	7.17
Malaysia	684.3	1260.2	1427.0	12.26	14.92	14.88	13.24
Japan	782.4	997.0	1189.3	14.01	11.80	12.40	19.29
South Korea	549.5	699.7	853.2	9.84	8.28	8.90	21.94
Indonesia	402.2	773.0	804.6	7.20	9.15	8.39	4.09
USA	409.6	564.4	687.3	7.34	6.68	7.17	21.78
Taiwan	441.9	463.6	481.4	7.91	5.49	5.02	3.84
Russia	227.0	303.8	383.1	4.07	3.60	4.00	26.10
Germany	182.3	264.8	314.5	3.26	3.13	3.28	18.77
Vietnam	169.2	331.6	272.5	3.03	3.92	2.84	-17.82
Laos	4.2	12.1	12.9	0.08	0.14	0.13	6.61
Cambodia	3.1	8.7	11.0	0.06	0.10	0.11	26.44

Source: Global Trade Atlas

3.4.2. Natural rubber import

3.4.2.1. Import varieties, value and quantities

The varieties of the natural rubber products imported started to change in 2006. Imported TSNR, or standard rubber, represented 63.6 percent of the total import volume and imported RSS represented only 17.4 percent. It is worth noting that RSS used to be the main natural rubber imported by China, but import volumes have been in constant decline since 2003. Table 6.16 shows the change in the imported natural rubber varieties, reflecting the changes in demand in the Chinese market. As mentioned in section 3.3, the production and export expansion of radial tyres is the driving force behind the demand for natural rubber. With technological improvements and product structure upgrading in the domestic tyre industry, the proportion of imported RSS (used to produce tyre tread) gradually decreased, while the volume of TSNR (suitable for producing radial tyres) imports kept increasing.

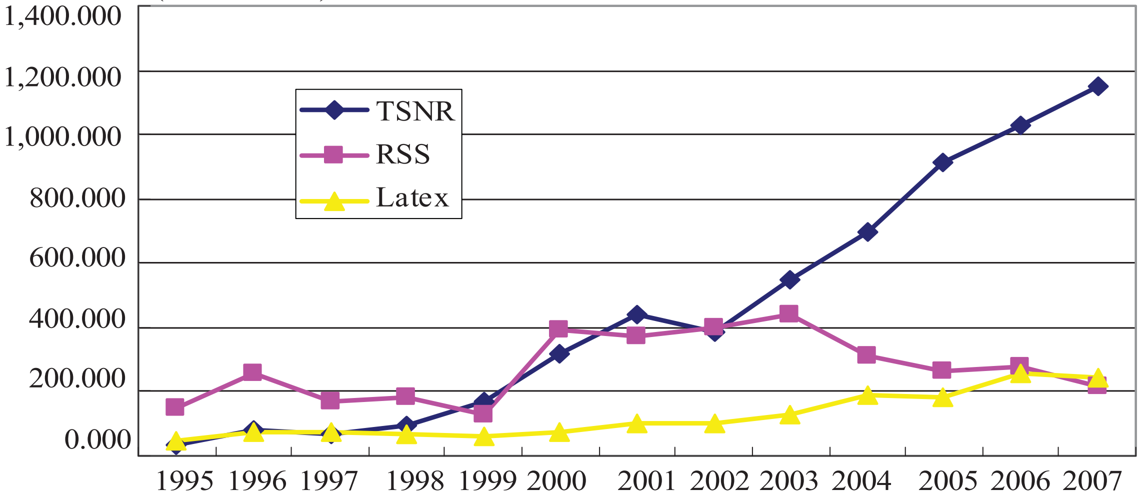
The volume of natural rubber imports in 2007 increased by 2.2 percent compared to 2006. This indicates a significant deceleration, as the growth rate of natural rubber imports was 14.6 percent in 2006. One reason contributing to the deceleration of natural rubber imports is the sharp increase in synthetic rubber imports. Many Chinese tyre manufacturers began using synthetic rubber as a substitute for natural rubber because the properties of synthetic rubber are acceptable for tyre manufacturing, and import duty is only 5 percent. Furthermore, RSS imports kept decreasing while that of TSNR kept increasing, indicating a continuous trend. The 22.9 percent decline in RSS imports since 2006, is another factor that contributed to the reduction in the natural rubber growth rate in 2007.

Table 6.16: Natural rubber import varieties and quantities for China

Natural Rubber	Thousand tonnes				% Share				% Change 07/06
	2004	2005	2006	2007	2004	2005	2006	2007	
Total	1284.38	1406.77	1612.02	1647.54	100	100	100	100	2.2
Natural rubber* Latex	189.55	181.57	257.14	240.14	14.8	12.9	16.0	15.6	-6.6
RSS*	314.86	263.86	280.42	216.30	24.5	18.8	17.4	13.1	-22.9
TSNR*	697.96	910.21	1025.87	1148.33	54.3	64.7	63.6	69.7	12.0
Natural rubber in other forms	81.97	51.04	48.53	42.71	6.4	3.6	3.0	2.6	-12.0
Others	0.04	0.10	0.06	0.07	0.0	0.0	0.0	0.0	-16.7

*Note: *NR: natural rubber; RSS: ribbed smoked sheet; TSNR: technically specified natural rubber*
Source: China Customs

Figure 6.2: Import Quantity of Different Natural Rubber Varieties for China, 1995-2007 (1000 tonnes)



Source: China Customs

3.4.2.2. Main importing sources

In 2007, China's main sources of natural rubber imports were Thailand, Malaysia, Indonesia and Vietnam. Together they accounted for 97.4 percent of the gross import quantity: Thailand accounted for 45.6 percent, Malaysia 27.3 percent, Indonesia 19.0 percent and Vietnam 5.5 percent. The import volume from Thailand was 751.52 thousand tonnes, reflecting an increase of 11.5 percent from 2006. The volume imported from Vietnam rose sharply by 86.3 percent in 2006 but then dropped by 11.4 percent in 2007. The quantity imported from Cambodia and Laos represented a small share of the total, but an increasing trend to import from these countries was observed.

Table 6.17: Natural rubber import quantities for China from the world, by country

Partner Country	Thousand tonnes				% Share				% Change 06/07
	2004	2005	2006	2007	2004	2005	2006	2007	
World	1284.38	1406.78	1612.02	1647.54	100	100	100	100	2.20
Thailand	642.82	611.56	673.79	751.52	50.05	43.47	41.80	45.61	11.54
Malaysia	311.64	408.80	429.54	450.11	24.26	29.06	26.65	27.32	4.79
Indonesia	207.85	271.40	334.22	313.27	16.18	19.29	20.73	19.01	-6.27
Vietnam	53.58	55.14	102.73	91.02	4.17	3.92	6.37	5.52	-11.40
Myanmar	6.20	8.38	11.68	16.34	0.48	0.60	0.72	0.99	39.90
Cambodia	2.22	3.32	5.75	6.44	0.17	0.24	0.36	0.39	12.00
Laos	1.38	3.64	5.90	6.26	0.11	0.26	0.37	0.38	6.10

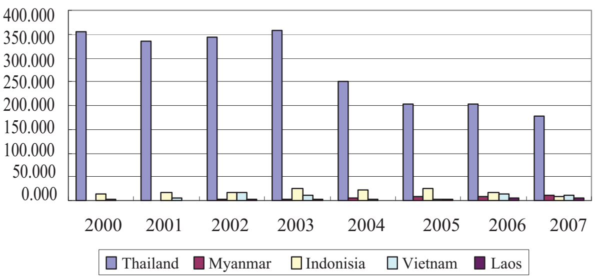
Source: China Customs

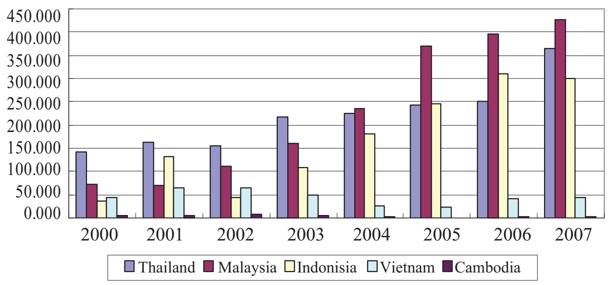
The price of rubber increased rapidly in the second half of 2005. As a result, many domestic small- and medium-sized tyre manufacturing enterprises started to take more account of their material costs, and began purchasing from Vietnam, India, the Philippines and Myanmar. The competitive prices from these countries enabled their products to dominate the domestic market rapidly. For example, the rubber industry in Vietnam developed quickly in 2005 and it exported 0.25 million tonnes of rubber—USD0.34 billion in value—from Mong Cai to China that year. This accounted for 43 percent of Vietnam's 2005 gross rubber export. The border trade between China and Vietnam has seen an unprecedented boom in recent years. Overall, as the mismatch between supply and demand intensified, China began to diversify its natural rubber import partners.

Figure 6.3 shows that most RSS imports come from Thailand, representing 82.6 percent of China's total RSS imports from the world in 2007. Figure 6.4 shows that the main TSNR exporters to China are Malaysia, Thailand and Indonesia. In 2007, of total TSNR imports, Malaysia accounted for 37.1 percent, Indonesia for 31.8 percent and Thailand 26.2 percent. The large increase in imports from Malaysia was because Malaysian TSNR was particularly suited to radial tyre production, and was therefore in demand by the Chinese market. Vietnam exports both RSS and TSNR while Laos mainly exports RSS. Cambodia mainly exports a little TSNR.

Figure 6.3 (left): RSS Volumes from Main Import Sources, 2000-07 (1000 tonnes)

Figure 6.4 (right): TSNR Volumes from Main Import Sources (1000 tonnes)



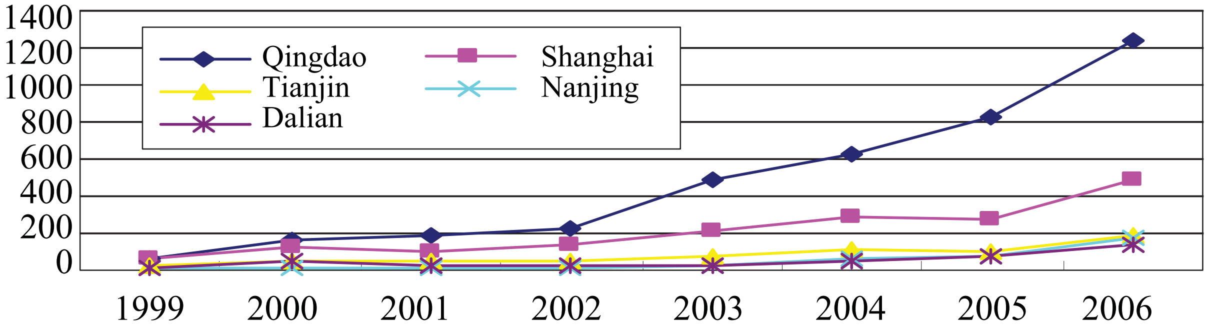


Source: China Customs

3.4.2.3. Main ports for import of natural rubber

The main ports handling China's natural rubber imports are Qingdao, Shanghai and Tianjin. In 2005, the value of natural rubber imported via Qingdao port was USD819.5 million, an increase of 30.6 percent from 2004 and accounting for 44.2 percent of total national import value. The values of natural rubber imported via Shanghai and Tianjin dropped slightly and accounted for 15.1 percent and 5.7 percent, respectively, of the total. Natural rubber imported from Thailand enters China via Qingdao (44.9 percent), Shanghai (19 percent), Nanjing (10.7 percent) and Tianjin (4.6 percent). Vietnamese natural rubber comes in through Qingdao (44.2 percent), Nanning (20.6 percent), Shanghai (11.4 percent) and Kunming (2.6 percent). The main ports for Malaysian imports are Qing Dao (56.3 percent), Shanghai (11.1 percent), Zhengzhou (4.6 percent) and Guangzhou (6 percent). The imported natural rubber is transported to Shandong province where 41.4 percent of China's tyre factories are located, Jiangsu province where 10.4 percent of the factories are located, and Zhejiang province where 8.9 percent are located.

Figure 6.5: China's main ports for natural rubber imports



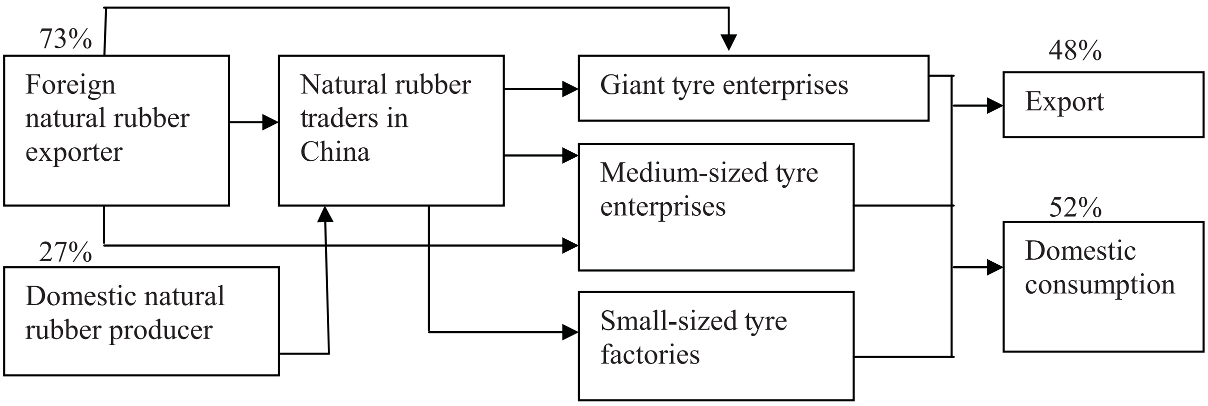
Source: China Customs

3.4.3. Marketing chains

3.4.3.1. Mapping routes from port to end users

Most tyre enterprises purchase domestically produced natural rubber from trading companies rather than directly from the domestic producer. This is because domestic producers request advance payment, while trading companies accept payment after delivery. For the purchase of imported natural rubber, situations vary according to the size of the tyre enterprise.

Figure 6.6: Route of natural rubber imports from port to end users



Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

The giant domestic tyre enterprises, such as Triangle, Chengshan, Fengshen, Linglong and Jiatong mostly import natural rubber directly from foreign suppliers. They import above 8000 tonnes of natural rubber every month. Usually the giant tyre firms export large quantities of tyre products; hence they prefer to import natural rubber and materials supplied by clients which do not require import duty. Some enterprises, such as Fengshen, have even established their own bonded factory. Generally, there are two options for purchasing. One is to sign an annual purchase agreement with a foreign rubber supplier; the price and shipping date are confirmed monthly according to the market situation. Another option is monthly purchasing based on the actual market price; the quantity purchased every time is more than a thousand tonnes, a very attractive prospect for foreign rubber suppliers. All of the purchased products are contracted for forward shipment.

Medium-sized tyre enterprises buy natural rubber by processing materials supplied by clients. Production stock is purchased according to the production plan and material stock every month. Hence the purchasing is quite random. Because of capital limits, these enterprises always purchase merchandise in a Bonded Zone directly from domestic trade companies.

Small-sized tyre factories purchase directly from domestic trade companies with monthly purchasing quantities of tens to hundreds of tonnes. Those who have an export business will choose the natural rubber stored in a bonded warehouse while others who do not export, or whose export is not sufficient, will purchase synthetic rubber with the lowest import duty.

3.4.3.2. Natural rubber traders

Compared to production enterprises, the circumstances of domestic companies engaged in the rubber trade are more complex. After the abolishment of the import quota system, more and more import and export rubber trading companies were set up. Most of them were located in Qingdao, Shanghai, Tianjin, Xiamen and Guangzhou. These companies vary greatly in their management scale and development strategies as well as credibility rating. Take Sinochem Holding Company Limited as an example. As a leading natural rubber trader in China, Sinochem has successfully extended its business to both upstream and downstream industries, including natural rubber production and processing. Other large-scale trading companies started to develop tyre businesses, exporting tyres made from imported natural rubber.

The existence of small foreign rubber trading companies and small domestic rubber processing enterprises provides plentiful room for small trade companies. They have established synthetic rubber processing factories, or have joined forces with domestic factories by buying some shares. However, foreign rubber companies have begun to establish branches or representative offices in the domestic market to access domestic end-user enterprises.

3.4.4. Costs and margins

3.4.4.1. Import prices

Figures 6.7 and 6.8 show that import prices have been driven up by stronger demand in China since 2001. In 2006, the average natural rubber import price from Thailand was about USD 2020 per tonne, an increase of 46 percent from 2005. Prices of RSS imports from different countries differed slightly, whereas there was little difference in that of TSNR imports.

Figure 6.7: RSS import FOB price from main export countries 1996-2007 (USD per tonne)

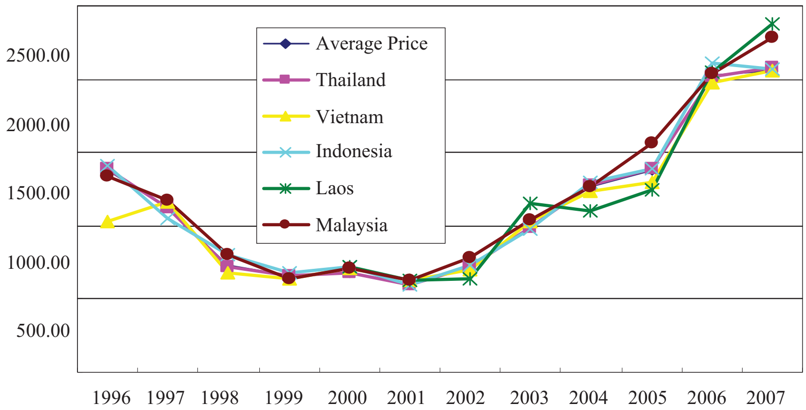
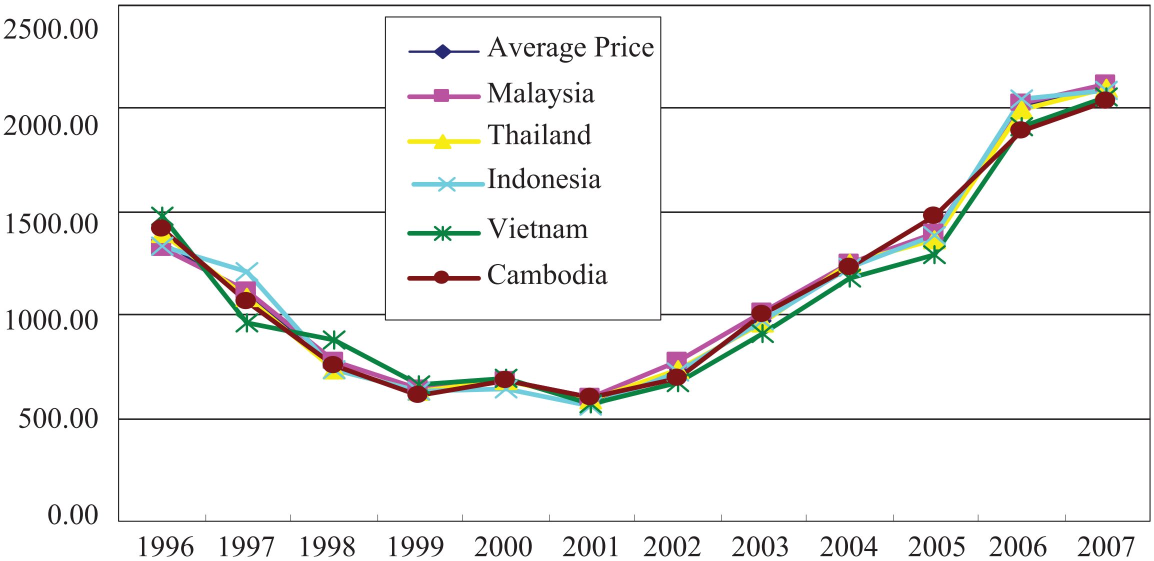


Figure 6.8: TSNR import FOB price from main export countries 1996-2007 (USD per tonne)



Source: China Customs

3.4.4.2. Cost structure

a) Transportation cost

After arriving at port in China most natural rubber imports are transported by train, as train freight is lower than bus transportation. Table 6.18 shows the transport costs from Qingdao, China's main port for natural rubber imports, to the region where the main tyre factories are located.

Table 6.18: Transport costs from qingdao to tyre factories, 2007

Port	Destination	By train			By bus		
		RMB/tonne	USD/tonne	Travel time	RMB/tonne	USD/tonne	Travel time
Qingdao	Shandong	￥100	$13	1-2 days	￥180	$24	1 day
	Jiangsu	￥200	$27	2 days	￥400	$53	1 day
	Zhejiang	￥250	$33	4-5days	￥550	$73	1-2 days

*Note: * Average exchange rate in 2007: USD1 = RMB7.5*
Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

b) Cost structure of imported natural rubber in 2006 (Thailand – China)

The tyre enterprises which import natural rubber directly from abroad are all tyre exporters. By the method of "processing trade", they import natural rubber at zero tariff, and value-added tax (VAT) on imported natural rubber is 17 percent; the cost calculation of the imported natural rubber is as follows:

Price of natural rubber imports = (FOB + sea freight + insurance) x exchange rate x 1.17
+ port handling fee + domestic transportfee

Taking the average FOB price of imported natural rubber from Thailand in 2007 as an example, the final price of natural rubber after arriving at tyre factories in Shandong province from Qingdao port differs slightly because of the different methods of transport. The results of the calculation are detailed in Table 6.19:

Table 6.19: Cost structure of imported natural rubber from Thailand to China, 2007

Item	Cost		% of total cost	
	By train	By bus	By train	By bus
Average FOB price/tonne	$2,350			
Sea Freight and Insurance/tonne	$40			
CIF price/ton*	￥17,925（$2390）		74.5	74.2
VAT (17%)/tonne	￥3047 ($406)		12.7	12.6
Import Duty (2600yuan/tonne)	￥2600 ($347)		10.8	10.7
Price after VAT and import duty/tonne	￥23,572 ($3143)			
Port handling fee/tonne	￥400 ($53.3)		1.6	1.7
Domestic transportation*/tonne	￥100 ($13.3)	￥180 ($24)	0.4	0.8
Final price of imported natural rubber/tonne	￥24,072 ($3210)	￥24,152 ($3220)	100	100

*Note: * Average exchange rate in 2007: USD1 = RMB7; ** domestic transport cost is calculated based on distance from Qingdao to other areas in Shandong province.*
Source: Survey by ASEAN Industrial Development Research Centre, KUST, 2008

Table 6.19 shows that, in addition to the FOB price, import duty (10.8 percent of total cost) and VAT (12.7 percent of total cost) are the main factors influencing the price of natural rubber for tyre factories. To reduce costs, almost 70 percent of the tyre enterprises that use imported natural rubber as a raw material apply the processing trade pattern. All of them are tyre exporters that have adopted the method of processing supplied material, and they pay zero tariff. In addition, they can take the 5 percent tax rebate after export as profit.

In the case where the tyre factories purchase natural rubber from a trading company, the trading company will charge approximately 200 yuan per tonne as the margin.

c) Cost structure of tyre production

Table 6.20 shows the cost structure of Chinese tyre factories. The cost of natural rubber is 30-40 percent of the total production cost of the tyre, indicating that the price of natural rubber plays a significant role in the final price of the tyre.

Table 6.20: Cost Structure of Tyre Factories, 2007

Item	% of cost structure
Natural rubber	30
Other raw materials	30-35
Production cost	30-35
Margin	5-10

Note: Table 6.20 is calculated based on the survey of the large scale tyre manufacturers when market demand was steadily increasing.
Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

3.4.4.3. Constraints and opportunities

Several constraints and opportunities impinge the development of China’s rubber industry:

a) Huge domestic demand driven by car and tyre production will lead to expansion of natural rubber trade.

b) Price of natural rubber will be the main factor affecting China’s tyre industry.

c) Industrial policies on tyre production and trade policies on tyre export will have a direct impact on natural rubber imports, both quantities and varieties.

d) Import duties on natural rubber and rubber products directly influence the quantities and varieties of rubber imported.

e) Upgrading of the tyre industry in China requires more TSNR than RSS, indicating a new requirement for industrial adjustment in the main natural rubber exporting countries to China.

4. Cassava

4.1. Cassava production in China

4.1.1. Cultivated area, yield and productivity

Cassava is the main source of starch in China. As such, cassava has been planted in southern Guangxi, Guangdong, Hainan, Yunnan, Fujian, Sichuan and Guizhou for more than 200 years. Guangxi Zhuang Autonomous Region, with a cassava cultivation area of 312,000 hectares, accounts for about 66 percent of China's total cassava growing area; it is the top province for cassava planting. Second is Guangdong province, with 90,000 hectares under cassava accounting for 19 percent of China's total cassava area. Hainan has a cassava area of 32, 000 (7 percent) and Yunnan provinces has 402,000 hectares (8.5 percent). Cassava planting in other provinces is minimal.

Table 6.21: Cultivation area, production and yield in China's main planting areas

Main province and region	**Cultivation area (ten thousand hectares)**				
	1996	**2000**	**2005**	**2006**	**2007**
Guangxi	28.89	26.43	26.95	28.89	31.20
Guangdong	14.62	12.41	10.33	9.91	9.10
Hainan	2.65	3.77	3.36	3.19	3.20
Yunnan	4.00	3.20	2.67	3.50	4.02
China	**50.16**	**45.81**	**43.31**	**44.60**	47.52
	Production (ten thousand tonnes)				
	1996	**2000**	**2005**	**2006**	**2007**
Guangxi	356.50	335.66	471.63	540.00	630.00
Guangdong	222.50	209.37	186.43	178.07	162.00
Hainan	33.10	55.60	53.30	54.40	57.44
Yunnan	46.00	37.80	32.30	57.80	76.00
China	**658.10**	**638.43**	**743.66**	**830.27**	925.44
	Yield (tonnes/hectare)				
	1996	**2000**	**2005**	**2006**	**2007**
Guangxi	12.34	12.70	17.50	19.29	20.20
Guangdong	15.21	16.86	18.02	17.96	17.80
Hainan	12.51	14.73	15.86	17.04	17.95
Yunnan	11.50	11.81	15.79	17.50	18.90
China	**12.89**	**14.03**	**16.79**	**17.95**	18.71

Source: Calculated based on the statistics provided by Provincial Departments of Agriculture

The temperature in China's cassava plantation areas ranges between 22 and 24 degrees centigrade, lower than that in other countries. Sometimes there are frosts. The planting period is between March and April and the harvest period is between December and January. The starch content in cassava is 24-25 percent maximum.

The area under cassava in 1996 was 501.6 thousand hectares, the production of fresh cassava was 6581 thousand tonnes, and the price of cassava sold by farmers was about 315yuan per tonne. The yield of cassava has been lower than that of other crops. As such, the cassava planting area has stayed at about 450,000 hectares for almost 10 years since 1996. Recently it has even shrunk. Even so, the growth rate of cassava yield has stayed constant at 1.65 percent per year for the last 10 years. For example, the yield in 2005 was 7,4366,000 tonnes, while the yield per hectare increased from 12.89 tonnes per hectare in 1996 to 16.79 tonnes per hectare in 2006. The average growth rate per year was 3 percent. This data indicates that the increased effectiveness of cassava production in China.

Since 2005 the development strategy of using cassava to produce ethanol fuel has been implemented in Guangxi Autonomous Region and Yunnan province, and has increased the demand for cassava for traditional uses. The size of the cassava planting area in Guangxi and Yunnan had recovered by 2006. It is estimated that the cassava planting area will increase from about 0.5 million hectares currently, to 1.0-1.5 million hectares in Guangxi, Guangdong, Hainan, Yunnan and other provinces in the next 10 years. Meanwhile the average yield will also increase because of its growing importance. With a yield of 20.2 tonnes per hectare and total yield of 6.3 million tonnes in 2007, Guangxi is the top cassava producing region in China.

4.1.2. Constraints and opportunities

4.1.2.1. Constraints

a) Undeveloped planting technologies. The choice of cassava cultivars is limited and the bulk of cassava products are ageing. In addition, cassava farming is quite rough. In many places, exploiting wild land is the main method for planters who are unaware of plant density, shortage of seeds and plant variety. Hence average yield remains low.

b) Poor processing technology. The cassava processing industry, especially technologically advanced industry, has developed slowly. Also, the low utilisation of cassava has resulted in low economic benefits from cassava production. Although there are more than 300 cassava processing factories at different scales, few are able to process and produce advanced products with a higher economic value, such as denatured starch.

c) Insufficient R&D input and promotion. R&D for cassava planting technology is far from fully developed in China due to lack of capital and resources. The poor payment and research environment have driven many professionals out of this industry. Further, the new cassava varieties and soild fertility technologies have reached only 20 percent of the total cassava areas.

4.1.2.2. Opportunities

a) The increasing importance of cassava as raw material for ethanol fuel production. In recent years, resultant of the rocketing price of petroleum, there has been increasing interest in biofuel production around the world. The US and Brazil are the biggest ethanol producers, accounting for 70 percent of the world total. In 2004, China initiated ethanol fuel projects which used maize as the raw material. However, the fast development of the maize ethanol industry, both in China and worldwide, drove up the price of maize. In 2006, China officially prohibited the further expansion of maize ethanol production while encouraging the development of non-grain ethanol production. As a result, cassava ethanol has grown in importance and the demand for cassava will be driven up higher.

b) Potential for future production expansion. Cassava is immune to drought and tolerant of extreme conditions. Most of the main cassava cultivation regions in China are located in tropical and subtropical areas with adequate sunshine, and where the average temperature is between 17 and 22 degrees centigrade. All types of land are suitable for growing cassava, especially hills and steep land which produce a higher yield of cassava and lower yields of other crops.

c) Establishment of the cassava industrial chain. Thirty percent of cassava is used as animal feed and 70 percent is used in industry, such as ethanol and starch production. China's robust economic growth contributes to the development of downstream cassava processing industries, including denatured starch and ethanol. A cassava industrial chain has been established in some areas because cassava planting, processing and marketing have been integrated into one system.

4.2. Demand analysis of cassava in China

4.2.1. Cassava consumption in China

Most cassava is used in industry, with 70 percent of cassava processed into cassava powder, alcohol and starch. Only 30 percent is used as animal feed. The main cassava ethanol factories are in Shandong, Jingsu and Guangxi where imported dried cassava is used as a raw material. Most cassava starch factories are in Guangdong and Guangxi, where fresh cassava is produced. As 40 percent of cassava is used in ethanol production, analysis of the development of the ethanol industry development will highlight the demand for cassava.

Table 6.22: Consumption of cassava in China, 2007

Cassava consumption		% of total	Location of factories
Industrial material	Ethanol	40	Shandong, Jiangsu, Guangxi
	Starch	20	Guangdong, Guangxi
	Others	10	Country wide
Animal food		30	

Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

4.2.2. Analysis of the development of the cassava downstream industry

4.2.2.1. Ethanol industry

a) With its robust production growth, the gap between the expanding supply and shrinking sales of alcoholic beverages becomes clear.

In recent years, alcohol production in China has increased at a fast and steady pace. Owing to the growing number of new and expanded projects launched in 2006, domestic alcohol production has rapidly increased. Alcohol production in 2006 exceeded record levels and increased by 47 percent from 2005. The gap between the expanding supply and shrinking demand for drinking alcohol in the domestic market has become prominent because the large-scale increase in alcohol production, as well as the abolishment of ethanol export rebates, has undermined increased consumption. However, the production growth rate of 8.4 percent in 2007 reflected a slowing down of ethanol industrial development, the result of national macrocontrol policies and industrial adjustment.

b) Drinking alcohol still dominates but fuel ethanol occupies more and more of the market share.

A market share of 71 percent in 2007 showed that drinking alcohol maintained its dominance. However, market demand has less room to expand while output tends to be steady. Fuel ethanol and ethanol without water have shown a clear increase, and fuel ethanol in particular shows promise with a growing market share.

c) The production of ethanol is concentrated in the raw material production area.

Generally speaking, Northeast and East China are the main ethanol producing regions. The provinces and autonomous regions that have the largest production of ethanol are Jilin, Jiangsu, Henan, Guangxi, Anhui, Heilongjiang and Shandong. The provinces of northeast of China, such as Jilin and Heilongjiang, are China's main maize producers. Jiangsu province in East China, along with Shandong province, has ports to import cassava, and Guangxi Zhuang Autonomous Region in Southeast China is China's major cassava production area. All these show that ethanol production is concentrated in the raw material production area.

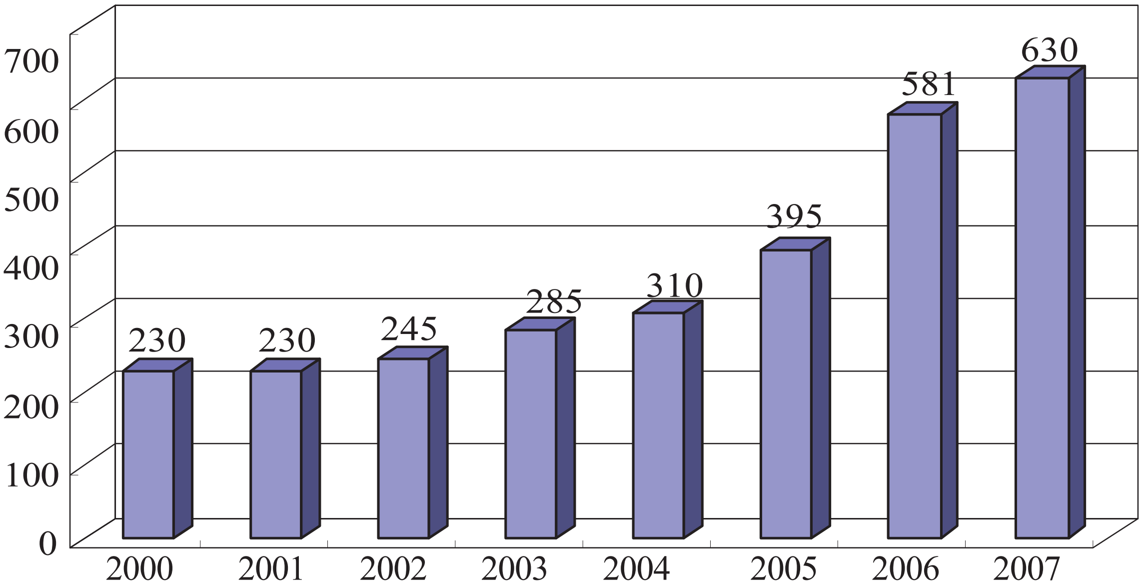
d) Ethanol production tends to be dominated by large enterprises.

The recent rapid development of the domestic ethanol industry suggests that ethanol production tends to develop at a large scale, with medium- and large-sized enterprises dominating the market. In 2008 there were 28 medium- and large-sized ethanol producing enterprises with sales values accounting for 56 percent of total domestic sales; 177 small-sized enterprises accounted for the remaining 44 percent.

e) Demand for ethanol increases rapidly.

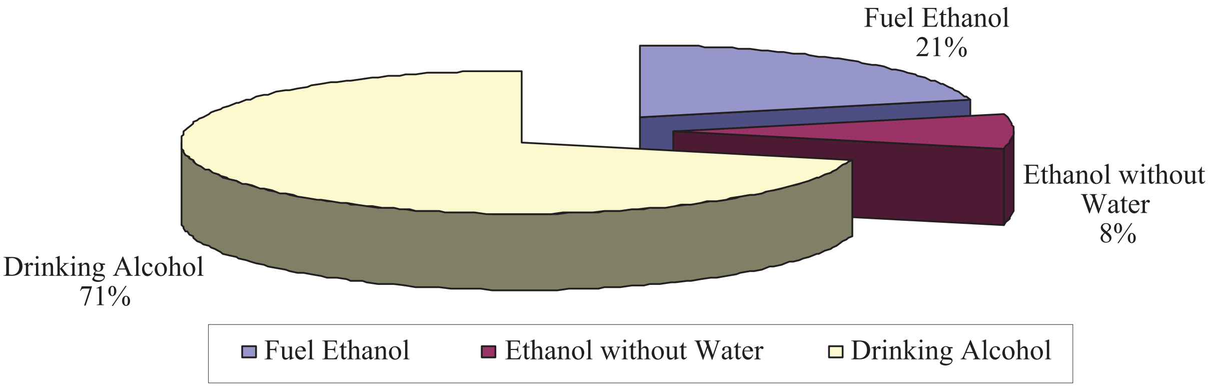
It is estimated that the total demand for ethanol, with a sustained growth momentum, reached 2.58 million tonnes in the first half of 2006 (Ethanol Branch of China Alcohol-making Industry Association 2007). Compared with 2006, the demand from spirits, chemical, fuel and export industries increased to various degrees. However, changes in the demand structure clearly indicate that the demand for ethanol from fuel and export sectors has increased notably.

Figure 6.9: Ethanol production in China, 2000-07(10,000 tonnes)



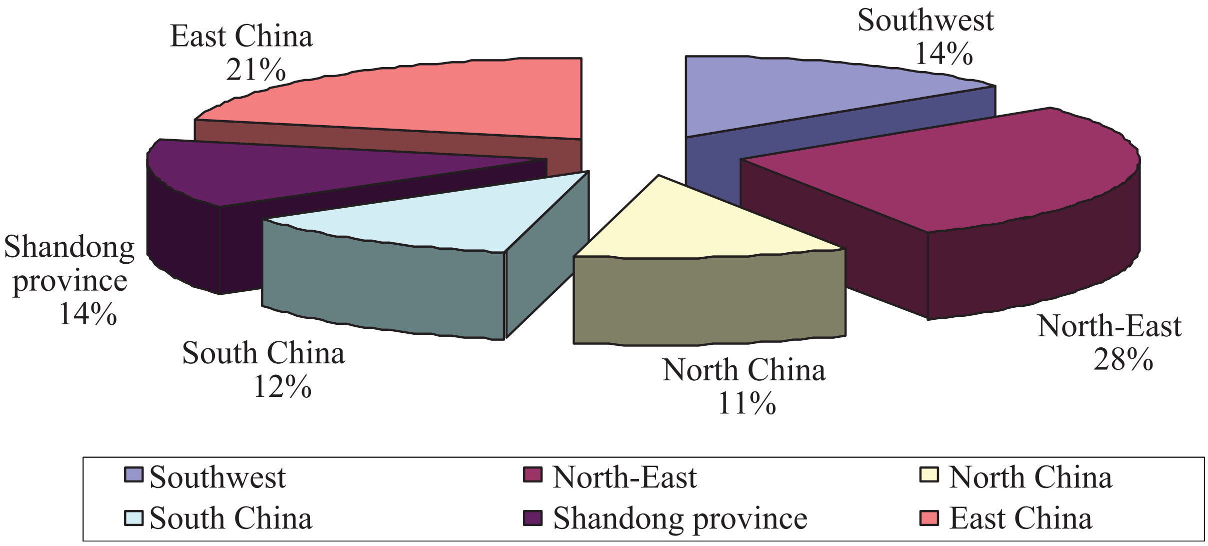
Source: China National Statistics Bureau

Figure 6.10: Products structure of ethanol in China, 2007



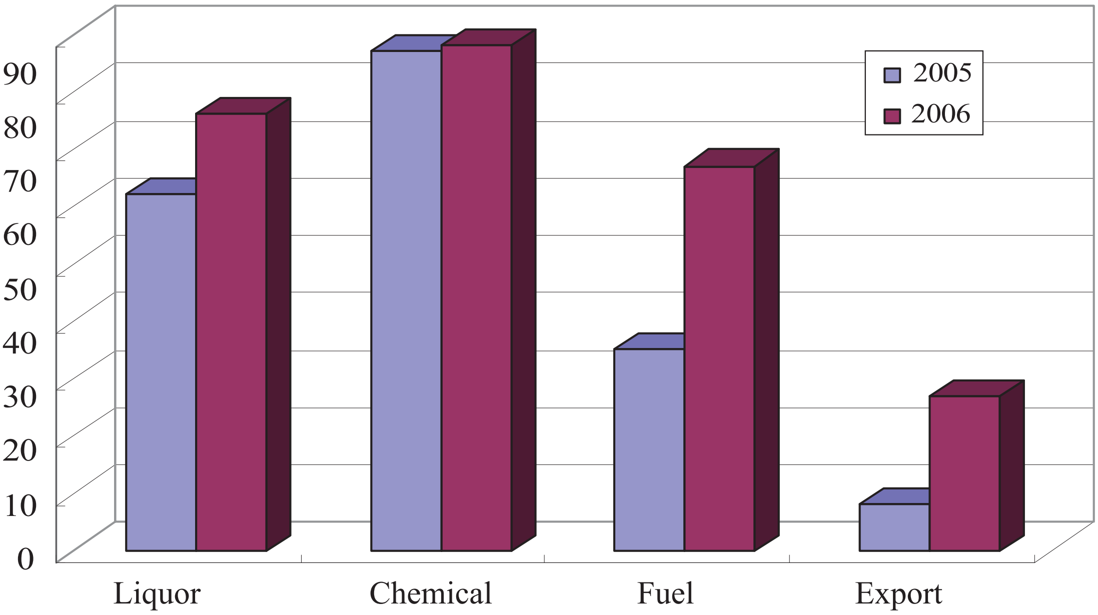
Source: China National Statistics Bureau

Figure 6.11: Regional distribution of ethanol production in China, 2007



Source: China Alcohol Industrial Association

Figure 6.12: Comparison of domestic ethanol demand in China, 2005-06

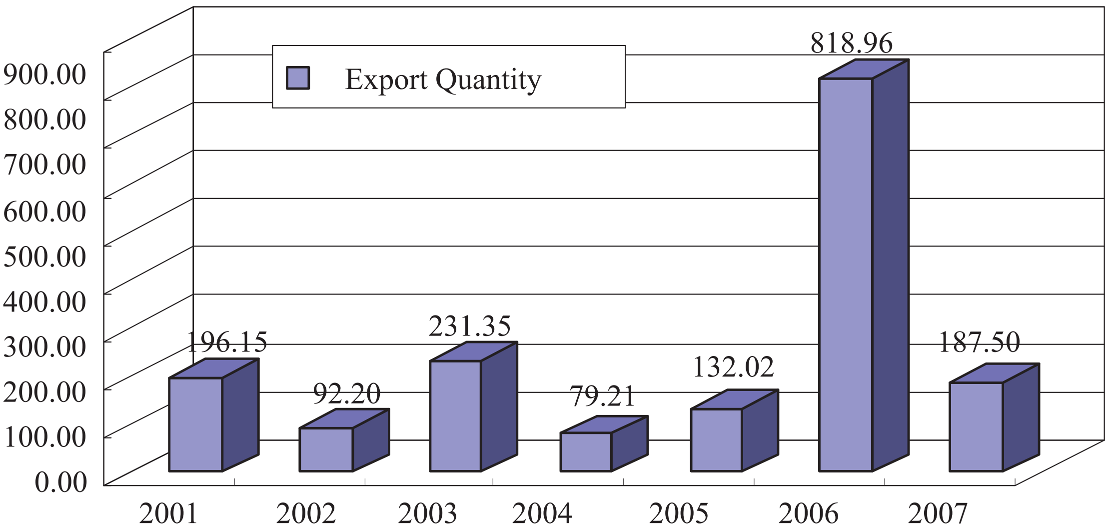


Source: Ethanol Branch of China Alcohol-making Industry Association

f) National policies directly influence ethanol exports.

China exported 819, 000 tonnes of ethanol in 2006, accounting for 16.3 percent of total production. This was an increase of nearly 600 percent from 2005. The huge demand from the international market, as well as state support through the ethanol export tax rebate, has contributed to increased ethanol exports. For domestic ethanol export firms, the tax rebate is a source of profit. However, in June 2006, the Ministry of Finance announced the abolishment of the tax rebate of 13 percent for exported ethanol, and forbid the processing of ethanol-related materials provided by clients. As a result, the total export volume of ethanol in 2007 dropped sharply to 1,875,000 tonnes. The ethanol produced for export was shifted to the already saturated domestic market, which led to intense competition and a decrease in the domestic market price.

Figure 6.13: Ethanol export for China, 2001-07(1000 tonnes)



Source: China Customs

In the final analysis, the production of ethanol in China since 2007 has started a period of industrial restructuring and upgrading under the guidance of related State policies. The price of cassava has now surpassed that of maize. This is partly due to the state policies on non-grain fuel ethanol production and the increasing demand for cassava from the international market since the first half of 2008. Therefore, the benefits gained by enterprises that produce cassava ethanol were greater than those gained by enterprises that produce maize ethanol. A large number of cassava ethanol enterprises did not produce anything until the second half of 2008.

4.2.2.2. Fuel ethanol industry

Although the history of fuel ethanol production is very short in China, it has a broad market with a rapid development pace. In the very beginning, the production of fuel ethanol was aimed at consuming surplus grains, like the stocked maize and wheat of preceding years. However, along with the expansion of fuel ethanol production and the further development of grain processing, the stocked surplus grains became exhausted. The grain supply in China is no longer what it used to be and has become increasingly tight. It now has a bearing on food security in China.

a) Production of grain ethanol

i. Most of the fuel ethanol in China is made from grain.

The current market pattern for fuel ethanol in China emerged in 2004. According to that year's production plans, four enterprises were designated to produce fuel ethanol: Jilin Fuel Ethanol Co.; Ltd., Henan Tianguan Group; Anhui Fengyuan Bio-chemical Co.; Ltd and Heilongjiang Huarun Ethanol Co. Ltd. The Tianguan Group took wheat as its main raw material and the other three took maize. The business scopes of these four companies were also identified in the plan (Table 6.23).

Table 6.23: Fuel ethanol enterprises in China, 2007

Enterprise	Productivity		Supply areas	Raw materials
	(10,000 tonnes/4)	(10,000 tonnes/06)		
Jilin Fuel Ethanol Co. Ltd.	30	40	Jilin, Liaoning	Maize
Heilongjiang Huarun Ethanol Co. Ltd.	10	25	Heilongjiang	Wheat
Henan Tianguan Group	30	50	13 cities in Henan, Hubei and Hebei	Maize
Anhui Fengyuan Bio-chemical Co. Ltd.	31	44	14 cities in Anhui, Shandong, Jiangsu and Hebei	Maize
Total	102	159	Heilongjiang, Jilin, Liaoning and other 27 cities in Henan, Anhui etc.	

Source: Ethanol Branch of China Alcohol-making Industry Association

Up until 2006, the provinces of Heilongjiang, Jilin, Liaoning, Henan and Anhui, as well as some areas of Hubei, Hebei, Shandong and Jiangsu provinces, used ethanol gasoline to replace normal lead-free gasoline. Also, Guangxi Zhuang Autonomous Region proclaimed in September 2007 that the sale of ethanol gasoline would take the place of normal gasoline from 15 December 2007. In 2005, the production of fuel ethanol in China totalled 1.02 million tonnes, just behind Brazil and the US, making it the third largest producer and consumer of fuel ethanol in the world. In 2006, the production of fuel ethanol in China amounted to 1.44 million tonnes and consumption of maize stood at about 4.75 million tonnes, calculated at the ratio of 1/3.3.

ii. With high costs but low prices, fuel ethanol enterprises have to depend on government subsidies.

In order to promote the use of ethanol gasoline, the State granted preferential subsidies on tax and price policies to the production of fuel ethanol. For example, the four designated fuel ethanol-making companies are exempt from the 5 percent consumption tax, and their value-added tax on making fuel ethanol is levied first and then returned according to the associated regulation. Besides these, subsidies are also granted to the stocked surplus grains used in the production of ethanol. However, in accordance with the state plan such subsidy will be reduced year by year, and will be abolished by 2008. That means the production of fuel ethanol will be market-based and competition among the enterprises will escalate. The choice of raw material will become the main priority for enterprises to secure a competitive edge.

iii. Current grain production will not satisfy demand from rapidly increasing fuel ethanol production.

Driven by the stable increase in industrial demand as well as demand from fuel ethanol enterprises, domestic demand for maize has escalated while maize exports have decreased year-by-year. Owing to the limitation of per unit output and the planting size, the production of maize in China has a slim chance of putting on large increases in the future.

The State Development and Reform Committee and the Ministry of Finance jointly issued a notice titled “The Regulation on the Development of Fuel Ethanol Projects”. This was designed to address the problems created by the exhaustion of stocked surplus grains and the escalated maize price, and to discuss the development of maize ethanol which could pose a big threat to food security in China. This required the halting of maize ethanol production projects across the country. By the end of 2007, the State had issued a series of regulations to promote the development of non-grain fuel ethanol.

b) Development of non-grain ethanol

In August 2006, China’s Grain Group issued a strategic bio-chemical energy plan for 2007-10. This plan aimed to establish ethanol production factories using new raw materials such as cassava, sweet potatoes and maize in Guangxi Zhuang Autonomous Region, Chongqing Municipality, and Hebei, Liaoning, Sichuan and Hubei provinces. According to the statistics, preparation for the production of 0.8 million tonnes of ethanol by China’s Grain Group in Guangxi Zhuang Autonomous Region, Hebei Province and Inner Mongolia has been carried out. These projects, which do not use raw materials such as maize and wheat, will reach target productivity by 2008.

In October 2006 the first domestic cassava ethanol-producing plant, invested in by China’s Grain Group, went into operation in Guangxi. Guangxi has an annual production of up to 0.2 million tonnes. Approved by the State Development and Reform Committee, this project was to start operating in December.

The first fuel ethanol production line in Qingyuan, Guangdong province, started operating in June 2007 and also used cassava as its raw material. The companies located in Hainan province and Guangxi Zhuang Autonomous Region, such as Hainan Yedao, Beihai, Guofa and Nanfan Chemical Industry Ltd, have the facilities to develop the cassava industry.

Though the State has withheld the approval of new maize ethanol enterprises, efforts to exploit the novel biofuel have never been suspended. Considering the food security situation in China, the development of ethanol-producing enterprises, while preserving the current production of maize ethanol, focuses on two non-grain ethanol varieties: cassava ethanol and cellulosic ethanol. Cassava ethanol is now mass produced and technologies involved in its production are relatively developed.

c) The future development of China's fuel ethanol industry

According to a plan titled "To Develop the Biofuel of Ethanol and Ethanol Gasoline for Cars during the Eleventh Five-year Period", China will produce 6 million tonnes of biofuel, including 5 million tonnes of ethanol fuel and 1 million tonnes of biodiesel. By the year 2020, 20 million tonnes of biofuel will be produced, including 15 million tonnes of ethanol fuel. The plan encourages the production of ethanol fuel using raw materials such as cassava, sugarcane and sweet potato. Meanwhile, there is a programme for the annual processing volume and industry structure of the raw materials. In 2006 a document titled "Provisional Measures to Manage the Special Fund for the Development of Renewable Energy" was printed and distributed by the Ministry of Finance. This pointed out that in an effort to exploit and develop renewable energy to replace petroleum, the development of biofuels such as ethanol and biodiesel should be given high priority. Ethanol biofuel here means the ethanol fuel made from cassava and sugarcane and so on.

4.2.3. Factors driving up demand for cassava in China

4.2.3.1. Further development of non-grain biological ethanol fuel industry

China's tough efforts to develop non-grain biofuel have been the driving force behind the demand for cassava in China. With its rapid economic development, China has become one of the top energy consumers in the world, second only to the US. In 2005, China consumed 332 million tonnes of crude oil, ranking second in the world. In the same year, China imported 119 million tonnes of crude oil, while it produced 181 million tonnes of crude oil. The crude oil produced at home clearly could not meet the huge domestic demand. It has become a priority for China's fuel energy industry to exploit novel energy resources and develop the biofuel industry based on ethanol, such as fuel ethanol and ethanol diesel. With increasing encouragement and support from the government, non-grain fuel ethanol should develop at an even faster pace.

4.2.3.2. Cassava: Ideal substitute for maize in fuel ethanol production

Cassava is the ideal substitute for maize as the raw material to produce ethanol, and the development of cassava ethanol has bright prospects.

a) Cassava is an excellent raw material for fuel ethanol production. Its unique properties guarantee that it can grow in a variety of environments, such as in drought-prone and infertile areas. Further, cassava can be planted with other crops since it does not compete for growing space. Hence, there is a high potential for the further expansion of cultivation areas. The unit yield will be increased if the super cassava varieties and new cultivation technologies are promoted in China.

b) Cassava has higher ethanol productivity than other crops. Research by the Ethanol Branch of China's Alcohol-making Industry Association indicates that among the crops used to produce ethanol, cassava has the highest ethanol productivity in output per unit. Sugarcane ranks second. The annual production of cassava per hectare is about 6000 litres, while that of maize is about 2050 litres. In other words, cassava can produce about 4000 litres more ethanol than maize in the same cultivation environment (Table 6.24).

Table 6.24: Comparison of ethanol production per hectare of different crops

Crops	Annual production of primary products (tonnes/hectare)	% sugar or starch content	Ethanol productivity of crop (litre/tonne)	Annual ethanol production (litre/hectare)
Cassava	40	25	150	6000
Sugarcane	70	12.5	70	4900
Sugar beet	45	16	100	4300
Sweet sorghum	35	14	80	2800
Corn	5	69	410	2050
Wheat	4	66	390	1560
Paddy	5	75	450	2250

Source: Ethanol Branch of China Alcohol-making Industry Association

Table 6.25: Cost comparison between cassava ethanol and maize ethanol (average market price Jan-Jul 2007)

	Fresh cassava	Maize
Raw material price (yuan/tonne)	450	1500
Raw material consumption (tonne)	7	3.3
Raw material cost (yuan/tonne)	3150	4950
Processing fee (yuan/tonne)	800	800
Dehydration fee (yuan/tonne)	100	100
Ethanol production cost (yuan/tonne	4050	5850
Sales expense (yuan/tonne)	100	100
Total cost (yuan/tonne)	4150	5950
Domestic market price (yuan/tonne)	4500	4500
Value of ethanol protein fertiliser (yuan/tonne of fuel ethanol)	0	960
Actual profit and loss (yuan/tonne)	350	-490
International market price (yuan/tonne)	5050	5050
Actual profit and loss in the international market (yuan/tonne)	550	60

Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

c) Compared to maize ethanol production, the production costs of cassava ethanol are lower. In recent years, with the development of the further processing of maize products, industrial demand for maize has increased drastically, both at home and abroad. The demand for maize in 2006 increased by 9 percent. Propelled by stong demand, the price of maize has been booming and the storage of maize dropped to its lowest level in history. In 2007, the price of maize outstripped that of cassava, and maize ethanol production costs were consequently higher than that of cassava ethanol. Table 6.25 shows that maize ethanol enterprises suffered losses of 490 yuan per tonne when no national subsidy was included and the value of the ethanol protein fertiliser was calculated. Meanwhile, cassava ethanol enterprises made profits of 350 yuan per tonne although no ethanol protein fertiliser was generated during cassava ethanol production.

4.2.4. Forecast of the future demand of cassava in China

4.2.4.1. Fresh cassava

China's rapid economic development provides a growing market for fresh cassava. Consequently, the price of cassava has shot up. Its average price in the main producing areas has risen from 300 yuan/tonne in 2000 to 380 yuan/tonne in 2005. The present processing capability for starch and ethanol requires more than 8 million tonnes of fresh cassava in the harvesting season (autumn and winter). If 70 percent of the total production of fresh cassava is used as raw material, then more than 11 million tonnes of fresh cassava will be needed to meet this demand. Given the newly established and expanded projects, the annual demand for fresh cassava will amount to 30 million tonnes.

4.2.4.2. Dried cassava

The import volume and value of dried cassava for China accounts for 50 percent of the global cassava trade, making China the biggest dried cassava importer in the world. Since imported dried cassava is mainly used in ethanol production, the growth of ethanol production at home has facilitated the expansion of dried cassava import. At present, some cassava factories in Shandong, Jiangsu and Anhui have to depend on imported dried cassava because domestically produced fresh cassava and dried cassava fail to meet domestic demand. For example, the production capacity of domestic cassava ethanol is about 1.36 million tonnes, requiring approximately 3.67 million tonnes of dried cassava. However, in 2006, total domestic production of fresh cassava amounted to 179.5 thousand tonnes, which only met the demand of domestic starch production.

4.2.4.3. Cassava starch

Compared with the year 2000, in 2004 the import volume and quota of cassava starch in China had increased by 73.2 percent and 97.2 percent, respectively. Its import volume (Hong Kong's share included) ranked first and its import quota second in the world. According to statistics released by Customs, China only produces 500 thousand tonnes of cassava starch and has to import 467 thousand tonnes, so there is big mismatch between supply and demand.

4.2.4.4. Denatured cassava starch

Total denatured starch production of all kinds in 2005 reached 0.6 million tonnes, including 0.2 million tonnes of denatured cassava starch. Demand for denatured cassava starch was about 1.8 million tonnes. With an underdeveloped production capacity, China faces a significant mismatch between the supply of and demand for denatured starch made from cassava. It is predicted that the total demand of denatured starch across the country will be 2.1 million tonnes, and denatured starch from cassava will total 0.75 million tonnes, indicating that the shortfall in denatured cassava starch will increase.

4.2.4.5. Cassava-made ethanol

China is suffering from energy shortages. Gasoline consumption in 2005 was about 43.66 million tonnes. If fuel ethanol supplants 10 percent of gasoline, then about 4366 million tonnes of ethanol will be needed for cars. Supported by the national policy of non-grain fuel ethanol production, the newly-established factories producing cassava ethanol will continuously drive up domestic demand for cassava. Specifically, the demand for dried cassava from these newly established enterprises will approach 3 million tonnes a year.

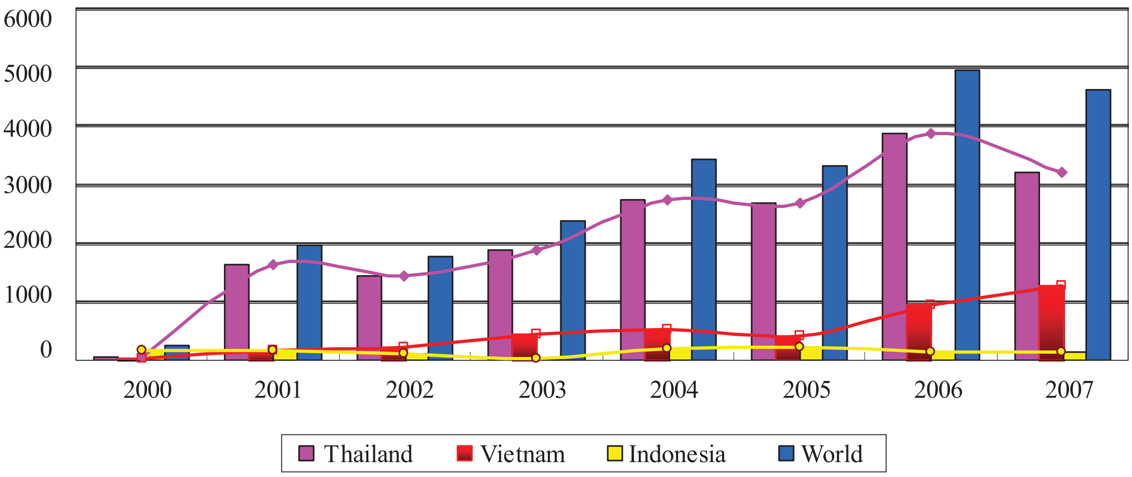
4.3. Trade and marketing of cassava

4.3.1. General situation

China is the biggest cassava importer in the world, with more than 700 thousand tonnes of cassava products imported annually. Cassava used to be a traditional export crop of China. Since the 1990s, expanding domestic demand has resulted in declining cassava exports. In 1998, cassava export ceased while imports reached 300,000 tonnes. In 2001, imported cassava from the world increased significantly. The total quantity of cassava imports increased 7.6 times compared to 2000. Dried cassava accounted for more than a 99 percent of the total imported cassava.

More than 80 percent of imported dried cassava was used in cassava ethanol factories. Driven by strong domestic demand, dried cassava reached its historical peak in 2006. China imported 4.95 million tonnes of dried cassava in total, an increase of 48.7 percent from 2005. However, because of the decrease in imports from Thailand, cassava imports declined by 6.6 percent in 2007.

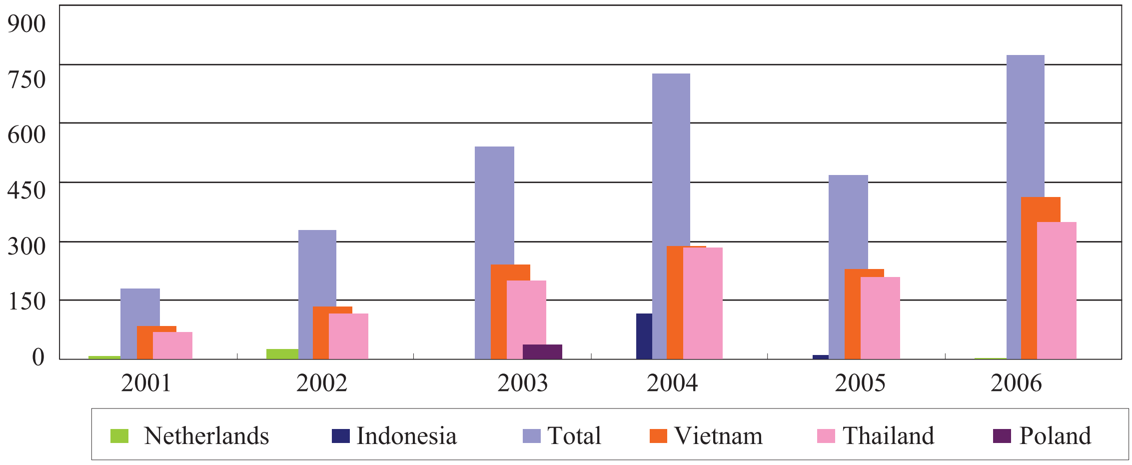
Figure 6.14: Import quantity of dried cassava for China from the world and main import countries, 2000-07 (thousand tonnes)



Source: China Custom

One of the factors contributing to the small quantities of imported fresh cassava is that importing plants with residues of fresh soil is forbidden under the Law on the Entry, Exit and Quarantine of Animals and Plants. Fresh cassava usually carries soil residues, so only a small quantity has been imported in recent years. Hence, only cassava starch factories in South China can use fresh cassava as their raw material because they are located close to the fresh cassava producing areas. Other starch factories in the North use maize as their raw material. It also explains the fast rise in imported cassava starch, indicating the increasing demand for processed cassava in China. In 2006 cassava starch imports reached 7.729 million tonnes, a rise of 65.4 percent compared with 2005. Vietnam and Thailand are the main cassava starch exporters to China.

Figure 6.15: Import quantity of starch cassava for China from the world and main import countries, 2001-06 (10,000 tonnes)



Source: China Customs

4.3.1.1. Major import sources of dried cassava

Thailand ranks top in dried cassava exports to China. In 2006, total dried cassava export from Thailand was 3.864 million tonnes, or 78.15 percent of China's total cassava imports. With total export of 935.4 thousand tonnes, Vietnam is the second biggest dried cassava exporter to China and accounts for 18.92 percent of the total. Indonesia is third. However, in 2007, total dried cassava imports declined by 6.58 percent compared to 2006. This was a result of the 17.12 percent decrease in dried cassava imports from Thailand, and the 3.91 percent decrease in dried cassava imports from Indonesia. In contrast, imports from Vietnam increased by 36.1 percent.

Table 6.26: China dried cassava import sources and quantities (10,000 tonnes)

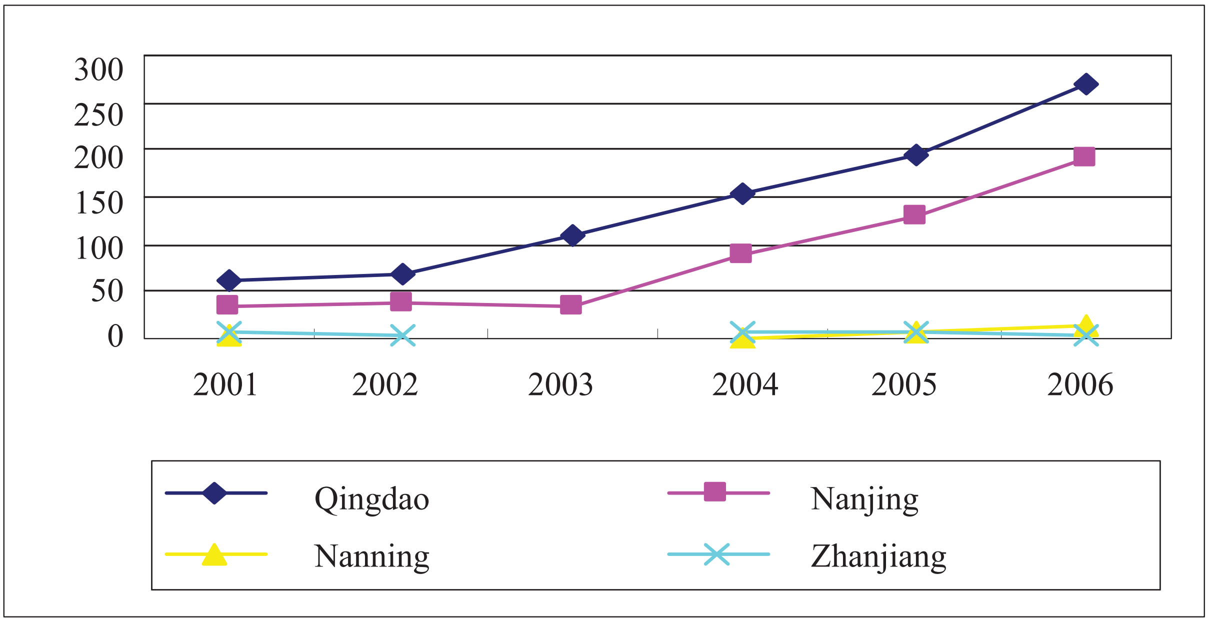
Country	Ten thousand tonnes				% Share				% Change
	2004	2005	2006	2007	2004	2005	2006	2007	06/07
World	3438.586	3325.599	4944.562	4619.198	100	100	100	100	-6.58
Thailand	2734.389	2695.576	3864.203	3202.647	79.52	81.06	78.15	69.33	-17.12
Vietnam	518.469	401.758	935.401	1273.240	15.08	12.08	18.92	27.56	36.12
Indonesia	185.728	228.265	144.784	139.124	5.40	6.86	2.93	3.01	-3.91

Source: China Customs

4.3.1.2. Major ports for dried cassava imports from Thailand and Vietnam

Most dried cassava from Thailand enters China from Qingdao port in Shandong province and Nanjing port in Jingsu province. Figure 6.16 shows that the import value has maintained a steady increase since 2001. In 2006, the combined dried cassava import value of Qingdao and Nanjing ports was 95.5 percent of total import value, with Qingdao port accounting for 60 percent. The latter was to meet the demand for ethanol production in Shan Dong, Jiangsu and Anhui provinces.

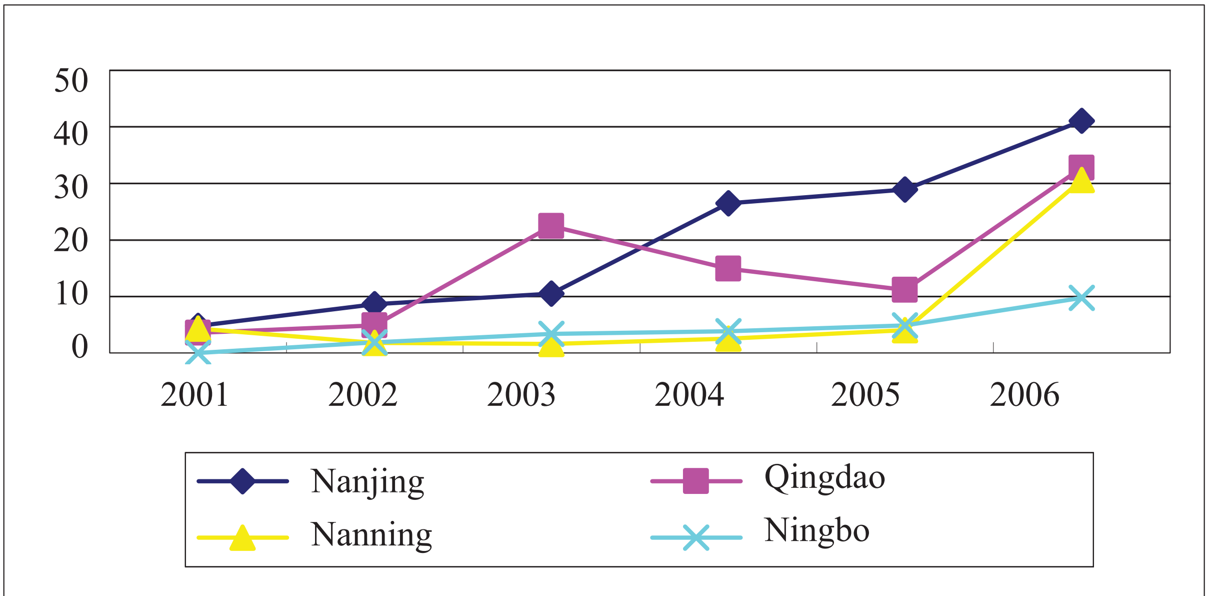
Figure 6.16: Major ports in China for dried cassava imports from Thailand (USD million)



Source: China Customs

With 87 percent of the total dried cassava import value in 2006, Nanjing (Jiangsu province), Qingdao (Shandong province) and Nanning (Guangxi Zhuang Autonomous Region) are the major ports of entry for dried cassava from Vietnam. Interestingly, the import value at Nanjing increased constantly while the value at Qingdao fluctuated between 2001 and 2006. The dried cassava import value in Nanning rose sharply in 2006 to 6.6 times that in 2005.

Figure 6.17: Major import ports in China for dried cassava from Vietnam (USD million)



Source: China Customs

More specifically, imported dried cassava is distributed from the main ports to their subports. In 2006, Lanshan and Rizhao in Shandong province, Lianyun port in Jiangsu province, and the coastal cities of Guangxi province served as the main distribution centres for dried cassava. Under the administration of Qingdao, Lanshan was the biggest cassava port, importing 1.188

million tonnes with a value of USD144.128, representing increases of 22.7 percent and 26.3 percent, respectively, compared with 2005. Lianyun, a subport of Qingdao, turned out to be the second biggest port for dried cassava imports, with import value reaching the historical peak of USD1 million in 2006.

4.3.1.3. Procedure after arrival at the port and problems

The imported cassava is first weighed. Then it is packed into sacks and transferred from the ship to the warehouse by truck. The cassava is weighed for a second time. The difference between the empty and the full truck is the cargo weight; 3500 tonnes of cassava can be discharged and transported into the warehouse every day.

The common problems of importing cassava are quantity shortage, live insects and a mustiness caused by simple packing. Cassava exporters are requested to supply an official fumigation certificate to prove that the cargo was fumigated against insect infestation in the country of origin. However, in recent cases, vermin were still present in imported cassava even though a fumigation certificate had been provided. In January 2005, the Lian Yun Port Entry-Exit Inspection and Quarantine Bureau found large quantities of vermin in 5200 tonnes of dried cassava imported from Thailand. On average, each kilogram of dried cassava carried 81 vermin. From 2005 to 2007, vermin were found by the Guangxi Provincial Entry-Exit Inspection and Quarantine Bureau in 8.5 percent of the 71 lots of dried cassava imported from Vietnam. In addition, four out of 267 lots of Vietnam-exported cassava starch carried vermin, and the quantity of sulphur dioxide exceeded the allowed amount on another four lots, affecting 35,000 tonnes with a value of USD6,849,000.

Improper packing methods might be another reason for the live vermin and mustiness. Dried cassava is usually stowed1-2 metres above deck, covered simply by a layer of canvas. The cargo is easily affected by damp and water.

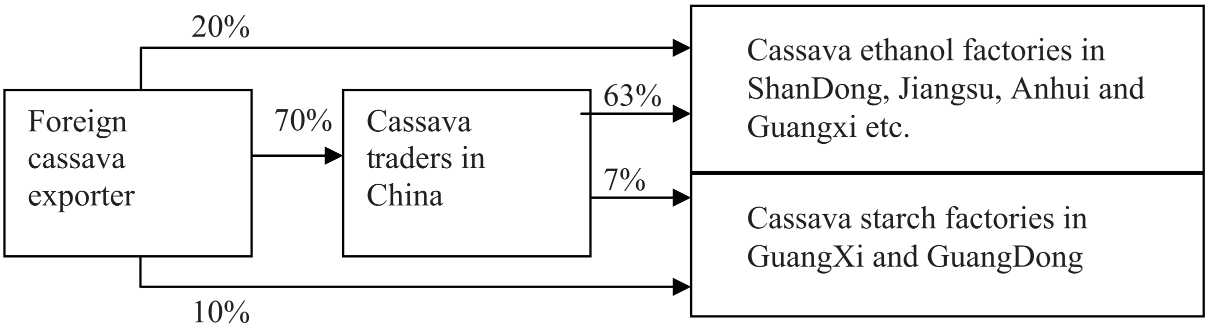
4.3.2. Marketing chains

4.3.2.1. Routes from port to end users

Imported dried cassava is mainly used for producing ethanol. As Figure 6.18 shows, cassava trading companies in China purchased 70 percent of imported dried cassava. Take Shandong Oriental Agriculture Products Trading Co. Ltd. as an example. The imported dried cassava value of the company reached USD42 million in 2005, and all the imported dried cassava was distributed to ethanol factories in Shandong, Henan and Anhui. Only the giant ethanol factories imported directly from abroad, while the medium and small-sized ethanol factories preferred buying from traders because it was less complicated and time consuming.

Cassava starch production accounts for only 8 percent of total starch production in China. Most of the cassava starch factories are in Guangxi and Guangdong provinces where fresh cassava is easier to acquire. Only around 17 percent of imported dried cassava is used for starch production. Further, the port in Guangxi makes it more convenient for starch factories to import directly from abroad.

Figure 6.18: Cassava routes from port to end users



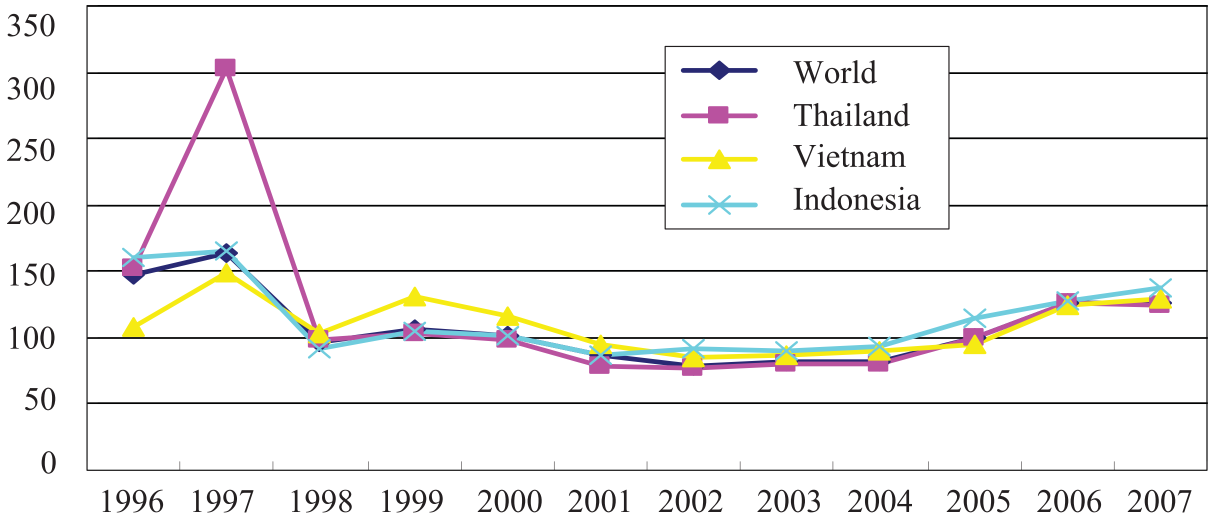
Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

4.3.3. Costs and margins

4.3.3.1. Import prices

As Figure 6.19 shows, the FOB price of dried cassava has increased steadily since 2002. In 2006, the FOB price rose steeply, by about 27 percent compared to 2005. The main factor contributing to the price rise was increased demand for dried cassava for fuel ethanol production, both domestically and abroad.

Figure 6.19: China dry cassava fob price from main import countries and the world (USD per tonne)



Source: China Customs

4.3.3.2. Cost structure of imported dried cassava (Thailand – China)

a) Transportation costs

After arriving at the port in China, most dried cassava is transported by bus. This is because the transit time is shorter, and the unit cost of bus transport cassava is lower than that of train freight. Transport costs are the first concern for ethanol factories as they weigh heavily on the low-value dried cassava. To cut costs, ethanol factories generally purchase cassava from the closest port. Time allowing, the dried cassava imported at Nanjing port will be transported by boat to ethanol factories in Anhui province; the transport fee is only 35 yuan per tonne, which is one third of the cost of bus transport. The transport costs are shown in Table 6.27.

Table 6.27: Transport costs from Lianyun port to ethanol factories, 2007

<table>
<tr><th rowspan="2">Port</th><th rowspan="2">Destination</th><th colspan="2">By bus</th><th colspan="2">By ship</th><th colspan="2">Duration</th></tr>
<tr><th>RMB per tonne</th><th>USD per tonne</th><th>RMB</th><th>USD/ ton</th><th>Bus</th><th>Ship</th></tr>
<tr><td>Qingdao (Lanshan, Rizhao)</td><td>Shandong</td><td>per tonne</td><td>USD per tonne</td><td>-</td><td>-</td><td>1day</td><td>-</td></tr>
<tr><td>Lianyun</td><td>Jiangsu</td><td>￥50</td><td>$6.7</td><td>-</td><td>-</td><td>1 day</td><td>-</td></tr>
<tr><td>Nanjing</td><td>Anhui</td><td>￥110</td><td>$14.7</td><td>￥35</td><td>$4.7</td><td>1day</td><td>5 days</td></tr>
</table>

*Note: * Average Exchange Rate in 2007: 1$ = 7.5RMB*
Source: Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

b) Cost structure of imported dried cassava, 2006 (Thailand – China)

In line with the China-ASEAN FTA and the implementation of the EHP in 2004, a zero tariff policy is applied to cassava imported from ASEAN countries. The VAT rate for imported dried cassava is 13 percent. The cost calculation of imported dried cassava is as follows:

Price = (FOB price + sea freight + insurance) x exchange rate x 1.13 + port handling fee + domestic transport fee + others

Taking the average FOB price of imported dried cassava from Thailand in 2007 as an example, the final price of dried cassava after arriving at ethanol factories in Shandong province from Lianyun port was approximately 1860 yuan per tonne. The FOB price, the selling price of the dried cassava exporters, played the most important role in the final price representing 80.7 percent of the total cost. In addition, operational costs, including port handling, fumigation and domestic transport, accounted for 8.8 percent of total costs. Hence the ethanol factories, the end users of the imported dried cassava, work hard to reduce transit times and costs. Table 6.28 illustrates the cost details.

Table 6.28: Cost structure of cassava imported from Thailand, 2007

Items	Cost	% of total cost
FOB price (USD/tonne)	$160	
Sea freight and insurance (USD/tonne)	$40	
CIF Price at RMB/tonne*	￥1500（$200）	80.7
Import duty (0%)	0	
VAT (13%)	￥195($26)	10.5
Price after VAT (RMB/tonne)	￥1695($226)	
Port handling fee (RMB/tonne)	￥80($10.7)	4.3
Domestic transport** (by bus, RMB/tonne)	￥50($6.7)	2.7
Fumigation fee(RMB/tonne)	￥35($4.7)	1.8
Final price of imported natural rubber	￥1860($248)	100

*Note: * exchange rate: USD1= RMB7.5; ** domestic transportation cost is calculated based on the distance from Lianyun Port to the Ethanol factories in Shandong*
Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST, 2008

c) Cost Structure of imported dried cassava, 2007 (Thailand – China)

Table 6.29 shows the cost structure of the ethanol factories in China. The cost of dried cassava represents 70-80 percent of the total production costs of ethanol, indicating that the price of cassava plays a significant role in ethanol's final price. It also explains why more than 50 percent of the domestic cassava ethanol factories stopped production at the end of 2007/early2008. At that time, the CIF price of dried cassava from Thailand reached USD230 per tonne, and cassava ethanol production costs increased to 5960 yuan per tonne. Producers suffered a loss because the market price of ethanol was only 5050 yuan per tonne. Hence the quantity of imported dried cassava declined in 2007.

Table 6.29: Cost structure of ethanol factories, 2007

Item	% of cost structure
Price of the imported dried cassava	70-80
Production cost	15-20
Margin	5 -10

Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

4.3.3.3. Constraints and opportunities

A host of factors impinge on the development of China's cassava production and trade:

a) Huge domestic demand driving the development of ethanol and fuel ethanol industries will lead to the future expansion of the cassava trade.

b) Intense competition and national macrocontrol policies for domestic ethanol industry will lead to industrial reshuffling in the short run.

c) Price of cassava will be the key influencing factor for the ethanol industry in China, and ethanol enterprises will endeavour to acquire price-competitive raw materials.

d) Industrial policies for ethanol production and trade policies for ethanol exports will have a direct impact on the quantity of cassava imports.

5. Policy Recommendations and conclusions

5.1. Review of existing policies

5.1.1. Natural rubber

5.1.1.1. Influences from downstream industrial policies on natural rubber trade

National policies for the car and tyre industry have had a direct impact on the trade in natural rubber, both quantities and varieties. Specifically, policy that encourages further development of the car industry will drive up tyre production and therefore the demand for natural rubber.

By creating a sound environment for using automobiles and nurturing a healthy automobile consumption market, domestic automobile consumption will be fostered and a large number of domestically-made automobiles will be exported to the international market. However, the national policies for the tyre-making industry focus more on structural optimisation and upgrading. These policies send the strong signal from China that it needs larger quantities of natural rubber for the manufacture of high-quality products. Following is a summary of related government policies:

a) The collective development of tyre-making enterprises is fostered in order to accomplish their structured optimisation and upgrading.

b) By adopting macrodeflation policies and exerting influence on the automobile industry, a number of tyre-making enterprises characterised by backward technologies, poor capital input and a lower market share, will be eliminated.

c) Technological advances are guided and supported by the State, and the development of radial tyres will be promoted while large-scale expansion of diagonal tyres will be restricted. According to the new consumption tax policy that took effect on 1 April 2006, the tax on diagonal tyres was lowered from 10 percent to 3 percent while radial tyres continued to be tax-exempt.

5.1.1.2. Influences from downstream products trade policies on natural rubber trade

The domestic tyre industry is facing increasing competition from imported tyres. The gradual import tax deduction is the promise China made when it joined the World Trade Organization (WTO). The actual tax rate on imported tyres was 15.9 percent in 2003. After China abolished the regulation on the import quota licence and lowered the tax rate on imported tyres by 3 percent, a great deal of tyres made abroad landed in the ports of China. The constant tariff decrease on imported tyres has resulted in their price dropping. Consequently, the price of some imported tyres is nearly the same as that of domestically made ones, and domestic tyre markets are facing more and more challenges. As far as the product mix is concerned, the bulk of imported tyres are radial tyres used for medium- and high-quality cars.

In 2006 the State confirmed that the tax rebate for exported tyres had been lowered by 2 percent to 13 percent. Since 1 June 2007, China has lowered its export rebates on tyres and other rubber products from 13 percent to 5 percent. The rising prices of raw materials and the decrease in the tax rebate for exported tyres have greatly reduced the benefits for China's tyre-making enterprises. The narrowing margin will drive tyre-making enterprises to seek natural rubber at a competitive price and to reduce transitional costs.

5.1.1.3. Influence of natural rubber trade policies

After China joined the WTO, the tariff on rubber decreased from 25 percent to 20 percent. The natural rubber import quota system was abolished in 2004 but an Auto Import Permit Licence still had to be applied for from the Provincial Department of Commerce. In 2007 China began to implement alternative duties on natural rubber commodities. Natural rubber, including smoked sheet rubber and standard rubber, with the lowest rate would be levied between the ad valorem tariff of 20 percent and the specific tariff of 2600 yuan per tonne. For natural rubber latex, the one with the lowest rate would be levied between the ad valorem tariff of 10 percent and a specific tariff of 720 yuan per tonne.

The rubber import mode and proportion in China is as follows: normal trade 10 percent, processing trade 70 percent, small-scale border trade 10 percent, and transferred commodities in a bonded zone 10 percent. Hence the processing trade, which took up 68 percent of natural rubber imports, adopted manufacturing processes that use supplied material at zero tariff. A 10 percent import tariff is payable on cross-border traded rubber. The import tariff for bonded zone trade, normally in imported synthetic rubber, is 5 percent.

Table 6.30: Import mode and rate of natural rubber for China

	Normal trade (%)	Processing trade (%)	Small-scale border trade (%)	Transferred commodities at bonded zone (%)
Share of total import	15	68	10	10
Tariff rate	20	0	10	5

Source: ASEAN Regional and Industrial Development Research Centre, FME, KUST

In 2006, the import tariff on natural rubber was 20 percent, much higher than the 5 percent import tariff on synthetic rubber. It is not surprising then that enterprises first import of choice is trade rubber with zero tariff, the second is synthetic rubber, and a few choose normal trade. China's imports of synthetic rubber have increased rapidly in recent years, by 19.2 percent in 2006 compared to 2005 and by 72.6 percent since 2001. In the same period, the proportion of synthetic rubber in normal trade increased from 45.7 percent to 64.2 percent (Table 6.31).

Table 6.31: Import quantity and value of synthetic rubber in China

Year	Quantity (thousand tonnes)	Value (USD million)
2001	752.958	794.108
2002	915.195	939.475
2003	1006.115	1152.478
2004	1094.783	1414.230
2005	1089.844	1798.175
2006	1299.425	2371.756

Source: China Customs

5.1.2. Cassava

5.1.2.1. Influences from downstream industrial policies on cassava trade

The demand for cassava is driven by national policies, which encourage the future development of the non-grain fuel ethanol industry. The related policies are as follows:

a) In accordance with the "Provisional Measures to Manage the Special Fund for the Development of Renewable Energy" issued by the Ministry of Finance in May 2006, ethanol biofuel is identified as ethanol fuel made from sugarcane, cassava and sweet *kaoliang* (sorghum).

b) In line with the notice, "The Regulation on the Development of Fuel Ethanol Projects", jointly issued in December 2006 by the State Development and Reform Committee and the Ministry of Finance, the examination and approval as well as recording of ethanol processing projects must be stopped across the country.

c) On 5 September 2007, the State Development and Reform Committee promulgated the "Guideline on the Promotion of the Healthy Development of Corn Further-processing Industry" (No.2245 Document of the State Development and Reform for Industries, 2007). According to this guideline, the examination and approval of any new corn further-processing programmes would, in principle, be ruled out. The existing industrial policies would be readjusted, and all new and expanded corn further-processing programmes would be subject to examination and approval of the relevant investment-managing department of the State Council. Meanwhile, the recording of corn further-processing programmes would be stopped instantly across the country. Projects under construction and intended projects would be resolved and recorded, but un-constructed projects would be stopped.

d) In line with "The Special Plan for the Development of Biofuel – Ethanol and Ethanol Gasoline for Cars during the Eleventh Five-year Period (2006-2010)", China would produce 6 million tonnes of liquid biofuel, including 5 million tonnes of ethanol fuel and 1 million tonnes of biodiesel. New ethanol production programmes, with a production of 4.2 million tonnes, using non-grain raw materials such as cassava, sweet *kaoliang* and straw, would be launched. The production of ethanol using materials such as cassava, sugarcane, sweet potato and sweet *kaoliang* would be encouraged, and the annual productivity of related raw materials and industrial mix extensively planned.

However, the ethanol industry is going through a period of upgrading and adjustment in China. This can be concluded from the following industrial and trade policies:

a) According to "The Guideline on the Regulation of Industrial Structure (2005)", China will forbid the construction of new ethanol production lines (fuel ethanol production programmes excluded). This policy dates back to the 14th Bill issued by the Finance and Economy Committee of China, which required that new ethanol production lines would be prohibited from 1 September 1999 onwards. The ethanol-making enterprises, which cannot comply with the related industrial policies and have a production of less than 30,000 tonnes, would be shut down year by year from 2006 to 2010.

b) At the end of October 2007, the State Development and Reform Committee promulgated the "Notice from the State Development and Reform Committee and Environmental Protection Administration on Eliminating Backward Production Facilities in Paper-making, Ethanol, MSG and Citric Acid Industries" (No. 2775 Document of Development and Reform Committee for Industrial Operation, 2007). In this notice the annual objective for related work from 2006-10 was outlined to eliminate the backward ethanol production of 0.101 million tonnes, 0.4 million tonnes, 0.444 million tonnes, 0.355 million tonnes and 0.3 million tonnes, respectively, in a five-year period.

c) In September 2006, the Ministry of Finance issued a notice to abolish the export tax rebate for ethanol and VAT (13 percent) for ethanol. The processing of ethanol related materials from clients is prohibited as well.

5.1.2.2. Cassava trade policy

According to China Customs, the tariff is 10 percent for fresh cassava and 5 percent for dried cassava. In addition, 13 percent of VAT will be collected in the import process. With the signing of the China-ASEAN FTA and the implementation of EHP in 2004, a zero tariff policy was applied to cassava imported from ASEAN countries. A Certificate of Origin is required in this case.

5.2. Recommendations for new policies

5.2.1. Implications of the 2008 financial crisis on the demand for natural rubber and cassava

The far-reaching financial crisis triggered by the US subprime mortgage crisis in September 2008 has dampened the world's consumption and, consequently, the economic development of major countries. China's GDP growth rate is expected to drop from 11.4 percent in 2007 to 9.8 percent in 2008 and to 7.5 percent in 2009 (World Bank 2008). The automobile-manufacturing and tyre-making industries will bear the brunt of the slowdown. The production of automobiles in China will decrease by more than 20 percent, and the annual increase in automobile production from 2009 to 2015 is forecast to be between 5 and 10 percent (National Passenger Cars Association Report 2008). Also, the export volume and value of tyres made in China dropped by 4.6 percent and 22.1 percent, respectively, in the first half of 2008. Statistics from the Association of Tyre-making Industry indicate that in September 2008 14 tyre-making enterprises were operating at a loss, accounting for about 33.3 percent of all enterprises. The storage of readymade products hit a record high, at 42.3 percent, signalling alarm with regard to production surplus.

The relatively recessed demand for ethanol in the domestic market reduced the demand for cassava in 2008. This was because: a) The export tax rebate for ethanol was abolished in 2007 and consequently the export volume of ethanol plunged; b) the tax rebate for chemical products was abolished in 2008, causing the export of chemical products to plummet and the sales of ethanol to slide thus affecting the sale of cassava; c) during the preparations for the 2008 Beijing Olympics, provincial and city government departments toughened their inspection of projects concerning environmental protection resulting in the closure of thousands of chemical plants and small-scale ethanol factories in East China; and (d) the about 60-70 percent decline in the international price of gasoline will reduce domestic and international demand for bio-ethanol, which is mainly produced from cassava.

The Chinese government has adopted counter-measures in the face of the global financial crisis, and has focused on domestic demand to facilitate the stable and fast development of its economy. As mentioned earlier, every 1 percent increase in GDP is found to promote a 0.9 percent rise in domestic demand for natural rubber. As long as China maintains its high annual GDP growth rate, the domestic demand for natural rubber will maintain a steady growth momentum. Besides, the Chinese automobile market is still in the development phase of its product life-cycle, and its annual growth rate of 5 -10 percent is robust in comparison with other countries. As for the Chinese tyre-making industry, on 17 November 2008 the Ministry of Finance promulgated the commodities and tax rate, raising the export tax rebate for the third time. It decided to increase the export tax rebate for rubber products such as tyres from 5 to 9 percent on 1 December 2008. The increased tax rebate means that domestic tyre-making enterprises will be entitled to more benefits. All of this implies that the demand for Chinese natural rubber will, to some extent, be secure and enjoy a relatively low increase rate in spite of the financial crisis.

The effect of the financial crisis has been far greater on cassava and its downstream industries than on natural rubber. However, with the release of policies to stimulate domestic demand and the advent of the New Year and Chinese Spring Festival, the domestic ethanol-making industry will rally. In addition, China has taken the development of ethanol fuel as its long-standing energy policy. Demand for cassava will multiply with the operation of newly established ethanol-making enterprises.

5.2.2. Policy recommendations

5.2.2.1. Natural rubber

a) To strengthen the introduction, selection and promotion of fast-growing and high-yielding rubber plants. Training, centred on rubber-tapping techniques and standardised rubber cultivation, should be extended to rubber-plantation farmers to improve technological production and productivity.

b) To give a full role to the Association of the Natural Rubber Industry to establish a fund for the development of the natural rubber industry. This should focus on the construction of a model science and technology park, reproduction and cultivation of seedlings, training on rubber-tapping, inspection of product quality, renovation of old rubber farms, promotion of new plant varieties and new technology, instituting a monitoring system for insect pests, and construction of infrastructure in rubber plantation areas.

c) To upgrade the small, scattered, all-inclusive traditional pattern of preliminary rubber processing, and expand the scale of processing factories. The key enterprises in the rubber processing industry should be fostered by consolidating, combining and reshuffling enterprises, as well as integrating small-scale enterprises.

d) To put the replaced rubber trees on rubber farms to the best use through comprehensive development. More effort should be put into the development of rubber-wood products and furniture in a bid to increase the added-value of rubber and the profit of the rubber planting industry.

5.2.2.2. Cassava

a) To facilitate the research, development and promotion of new cassava varieties and high-yield cultivation techniques. Financial support from the government and other channels should be strengthened to optimise the research, development and promotion of cassava, centred on scientific and technological innovation. The research team should be enlarged and research facilities upgraded.

b) To set up the All-China Association of Cassava Planting Industry so that departments and enterprises concerned with the research, development, promotion, production and processing of cassava in different provinces and regions will be united. The outstanding trans-department, trans-area and trans-field issues can then be settled through consultative coordination and planning. Therefore, a long-standing and reliable guarantee in terms of organisation and management will be created for the industrialisation of cassava.

c) To bolster the key enterprises. For a number of key enterprise blocs, having an international competitive edge will be fostered by consolidation, combining and reshuffling. These enterprises will take the leading role in the sale, processing and cultivation of cassava, and promote the industrialised cassava production pattern, “Enterprises + Science and Technology + Farmers + Production Base”.

5.2.2.3. Regional cooperation

a) To establish a subregional cooperation and consultation mechanism among countries. The scientific and technological cooperation and technological exchange should be strengthened, and an information exchange and sharing within regions facilitated. A unified standard for product quality of natural rubber and cassava should be set up.

b) To sign the intergovernmental purchasing and cooperation agreements. This will make project cooperation stable and consistent, and ensure that the implementation of projects is supported by the central and local governments in the subregion.

c) To urge countries in the subregion to improve related laws and regulations. Such improvements are necessary to ensure that any projects carried out in-country are protected by law, and that policies and measures are conducive to the cooperation and development of the natural rubber and cassava industries. This would also be of benefit to enterprises involved in cooperation.

d) To promote complementary development and industrial cooperation in subregions according to countries' different levels of economic development, technology and resource endowment. For example, countries involved in the upstream industrial chain can make the most use of their vast planting area and rich labour resources to develop a growing industry. Countries in the downstream industrial chain can take advantage of their relatively developed preliminary processing techniques and abundant capital to provide financial and technological support for others, so as to maximise the benefit generated by cooperation.

In summary, it is imperative to further exploit the active role of regional cooperation in the face of the financial crisis. All countries concerned are expected to accelerate the establishment of related coordination and communication mechanisms in the subregion, share information regarding supply-and-demand and the development of industries concerned, expand the scope of communication and coordination, and jointly commit to industrial cooperation. This will help to meet the challenges of the global financial crisis.

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