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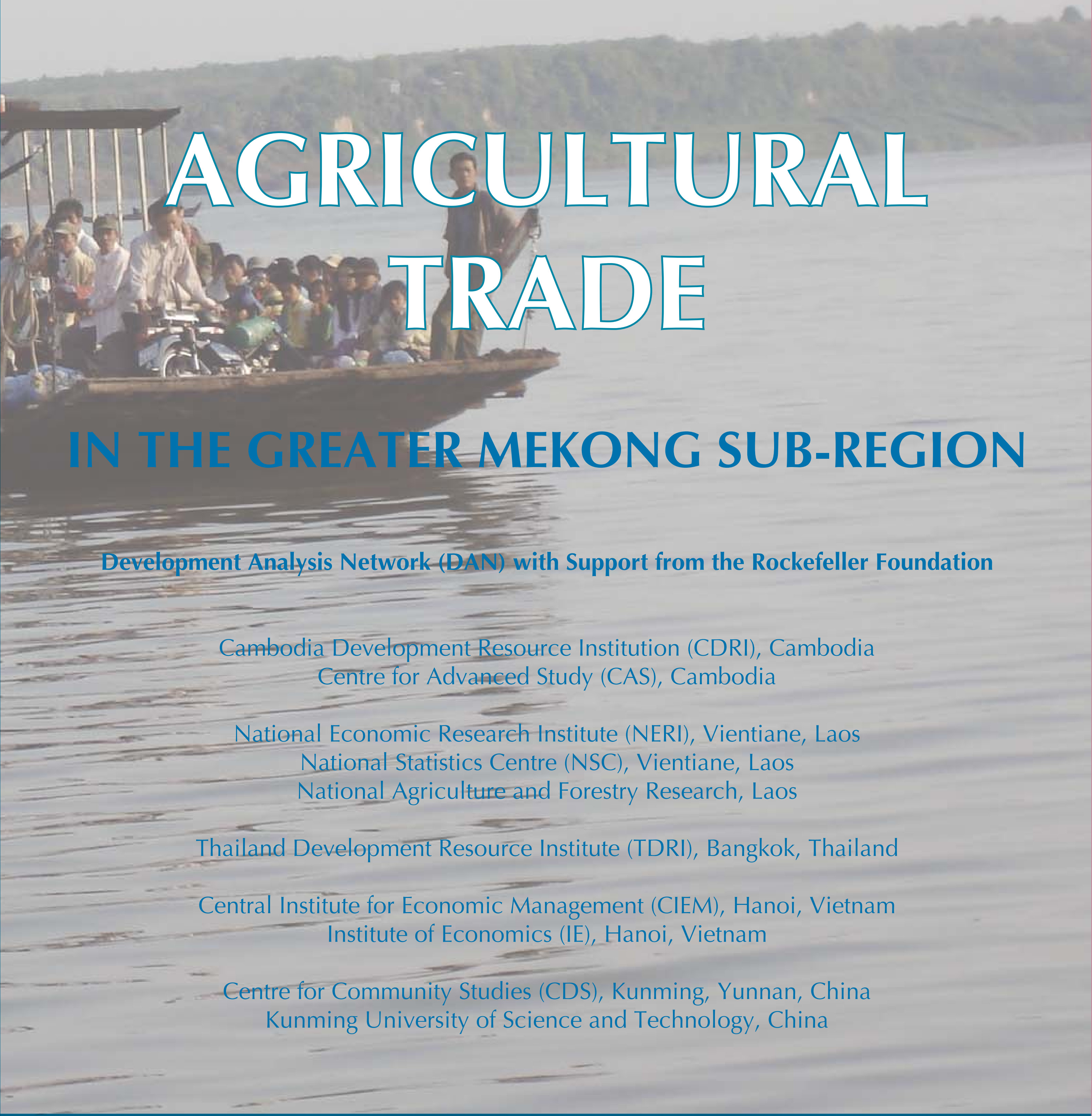

AGRICULTURAL TRADE

IN THE GREATER MEKONG SUB-REGION

Development Analysis Network (DAN) with Support from the Rockefeller Foundation

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

A Project of the Development Analysis Network (DAN)
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Agricultural Trade in the Greater Mekong Sub-Region: Synthesis of the Case Studies on Cassava and Rubber Production and Trade in the GMS Countries, June 2009

Agricultural Trade in the Greater Mekong Sub-region: Synthesis of the Case Studies on Cassava and Rubber Production and Trade in the GMS Countries[1]

Like the river that links them together, agriculture represents one factor that incites some sense of commonality and regional connection among the countries of the Greater Mekong Sub-region (GMS). Indeed, the contribution of the sector to the economies of the GMS countries vary, with such contribution being huge in the case of Lao People's Democratic Republic (PDR) and Cambodia and much less so in the case of China, Thailand and Vietnam. However, there are certain notable commonalities in the characteristics of their agricultural sectors which general trends have come to corroborate. Such are as follows:

- The agriculture sector is a major source of employment. The sector has approximately employed about 75% of Lao PDR's labor force, 50% of Cambodia's and Vietnam's and 40% of Thailand's and China's.[2] Altogether, it employs about a third of the subregional population.

- Development of the agricultural sector is a vital component of poverty reduction strategies. Put simply, this is so because poverty, at least according to what available data have indicated3, 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 the primary producers (as opposed to the other actors in the value chain), a pro-farmer agricultural development has been considered as 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 labor, 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, Lao PDR, 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 food production and biofuel generation.

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 purportedly paved the way for the formal acknowledgement of the subregional grouping. It essentially aims for the development of its individual members through deepening of their regional economic ties. The achievement of this goal has been mainly driven by the strategy of putting in place the "hardware" of national and regional growth, namely infrastructure. Since its inception, it has been observed that the Program through the investments facilitated through

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1 Excluding Myanmar.
2 For the relevant data, see ADB (2008) and IMF (2009).
3 Such statistics for identified survey years can be found in World Bank (2008).

it has been significantly influential in shaping the development of the Mekong region and that the decisions made under it have had major impact on the livelihood of farmers and fishers in the GMS countries.[4]

Agriculture has been identified as one of the priority sectors under the GMS Program. At the policy level, a Ministerial Conference coordinates regional cooperation on the matter while at the operational level, a Working Group on Agriculture (WGA) handles the task of proposing 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 2006-2010, the Agriculture Ministers of the GMS countries acknowledged the new challenges confronting the agricultural sector and reaffirmed their commitment to strengthen subregional cooperation in such areas as cross-border agricultural trade and investment and exchange of agricultural information.[5] Echoing this, the WGA during their Fifth Meeting in September 2008 made reference to the bigger room for cooperation in light of the recent food and energy crises and the perennial challenge posed by climactic change. Now more than ever, the vitality of harmonizing agricultural trade strategies and improving regional exchange and public dissemination of agricultural information has been put forward.[6]

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 relation to 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.[7] 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. Well-researched by respected institutions[8], the studies constitute one part of a series of research on GMS that is 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[9] 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

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

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

6 See the Summary of Proceedings of the Fifth Meeting of GMS Working Group on Agriculture in Lao PDR in 22-24 September 2008.

7 Under the GMS Program, the Agriculture Information Network Service (AINS) was launched in 2007. It was noted however that 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.

8 The case studies were undertaken under or by 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 Lao PDR, Dr. Linkham Douangsavanh, Dr. Bounthong Bouahom, and Mr. Bounthieng Viravong; for Thailand, Thailand Development Research Institute Foundation; and for Vietnam, the Nong Lam University

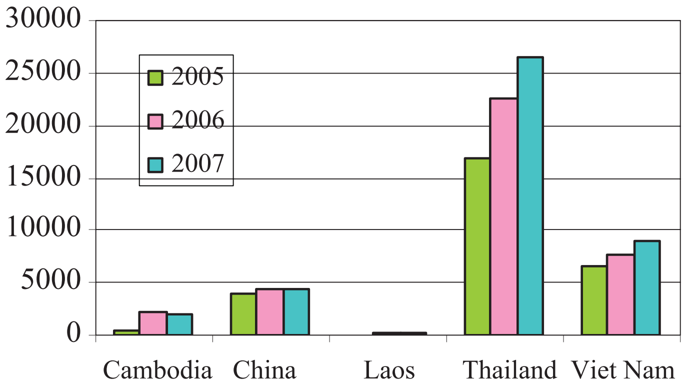
9 With the exception of the case study on Lao PDR.

each of the GMS countries, there are nonetheless reasons common among such 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 as it is a good substitute for rice, the main staple in most GMS countries, and feed for livestock. It too has become a profitable cash crop as the demand for it in industries such as 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 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). Both commodities play a central role in employment creation and poverty reduction.

On Cassava

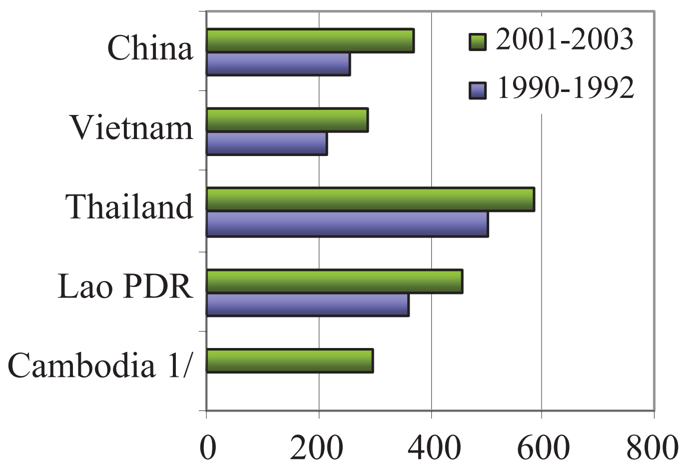
Notwithstanding some periods of decline, aggregate cassava production in Cambodia, China, Thailand and Vietnam (GMS-4) has been on the rise over time (see Figure 1 for pre-crisis levels). While an increase in cultivation areas does account in part for this trend, a more notable causal factor was the improvement in yield. In China for instance, cassava production increased over the period 1996-2007 during which planting areas actually shrunk. Estimatedly, the country during that period posted a 3% 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% versus 0.9% average annual growth), posting an average growth in yield of 5% 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 the period 1990-1992 to the period 2001-2003 was 17% for Thailand (coming from a relatively higher base), 35% for Vietnam and 45% for China (Figure 2). In terms of positions in trade, Thailand is presently the largest cassava exporter in the world with domestic demand for its cassava accounting for only about 25% of total production. China is a major

Figure 1: Cassava Production, thousand tons



Source: FAOSTAT data and estimates

Figure 2: Agricultural Value Added Per Worker, Constant 2000 US$



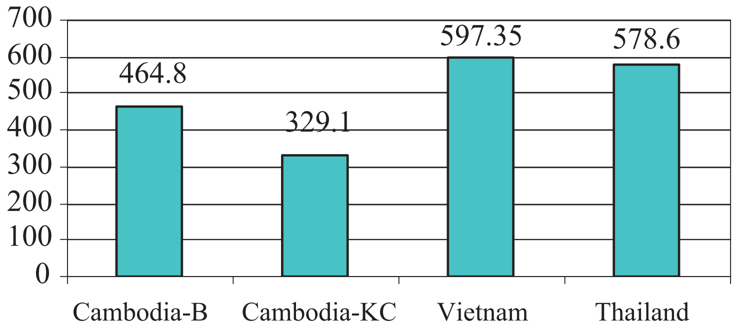
1/ No available data for 1990-1992
Source: World Development Report 2008

net importer, with its demand for cassava especially driven by growth in its ethanol industries. Vietnam is similarly a major exporter while Cambodian exports unfortunately lags behind.[10]

Cassava is a highly adaptable crop. It is able to grow in diverse climates and soil with low fertility. It is normally planted during the rainy season and advisable to be harvested 10-12 months after planting to optimize its starch content. The marketing and trading chains for this commodity, though of course with case-to-case variations[11], 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 have been noted to be barring greater growth in production and trade. Such are as follows:

- *Increasing production cost*. Agricultural production remains labor-intensive and for stated reasons such as labor migration, labor costs have shot up. Costs of other inputs such as chemical fertilizers were noted to have surged as well due to high inflation. Land rentals too have become more expensive.

Figure 3: Production Costs, US$/ha



Notes: Cambodia-B and Cambodia-KC stand for the production costs in Cambodia's Battambang and Kampong Cham provinces respectively, 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 2006/2007; see the case studies for details.

- Figure 3 compares the production costs in Vietnam, Thailand and Cambodia (Battambang and Kampong Cham provinces), as surveyed. Noticeably, the costs in the surveyed Cambodian provinces were significantly lower than the purported costs in Vietnam and Thailand.[12]

- *High cost of credit*. To pay for higher production costs and finance agricultural investments, many cassava farmers have resorted to credit. In the case of Thailand, an estimated 90% 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 with comparatively lower rates. By contrast, many Cambodian farmers turn to private money lenders for loans which come with very high interest (although microfinance institutions in the country have been assuming greater role in agricultural lending).

10 Note that official statistics on cassava trade may not completely reflect actual trade as significant informal exchange happens at the borders of GMS countries.

11 For instance, the marketing and trading chains in China who is a net importer of cassava would obviously have variations from the chains for its neighbors who are net exporters.

12 This interpretation must be cautiously considered however given the differences in reference scenarios (see the notes for Figure 3) and possible factors affecting survey results. Refer to the individual case studies for clearer detailing and explanation of the costs.

- *Insufficient market information*. Information on price movements in the regional and global markets has been generally scarce and inaccessible. Hence, the GMS farmers has been confined to their role as 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 partly provides an illumination to the imperative of a pro-farmer agricultural development which carries the big gains for poverty reduction.

- *Outmoded planting technologies.* Traditional cassava varieties and cultivation methods are still being used by many farmers. There appears to be slow adoption in some cases of the high-yielding varieties (which may have lower market price but entails lesser production requirements) and newer cultivation techniques.

- *Demand and Supply Mismatches.*[13] 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 to oversupply of cassava around December and February during which most cassava are harvested at the same time. This oversupply 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 heading to the processing factories, urban centers or borders pushes up the cost of transportation. In Thailand's case, the underdeveloped state of the rail transportation 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 have also been found to be cumbersome and the exaction of informal payments at the borders continues to be a highly frustrating practice.

On the bright side, there is a huge basket of opportunities that, with prudent management and appropriate supporting resources, can bring forth huge gains for cassava production and trade while cushioning against the concomitant costs. Prominent among these are as follows:

- *Growing demand for biofuels.* The share of biofuels in global energy supply and energy consumption is currently small and will appear to remain so in the immediate decades. Biofuels presently account for a mere 1.9% of total bioenergy and 0.9% of transport energy consumption. By 2015 and 2030, its share of transport energy consumption is projected to increase only to 2.3% and 3.2% respectively. While minimal, this expansion nonetheless has significant implications for the agricultural sector. Liquid biofuel production, particularly ethanol, makes use of agricultural commodities such as the common sugar crops and the

13 This is subject to the effects of the global economic downturn. See Box 1 for a brief account on the matter.

starchy crops, maize, wheat and cassava. Mounting demand for ethanol, expected to resume despite the global crisis, is therefore expected to tweak upward the prices of these products. An estimate is that the price of cassava shall increase by 11% on average as a result 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 along with a threat against food security of the world's poor as well as environmental sustainability and it will take certain measures for biofuel expansion to coexist amiably with these other pillars of development.[14]

- *Rising Chinese demand.* China's industrial growth is inevitably accompanied by mounting demand for raw materials. Currently, China is the biggest importer of dried cassava in the world. In relation to its ethanol production, more than 80% of the imported dried cassava is used in this industry. The advantages of using cassava are its research-discovered higher ethanol productivity as well as higher revenue streams compared with maize for instance. Considering the foreseen growth in its ethanol as well alcohol industries despite and withstanding the effects of the crisis, the gap between the demand for and supply of dried cassava in the country is projected to reach as much as 7-7.5 million tons by 2010. This certainly suggests wider room for imports. With their membership in the WTO, the ASEAN-China free trade agreement (FTA) with China, and partnership under the GMS Program, the GMS countries stand to fill in the supply gap as they already are doing. The top and next major dried cassava exporters to China are Thailand and Vietnam respectively.

- *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's case, cassava demand is anticipated 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 actually operating below potential, specifically 60% only of their full capacity due to lack of cassava supply. Satisfying this shortage is considered a pressing need, so much so that some processing factories committed to offer floor price for cassava.

- *Widening use of HYV*. While many farmers are still affixed to the traditional varieties and methods, there has nonetheless been a widening adoption of the high yielding seed varieties in the GMS countries. This trend is foreseen to lead to better productivity and output.

One other cited opportunity relates to the price of the cassava which has grown at an average rate of 12% per year at least prior to the crisis. Greater demand for the commodity 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.[15] The recent sharp drop in cassava price following the global economic meltdown exemplifies this risk (see Box 1).

14 See FAO (2008a). As mentioned in this report, biofuel's estimated share of 2.3% and 3.2% of total transport energy consumption by 2015 and 2030 is by the International Energy Agency (IEA). Meanwhile, the 11% increase in cassava price on average was an estimate by International Food Policy Research Institute (IFPRI).

15 For discussion of the profit margins received by actors along the value chain, see the individual case studies. Note the differences in the underlying reference scenarios and data sources of the calculations.

Box 1: Down the Prices....: Impact of the Global Crisis

The commodities boom has skidded to an end as a result of the global economic downturn. Cassava and rubber were two of the commodities horribly 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 for price support, Cambodian authorities asked cassava farmers to delay harvest and Thailand, Malaysia and Indonesia have banded together to seek for 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 of how record-high incomes from last year can abruptly be slashed by half or even more. The average price of cassava flour and starch, which just peaked in March 2008, went down by 30% six months after while rubber prices dropped by more than 50% as of mid-March 2009 from its pre-crisis levels. Protectionist policies that ensued in response to these developments have worsened the situation for and increased the frustration of some affected parties. Cambodia for instance has been affected by reportedly how the Thai government has allowed its businessmen to only buy from Thai farmers and blocked cassava supplies at the border.

According to the World Bank, recent price trends concerning agricultural products need to be considered from a longer term perspective and that policy responses need to take into account the cyclical nature of commodity markets. While the outlook for 2009 on the rubber and cassava industries remains uncertain, from a longer-term perspective, there is certainly a silver lining as depicted by the continued optimistic forecasts 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 importantly pointed out that the Chinese government has already undertaken 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 eventually 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 shall be upward pressure on the prices and this can eventually prompt production and trade to pick up again.

On Rubber

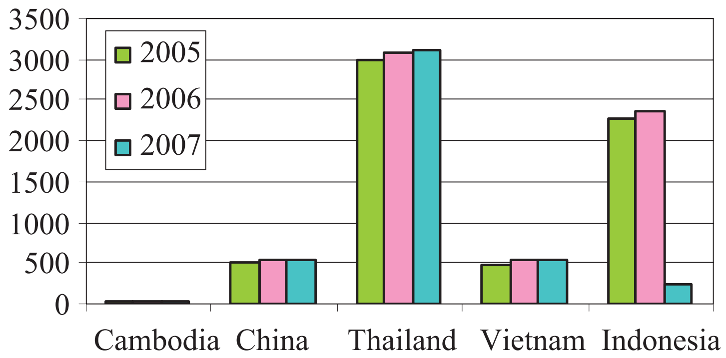
GMS countries, Thailand, Vietnam and China, are frontrunners in global rubber production (Figure 4). Thailand has been the world's number one rubber producer since 1991, surpassing Indonesia. It has also emerged as the world's largest rubber exporter. Around 90% of its produced rubber is exported and China, Japan, Malaysia and the US are its primary markets. China is among the top rubber producers in the world as well but it happens to be also the world's number one consumer of rubber. Vietnam is both a major producer and exporter. While Cambodia and Lao PDR have very minimal shares in the global rubber production and trade, this commodity is nevertheless a major commercial crop and export earner for Cambodia and holds great promise in the case of Lao PDR due to the interest of foreign investors.[16] Additionally, for all GMS countries, the labor-intensive rubber sector is a vital source of employment for

16 Similarly note that official statistics on rubber trade may not completely reflect actual trade as significant informal exchange happens at the borders of GMS countries.

the relatively poor. Growth in rubber production of the GMS countries has been attributed to increase in cultivated areas, the use of HYV and foreign investment. Progress in improving yield however seems to be mixed and, at least in the recent years and based on available data, has not been as significant or pronounced as that for cassava.[17]

While Thailand has shown a notable rise in yield in the past two decades, the growth in China's rubber production was a consequence more of the expansion in cultivation areas since no significant improvement in yield was recorded over the same period. It is worth noting that rubber production growth in the GMS countries seems to have been considerably government-led through such policies as distribution and privatization of state-owned plantations for the benefit of both big private companies and smallholders as well as various forms of state support including subsidies and credit. In Cambodia, smallholder rubber plantation has soared following the decision of the government to offer parts of the state plantations to rubber farmers employed in the government. In China's case, 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 Lao PDR, the government has identified rubber sector development as a priority means of elevating the economic status of upland Lao farmers and replacing opium cultivation. Some Chinese investments in the rubber industry have in the recent years flocked to the country. In Vietnam, about 70% of rubber production comes from state farms, or those supported by the government in terms of land, credit and technology. In Thailand, rubber production is dominated by smallholdings which altogether account for 93% of all the rubber plantations 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.

Figure 4: Natural Rubber Production, thousand tons



Source: FAOSTAT data and estimates

The economic life of a rubber tree can essentially be divided into two: around 6-7 years at the immature stage and 25-30 years at the productive stage[18]. The production costs and profit margins[19] are different for these two stages. In the case of Thailand, average production cost for Year 1-6 was estimated at US$432.6 per year and for Year 7-25 at US$797.3 per year. Meanwhile, estimated production cost at Year 7 in Cambodia, excluding land rental, is US$580 per hectare. For Vietnam, the surveyed total production cost (for the whole production cycle) reached US$321.3 per ton of rubber milk. For Lao PDR, the surveyed total cost for Year 1 reached Kip 11,980,000 (around US$1400); for Year 2-6, Kip 16,350,000 (around US$2,000); and for Year 7-25, 143,610,000

17 See for instance the FAOSTAT data on yield for rubber of the GMS countries in the recent years. Note however that in terms of the past decades, such yield has indeed significantly improved specifically for Thailand and Vietnam.

18 However, the period for each stage may still vary according to weather and soil conditions.

19 Until such time that the rubber trees become productive and are tapped, financial returns mainly come from intercropping with other cash crops or renting the land to other farmers for the same purpose.

(around US$17,200).[20] Though again with case-to-case variations[21], 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 fewer 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 plight. Among the key challenges more or less commonly identified in the case studies are:

- *Increased production costs.* Costs of inputs have swelled. Labor costs have gone up for several reasons such as shortage of labor (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, labor cost in Cambodia has been increasing and is currently at US$2-2.5 per day per worker. In Thailand, the prices of fertilizer, rubber varieties and chemicals have gone up as a result of inadequate supplies.

- *Underdeveloped scientific and technological knowledge and capacity.* This problem was particularly emphasized in the case of China 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 as outmoded rubber seeding and tapping techniques, lack of choice on and adoption of the new varieties and insufficient knowledge of the optimum conditions for rubber planting.

- *Adverse weather conditions.* From drought to typhoons, a host of horrid weather conditions challenge rubber production in the Mekong region. China's natural environment is not really suitable for rubber production. The country's top provincial rubber producer, 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 Lao PDR, such information is said to be virtually non-existent. This inadvertently 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 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% of GDP or 50% of total export value. In Thailand, these costs are driven up by the inefficiency and inadequacy of train transportation in the country and underutilization of Thai ports.

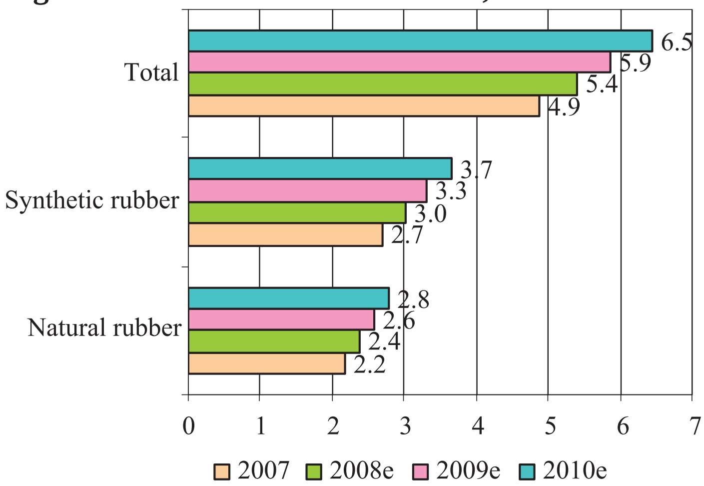
20 There are differences in the underlying reference scenarios and data sources of the calculations. The same is true for the calculations of profit margins. For clearer detailing and explanation of the calculations and presentations, see the individual case studies.

21 Aside from the variation in the chains of a net importer and exporter, there are also variations say between Vietnam whose rubber production is dominated by state farms and Thailand whose production is dominated by smallholdings (both noted in the main text). Lao PDR also does not have a processing industry, as mentioned in the case study.

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 against national or foreign counterparts that engage in acts of corruption or tax evasions or abuse the condition of weak legal enforcement in the country.

Figure 5: Chinese Rubber Demand, million tons



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

- *Inefficiencies in state farms.* While state farms in Vietnam are superior in terms of economies of scale, credit, technology and human resource, they have been found to be suffering from management problems and limited working incentives. These result to 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 in the state farms have an average processing capability of 1600 tons per year, well below the annual rubber production of 10 thousand tons 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 5) albeit the effects of the global economic crisis may have slowed down the pace of expansion. Much of the envisioned increase in world rubber consumption owes itself to China's economic enlargement. Interestingly, a strong positive correlation was discovered between China's GDP and rubber consumption; specifically, that a GDP growth of 1% has coincided with a rubber consumption growth of 0.9%. The China Rubber Industry Association projected that Chinese natural rubber consumption will increase from 2.2 million tons in 2007 to 2.8 million tons by 2010, 3.5 million tons by 2015 and 4.5 million tons by 2020.. Several factors are expected to drive this upward trend including the development of China's automobile industry, highway transportation and related industries (e.g. coal, electricity, construction) and increased investment in such industries as 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 well fall short of being able to meet the country's rubber demand. Ergo, a sizeable opportunity exists for rubber exporters especially for China's partners in the GMS. Thailand of course is already China's top major exporter and Vietnam has some export share though it can potentially be more competitive than non-GMS exporters. Unfortunately, the export shares of Cambodia and Lao PDR are practically negligible. The latter two countries will have to upgrade their rubber processing 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 when the prices experience an abrupt and sharp decline. The global financial crisis once again demonstrated this volatility.

Conclusions and Policy Recommendations

All GMS governments have situated agriculture at the centerpiece of their official strategies and plans, unsurprisingly so because of the central role that this sector plays in employment and poverty reduction as stated at the very outset. While the opportunities appear to remain ripe 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 paint 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 individual development of their sectors vitally rely on the development of cross-border links, be such links 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 reversal of the constraints.

The case studies have insightfully advanced policy recommendations that take in the abovementioned purpose. Incidentally, these proposals resonate the thrust of the GMS Program on agriculture. Key among the recommendations are as follows:

❖ *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"[22]. Technological gap can be added to this and effectively, 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 effectively constitute this gap. Addressing it entails such specific measures as: improving agricultural extension services, be it through conduct of training, provision of technical advice or promotion of HYV; improving the AINS and developing other information exchange systems; increasing R&D; and investing more in and transfer of knowledge and technology pertaining to crop management, agricultural biotechnology and other related innovations. Because of the greater benefits and lesser costs attached to achieving economies of scale, the aforementioned measures can be more fruitfully undertaken in the framework of public-private partnerships or regional cooperation. Already, the GMS Program under its Core Agricultural Support Program 2006-2010 has accommodated most of these proposed measures in its strategies. Whether or not such frameworks exist however, public investments must be made in support of the recommended actions.

22 World Bank (2007).

- *Improved Hardware for Improved Trade.* As mentioned in the beginning, investments under the GMS program have chiefly been funneled towards the improvement of the hardware component of GMS growth namely physical infrastructure. Indeed, the problems of poor road conditions, underdeveloped rail transport system and, high logistics costs underscore the significance of putting in place this component. Greater public investment in physical infrastructure must remain a policy priority as they already are in the GMS countries. Facilitating external investment through say the GMS Program is undoubtedly productive as they distribute the financial and management burden.

- *Lower Trade Facilitation Costs.* Probably the first step towards fulfilling this objective is to push for greater harmonization of quality control standards. This will consequently reduce the cumbersomeness of 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 lowering informal trade facilitation costs. The solution to this ranges from greater computerization of systems to weeding out corrupt officials.

- *Increasing the value-added.* Obtaining results for this objective entails such important measures as 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 further made more competitive through such policies as 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 globalization and liberalization dominating the workings of the cassava and rubber markets, there is a real threat against the survival of smallholders. GMS governments have to make sure that their priority attention is at least balanced towards attending to the needs of both big commercial producers and smallholders. Fortunately, actual policies of GMS governments seemed to have not lost sight of this lesson, likely so because in some cases, smallholdings do have significant share in the countries' rubber or cassava production. The GMS Program on agriculture also has fortunately acknowledged the imperative of greater engagement with smallholders. Beyond acknowledging and planning however, more action has to be done in ensuring state support. Assistance can range from securing land rights and promoting microfinance agricultural lending to improving rural infrastructure and enhancing seed and fertilizer market and distribution systems.

- *Diversification of markets.* Current production and export strategies appear to be directed mainly to expanding niches in China. While this is justifiable because of China's even bigger prospective demand for rubber and cassava, the importance of scouting for potential in minor 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 above policy recommendations. The first was earlier alluded to in that there is no one-size-fits-all solution to the challenges being faced by the GMS countries. A "best-fit" approach that is complemented by a regional approach is bound to result in bigger gains. It was likewise

mentioned above that primarily and ultimately, the GMS countries are competitors in the global cassava and rubber markets. This leads to the second caveat which defines the need to promote "complementary development" in the Mekong region. The 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? A pro-farmer agricultural development would lead to a menu of policy choices that grants prioritization to smallholder engagement, rural infrastructure and grassroots dissemination of market information, amongst others. If cassava and rubber are to become the future of agricultural production and trade for GMS countries and the region, the abovementioned policy recommendations and caveats must be taken to heart.

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Agricultural Trade in the Greater Mekong Sub-region: The Case of Cassava and Rubber in Cambodia

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Abbreviations and Acronyms

ACFTA	ASEAN-China Free Trade Agreement
AFTA-CEPT	ASEAN Free Trade Area-Common Effective Preferential Tariff
ASEAN	Association of Southeast Asian Nations
AFD	Agence Francaise de Development
DRC	Dry Rubber Content
DTIS	Diagnostic Trade Integration Study
FAO	Food and Agriculture Organization
FTA	Free Trade Agreement
EHP	Early Harvest Program
GDP	Gross Domestic Product
GMS	Greater Mekong Sub-region
GSP	Generalized System of Preferences
GVA	Gross Value Added
IMF	International Monetary Fund
LDC	Least Developed Country
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoC	Ministry of Commerce
NSDP	National Strategic Development Plan
RGC	Royal Government of Cambodia
RRIC	Rubber Research Institute of Cambodia
SEDP	Socio-Economic Development Plan
SPS	Sanitary and Phytosanitary
UNDP	United Nations Development Programme
VAT	Value Added Tax
WTO	World Trade Organization

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1. Introduction

Cambodia's agricultural sector accounted for 27 percent of the Gross Domestic Product (GDP) in 2007 and employed approximately 56 percent of the total labour force, especially the poor, in the same year (IMF, 2009). The sector, however, 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 despite the fact that the country has comparative advantage in it. In 2007, total agricultural exports reached USD 106.3 million or 2.6 percent of total exports, while agricultural imports amounted to USD 282.1 million or 5.2 percent of total imports.[1] In terms of trade within the Greater Mekong Subregion (GMS), Cambodia's agricultural exports to other GMS countries represented about 22 percent of the country's total agricultural exports, while agricultural imports 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.[2]

Cambodia's agricultural trade with countries in the GMS is governed by many preferential trade schemes viz. the ASEAN Free Trade Agreement-Common Effective Preferential Tariff (ASEAN-CEPT) for trade with ASEAN members, and the Early Harvest Program (EHP) and agreement on trade in goods under ASEAN-China Free Trade Agreement (ACFTA) for trade with China. These trade agreements require Cambodia to reduce and eliminate tariff and non-tariff barriers on agriculture in exchange for wider market access for agricultural exports in its partners' markets (the "principle of reciprocity"). This, in principle, will stimulate more movement of agricultural goods within the region and thus lead to specialization according to country's resource endowment. Although Cambodia has a potential comparative advantage in the primary sector due to its abundance of cultivable land, it is short of skills (Toshiyasu, Chan and Long, 1998[3]). Even with comparable competitiveness in certain agricultural goods such as maize, soybean 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 systems connecting production centre with export gates, lack of marketing information and trade supporting services, and high cost of trade facilitation.

Having strongly recognized the importance of agricultural trade sector development in boosting economic growth and reducing poverty, the Royal Government of Cambodia (RGC) has been undertaking the dual approach of enhancing agricultural exports while implementing a sectoral development strategy. Under the leadership of the Ministry of Commerce (MoC) and with support from UNDP and other donors, RGC launched the Trade Integration Strategy known as Cambodia's Diagnostic Trade Integration Study (DTIS) 2007 in mid-2006 to develop a more strategic view of Cambodia's trade sector development. The specific objective of DTIS 2007 are as follows: identify possible priority products or services as a basis for strengthening and diversifying Cambodia's export sector; identify bottlenecks that need to be removed to promote development of these export sectors; and serve as basis for formulating trade sector development priorities. Of the 19 sectors identified in DTIS 2007 as potential exports, 9

1 WTO's trade statistics 2009.

2 UN ComTrade 2008.

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

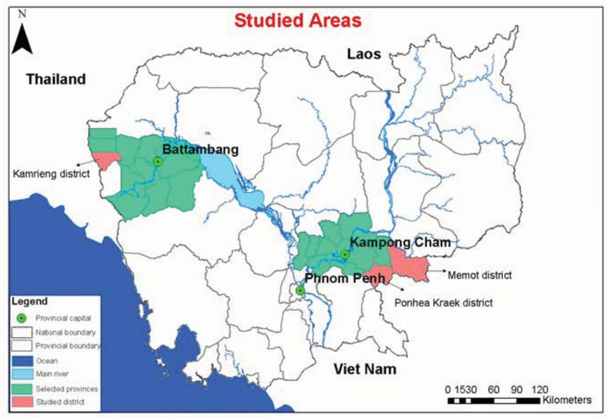
are agricultural goods including cashew nuts, cassava, corn, fishery, livestock, rice, rubber, soybeans, and fruits and vegetables.

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 cross-cutting trade-related legal and institutional action plans for 19 potential export sectors intended to strengthen business and investment environment for export development. However, it did not touch upon certain other important aspects such as comparative production cost of selected agricultural goods, marketing chains, challenges and opportunities for agricultural production and marketing, and regional market flows. Since there was no study that focused on these issues with a view to enhance agricultural trade in the GMS, the study undertaken herein is designed to fill this knowledge gap. The overall objective of this study is to examine how agricultural trade in the region can be promoted in a manner that will optimize the benefits and minimize the negative impacts. The study selected cassava and rubber for in-depth analysis based on the following criteria: (1) said commodities require research and policy interventions and were not significantly studied in the past, and (2) importance of the commodities in terms of present and future potential in employment creation and poverty reduction.
This report is structured into seven sections. Section 1 provides an introduction to agricultural production and trade. Section 2 discusses research methods used in the study. Section 3 looks at production components of cassava and rubber with emphasis on production practices, production cost, production challenges and opportunities. Section 4 examines trade in cassava especially in the areas of trade flows, trade costs and margin and marketing challenges and opportunities. Section 5 discusses trade in rubber and Section 6 provides conclusion and presents policy recommendations.

2. Methodology

In order to address all key questions, the study used a combination of two approaches: desk research and field survey. The major activities in the desk research included reviewing policy documents, literature reviews and overview of statistical data. Field survey consisted of farmer survey, trader survey and key informant interviews with village and district chiefs, district agricultural officials and representative of processing companies. Field surveys were conducted in May 2007 in two provinces, Battambang and Kampong Cham, where the commodities under study are produced and significant cross border trade with neighbouring countries happens. Kampong Cham is located in the eastern part, while Battambang is located in the western part of the country. Memot and Ponhea Kraek districts of Kampong Cham were chosen as study sites for both rubber and cassava survey, while Kamrieng district of Battambang was selected as the location for cassava survey (See the map below).

Figure 2.1: Map of Study Sites



Farmer Survey

Farmer survey was conducted to collect information from farmers on production

process and costs, production challenges, pricing, and margin. For cassava, 37 farmers in Battambang were randomly selected for the survey and 32 farmers in Kampong Cham. For rubber, the survey was made only in Kampong Cham and 39 farmers were selected.

Trader Survey

Trader survey was used to collect information on marketing chains, trade flows and associated cost and margin in relation to the trade of the commodities under study. Structured questions were asked to capture certain common issues while not telling the whole story line. To complement this weakness, the study also conducted in-depth interviews with traders by trying to learn their respective trading activities and understand the overall picture of commodity trade in their regions.

Key Informant Interview

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 respective villages and districts. The research team also conducted interviews with representatives of cassava and rubber processing factories in Kampong Cham to understand their sourcing and selling processes.

3. Production

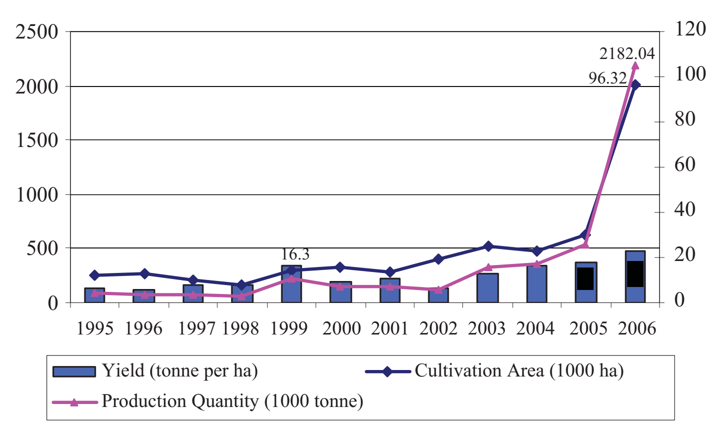
3.1. Cassava

3.1.1. Overview of Cassava Production

Figure 3.1 illustrates the historical development of cassava production in Cambodia in terms of cultivation area, total production quantity and productivity. The graph suggests that cassava production experienced rapid expansion between 2005 and 2006. The total production quantity reached 2.19 million tonnes in 2006, up from 0.54 million tonne in 2005 and 0.18 million tonne in 2000. The jump in total production quantity was largely attributable to the swift increase in cultivation areas and higher productivity. Total cultivation areas in 2006 reached 96,324 ha, about 3 times bigger than the area in 2005 and 6 times larger than that in 2000. The average yield in 2006 was 22.65 tonnes per ha, compared to 17.87 tonnes per ha in 2005 and 10.47 tonnes per ha in 2001.

In terms of distribution by provinces, Kampong Cham was the largest production centre at least in 2005 with cultivation areas of 11,719 ha and production quantity at 244,605 tonnes. In the same year, the average yield in this province was the second highest at 20.9 tonnes per ha. Kampong Speu was the second largest cassava producer followed by Siem Reap, Kampong Thom, Battambang and Preah Vihear (more details in Table 3.1). Cultivation areas in the top 5 provinces represented about 78 percent of total cultivation areas, while their production quantity accounted for 92 percent of total national production in 2005.

Figure 3.1: Cassava Production in Cambodia



Source: FAOSTAT

In terms of productivity, it varies significantly across provinces with the highest yield at 27 tonnes per ha and the lowest yield at 2.5 tonnes per ha in 2005. Battambang province had the highest productivity, followed by Kampong Cham (20.9 tonnes per ha), Koh Kong (19 tonnes per ha), and Kampong Speu (14.7 tonnes per ha). The lowest productivity was seen in Pursat and some other provinces such as Kampong Chhnang (3.2 tonne per ha), Kampot (3.7 tonne per ha), Steung Treng (4.0 tonne per ha), and Svay Rieng (4.5 tonne per ha).

Table 3.1: Cassava Production by 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	20.9	244,605	4,639	11.97	55,520
Kampong Speu	3,269	14.7	47,698	1,200	6.8	8,160
Siem Reap	1,182	11.6	13,698	1,222	8.59	8,118
Kampong Thom	895	7	6,009	1,927	6.52	10,295
Battambang	770	27	20,813	1,148	12	13,775
Preah Vihear	681	10	6,810	93	10	900
Takeo	582	6	3,499	695	8.98	6,179
Others	3,651	-	18,918	5,355	-	44,816
TOTAL	22,749	16.08	362,050	16,279	9.61	147,763

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

3.1.2. Cultivation practices

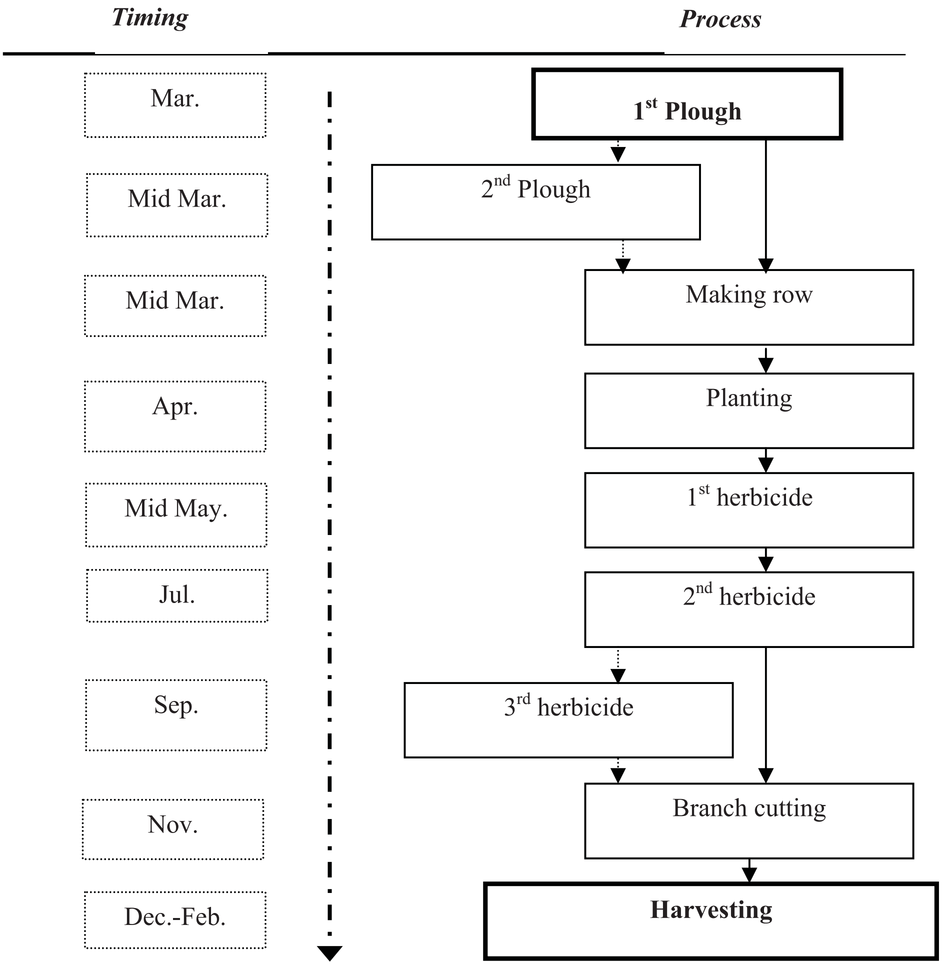
Cassava, a kind of crop that is adaptable to diverse climates and can be grown in areas with low soil fertility, is either planted as a single crop or intercropped with maize, legumes, vegetables, rubber or other plants. Cassava is normally planted during February-April and harvested in 8 to 12 months' time according to market price and availability of labour for harvesting. The cultivation practices among western and eastern provinces of Cambodia have a lot of similarities with few notable differences due to different soil and climate conditions.

In Kamrieng district of Battambang province, cassava is monocropped and usually grown in March. The earliest growing is in February and the latest is in April. The first ploughing starts

in March before the forecasted rainfall, followed by the second plough and row making in the middle of March. Most farmers hire local tractor owner to plough and hire dozen of labourers to make row for planting. Majority of them have their land ploughed two times, while about 5 percent of farmers do it only once due to lack of financial resource. The major difference between the two options is variation in yield, with the practice involving more thorough land preparation resulting in greater yield.

Planting seeds usually takes place in April in which majority of farmers use their own plant cuttings from the previous harvest. Herbicide is necessary in Kamrieng district and it needs to be applied at least two times as herbs grow high and thick. The first herbicide is carried in the middle of May and the second application follows one month and a half later. The application of third herbicide varies among farmers, depending on the herb condition as well as their financial resources. Finally, cutting some branch of cassava trees is normally practised a month or so before harvesting to allow enough sunlight for the root to grow bigger.

Figure 3.2: Cassava Cultivation Process and Timing



The whole process of cassava production in Memot district, Kampong Cham province is very similar to that in western parts. Cassava is mostly planted with other crops especially rubber during April-May and harvested in December-January. Farmers in most cases also use considerably more labour instead of a tractor to undertake land preparation because cassava is grown in between other crops. However, unlike farmers in western areas who use a lot of herbicide for grasses that grow high and thick in the region, farmers in Memot use minimal

herbicide to kill the grasses. This saves Memot farmers considerable amount of money and thus makes their production cost lower.

3.1.3. Production costs

The cost of cassava production involves expenditures on the following key items: land rental, land preparation, labour, and credit. Since production cost differs considerably between the two study sites, the analysis below divides calculation of production cost into two parts: *cost of production in the western part and cost of production in the eastern part.*

Cost of Cassava Production in the Western Part

All expenditures are grouped into two cost clusters: *imputed cost of family inputs and cost of purchased inputs*. Almost all farmers (99 percent) have grown cassava on their own land. Although this does not cost them any rent, the imputed rental expense in 2007 is estimated at USD 119.95 per ha based on market price of land rental.

Cost of land preparation involves expenses on ploughing and row making, which farmers usually hire a local tractor owner to do. On average, the first plough cost about USD 48.53 per ha, while the second plough cost USD 41.75 per ha in 2007. Herbicide and plants are the only major inputs for cassava production and the total cost of herbicide and plants in 2007 was USD 85.52 per ha, of which the former cost USD 46.16 per ha and the latter cost USD 39.36 per ha.

Labour cost is also a significant production expense given the fact that cultivation requires intensive use of labour. In addition to family workers, farmers hire labourers for the whole production process. Shortage of labour is prominent and thus its costs is rather high at USD 2.77 per person per day on average or USD 89.25 per ha for total labour. Another emerging expense facing farmers in cultivation is credit cost. About 78 percent of farmers borrow some money from private lenders to pay for the necessary expenses in production. Such informal credit has very high interest rate, averaging 3.42 percent per month or equivalent to total loan cost of USD 60.8 per ha in 2007.

The total expenditure for cassava production in Kamrieng in 2007 was USD 464.8 per ha, of which 26 percent went to land (imputed), 19 percent to land preparation, 18 percent to inputs, 19 percent to labour, and 13 percent to loan. The cost of family inputs imputed at market price represented 36 percent of total production cost, while the cost of purchased inputs accounted for the majority in 2007. Table 3.2 below sets out the cost of cassava production in Kamrieng in more detail.

Table 3.2: Cost of Cassava Production in Kamrieng District, Battambang 2007

Itemized 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. Labor 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

Cost of Cassava Production in the Eastern Part

Table 3.3 summarizes the cost of cassava production in Memot district, Kampong Cham province, in 2007. The grand total of cassava production costs was USD 329.1 per ha, significantly lower than that in Kamrieng district. Land cost appeared to be the largest expenditure in the production at USD 131.78 per ha, followed by labour at USD 113.62 per ha in 2007. Input costs constituted the third biggest expense at USD 46.32 per ha, followed by land preparation at USD 22.54 per ha and cost of loan at USD 7.58 per ha in the same year.

Farmers in Memot district use herbicide much less than those in Kamrieng district; thus, the cost on this item is significantly lower (USD 8.29 per ha vs. USD 46.16 per ha). Only 8 percent of farmers in the eastern part, compared to 78 percent in the western part, borrow some money from private money lenders to finance cassava production and this makes the total cost of loan relatively lower.

In terms of expenditure category, imputed family inputs contributed about 62 percent of total production cost while purchased inputs accounted for the rest in 2007. This was the reverse of the expenditure pattern in Kamrieng district and thus one of the major differences in production cost between the two areas.

Table 3.3: Cost of Cassava Production in Memot District, Kampong Cham 2007

Itemized 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**
- Fertilizer	Kg	-	-	0	82	0.0072	0.59	**0.59**
- Herbicide	can	-	-	0	3	3.25	8.29	**8.29**
D. Labor 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

3.1.4. Challenges and opportunities

Challenges

Although cassava increasingly becomes more attractive for farmers to choose among the cash crops, its cultivation and production face several challenges. The most important difficulty farmers always complain about is the significant rise in labour cost and price of agricultural inputs and services brought about by high inflation. There is a shortage of labour especially in the western part where many people opt to migrate to work in Thailand. This increasing expenditure forces majority of farmers especially in the western part to borrow some money from private money lenders at high interest rate to finance production. As the cost of credit is high, it reduces considerable amount of margin after harvest.

Another key challenge facing farmers is lack of support in introducing seed variety that provides higher productivity. There is neither extension service to help farmers address the technical issues arising during the production process nor sufficient marketing information about the development of cassava price in the regional and national markets. In such setting, farmers are, in most circumstances, price takers and traders are price setters. As a result, farm gate prices are

relatively lower and farmers' margins, smaller. The other constraints for farmers include heavy dependence on rainfall, shortage of land preparation service providers, unpredictable closure of border gates, and limited access to microfinance at reasonable interest rate.

Opportunities

There are several opportunities emerging in cassava production for farmers. First, productivity could even be further raised given that good seed varieties are introduced and some critical production problems such as limited understanding of use of herbicide and rising price of agricultural inputs are better addressed.

Second, provision of extension services can boost cassava productivity. As earlier mentioned, extension service is currently nonexistent; farmers cultivate cassava based on the knowledge that they learned from elder generation and from one another. Dissemination of better cassava cultivation practices can be done relatively easier by the government and NGOs. Such intervention would be very useful for farmers to increase productivity and quality of cassava outputs.

Third, there is considerable amount of idle land that can used to expand the cultivation areas, as observed by the study team in the field. The quality of new areas is more fertile, promising higher yields.

Lastly, an initiative to forge closer cooperation among GMS countries in cassava production and trade would be a good opportunity for Cambodian farmers. It would be beneficial to deepen cooperation with Thailand and Vietnam for instance, they being the largest cassava exporters in the region with appropriate selection of variety and better cultivation practice.

3.2. Rubber

3.2.1. Overview of Rubber Production

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 creation. The gross value added (GVA) of rubber in 2006 is estimated at US$103.61 million or about 5 percent of agricultural sector production (MAFF, 2008).

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

The main rubber producing provinces in Cambodia are Kampong Cham, Kratie, Kampong Thom and Ratanakiri. According to the Ministry of Agriculture, Forestry and Fisheries (MAFF, 2007), rubber is grown on about 70,000 hectares of land, of which 44,850 hectares are state

owned and private company owned, while 25,150 hectares are smallholders' plantations. Cambodia had seven state-owned plantations covering about 80% of total plantation areas. However, the government's policy to privatize rubber plantations in the form of divestment has increased rubber plantation areas owned by private companies and smallholders.[4] As November of 2008, six of the state-owned rubber plantations (Peam Cheang, Krek, Memot, Snoul, Chamka Ondoung, and Beung Ket) have been privatized.[5]

Rubber plantations under smallholders have increased rapidly largely due to the government policy to provide parts of state-owned plantations to rubber farmers employed by the government. With financial support from Agence Francaise de Development (AFD), the development of smallholder rubber production projects has been carried out in Kampong Cham province, the rubber production of which accounts for the largest share in total rubber production. The AFD project started in 1999 with 349 participating farmers and over 887 hectares. In 2007, smallholder plantation areas increased to about 10,000 hectares. However, according to the General Directorate of Rubber Plantation of MAFF, both smallholder plantation in and outside AFD project totalled 30,000 hectares in 2007.

Majority of smallholders have rubber plantations of 1-2 plots, averaging 2.8 ha in size. Households in Ponhea Krek district have bigger land size than those in Memot (see more in Table 3.4). In terms of land ownership, survey results revealed that farmers got their lands through four different ways: distribution from the state (22 percent); clearing forest (6 percent); purchase from others (39 percent); and receiving from parents and relatives (33 percent). Further, at least at the time of the survey, 14 percent of the farmers had land title, 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.

Table 3.4: Household ownership of rubber land

Description		Ponhea Krek	Memot
Land Size (ha)	Minimum	0.8	0.7
	Maximum	12.0	8.0
	Std.	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

3.2.2. Cultivation practices

Life cycle and land use

Rubber plants take six to seven years to mature and start yielding. Tapping of rubber trees starts in the fifth to seventh year after planting and then continues for 25 to 30 years. After 30 years,

4 An Anukret or sub-decree on the creation of a national permanent commission for coordinating the privatization and the promotion of rubber plantations was issued in September 1994.

5 Rubber Development Department/General Directorate of Rubber Plantations

a decline in latex production makes further tapping of the trees uneconomic. The trees are then removed and replaced with new seedlings (Mead, 2001). Naturally, when the rubber trees are still young, they give low concentrated latex; when they become older, the concentration becomes higher. In other words, the older the tree, the more concentrated is the latex produced. The time comes when the rubber tree becomes too old that the latex become too concentrated to flow. Hence, no more latex from such tree can be tapped.

In order to sustain long-term productivity and efficiency of land use, a different rubber planting arrangement, known as the hedgerow avenue planting pattern, is introduced, in the aim of having high light transmission preferably throughout the economic life of rubber. The spacing pattern of rubber with wide inter-row of 18 to 25 meters maintains the economic density of rubber at 400 to 500 trees/ha and provides a better long-term environment for further increase in crop diversity. This method seems to slightly affect the growth performance and yield of the inter-row (IRRDB, 2001).

At the early stage when rubber trees have not so many leaves allowing sunlight to penetrate through, farmers plant short term cash crops in the space between rubber trees. In some cases when rubber farmers cannot afford to grow subsidiary crops in rubber plantation, they allow their villagers to do so. In exchange, villagers have to pay land rental of around 50 dollars per hectare per year. They only have verbal agreement that usually depends on trust, mutual interest and sympathy of plantation owners for poor landless families. The most common crop grown on rubber land last year was cassava. This was expected to happen again in 2008 due to the good prospects for cassava.

The cultivation of other crops in rubber plantation could be extended to more than three to four years before the trees start to shade most of the land area. Although revenue from non-rubber cultivation is relatively smaller, it helps offset continuous expenditures on rubber plantation. According to focus group discussions with farmers, when food price increases everywhere this year, it would attract more people to make use of young rubber land to grow cash crop.

Farm inputs

There are several rubber varieties planted in the study sites. Introduced to Cambodia long time ago, the GT1 variety is the most popular one, followed by the PBM variety. About half of rubber smallholders buy seedlings from companies while the other half could not afford to do so and thus depend on using mixture of different types of seeds collected from other farms. The latter practice costs less in term of cash expenditure but provides lower yield.

Table 3.5: Type of rubber seeds used

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

** is referred to used seeds that can not be specified by farmers due to mixture of different types of seeds. Usually, they are poor farmers who can not afford to buy pure seeds from company.*
Source: CDRI's rubber farmer survey 2008

In general, family workers are largely used in the production process from land preparation to planting and harvesting. Hiring labourers for harvesting is also practiced especially by rubber households who have insufficient family workforce. Farmers use chemical fertilizers more than organic fertilizers and fertilizer is often applied more at the beginning when seedlings are planted and again a year before opening for harvesting.

The main equipment for harvesting are bowls or cups, few large containers of 30 liters, and special knives or chisels. Chisel is used to incise the bark so as to wound the resin canals without damaging the cambium. Most of those employed for tapping are paid on a monthly basis and only few are paid on a daily basis. In addition to the pay from rubber owner, hired workers can also collect rubber leftover in cups that allow them to earn extra.

Harvesting

In one year tapping cycle, the weather in the plantation changes about every two to three months affecting the rubber's physiology. The change in physiology affects the concentration and yield. When little rainfall comes, there is consequently little water in the soil and the bark of a rubber tree remains hard and thus could only keep small amount of water. This results in high concentration of latex. High concentration slows down the flow of latex and, as a result, less sap can be obtained. In other words, rubber clones with high latex concentration will give very low yield, but rubber clones with low latex concentration will give higher production yield.

During the mid rainy season when there is more rain, the soil starts to saturate with water, the bark starts to become soft, and the concentration of latex decreases. When the concentration is less, latex flows longer and thus generates more yields. Rubber clones with high concentration provides less yield than the clones with low concentration. When the rain starts to subside and the cold wind spreads, the coldness makes latex coagulate slower and causes the latex 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 condition causes latex to flow slower and thus reduces the yield. In this case, clones with low concentration gives more production yield and vice versa. Overall production yield is reduced.

It is noticed that the temperature also affects the yield because latex does not flow when the temperature is high. In high temperature regions, low concentrated clones are less affected than high concentrated clones. The workers should tap in early morning when the soil is cool so that it is possible to obtain more latex. In general, rubbers can produce more latex in regions where there is a long cold season and short drought season.

Usually, farmers only collect once from one cut on the tree surface. When the price of rubber increases, farmers collect twice from two cuts. However, survey results showed that only 30 percent of farmers made double collection in response to the rise in rubber price. In general, rubber trees are tapped every 2-3 days but good price attracts farmers to tapping more often. During the survey when rubber price was high, the majority (64 percent) did tapping at an interval of 2-3 days, while the rest tried to tap daily.

3.2.3. Production costs

Rubber plantation 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. The returns from cash crop or land rent are not included in the study's cost calculations but it can be simply done by including 50 dollars per hectare per year (see the explanation in cultivation practices above). An important phenomenon that happened in recent years was the rapid increase in land price. Most of rubber lands especially those connected to the main roads were valued at around 20,000 dollars per hectare, while the rest were valued at 5,000 to 15,000 dollars per hectare.

Main inputs in rubber production include land, labour and capital. Labour cost is on increasing trend, reaching 2-2.5 dollars per person per day, about a third higher than the daily pay few years ago. This is due to the increasing employment opportunities for villagers in other agricultural and non-agricultural sectors both inside and outside the studied areas. In early 2008, when it was time for cassava harvest, there was high competition for labour, pushing the labour cost higher. High inflation also contributed to consistent demand for higher wages.

Labor is the main cost item and it varies from the first year to the harvesting period. It is intensively used for land preparation and planting as well as for tapping. According to the results of the farmer survey, the average cost of labor accounts for about 70 percent of total production cost.

Shortage of skilled tappers is considered a serious problem and it could result in significant losses due to vacant tapping blocks. Hiring of unskilled tappers results in damages to the cambium and also high bark consumption rates. Damages to the cambium and high bark consumption rates result in poor bark renewal. When poorly renewed bark is tapped, there will be a decline in yield.

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

As for input material cost, buying seedling is the highest cost in year one. Input material cost would have been higher if all rubber farmers had to buy seedlings from companies (as seen in Table 3.6, only 50 percent of farmers buy seedlings). Per the results of the survey, total cost of rubber is high at 439 dollars per hectare in year one and gradually decreases to 209 dollars in year six. The cost increases to as much as 580 dollars on average when harvesting starts. Total production cost is estimated at 1,714 dollars per hectare from year one to six, before the trees produce latex.

Table 3.6: Cost of Rubber Production in Memot and Ponhea Kreak, 2007 *(In USD per ha)*

	Year I	Year II	Year III	Year IV	Year V	Year VI	Year VII
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 high yielding clones being widely planted with 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 the cutting down of the trees, farmers would apply some chemical to accelerate the production, a final root out. Some plantation owners want to practice double collection and yield stimulation when they can receive good prices. They realized that this method could exhaust their trees faster than usual practice.

3.2.4. Potential and policies

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

These free trade agreements enable Cambodia to gain more preferential access to major markets for its exports of rubber. China, for example, is one of the largest consumers of rubber. Lower import tariff on rubber products implemented under the ASEAN-China Free Trade Agreement would stimulate greater export from Cambodia and thus increase domestic rubber production. The way forward for Cambodia should be to improve the quality of rubber processing to a level that lives up to the demands of China's market and provide competitive prices for its rubber products.

3.2.5. Constraints and opportunities

According to Burger and Smith (2001), the economies of key players in the natural rubber market both on the demand and supply sides were severely affected by the Asian financial crisis. The crisis resulted in turbulent developments in the natural rubber market during the crisis period until 2000. Until recently when rubber prices rose, farmers felt discouraged by low rubber prices. Rubber plantations need long time investment 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 that they are at a disadvantage vis-à-vis Cambodian or

foreign rivals who engage in acts of corruption or tax evasion, or take advantage of Cambodia's poorly enforced legal regulations.[6] This situation would result in some large firms taking advantage and control of the rubber industry in the country.

According to the theory of demand and supply, higher yield of agricultural products in the country should enable Cambodia to offer agricultural commodities at lower prices. This however is not the case because Cambodia's trade openness and facilitation have linked domestic prices to international prices. As a result, the prices of agricultural commodities have moved up with regional and international prices, especially in early 2008 when prices skyrocketed. High price of fuel also makes it difficult for synthetic rubber production. Anyhow, because the prices of all

agricultural commodities remain comparatively high together with the demand for rubber for tire production, there is a bright future for rubber producers for at least a few more years.

Supporting services as well as interventions from concerned ministries have so far not been actively provided. The research and extension activities are more efficient and effective with the involvement of the private sector, resulting in changes in farming techniques among farmers. Furthermore, marketing issues have been less problematic due to the high demand for agricultural commodities, improvement of physical infrastructure, and trade facilitation.

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

There is generally little or no discrimination against foreign investors either at the time of initial investment or after investment. Cambodia's 1994 Law on Investment established an open and liberal investment regime that allows Cambodian and foreign citizens to freely enter and exit all sectors of the economy. Full foreign ownership is permitted in most sectors, except land. Article 44 of the Constitution provides that only Cambodian citizens and legal entities have the right to own land.[7] The country's liberal investment policy would attract more foreign investment in the future.

6 Cambodia Country Commercial Guide FY 2006

7 Cambodia Country Commercial Guide FY 2006. See also Constitution of the Kingdom of Cambodia, as amended.

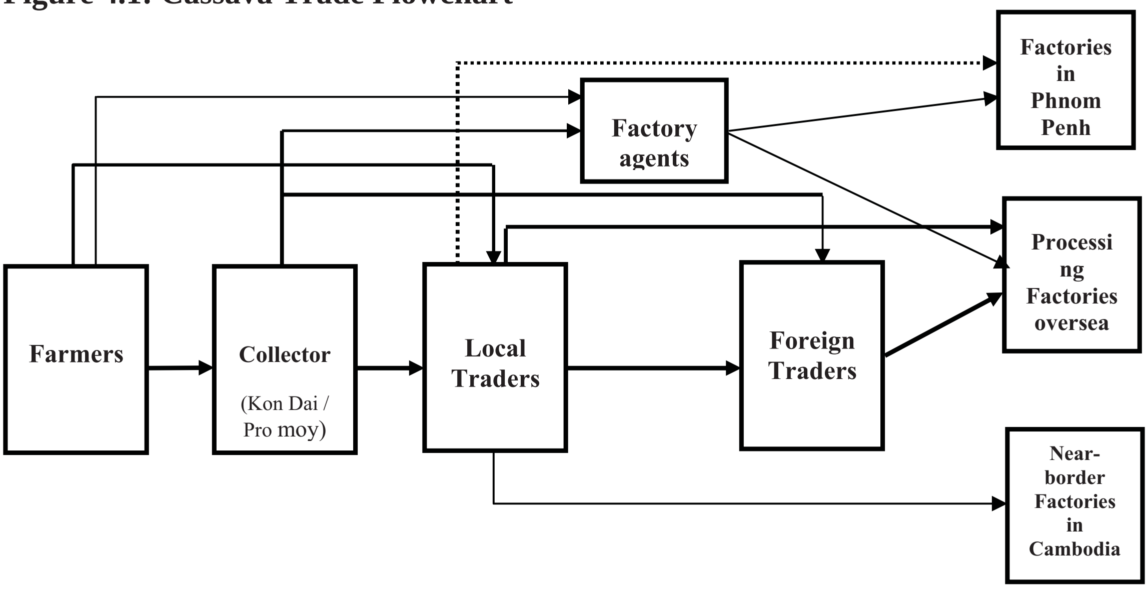
4. Trade

4.1. Trade in Cassava

4.1.1. Marketing chains

Cassava trade in Cambodia involves many key players including farmers, collectors, traders, factory agents, and processing factories. As illustrated in the trade flowchart below (Figure 4.1), the marketing chain of cassava has many layers, with the collectors and traders serving as the main intermediaries among farmers and processing factories. Foreign traders also play a key role in the cassava trade in Cambodia with larger amount of cassava outputs being purchased by them for sale to processing factories in their countries later on. Provided that the research team encountered some difficulties in getting access to local processing factories and foreign traders, the following stakeholder analysis focuses on three key players namely farmers, collectors, and traders.

Figure 4.1: Cassava Trade Flowchart



Farmers

Cassava farmers have few options in selling their outputs. Their rationale choice is based on many factors such as anticipated revenue, associated costs, and availability of resources. Sale practices vary between the western and eastern parts and are summarized below as the various options. Figures indicated hereunder are based on survey results for the year 2007.

Farmers' Practices in the Western Part

Majority of farmers sell raw cassava to traders (hereafter referred to as *Option 1*). Under Option 1, traders pay all associated costs including harvesting and transportation. At an average price of USD 33.75 per tonne and average output of 24.01 tonne per ha, farmer's revenue from this sale option was USD 810.3 per ha.

Another emerging sale option that farmers can choose is to bring raw cassava to the storehouse of factory agents (hereafter referred to as *Option 2*). Under Option 2, the costs of harvesting and transportation are the farmers' responsibility. At an average price of USD 42.4 per tonne and average output of 24.01 tonne per ha, farmer's revenue from this sale option was USD 1020.43 per ha. Given shortage of labour for harvesting and increasing cost of transport, farmers are not so convinced to sell their outputs via this option.

The last practice, referred to as *Option 3*, involves farmers selling dried cassava to traders. Farmers pay for harvesting cost, while transportation cost is the traders' responsibility. At an average price of USD 90.83 per tonne and average output of 24.01 tonne per ha and approximately 100 kg of raw cassava or 55 kg of dried cassava, farmer's revenue from this sale option was USD 1199.39 per ha.

Table 4.1: Gross Revenue from Cassava Sales in Kamrieng District, Battambang 2007 (in USD)

	Option 1 (raw cassava)	**Option 2** (raw cassava)	**Option 3** (dry cassava)
Price (in USD per tonne)	33.75	42.4	90.83
Average Output	24.01	24.01	24.01
Gross Revenue per ha	810.3	1020.43	1199.39

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

Farmers' Practices in the Eastern Part

One interesting difference between the practices in the western and eastern parts is that sales in the latter region are not based on the exact weight of cassava but rather on an offered lump sum per ha. Traders visit the farm to estimate the output and offer a lump sum payment hereafter referred to as *Option 1* for the eastern part). The costs of harvesting and transportation are the traders' responsibility. About 31 percent of farmers in the eastern part sold their outputs this way. Average revenue from this sale option was equivalent to the average lump sum payment of USD 667.47 per ha.

There is a considerable proportion of farmers in the eastern part that choose to sell raw cassava to traders (*Option 2).* In this case, farmers bear the cost of harvesting, while transportation cost is borne by the traders. About 48 percent sold raw cassava under this option. At an average price of USD 58.28 per tonne and average output of 13.28 tonne per ha, farmer's revenue from this option was USD 774 per ha.

The last option is sale of dried cassava to a trader with the farmers shouldering the harvesting and transportation costs (hereafter referred to as *Option 3*). About 20 percent of farmers preferred to sell their output this way, the average price they got being USD 149.1 per tonne. At an average output of 13.28 tonne per ha and approximately 100 kg of raw cassava or 50 kg of dried cassava, farmer's revenue from this sale option was USD 990.03 per ha.

Almost all farmers do not have prior sale contract with traders or factory agents and in most circumstances, they are price takers. Traders try to push down the farm gate price as low as possible and being price takers, this puts farmers at a disadvantage during price negotiation.

Asked about their satisfaction on price during the survey, farmers expressed different views. For example, about 86 percent of farmers in the western part thought that the price they get from collectors/traders is fair, while 14 percent of them believed that the price is below the market price. Of the farmers in the eastern part, 43 percent thought they sell based on market price, while 38 percent argued they received below-the-market price.

Table 4.2: Gross Revenue from Cassava Sales in Kampong Cham, 2007 (in USD)

	Option 1 (Lump sum)	**Option 2** (raw cassava)	**Option 3** (dry cassava)
Price (in USD per tonne)	-	58.28	149.1
Average Output	-	13.28	13.28
Gross Revenue per ha	667.47	774	990.03

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

Collectors

Collectors, or "*koun dai*" or "*promoy*" in the local language, are the major market agents in the cassava marketing chain. They are independent agents of traders and receive commission fees based on the amount of cassava purchased. According to collector survey, in the case of Kamrieng district for example, a collector who represents Thai traders in purchasing cassava from farmers can get a commission of USD 1.25 per tonne for their service. Some collectors work for local traders who later sell cassava to Thai traders either on commission basis or margin basis. In this case, these collectors get between USD 0.50 and USD 0.75 per tonne for their service.

Local Traders

Few local wealthier persons in the study sites are in the cassava trading business. It is a fairly lucrative business that however requires financial resources, facilities (i.e. storehouse), good communication, and confidence from farmers. Local traders in certain circumstances act as collectors for foreign traders and receive commission fee of USD 1.25 per tonne for their service. In some circumstances, local traders compete with foreign traders in purchasing cassava from farmers for sale to such foreign traders at higher price.

Traders in the western part for example bought raw cassava at an average price of USD 32.50 per tonne and sold them to Thai traders at USD 41.25 per tonne on average. After the harvesting cost, about USD 5 per tonne, was paid by them and the transportation cost was paid by Thai traders, the local traders' average margin was USD 3.75 per tonne. In the case of dried cassava, they bought them at USD 90 per tonne on average and sold them at an average price of USD 105 per tonne. With harvesting and loading cost at around USD 6.5 per tonne, local traders gain USD 8.5 per tonne. Table 4.3 summarizes the trading options and their respective margin. Traders' decision making depends on combination of factors including communication and connection with foreign traders, availability of labour services, and financial reserves.

Table 4.3: Margin of Local Traders in Kamrieng District, Battambang 2007 (in 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

Margin is the difference between sales revenues and costs (including production cost, harvesting cost and transportation cost). Margin varies 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 their cassava yields as elaborated in the earlier section, the following margin analysis is disaggregated into three cases and in each case, distinction between two scenarios is made. Under *Scenario 1,* production cost includes imputed family inputs; by contrast, under *Scenario 2,* production cost excludes family inputs. Figures indicated hereunder are likewise based on survey results for the year 2007.

Farmers' Margin in the Western Part

Table 4.2 shows the margins of farmers in Kamrieng district under the three different sales options in 2007. Option 1, which is the most common practice in the region, generated sales revenue of USD 810.3 per ha. Given that harvesting and transportation costs are the trader's responsibility, the average margin for farmers under this option was USD 512.6 per ha if family inputs and labour are not considered in cost calculation (*Scenario 2*), and USD 345.5 per ha in the case that family inputs are imputed in production cost.

Under Scenario 2, the revenues from Option 2 and option 3 were greater but were partly offset by payments to cover the harvesting cost (USD 160 per ha for Option 2, and USD 372 for Option 3) and transportation cost (USD 41.53). If family inputs and labour were not imputed in production cost (*Scenario 2*), farmers got margin of as high as USD 529.69 per ha from Option 3 and USD 521.2 per ha from Option 2. Table 4.4 also suggests that the margins vary slightly among the three options and the differences are not significant enough for farmers to give up the current common sale practice, which is the most convenient for them in terms of time consumed.

This result confirms the qualitative information collected from in-depth interviews with farmers that majority of them prefer Option 1. It is because other options involve them in many other activities including harvesting and cutting root, drying and collecting cassava chips. The difference in margin is insignificant and not big enough for them to try other sale options. If family inputs are imputed into total production cost (*Scenario 1*), the margin dropped to USD 345.5 per ha for Option 1, USD 354.1 per ha for Option 2, and USD 362.59 per ha for Option 3. Like in scenario 2, results suggest that variations among all options are not significant.

Table 4.4: Margin from Cassava Production in Kamrieng, Battambang 2007 *(in US Dollar)*

	Option 1		Option 2		Option 3	
	Scenario 1	*Scenario 2*	*Scenario 1*	*Scenario 2*	*Scenario 1*	*Scenario 2*
A. Gross Revenue	810.3	810.3	1020.43	1020.43	1199.39	1199.39
B. Total Cost	464.8	297.7	666.33	499.23	836.8	669.7
- Production Cost	464.8	297.7	464.8	297.7	464.8	297.7
- Harvesting Cost	0	0	160	160	372	372
- Transportation Cost, if any	0	0	41.53	41.53	0	0
C. Margin	**345.5**	**512.6**	**354.1**	**521.2**	**362.59**	**529.69**

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

Farmers' Margin in Eastern Parts

Like in the western part, the analysis of margins in Memot district in 2007 is disaggregated into three options and two scenarios. The scenarios are exactly the same in which under scenario 1, production costs include family inputs and under Scenario 2, only purchased inputs are considered. As mentioned in the earlier section, farmers' revenue from Option 1 was USD 667.47 per ha, USD 774 per ha from Option 2, and USD 990.03 per ha from Option 3.

Table 4.5 shows that if family inputs and labour are not considered in the cost calculation (*Scenario 2*), the margin reached USD 542.37 per ha for Option 1, USD 620.48 per ha for Option 2 and USD 779.47 per ha for Option 3. These results suggest that the last option results in the highest margin and variation with other options is significant. However, not all farmers are able to choose this option. It is observed that only a small group of wealthier farmers who own mini truck can make bigger margin from cassava sale and this type of farmers also acts as a middleman between farmers and foreign traders.

If family inputs are imputed into the total production cost (*Scenario 1*), the margin dropped to USD 337.37 per ha for Option 1, USD 399.74 per ha for Option 2, and USD 550.86 per ha for Option 3. Like in *Scenario 2*, margins between Option 1 and Option 2 differ slightly, but the difference varies significantly between Option 3 and other options.

Table 4.5: Margin from Cassava Production in Memot, Kampong Cham 2007 *(in US Dollar)*

	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 facing key players in cassava market chains have several dimensions. First is the lack of marketing 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 pricing updates, farm gate prices are usually pressed down to the level that are far below current market prices.

The second constraint in trade flow is poor physical infrastructure. The condition of roads connecting main cassava production centre to main urban areas and to border checkpoints is very poor. This makes the cost of transportation and thus the transaction cost along the chains, high. Bad road condition also hinders processing factories in urban areas from competing well with foreign traders in purchasing cassava from farmers because they have the disadvantage of getting access to the production place at higher cost. Consequently, farmers have little choice as to whom to sell and have little power in setting the price.

Thirdly, the value-added along cassava value chains is very limited. Majority of cassava outputs in the study sites are exported across the border to Thailand and Vietnam where they are further processed for export to third countries. There is a limited number of processing factories in main cities or near production centre and the input cost of processing including materials, fuels, and electricity are very high. Unlike the garment industry, cassava trade and processing have received minimal trade support. In the absence of these necessary settings, cassava does not itself generate significant value added.

The fourth problem arising in cassava trade flow concerns border issues. Traders complain about high border fee for cross border trade. In the case of Kamrieng district, for example, trader needs to pay USD100-150 to both Cambodia and Thai border officers for transporting cassava across the border. The fee has direct impact on trader's margin and indirect impact on farmer's margin. Another related issue concerns unpredictable border closure and this occasionally happens with the border between Cambodia and Thailand. It is even worse if such temporary closure takes place during the harvesting period because it makes cross border trade impossible; thus, farm gate prices decline. From our in-depth interview with village chiefs, farmers especially those that need urgent money from harvest to repay loan are adversely affected by temporary border closures.

Opportunities

Opportunities emerging in the cassava market chain and cassava trade have many dimensions. First is the constant increase in international price of cassava. Cassava price has risen substantially over the last 7 years at an average rate of 12 percent and such a rapid rise has been a result of stronger demand for cassava. The price of tapioca (hard pellets), for example, at F.O.B Bangkok was USD 113.25 per tonne in 2007, up from USD 78.04 in 2004 and USD 55 in 2000. The price of tapioca starch at F.O.B Bangkok was USD 250.5 per tonne in 2007 compared to USD 157.42 per tonne in 2000.[8] Given the increasing global and regional demand for cassava, its price is likely to rise further.

8 FAO's International Commodity Prices at http://www.fao.org/es/esc/prices/PricesServlet.jsp?lang=en

The second emerging opportunity for cassava trade is the high potential for export development and market diversification. Cassava is among the 19 priority export sectors identified by the government for inclusion in the DTIS 2007. Although its current export is somewhat limited, cassava is considered as the key commodity that has high export potential largely due to the fact that the demand from world market is high and domestic supply capacity is good. In terms of market access, cassava exports from Cambodia are provided tariff preferences by several countries such as members of ASEAN, EU, and China through either free trade agreements or General System of Preference (GSP) programs for Least Developed Countries (LDCs).

The third opportunity concerns expansion of value added in cassava value chains. Since cassava can be used for many purposes and processed into a variety of products, cassava industry could be localized to attract investment into ago-industry such as food processing, medicine, bio-fuel, animal feeding, and liquor (MoC, 2007). The growth of these ago-industries would have huge implications for cassava production and the farmers' livelihoods.

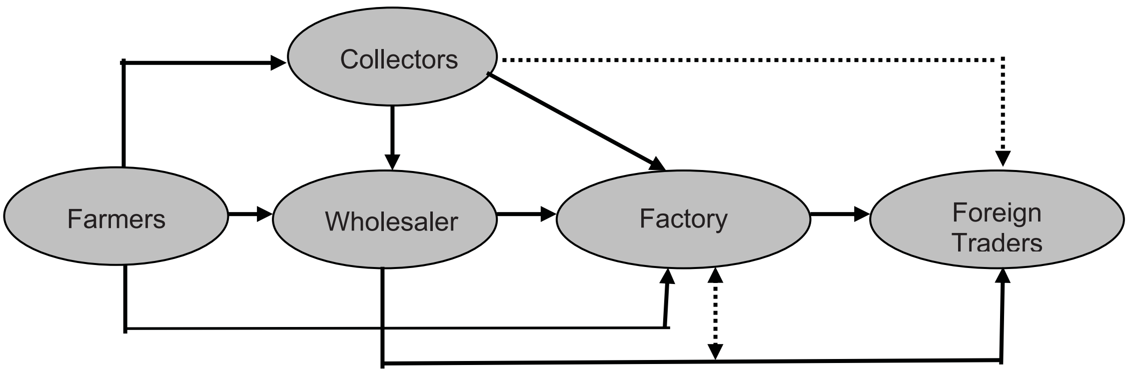
4.2. Trade in Rubber

4.2.1. Marketing chains

Mapping routes from farms to point of export

From farm to export, there are several significant players as shown in figure 5.1. Rubber farmers whose farms are close to the factory sell their product in the form of latex, while those whose farms are far from the main street and factory need to convert rubber latex into solid form before selling. In order to transform latex into solid mass, 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 5.1: Flow chart of rubber products in Cambodia



Farmers at present have more choices in terms of to whom they want to sell their produces. This is the result of the free market economy that allows many traders and enterprises to access and buy product in one area. According to the survey, majority of farmers (63%) sell their products to wholesalers (those who have a network to buy latex at farm and sell it to factory). Thirty percent of farmers (mainly those whose farms are close to the factory) sell their products directly to factory. Another 7 percent of rubber farmers sell to different collectors.

Table 5.1: Rubber market for farmers

Types of person farmers sell products to	*Percent*
Processors or factory	30
Collectors	7
Wholesalers (buy for processing and then sale)	63

Source: CDRI's rubber farmers survey in 2007

Wholesalers buy latex from smallholders for sale to the factory or transport to factory for processing and then export. As for small collectors, they buy latex from farmers and sell such to wholesalers and factories in their areas. However, there are some collectors who buy rubber for sale to Vietnam. This is illegal but it actually happens. They transport rubber on motorbike which can carry up to 300 kg per motorbike. One wholesaler can buy between 10 to 20 tonnes a day but the volume can be reduced to around 10 tonnes a day when small collectors are active.

Cambodia exports an unrecorded amount of rice and other agricultural products to Thailand and Vietnam but there are no recent official data regarding the unrecorded exports of those products.[9] This is not exceptional to natural rubber. In 2004, Cambodia recorded 39 million dollars of rubber exports, while 76 million dollars went unrecorded. However, the gap of recorded and unrecorded data has been reduced in recent years. It still remains high though. According to the study's estimation, the unrecorded amount is as much as the recorded amount.

4.2.2. Processing

So far, rubber produced in Cambodia is for export only due to lack of capacity and investment in processing natural rubber into consumer products such as car tire. Only semi-processed (dry) rubber, not latex, is allowed to be exported. All state-owned enterprises have rubber processing factories. Government has issued a ban on export of unprocessed rubber and this leaves rubber smallholders little choice but to sell their collected latex to state-owned and private enterprises for processing and export. Apart from rubber processing, there is also processing of rubber trees into furniture. However, most of the rubber trees are for export to Vietnam where they are manufactured into furniture.

Cambodia produces and exports mostly TSR5 and TSR5L, which represent about 80 percent of total export volume.[10] However, the share of these two types is only about five percent of total world demand. If Cambodia wants to capture more market in the future, it should consider producing other types (e.g. TSR 10 and TSR20) that have high world demand for tire production.

4.2.3. Costs and margins

Farm gate prices

According to the farmer survey, rubber farmers can sell their latex at around 1,750 dollars per tonne of dry rubber content (DRC) at farm gate.

9 FY 2006 Country Commercial Guide for Cambodia; available at http://cambodia.usembassy.gov/
10 The figure was for 2005, extracted from EIC (2007).

Middlemen

Middlemen or wholesalers buy latex and transport it to storage. Collection of latex from farm, transport, drying and storage cost about 125 dollars per tonne of DRC.

Processing

Processing of rubber into dry rubber (rubber block) cost about 100 dollars per tonne of DRC. Processing cost was higher several years ago at 125 dollars per tonne. Lower processing cost is a result of competition among factories and availability of cheaper electricity from Vietnam.

Exports

Officially, only rubber block (dry rubber after semi processed) is allowed to be exported. However, illegal raw solid rubber export to Vietnam still exists and it was estimated that about 500 kg of solid rubber was sold to Vietnam daily during harvesting season.

Sale price in 2005 was at $1,391/tonne, up from $1,175/tonne in the previous year. The price has increased up to $2,330/tonne during the time of survey. Exported rubber is subjected to duty at the rate of 10 percent. Usually, exporters use big truck to transport rubber block from factory to Vietnam. The transport cost on paved road is estimated at 3-4 dollars per tonne over 10 kilometres.

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 for rubber in China. Rubber from large Cambodian companies is exported to China or Malaysia through Vietnam. As for rubber from small companies, Vietnamese companies buy them for exporting to China.

5. Policy Recommendations and Conclusions

For Cassava

Cassava crop in Cambodia has witnessed impressive development in recent years with rapid increase in production, productivity, and export volume. The total national production quantity in 2006 jumped to 2.19 million tonnes with average productivity at 22.7 tonnes per ha. While cost of production varies considerably across provinces according to geographical conditions and cultivation practises (USD 464.8 per ha for Battambang and USD 329.1 per ha in Kampong Cham), farmers’ margins do not differ significantly and are about USD 340 per ha on average.

Although many trade statistics suggest that Cambodia has exported limited volume of cassava to few markets mainly Indonesia and Malaysia, substantial exports have taken place through informal cross-border trade to Vietnam and Thailand, and these have not been properly recorded in official trade statistics. Exports are in fresh or dried cassava chip without going through processing stage. With very limited number of enterprises involved in cassava processing and exports, the value added in cassava value chains is low.

In the DTIS 2007, cassava is identified as a major export sector that has high export potential with considerable impact on human development in Cambodia. This is largely because the country has good capacity to produce cassava at comparable level in the region (production cost and productivity are somewhat comparable with those in Vietnam and Thailand) and global demand for cassava is on upward trend. In terms of market access, many countries including ASEAN members, EU and China have provided Cambodia with tariff preference for its cassava exports either under regional free trade agreements viz. AFTA or ASEAN-China FTA or under GSP programs of developed countries for LDCs. These certainly become strong push factors prompting the country to develop cassava production and enhance cassava exports at greater value added.

There are actually certain severe limitations and challenges that constrains Cambodia from fully achieving the potential of cassava and these are summarised as follows:

Absence of a clear policy and institutional framework: While the nation 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 for the development of resource-and technology-based production systems including ago-industries have not been developed. There is neither solid legal framework nor clearer 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 country's hygiene requirements, obtaining such certification or so-called SPS certificate is so time-consuming, costly and entails difficult process for enterprises. This is primarily because of limitations in capacity and facilities of the responsible and supporting institutions.

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

Inadequate extension services: The arrangements and 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 extending 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: Market mechanisms to facilitate the movement of agricultural products from farmers to end-users (both domestic and international markets) do not function well (Hing & Nou, 2006). Farmers seem to have less bargaining power than middlemen, 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 Organization (FAO), 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 constraining easier access to production centres. This resulted in higher transaction cost, unequal access to production base among processing factories in urban areas and adjacent foreign traders, and greater informal cross-border trade at lower value added.

The government has strongly recognized these challenges as clearly articulated in various socio-economic development plans (SEDP I, SEDP II, NSDP) as well as trade strategies. Those policies have even proposed clear priority policy actions and strategies aiming at developing the agricultural sector and promoting agriculture in the context of regional and global trading systems. On enhancement of agricultural sector, priority agendas include development of comprehensive sectoral 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 infrastructures. On agricultural export development, priority actions are improving market access and maximizing benefits from preferential trade, better trade facilitation and building up regulatory framework and institutional capacity to better implement trade policy.

Past experiences suggest that the government had very good and fairly comprehensive policies pinpointing critical problems, but it paid little attention to implementation issues. Although the government has made good progress on many priority actions and reform programs, the outcome would be much better if they are more effectively implemented. In this context, it should be the 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 if effective implementation is sought.

Strong leadership: This is one of the critical elements of successful regulation enforcement and reform programs especially so in the case of Cambodia given the country's political and economic context.

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

Sufficient financial and human resources: Resource mobilization needs to be strengthened in the process of policy implementation. This can be done through either increasing government budget or seeking more development assistance from donor communities.

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

For Rubber

Cambodia's rubber industry is identified in DTIS 2007 as a sector that has high export potential. Domestic supply conditions are scored high with the following strengths and opportunities: comparable quality of raw rubber; high potential for expansion of planted areas; potential future development of value-added rubber industry; and trends toward full privatization of state-owned enterprises (MoC, 2007). Notwithstanding the priority actions suggested in DTIS 2007, several policy recommendations are raised hereunder to particularly address critical problems and challenges facing rubber farmers as well as exporters.

One major problem that this study, together with other relevant publications,[11] has identified concerns productivity. The average yield of rubber in Cambodia is low as compared to major rubber producing countries in the region. This is largely attributable to the existence of rubber trees with age of over 25 years, and use of low-yield seed. The latter factor often happens with smallholders. According to the study, about half of rubber smallholders could not afford to buy rubber seeds but use mixture of different types of seeds collected from other farms. Such practice costs them less but provides lower yield.

Two possible policies could effectively address the problem of low productivity. First is to provide high-yield rubber varieties to smallholders. That can be done through government or donor's assistance project to support rubber smallholders or/and project that aims to provide low interest credit for rubber farmers who lack sufficient resources for plantation. Second policy is the promotion of research and development in rubber varieties and cultivation practices. Government needs to enhance rubber research activities through strong funding support for the Rubber Research Institute of Cambodia (RRIC) and to promote the application of new rubber clones in both smallholder and private estates.

Another critical issue that deserves policy attention concerns marketing chains and export costs. Rubber farmers, smallholders in particular, lack information on price and market trends leaving them at a disadvantage when they negotiate a price for their latex. 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' organization. Assistance at the early stage is needed to enhance the better functioning of the organization towards becoming an independent and self-supportive institution. A farmers' organization would be the appropriate institution that can better address issues relating to the market and marketing information as well as cultivation and management.

Rubber exporters also face certain critical challenges that need policy emphasis. First, the quality of latex varies, with those collected from smallholders in particular containing lower quality. Second, rubber processing has not been fully operated. Third, cost of export remains high and therefore competitiveness low. Transportation cost, customs clearance and logistic efficiency remain critical challenges to improving the sector's export price competitiveness. Albeit improved, the performance of Cambodia's rubber sector tends to remain poorer than those of the major producing countries in the region. Fourth, a considerable proportion of Cambodian rubber export price is devoted to hidden expenses, domestic sales tax, and export tax, regardless of customs efficiency and logistics competence. Natural rubber is exported

11 See EIC (2007) and MOC (2007) for instance.

through two channels, namely Sihanoukville sea port and Vietnamese border. Hidden costs are incurred through both channels and represent about 5 percent of the total fob value. (Khun et al. 2008:19-20).

Enhancing the quality of processed rubber must be priority action. Recent admission of Association of Rubber Development of Cambodia (ARDC) to the International Rubber Association (IRA) is regarded as a good starting point to quality improvement and facilitation of rubber trade. But much remains to be done for Cambodian Rubber Research Institute (CRRI) to gain accreditation from internationally recognized standard organizations like IRA.

Reducing export cost must be included in the priority policy agenda if the government is to promote rubber exports. Cambodia's rubber competitiveness is low compared to Vietnam's and Thailand's. High export cost is one of the major factors contributing to weak performance. There has been notable achievement in the government's effort to enhance trade facilitation. Yet, certain critical issues such as eliminating hidden cost, improving efficiency of logistics, and enhancing transportation cooperation with neighbouring countries such as Vietnam should be priority actions for promoting exports in general and for raising rubber competitiveness and materializing 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				

1

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

Agricultural Trade in the Greater Mekong Sub-region: The Case of Natural Rubber and Cassava in China

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Cambodia, Vietnam, Lao PDR, Thailand and China

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Contents

Abbreviations and Acronyms

ASEAN	Association of Southeast Asian Nations
CDRI	Cambodian Development Resource Institute
DAN	Development Analysis Network
GDP	Gross Domestic Product
EHP	Early Harvest Program
FME	Faculty of Management and Economics
FTA	Free Trade Agreement
GMS	Greater Mekong Sub-region
KUST	Kunming University of Science and Technology
kW	Kilowatts
NR	Natural Rubber
R&D	Research and Development
RMB	Renminbi
RSS	Ribbed Smoked Sheet
SCR	Standard (__________) Rubber
TNSR	Technically Specified Natural Rubber
US	United States
VAT	Value-Added Tax
WTO	World Trade Organization

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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 trade in the international trade of agricultural products keeps increasing, particularly with regard to the import of agricultural products into China. In 2006, the total value of agricultural product imports into China from ASEAN countries reached 495 thousand yuan, 2.3 times more than from the European Union. This made ASEAN countries the number one import zone for China's agricultural products.

Mutual agricultural product trade developed at a fast pace thanks to the implementation of the Early Harvest Program (EHP), the pioneering program of the China-ASEAN FTA. From 2002 to 2006, the total annual trade value, import value and export value of China-ASEAN agricultural products increased by 20.9%, 29.3% and 18.6% respectively. The trade deficit of the China-ASEAN agricultural product trade keeps increasing, and is claimed to be the main factor contributing to the trade deficit of China's global agricultural products. In 2006, the deficit of the China-ASEAN agricultural product trade was 1.9 billion US dollars while the total deficit of China's agricultural trade was only 0.96 billion US dollars. The increasing trade deficit indicates that the ASEAN countries have begun to rely more on the Chinese market for their domestically produced agricultural product sales.

As well as being the main ASEAN countries to export agricultural products to China, Thailand and Vietnam are also China's fellow member countries comprising the Greater Mekong Sub-region (GMS). In 2006, Thailand and Vietnam ranked 8th and 20th as the biggest markets for China's agricultural product imports. The agricultural product trade value between China and the two other GMS member countries, Lao People's Democratic Republic (Lao PDR) and Cambodia, increased annually even though the present value is comparatively small. To meet the expanding domestic demand driven by its fast economic development, China mainly imports agricultural products used as resources or industrial raw materials. Natural rubber and cassava are the two main agricultural products which China imports from fellow GMS member countries.

In 2007 natural rubber imported from Thailand and Vietnam accounted for 33% and 3% respectively of the total amount of China's natural rubber imports. In 2006, China imported four times more Technically Specified Natural Rubber (TSNR) from Cambodia than in 2005, although only a few Ribbed Smoked Sheet (RSS). RSS from Lao PDR is the main imported natural rubber variety from said country and it has a 2% share of China's global RSS imports. Lao PDR also began to export TSNR to China in 2004.

The imported quantity of dried cassava from Thailand and Vietnam accounted for 78% and 19% respectively of China's total cassava import in 2006. Cambodia does not currently export cassava to China but Lao PDR 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 farmers' incomes and national revenue. The project "Agricultural Trade in the Greater Mekong Sub-Region: Case-studies of Rubber, Cassava and Cattle" is one of the continuing regional research series housed under the 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 team from the ASEAN Regional and Industrial Development Research Centre, which is 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 pointed out earlier, natural rubber and cassava are China's two major imported natural products from the other four GMS member countries. As China is positioned at the high end of the value chain, the situation of demand and downstream industry in the country will be analysed.

Following this introduction (Part 1) and the discussion of the methodology (Part 2), Parts 3 and 4 of this report present China's production, consumption and trade of natural rubber and cassava. The production situation is presented to show the limited domestic supply. The discussion on consumption on the other hand focuses on present demand and the development of the downstream industry in related products (e.g. tyres, cars, ethanol, fuel ethanol etc.) Factors driving the development of the downstream industry in China, along with demand forecasts, show the great potential demand for natural rubber and cassava in China. Finally, the discussion on rubber and cassava trade looks at the import varieties, value and quantities, and ports. Also, the mapped routes from the import port to the end users clearly show the marketing chains after the products' arrival at the Chinese port. The sub-sections on costs and margins in Parts 3 and 4 present the changes to the import price and the cost structure of the imported products after arrival at the domestic factories. It is not surprising to find that the imported prices of natural rubber and cassava play a significant role in the final cost structure of the end products in the related downstream industries, industries which use natural rubber and cassava as the raw material.

Part 5 puts forward policy recommendations for the further development of regional agricultural trade and related industries. This is based on the review of the existing policies.

1.2. Objectives

This report is designed to give an overview of China's natural rubber and cassava production, consumption and trade with other GMS member countries.. The specific objectives are: (1) to understand the domestic production, consumption and demand situation 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 the regional trade situation; and (4) to provide policy recommendations for the future expansion of related product trade in the regional areas from the demand side.

2. Methodology

This study was primarily based on existing literature and collected primary data. Data were collected through in-depth interviews with various stakeholders in different aspects of the trade in raw material and the production of and trade in downstream products, Two different methods were used in this study:

a) Desk research: This was a review of the existing literature concerning natural rubber and cassava production, and the development of downstream industries.
b) Fieldwork interviews and surveys: The fieldwork interviews and surveys were conducted at Yunnan natural rubber farms and processing factories, and ethanol factories located in Hekou city. The purpose was to examine the primary data for the cost information.
c) Semi-structured interviews: The semi-structured interviews were undertaken with the natural rubber producers, rubber traders, cassava traders, tyre manufacturers and exporters, and ethanol factories located in Anhui and Yunnan Provinces in order to uncover 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 located 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 ranked number 5 in the world.

Table 1: Natural Rubber Production in the Main Provinces in China

Province	2000			
	Cultivated area	Harvested area	Yield	yield per hectare
	1,000 hectares	1,000 hectares	1,000 tons	Ton/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 the total cultivated area of natural rubber in China was 1315.10 thousand hectares, and the production was 593.50 thousand tons. This was an increase of 109% and 22.9% respectively compared with 2000. The total production in 2007 ranked fifth in the world and represented 5.89% of the total global natural rubber production. Affected by typhoon "Weida" in 2004, the natural rubber production of Hainan Province dropped significantly in 2005 and resumed gradually in 2006 and 2007. However, due to the cold, snowy winter in 2007, production in 2008 was estimated to drop.

Table 2: Natural Rubber Production in China

Year	Cultivated area	Harvested area	Yield	yield per hectare
	1,000 hectares	1,000 hectares	1,000 tons	Ton/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: The statistical annual report of the Ministry of Agriculture of China.

Table 2 shows that the cultivated area and production maintained stable levels before 2003. The increased production was generated by the 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 really suitable for natural rubber production. Frequent typhoons in Hainan destroy the natural rubber trees while frost descends in the winter time in Yunnan Province. The frosts negatively influence natural rubber production because the cultivation areas are located in mountainous land, 600 metres above sea level.

3.1.2. People Engaged in Natural Rubber Industry

Presently there are more than 150 rubber farmers and about 180 thousand households engaged in natural rubber cultivation. Among the 6 million people involved in the natural rubber industry in China, 1.5 million are engaged in natural rubber planting, about 600 thousand are engaged in the natural rubber products industry, and another 4 million are engaged in related industries such as technology services, transportation and equipment manufacturing.

3.1.3. Development of the Private Sector

In China the state-owned rubber farms have contributed to the improvement of infrastructure in local areas, while the private rubber industry has been an important driving factor in the further development of the natural rubber industry. By the end of 2005, the privately owned rubber-cultivated area in China was 300 thousand hectares, representing 40.5% of the total rubber-cultivated area, and the yield accounted for 38.5% of the total. Driven by the increasing market price, individual households have shown great enthusiasm for fostering natural rubber production. Additionally, more farmers are attracted by the characteristics of the natural rubber industry, such as less input, small market risk and long economic life. The private rubber industry has more room for development in terms of technology, production and cultivation size. As a result, it has played an important role in increasing farmers' income, improving their well-being, promoting the development of rural areas and guaranteeing social stability. Let us take Xishuangbanna Prefecture as an example. It is the most important rubber base in Yunnan, accounting for 75% of the total rubber production there. In 2005, the rubber industry provided a net income per capita of 615 yuan for all 280 thousand people in the Prefecture, which represented 27.8% of farmers' net income per capita. In 2006, it provided a net income per capita of 875 yuan; an increase of 43% compared to the previous year.

3.1.4. Natural Rubber Varieties in Chinese Market

Natural rubber is classified into Latex, RSS and TSNR or Standard Rubber (SCR). RSS and TSNR have the highest consumption rate in the international market. The 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. The grade, origin and purpose of use of different natural rubber varieties which are mainly consumed in China's market are presented in Table 3.

Table 3: Grade, Origin and Purpose of Use of Natural Rubber in China

		Main Domestic Produced Varieties	Main Domestic Consumed Varieties	Main Import Varieties	Purpose of Use
RSS	RSS1				Medical products, inner tyres etc.
	RSS2				Inner tyres and other industrial products
	RSS3		√	√	Tyre tread, rubber pipes etc.
	RSS4 and RSS5				Low quality rubber products
TSNR or SR	SR5	√	√		High quality industrial products, such as engineering seat etc.
	SR10 and SR20	√	√	√	Tyres , conveyer belts etc.
	SR50	√			Low quality rubber products

Source: China Rubber Industry Association

3.1.5. Constraints and Opportunities

3.1.5.1. Constraints

To begin with, the size of low-yield rubber farms occupies a large percentage of the aggregate. China currently boasts 1.95 million mu (about 0.13 million hectares) of old rubber farms, which have a yield of 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 plants and underdeveloped rubber tapping techniques, their production potential has not been fully realised.

Secondly, the planting areas for natural rubber are poorly distributed and there are not many choices for new cultivated varieties of rubber plants. Take Hainan, the province with the biggest natural rubber cultivation, as an example. The factors leading to the lack of choices and new cultivated varieties include the rubber planters' ignorance about the growth of rubber plants, insufficient knowledge about the conditions of natural rubber planting, and their prevalent practice to plant rubber in the eastern part of Hainan, which is subject to typhoons. Consequently it takes a long time to promote the superior and new breeds of natural rubber in this Province, and high-quality standard rubber depends on imports in the long term. All these are the outstanding contradictions between the mix of natural rubber products and the market demand in China.

Thirdly, the overall benefit of the natural rubber industry is far from substantial. The staple products of the natural rubber industry include rubber, wood and seed oil as sideline products. To date, less attention has been paid to the growth and plant-preserving volume of natural rubber in China. For example, of the furniture exported from Malaysia, about 70%-80% is made of natural rubber wood and the value of exported rubber wood furniture from Malaysia amounts to US$2 billion per year.

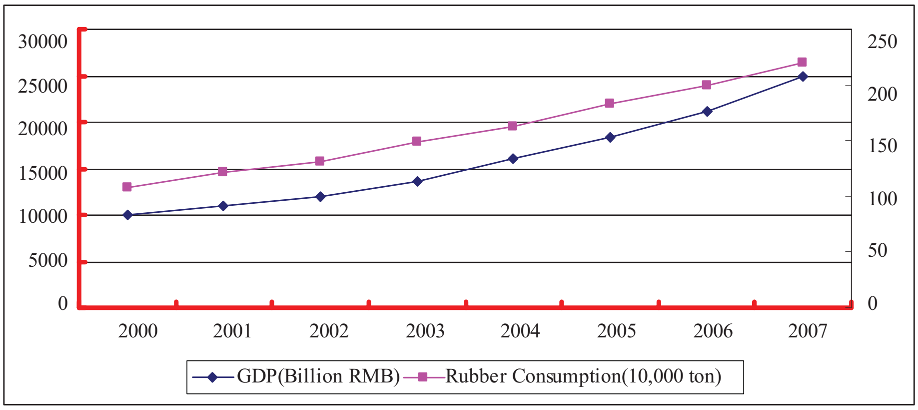
Finally, rubber processing factories in China do not have a large production scope and the research and development (R&D) of related products is inadequate. The average processing capability of the rubber processing factories controlled by state farms is only 1600 tons per year, though the total number of such factories is 324. In comparison, the annual rubber production of the main rubber planting countries in Southeast Asia exceeds 10 thousand tons. The small scale operation of rubber processing factories in China finally results in a higher cost of production and poor quality.

3.1.5.2. Opportunities

As one of the strategic resources in the world, 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 natural rubber consumption level. In most cases, whenever aggregate GDP grows by 1%, China's domestic natural rubber consumption rate increases by 0.9% accordingly (See Figure 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. In 2008, China is estimated to enjoy an annual economic growth rate of more than 10%. Hence, the total natural rubber consumption level in China will still see a moderate increase.

Figure 1: Natural Rubber Consumption and GDP in China, 2001-2007



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 tons. China took the greatest amount of this, 22.7%, with a total consumption of 2.19 million tons. The second biggest consumer was the United States (US), whose natural rubber consumption was 1.145 million tons, comprising 11.8% of the total world consumption. Japan came third (See Table 4).

Table 4: Natural Rubber Consumption in the World, 2000-2007 (10,000 ton)

Countries	2000	2001	2002	2003	2004	2005	2006	2007
World	732	719	754	795	828	874.2	920.2	967.2
China	108	121.5	131	148.5	163	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	71.7	74.5	78.6	82.8	87.4
% of China' consumption of the world	14.8	16.9	17.4	18.7	19.7	20.9	21.8	22.7

Source: International Rubber Study Group

With its huge population and rapid economic development, China is the greatest consumer of natural rubber in the world. By 1993 China's demand for rubber had exceeded that of Japan and was second only to the US. Since 2001 China has replaced the US as the largest consumer of natural rubber in the world (rubber demand in 2001 was 1.215 million tons while that of the US was 0.974 million tons). Presently, despite only producing 7% of the world's natural rubber, China uses 20% of the world's total natural rubber and consumption keeps increasing at an average of 11% per year.

3.2.2. Self Supply Rate of Natural Rubber in China

Driven by increasing demand, the natural rubber self-supply rate of China declined from 44.7% in 2000 to 27.1% in 2007. Statistics also show that 72.9% 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 tons in 2010, 3.5 million tons in 2015 and 4.5 million tons in 2020. Also, the World Rubber Research Organisation estimates that the Chinese 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 for further production expansion in China because of the limited rubber cultivation area and scale of planting. Besides, the potential production peak of natural rubber in China is only 800 thousand tons. Therefore the gap between domestic supply and demand will continue to widen, and China will become more dependent on the international natural rubber market in the long run.

Table 5: Domestic Natural Rubber Production and Consumption in China, 2000-2007

Year	2000	2001	2002	2003	2004	2005	2006	2007
Production (10,000 tons)	48.31	47.75	52.74	56.5	57.55	51.10	53.79	59.35
Consumption (10,000 tons)	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-supply Rate (%)	44.7	39.3	40.3	38.1	32.3	28.0	26.6	27.1

Resource: Production statistics are from the statistical annual report of the Ministry of Agriculture of China and 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) it is clear to see that tyre-making is the top driving force for natural rubber consumption, with 68% 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 it can be concluded that 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 saw a huge increase in the purchase of private cars after 2003 which, to a large extent, encouraged the production of rubber. Although the Chinese tyre industry has been plagued by trade barriers and anti-dumping charges, the restructuring of domestic tyre enterprises has got under way. The production and export of high value-added tyre products such as radial tyres maintains a stable momentum of growth.

Table 6: Percentage of Natural Rubber Consumption in Main Rubber Products in China, 2007

Rubber Products Categories	% of NR Consumption	Areas of the Factories' Location in China
Tyres	68%	North and East of China such as Shandong, Jiangsu, Zhejiang
Rubber products for industrial use, pipes etc.	13%	Country wide
Rubber products for daily use, shoes etc.	8%	Country wide
Latex products	8%	Country wide
Others	3%	
Total	100%	

Source: China Rubber Industry Association

Presently China's tyre production 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 RSS from Thailand (RSS3) is mainly used to make the tyre tread. The domestically produced SCR5 is equal to RSS3 in terms of 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 lowered export tax rebates and the soaring price of raw materials like natural rubber, continued their rapid development and improved performance.

3.3.2.1. Production of the Tyre Industry and Other Rubber Products

As the main rubber product, tyres account for almost 70% of the total natural rubber consumption. The table below shows that tyre production in recent years has maintained a stable and rapid growth, especially the production of radial tyres which enjoys an annual increase of 20%, revealing the further upgrading of product structures in the tyre-making industry (See Table 7

and 8). Table 9 also shows that production of non-tyre rubber products has maintained a 7% increase in recent years.

Table 7: The Tyre Production in China, 2002-2007 (Unit: 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 8: Motorcycle Tyre Production and Force-propelled Vehicle Tyres, 2002-2007 (Unit: 10,000 pieces)

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 9: The production of Non-tyre Rubber Products in China, 2002-2007

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 Tyre Industry and Other Rubber Products

Tables 10 and 11 indicate that the export of tyres and rubber conveyer belts has enjoyed a year on year increase. In 2007 exported tyres accounted for 47.56% of the total production, an increase of 30.8% from the previous year. Additionally the export of another two major rubber products, the conveyer belt and V belt, increased by 12.4% and 32% respectively in 2007.

Table 10: The Volume of Tyre Export, 2002-2007 (Unit: 10,000 pieces)

Year	Export Quantity	% of the Total Production	% Change from the 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 11: Rubber Conveyer Belt Export of Member Enterprises, 2002-2007

Products	2002	2003	2004	2005	2006	2007
Conveyer belt 10,000m^2	284	372	594	856	1199	1369
% change	-14.7	40.0	59.7	44.1	40.1	14.2
V belt/ 10,000A 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 Further Development of the Rubber Industry in China

3.3.3.1. The 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% in 2007 marked the fifth consecutive year that China's economic development maintained a more than 10% increase. Although further macro-control policies have been decided at the Economic Affairs Conference held by the central government, China's economic development is forecast to maintain a high growth rate which will fuel the further stable development of the rubber industry in China.

3.3.3.2. The Development of the Automobile Industry

As the backbone industry 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% increase compared with the previous year. With further market expansion in 2008, the production target of 10 million cars will be hit or approached. 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 gone into the international market. Since 2006 China's automobiles have been exported to other countries in large quantities. Automobile exports in 2007 reached 600 thousand, or 7% of the total production. 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 12. Automobile Demand, Production and Ownership in China, 2005-2010 (Unit: 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. The Stable Development of Highway Transportation

China will continue to implement the principle of giving higher priority to the development of highway transportation, further upgrading the highway network, focusing on the construction

of a national expressway network, and further improving the highway network at national and provincial levels. 2007 saw the basic link-up of five highways running from north to south and seven horizontal lines running from east to west, forming national main highway networks, among which 76% of the roads are expressways. The total extension of China's expressways reached 53,000 km, ranking second in the world. The construction of more roads will significantly increase the demand for rubber products, such as tyres and rubber, which are needed in construction projects.

3.3.3.4. The Stable Development of Related Industries

The industries that have an intimate relation with rubber production, such as coal, electricity, construction materials and machine-making, still enjoy stable development and will continue to drive the demand for rubber pipes and other rubber related products. 2007 saw China's coal production reach a historical peak of 2.4 billion tons, a 9% increase compared with the previous period. In the same year, crude steel reached 480 million tons, a 14% increase compared with the past year; raw steel produced by furnaces, estimated to be 465 million tons, showed a 12.4% increase from its level in 2006; and the power-generating volume amounted to 3.1849 trillion kilowatts (kW) per hour, an increase of 15.8% compared also with the previous period. By the end of 2007 the total installed capacity of power plants approached 7 billion kW and increased several fold in 5 years, which is a unique achievement during the past 50 or 100 years. It is predicted that the aforementioned sectors will maintain a sound momentum of growth in 2008.

3.3.3.5. Investment from Foreign and Private Sectors

Chinese private enterprises have increased their investment in the tyre-making industry in China, which will accelerate the development of the rubber industry in the country. This is in addition to the business expansion of established foreign enterprises such as Michelin, Goodyear, Bridgestone, Coopertire and Pirelli.

3.3.3.6. Further Expansion of Rubber Products Export

Recent years have witnessed more and more anti-dumping charges involving exported rubber products such as tyres made in China. What is worse, from June 1 2007 China lowered its export rebates concerning tyres and other rubber products from 13% to 5%. All these have cast a shadow over the export of rubber products. However, thanks to the structural upgrading of rubber products such as tyres, the quality of Chinese rubber products is approaching international levels and the products' competitiveness is improving. The export volume of rubber products will be stabilised at a beneficial level with the gradual reduction in trade friction.

3.3.4. Forecast of the Future Demand for Rubber Products

In summary the rubber industry in China faces more opportunities than challenges, and will see more benefits than risks in the future. The total increase in the industry will be about 5-10%. Tyre-making will be a fast growing sector and its production annual growth rate will be maintained at 10-15%.

The continuing demand for rubber in coming years will not fluctuate but will slow somewhat over time. Rubber consumption in 2008 will exceed 5.4 million tons, including 2.38 million tons of natural rubber and 3.02 million tons of synthetic rubber. It is predicted that by the year 2010, 6.45 million tons of rubber will be consumed, including 2.80 million tons of natural rubber and 3.65 million tons of synthetic rubber (See Table 13). It is not difficult to conclude that 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 2008-2010.

Table 13. Predicted Future Rubber Demand in China, 2006-2010 (Unit: 10,000 tons)

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

*Source: Calculated based on the Statistics provided by China Rubber Industry Association. Statistics with * are estimated.*

3.4. Trade and Marketing of Natural Rubber

3.4.1. General Rubber Import Situation

3.4.1.1. Import Values

Recent years witnessed the rise of rubber product imports in China, and the average annual growth rate of rubber product import value rose to 27% from 2000 to 2007. In 2007 the total value of rubber product imports was US$9589.32 million, a 13.5% rise compared to 2006. The import value of natural rubber reached US$3257.50 million, accounting for 34.0% of the total value of rubber product imports.

Table 14: Rubber Product Import to China from the world in USD

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% of the total import value. Malaysia and Japan represented 14.88% and 12.40% respectively. According to China Customs, 80% of the rubber products that China imported from Thailand were natural rubber (4001). China imported Synthetic rubber (4002) and Articles Nesoi of Unhardened Vulcanised Rubber (4016) from Japan. In addition China also imported rubber products from Vietnam, Lao PDR and Cambodia. Although the import value from those countries represents a comparatively small share, the overall increase is clearly observed (see Table 15).

Table 15: The Import Sources of Rubber Product for China in USD

Partner Country	$US million			% Share			% Change 2006/2007
	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
S. 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
Lao PDR	4.2	12.1	12.9	0.08	0.14	0.13	6.61
Cambodian	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

2006 witnessed changes in the natural rubber import varieties. The imported TSNR, or standard rubber, represented 63.6% of the total imported natural rubber quantity. The imported RSS represented only 17.4%. It is worth noting that RSS used to be the main imported natural rubber for China, but its imported quantity has been in constant decline since 2003. Table 16 shows clearly the change in the imported natural rubber varieties, reflecting the changes in demand of imported natural rubber in the Chinese market. As mentioned in Section 3.3, the production and export expansion of radial tyres is the major driving force behind the demand for natural rubber. With technological improvements and product structure upgrading in the domestic tyre industry, the proportion of the import quantity of RSS which is used to produce the tyre tread gradually decreased, while the import quantity of TSNR which is suitable for producing radial tyres kept increasing.

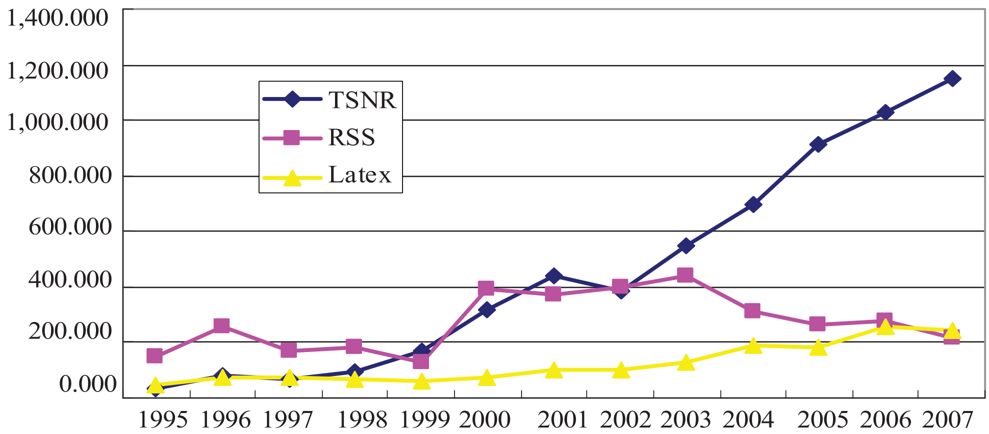
In 2007 the total natural rubber import quantity increased by 2.2% compared to 2006. Despite the increase, this actually indicates a significant deceleration, as the NR import growth rate was 14.6% in 2006. One reason contributing to the deceleration of NR imports is the sharp increase in synthetic rubber imports. Many Chinese tyre manufacturers began to use synthetic rubber as a substitute for natural rubber because the product property of the synthetic rubber is acceptable for tyre manufacturing, and its import duty is only 5%. Furthermore, the imported RSS quantity kept decreasing while the TSNR kept increasing, indicating the continuous trend of 2006. The decline of the imported RSS, a 22.9% decrease compared to the previous year, is another factor which contributed to the reduction in the natural rubber growth rate in 2007.

Table 16: Natural Rubber Import Varieties and Quantities for China

Natural Rubber	Thousand Tons				% Share				% Change
	2004	2005	2006	2007	2004	2005	2006	2007	07/06
Total	1284.38	1406.77	1612.02	1647.54	100	100	100	100	2.2
NR* 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
NR 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

*Source: China Customs *NR: Natural Rubber; RSS: Ribbed Smoked Sheet;*
TSNR: Technically Specified Natural Rubber

Figure 2. Import Quantity of Different Natural Rubber Varieties for China, 1995-2007
(Unit: 1000 tons)



Source: China Customs

3.4.2.2. Main Importing Sources

In 2007 the main natural rubber importing sources for China were Thailand, Malaysia, Indonesia and Vietnam. They accounted for 97.4% of the gross import quantity. Thailand accounted for 45.6%, Malaysia 27.3%, Indonesia 19.0% and Vietnam 5.5%. The import quantity from Thailand was 751.52 thousand tons, reflecting an increase of 11.5% compared to 2006. The import quantity from Vietnam rose sharply by 86.3% in 2006 but the quantity dropped by 11.4% in 2007. The NR import quantity from Cambodia and Lao PDR represented a small share of the total import quantity, but the increasing trend to import from these countries was clearly observed.

Table 17: Natural Rubber Import Quantities for China from the World, Classified by Country

Partner Country	Thousand Tons				% Share				%Change
	2004	2005	2006	2007	2004	2005	2006	2007	06/07
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
Lao PDR	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 latter 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, Philippines and Myanmar amongst others. 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 tons of rubber - US$0.34 billion in value - from Mong Cai to China that year. This accounted for 43% 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 3 shows that most RSS is imported from Thailand, and the import quantity of RSS from Thailand represented 82.6% of the total RSS import quantity from the world in 2007. Figure 4 shows that the main TSNR exporters to China are Malaysia, Thailand and Indonesia. In 2007 the TSNR import quantity from Malaysia, Indonesia and Thailand accounted for 37.1%, 31.8% and 26.2% of the total, respectively. The large increase in TSNR import quantity from Malaysia was because the TSNR made in said country was particularly suited to radial tyre production, and was therefore well accepted by the Chinese market. Vietnam exports both RSS and TSRN while Laos mainly exports RSS. Cambodia mainly exports a little TSNR.

Figure 3: RSS Import Quantity from Main Import Sources, 2000-2007 (Unit: 1000 tons)

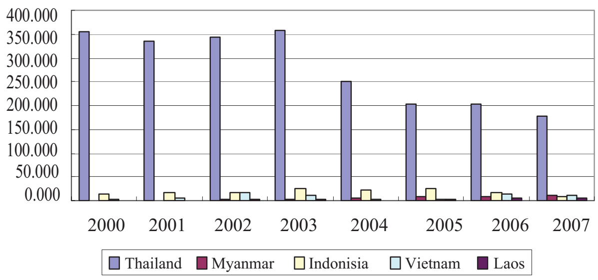
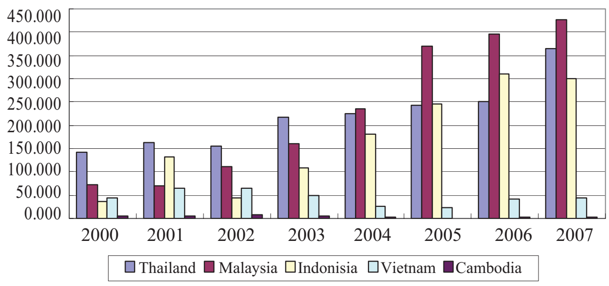


Figure 4: TSNR Import Quantity from Main Import Sources (Unit: 1000 tons)

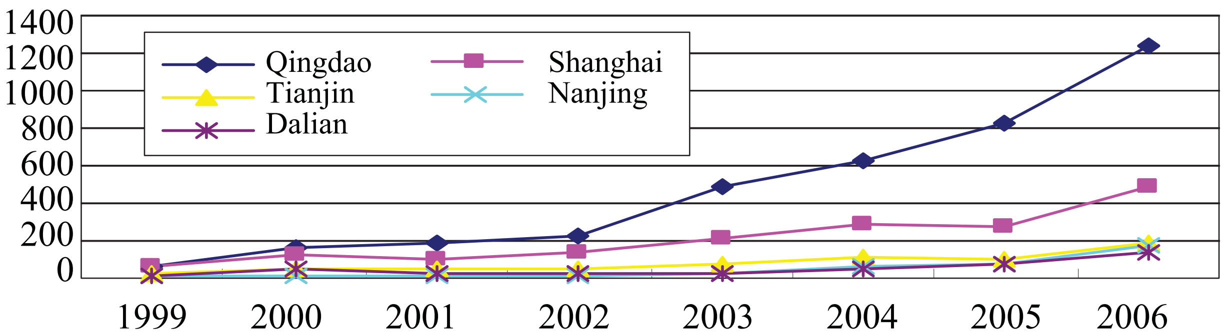


Source: China Customs

3.4.2.3. Main Natural Rubber Import Ports

The main natural rubber import ports in China are Qingdao, Shanghai and Tianjin. In 2005 the import value of natural rubber in Qingdao was US$819.5 million, an increase of 30.6% from the previous year and accounting for 44.2% of the total national import value. The import value of Shanghai and Tianjin dropped slightly and accounted for 15.1% and 5.7% respectively of the total. Natural rubber imported from Thailand enters China via Qingdao (44.9%), Shanghai (19%), Nanjing (10.7%) and Tianjin (4.6%). Vietnamese natural rubber comes in through Qingdao (44.2%), Nanning (20.6%), Shanghai (11.4%) and Kunming (2.6%). The main import ports for Malaysia are QingDao (56.3%), Shanghai (11.1%), Zhengzhou (4.6%) and Guangzhou (6%). The imported natural rubber is transported to Shandong Province where 41.4% of China's tyre factories are located, Jiangsu Province where 10.4% of the factories are located, and Zhejiang Province where 8.9% are located.

Figure 5: Main Natural Rubber Import Port in China

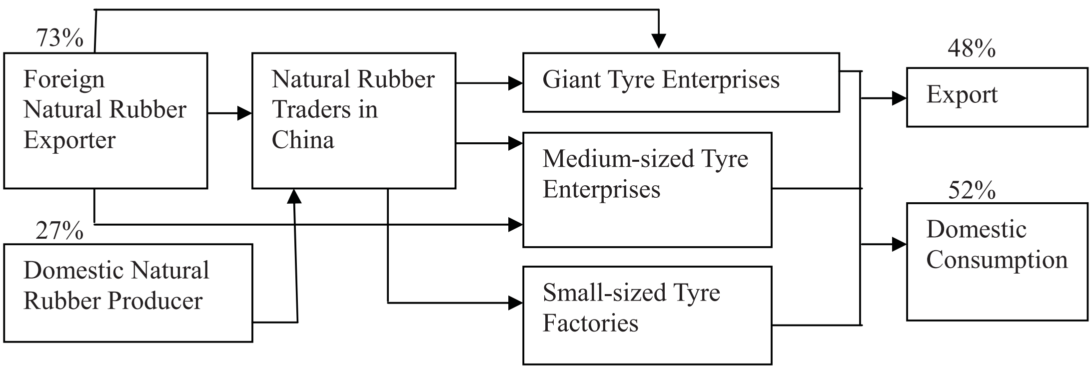


Source: China Customs

3.4.3. Marketing Chains

3.4.3.1. Mapping Routes from Import Port to the End Users

Figure 6: Imported Natural Rubber Mapping Routes from Import Port to the End Users



Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

Presently most tyre enterprises purchase domestically produced natural rubber from trading companies rather than directly from the domestic producer. The reason for this is that the domestic producers request advanced payment before the goods are delivered, while trading companies accept payment after the goods are delivered. For the purchasing of imported natural rubber, situations differ according to the size of the tyre enterprises.

Most of the giant domestic tyre enterprises, such as Triangle, Chengshan, Fengshen, Linglong, and Jiatong, import natural rubber directly from their foreign suppliers. Their import quantities of natural rubber are above 8,000 tons every month. Usually the giant tyre enterprises export high quantities of tyre products; hence they prefer importing natural rubber and processing materials supplied by clients which do not require an import duty. Some enterprises, such as Fengshen, have even established their own bonded factory. Generally speaking there are two options for purchasing. One option is to sign an annual agreement with a foreign rubber supplier to confirm the yearly purchasing quantity. Every month the price and shipping date will be confirmed according to the market situation. Another option is monthly purchasing based on the actual market price. The purchasing quantity of the second option is more than a thousand tons every time, which is very attractive to foreign rubber suppliers. All of the purchased products are contracted for forward shipment.

The medium-sized tyre enterprises purchase natural rubber by processing materials supplied by clients. Purchasing plans are made according to the production plan and material stock every month. Hence the purchasing is quite random. Because of capital limits, these enterprises always purchase the merchandise in a Bonded Zone directly from the domestic trade companies.

Small-sized tyre factories directly purchase from the domestic trade companies with monthly purchasing quantities between tens and hundreds of tons. Those who have an export business will choose the natural rubber stored in the bonded warehouse while others who do not export, or whose export is not sufficient, will purchase the synthetic rubber with the lowest import duty.

3.4.3.2. Natural Rubber Traders

Compared to production enterprises, the circumstances of domestic trade companies which deal with rubber trade are more complex. After the abolishment of the import quota system, more and more import and export companies that were involved in the rubber business were set up. Most of them were located in Qingdao, Shanghai, Tianjin, Xiamen, and Guangzhou. These companies have great differences 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 the business of tyre exports processed using imported natural rubbers

The existence of small foreign rubber companies and small domestic rubber processing enterprises provides a spacious room for the small trade companies. They established synthetic rubber processing factories, or united with domestic factories, by buying some shares. However,

foreign rubber companies have begun to establish branches or representative offices in the domestic market to get access to domestic terminal enterprises. The development of those small domestic trading companies is narrowed down accordingly.

3.4.4. Costs and Margins

3.4.4.1. Import Prices

Figures 7 and 8 clearly 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 $2020 / ton, an increase of 46% compared with the previous year. Prices of the imported RSS from different countries differed slightly, whereas there was little difference in TSNR imported prices.

Figure 7: RSS Import FOB Price from Main Export Countries 1996-2007 (Unit: US$/ton)

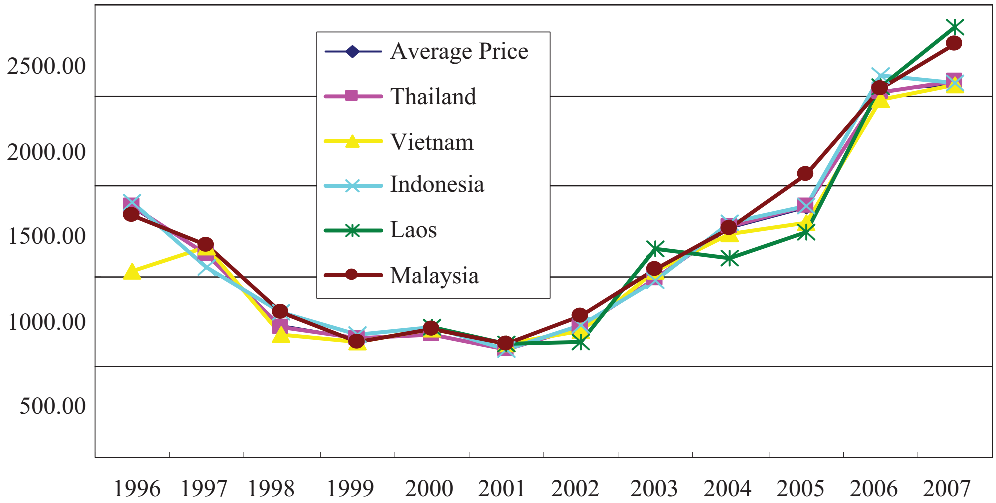
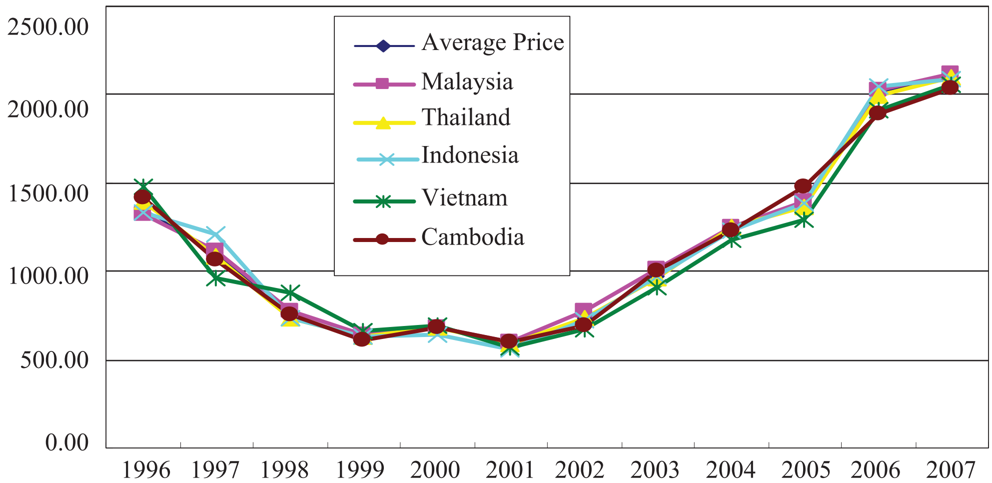


Figure 8: TSNR Import FOB Price from Main Export Countries 1996-2007 (Unit: US$/ton)



Source: China Customs

3.4.4.2. Cost Structure

a) Transportation cost

After arriving at the port in China most of the natural rubber is transported by train, as the cost is lower compared to transportation by bus. The transportation costs from Qingdao, the main natural rubber import port in China, to the area where the main tyre factories are located are indicated in Table 18.

Table 18: Transportation Costs from Qingdao to the Tyre Factory Destinations, 2007

Port	Destinations	By train			By bus		
		RMB/ton	USD/ton	Travel time	RMB/ton	USD /ton	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

** Average Exchange Rate in 2007: 1$ = 7.5RMB*

Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

b) Cost structure of the imported natural rubber 2006 (Thailand – China)

The tyre enterprises which import the natural rubber directly from abroad are all tyre exporters. By the method of processing trade, they import the natural rubber at a zero import duty. The value added tax (VAT) rate for the imported natural rubber is 17%. Hence the cost calculation of the imported natural rubber is as follows:

Imported natural rubber price = (FOB + Sea freight + Insurance) x Exchange rate x 1.17 + Port handling fee + Domestic transportation fee

Taking the average FOB price of imported natural rubber from Thailand in 2007 as an example, the final price of the natural rubber after arriving at tyre factories located in Shandong province from Qingdao differs slightly because of the different methods of transport. Calculation results are detailed in Table 19:

Table 19: Cost Structure of the Imported Natural Rubber from Thailand to China, 2007

Items	Cost		% of the total cost	
	By train	By bus	By train	By bus
Average FOB price/ton	$2,350			
Sea Freight and Insurance/ton	$40			
CIF Price/ton*	￥17,925（$2390）		74.5	74.2
VAT(17%)/ton	￥3047 ($406)		12.7	12.6
Import Duty (2600yuan/ ton)	￥2600 ($347)		10.8	10.7
Price after VAT and Import Duty/ton	￥23,572 ($3143)			
Port Handling Fee/ton	￥400 ($53.3)		1.6	1.7
Domestic Transportation*/ton	￥100 ($13.3)	￥180 ($24)	0.4	0.8
Final Price of Imported Natural Rubber/ton	￥24,072 ($3210)	￥24,152 ($3220)	100	100

** Average Exchange Rate in 2007: 1$ = 7.5RMB*

**The domestic transportation cost is calculated based on the distance from Qingdao to other areas in*

Shandong Province. Source: Survey by ASEAN Industrial Development Research Centre, KUST, 2008

Table 19 shows that, in addition to the FOB price, the import duty and VAT are the main factors influencing the natural rubber price for the tyre factories, as these two factors account for 10.8% and 12.7% of the total cost. To reduce the cost, almost 70% of the tyre enterprises that used the imported natural rubber as raw material will apply the trade pattern of processing trade. All of them are tyre exporters who adopt the method of processing supplied material, and they actually pay zero tariff. Besides, they can take 5% of the tax rebates after export as their profits.

In the case where the tyre factories purchase the natural rubber from the trading company, the trading company will charge approximately 200Yuan / ton as the margin.

c) Cost structure of the tyre production

Table 20 shows the cost structure of the tyre factories in China. The cost of natural rubber takes 30-40% 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 20: Cost Structure of Tyre Factories, 2007

Cost Items	% of the cost structure
Natural Rubber	30%
Other Raw Materials	30-35%
Production Cost	30-35%
Margin	5%-10%

Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

Remarks: Table 20 is calculated based on the survey of the large scale tyre manufacturers when the market demand was stably increasing.

3.4.4.3. Constraints and opportunities

Several constraints and opportunities impinge on the development of China's rubber industry including the following:

a) The huge domestic demand driven by the development of car and tyre production will lead to the future expansion of the natural rubber trade.
b) The natural rubber price will be the key factor affecting the tyre industry in China
c) The present industrial policies on tyre production and trade policies on tyre export will have a direct impact on the natural rubber import quantities and varieties.
d) The import duties on natural rubber and rubber products directly influence the import quantities and varieties of rubber.
e) The upgrading of the tyre industry in China requires more TSNR than RSS, indicating the new requirement for the 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, Guizhou and so on for more than 200 years. Guangxi Zhuang Autonomous Region, with a 312 thousand hectare cassava planting size, accounts for about 66% of the total planting size in China. Hence it is the number one province for cassava planting. Second is Guangdong Province, with a 90 thousand hectares cassava planting size accounting for 19% of the total. Hainan Province and Yunnan Province have cassava planting sizes of 32 and 40.2 thousand hectares respectively, which account for about 7% and 8.5% of the total. Cassava planting in other provinces is minimal.

Table 21: The Cultivation Area, Production and Yield in the Main Planting Areas in China

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 tons)				
	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 (tons/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 the Department of Agriculture of the above listed Provinces

The temperature range of the cassava plantation areas in China is between 22-24 degrees centigrade, which is lower than that of other countries. Sometimes there are frosts. The planting period is usually between March and April and the harvest period is between December and January. The starch content in cassava is 24-25% (the maximum content is 25%).

In 1996 the cassava planting area was 501.6 thousand hectares, the production of fresh cassava was 6581 thousand tons, and the price of cassava sold by farmers was about 315yuan per ton. The small domestic average area of agricultural land has meant that the cassava yield has been comparatively lower than other plants. As such the planting area of cassava has stayed at about 450 thousand hectares for almost 10 years since 1996. Recently it has even shrunk. Although the planting area has shrunk, the growth rate of the cassava yield has been kept at 1.65% per year for the last 10 years. For example, the yield in 2005 was 7436.6 thousand tons, while the yield per hectare increased from 12.89 tons per hectare in 1996 to 16.79 tons per hectare in 2006. The average growth rate per year was 3%. All these aforementioned data prove that the effectiveness of cassava production in China has somehow increased.

Since 2005 the development strategy of utilising cassava to produce ethanol fuel has been proposed and conducted in Guangxi Autonomous Region and Yunnan Province, and increased the demand for cassava for traditional uses. The size of the planting area for cassava 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 and regions in the next 10 years. Meanwhile the average yield level will also increase further because of its increased importance. At present the average yield of cassava in Guangxi ranks first in China. The average yield in 2007 was 20.20 tons per hectare, while the total yield was 6.3 million tons.

4.1.2. Constraints and Opportunities

4.1.2.1. Constraints

a) Undeveloped planting technologies. There is a lack of choice of cassava varieties and the bulk of cassava products are ageing. Additionally the management of cassava cultivation is quite rough. In many places, exploiting wild land is the main method for planters who are unaware of the density of plants, shortage of seeds or the plant variety. Hence the average yield remains low.

b) Poor processing technology. The cassava processing industry, especially the advanced processing industry, has developed slowly. Also, the low utilisation of cassava resulted in low economic benefits from cassava production. Although there are more than 300 cassava processing factories at different scales, few factories are able to process and produce advanced processed products with a higher economic value, such as denatured starch.

c) Insufficient R&D input and promotion. Presently the cassava planting technology R&D system is far from fully developed in China because it lacks capital and resources. The poor payment and research environment have driven many professionals out of this industry. Additionally, the popular areas for the new cassava varieties and fertility cultivation technology reached only 20% of the total national cassava planting areas.

4.1.2.2. Opportunities

a) The increasing importance of cassava as raw material for ethanol fuel production. Recent years have witnessed increasing interest in biofuel production around the world, resulting from the rocketing price of petroleum. The US and Brazil are the biggest fuel ethanol producers,

and their total production accounts for 70% of the world total. In 2004 China initiated fuel ethanol projects which used maize as the raw material. However the fast development of the maize fuel ethanol industry, both in China and worldwide, significantly drove up the price of maize. In 2006 China officially prohibited the further expansion of maize fuel ethanol production whilst encouraging the development of non-grain fuel 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 as well as being tolerant to extreme growing conditions. Most of the main cassava cultivation regions in China are located in tropical and sub-tropical areas with adequate sunshine, and where the average temperature is between 17-22 degrees centigrade. All kinds of land is suitable for cassava growing, especially hills and steep land which produce a higher yield of cassava and lower yield of other plants.

c) Establishment of the cassava industrial chain. In China 30% of cassava is used as animal food while another 70% is used for industrial purposes, such as ethanol and starch production. The rapid and constant economic growth in China contributes to the development of the downstream cassava processing industries, including denatured starch, ethanol and fuel ethanol. In some areas a cassava industrial chain has been established 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 for industrial materials, with 70% of cassava processed for cassava powder, alcohol and starch. Only 30% is used as animal food. The main cassava ethanol factories are located in Shandong, Jingsu and Guangxi where the imported dried cassava is used as a raw material. Most cassava starch factories are located in Guangdong and Guangxi where the fresh cassava is produced. As 40% of cassava is used as a raw material in ethanol production, analysis of the ethanol industry development will be focused on the demand for cassava.

Table 22: Consumption Proportion of Cassava in China, 2007

Cassava Consumption		% of the total	Location of the Factories
Industrial Material	Ethanol	40%	Shandong, Jiangsu, Guangxi etc.
	Starch	20%	Guangdong, Guangxi etc.
	Others	10%	Country wide
Animal Food		30%	

Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

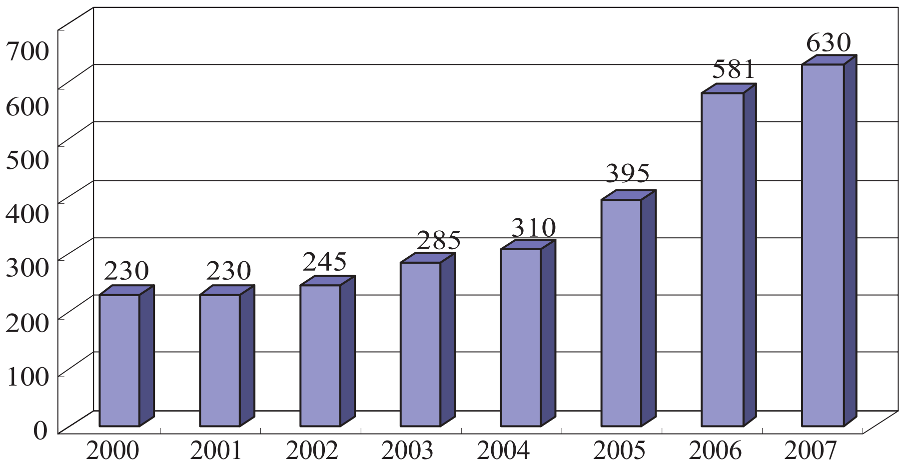
4.2.2. Analysis of the Development of the Cassava Downstream Industry

4.2.2.1. Ethanol Industry

a) With its robust production growth, the gap between the expanding supply and shrinking sale of drinking alcohol becomes clear.

In recent years, alcohol production in China has maintained a fast-paced increase. Owing to the increased production of new and expanded projects launched in 2006, domestic alcohol production has rapidly increased. In 2006 China saw its alcohol production exceed record levels and increase by 47% compared with the previous year. 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 the vigorous expansion in consumption. However, the production growth rate of 8.4% in 2007 reflected a slowing down of ethanol industrial development, the result of national macro-control policies and industrial adjustment.

Figure 9: Ethanol Production in China, 2000 to 2007 (Units: 10,000 tons)

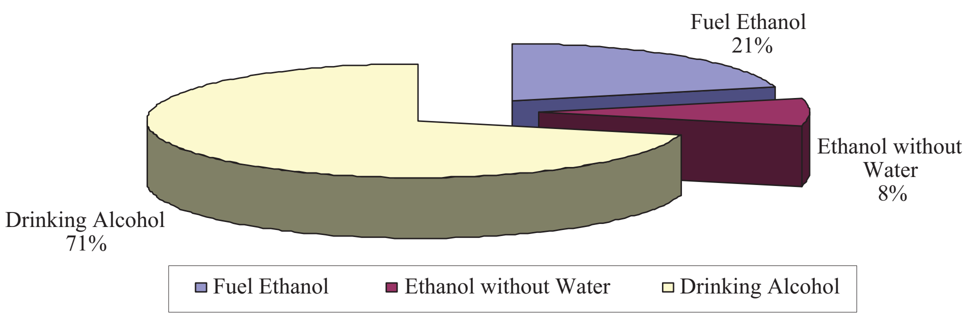


Source: China National Statistics Bureau

b) Drinking alcohol still dominates but fuel ethanol occupies more and more of the market share.

A market share of 71% in 2007 showed that drinking alcohol maintained its dominance. However its market demand has less room to expand while its 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.

Figure 10: Products Structure of Ethanol in China, 2007

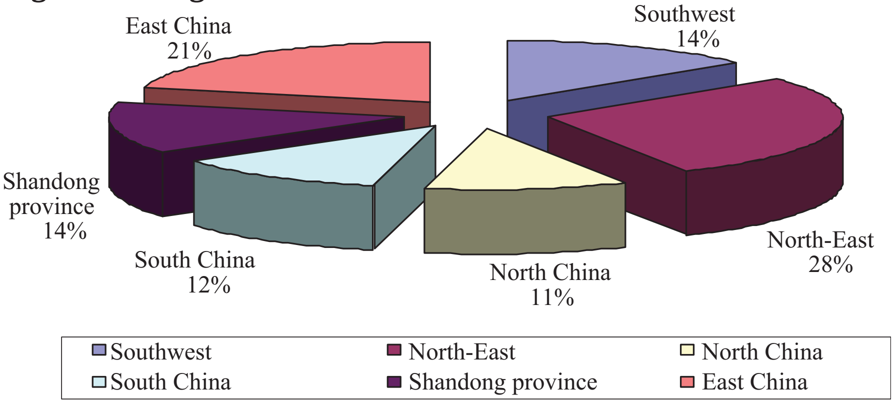


Source: China National Statistics Bureau

c) The production of ethanol is concentrated in the raw material production area.

Generally speaking, the Northeast and East of China are the main ethanol producing areas. The provinces and autonomous regions that have the largest production of ethanol are Jilin, Jiangsu, Henan, Guangxi, Anhui, Heilongjiang, and Shandong. The provinces located in northeast of China, such as Jilin and Heilongjiang, are China's time-honoured main maize producers. Jiangsu province in East China, along with Shandong province, had its ports to import cassava, and Guangxi Zhuang Autonomous Region in Southeast China is the major production area for cassava in China. All these show that ethanol production is concentrated in the raw material production area.

Figure 11: Regional Distribution of the Ethanol Production in China, 2007



Source: China Alcohol Industrial Association

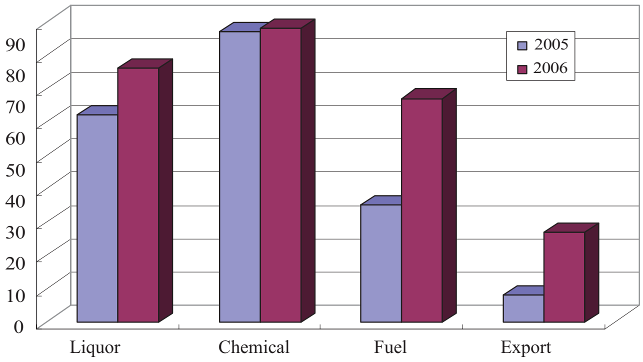
d) Ethanol production tends to be dominated by large enterprises.

Rapid development of the domestic ethanol industry in recent years 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 a sales value accounting for 56% of the total domestic sales. 177 small-sized enterprises accounted for the remaining 44%.

e) Demand for ethanol increases rapidly.

It is estimated that the total demand for ethanol, with a sustained momentum of growth, reached 2.58 million tons in the first half of 2006 (Ethanol Branch of China Alcohol-making Industry Association, 2007). Compared with the previous year, the demand from spirits, chemical, fuel and export industries increased in varied degrees. However changes in the demand structure clearly indicates that the ethanol demands from fuel and export sectors have increased notably.

Figure 12: A Comparison of Domestic Ethanol Demand between 2005 and 2006 in China

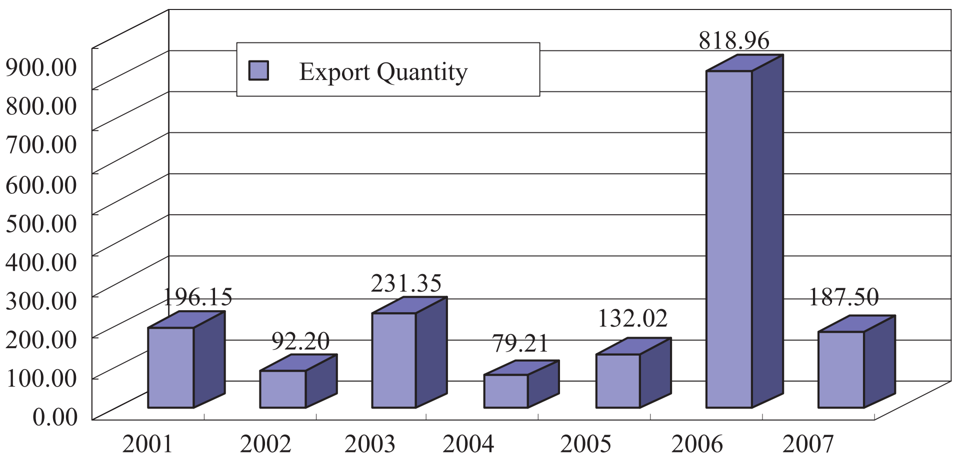


Source: Ethanol Branch of China Alcohol-making Industry Association

f) The national policies directly influence ethanol exports.

China exported 819 thousand tons of ethanol in 2006, which accounted for 16.3% of the total production. This was an increase of nearly 600% compared with the previous year. The huge demand from the international market, as well as state support through the ethanol export tax rebate, has contributed to the increased export of ethanol. For domestic ethanol export enterprises the tax rebate is a source of profit. However in June 2006, the Ministry of Finance announced that they were abolishing the tax rebate of 13% for exported ethanol, and that the processing of ethanol-related materials provided by clients was forbidden. As a result, the total export volume of ethanol in 2007 dropped sharply to 187.5 thousand tons. 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 13: Ethanol Export for China, 2001-2007 (Units: 1000 ton)



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. Additionally, it is worth noting that the price of cassava has now surpassed the price of maize. This is due, in part, 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-made ethanol were greater than the benefits gained by the enterprises that produce maize-made ethanol. A large number of cassava-made 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 were 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 Made Fuel Ethanol

i. At present, most of the fuel ethanol in China is made from grain.

   2004 saw the existing market pattern for fuel ethanol in China come into being. 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 companies took maize. The respective business scopes of the four aforementioned companies were also identified in the plan (see Table 23).

   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 December 15, 2007. In 2005 the production of fuel ethanol in China totalled 1.02 million tons, 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 tons and consumption was about 4.75 million tons of maize, calculated at the ratio of 1/3.3.

Table 23: Fuel Ethanol-making Enterprises in China, 2007

Enterprises	Productivity		Supply Areas	Raw Materials
	(10,000 ton /04)	(10,000 ton/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

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% consumption tax, and their value-added tax on making fuel ethanol is levied first and then returned according to the related 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. The current grain production will not satisfy the demand from rapidly increasing fuel ethanol production.

Driven by the stable increase of industrial demand as well as the current demand of fuel ethanol making 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 having large increases in the future.

The State Development and Reform Committee and the Ministry of Finance jointly issued a notice entitled “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 price of maize, and to discuss the development of fuel ethanol made from maize which could pose a big threat to food security in China. This required the examination and approval, as well as recording, of maize ethanol production projects to be stopped across the country. By the end of 2007, the State issued a series of related regulations to energetically promote the development of non-grain fuel ethanol.

b) Development of non-grain-made Ethanol

In August 2006 China’s Grain Group issued a strategic bio-chemical energy plan for 2007-2010. This plan aimed to establish ethanol production factories using new raw materials such as cassava, sweet potatoes and maize in Guangxi Zhuang Autonomous Region, Hebei Province, Liaoning Province, Sichuan Province, Hubei Province and Chongqing Municipality. According to the statistics, preparation for the production of 0.8 million tons 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 their targeted productivity by 2008.

In October 2006 the first domestic cassava fuel ethanol-producing project, invested in by China’s Grain Group went into operation in Guangxi. Guangxi has an annual production of up to 0.2 million tons. Approved by the State Development and Reform Committee, this project was planned to start operation in December.

The first fuel ethanol production line in Qingyuan, Guangdong Province, started operation 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 fuel ethanol enterprises, efforts to exploit the novel biofuel have never been suspended. Considering the food security situation in China, the development of fuel ethanol-producing enterprises, while preserving the current production of maize-made ethanol, is focused on the following two areas: cassava-made ethanol and cellulosic ethanol. These two types of ethanol belong to the non-grain-made ethanol variety. Cassava-made 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 special plan entitled "To Develop the Biofuel of Ethanol and Ethanol Gasoline for Cars during the Eleventh Five-year Period", China will produce 6 million tons of biological liquid fuel during this period, including 5 million tons of ethanol fuel and 1 million tons of biological diesel oil. Additionally, by the year 2020, 20 million tons of biological liquid fuel will be produced, including 15 million tons of ethanol fuel. In this plan the production of ethanol fuel using raw materials such as cassava, sugarcane and sweet potato is encouraged. Meanwhile, the annual processing volume and industry structure of the raw materials is clearly programmed. In 2006 a document entitled "Provisional Measures to Manage the Special Fund for the Development of Renewable Energy" was printed and distributed by the Ministry of Finance. This explicitly pointed out that in an effort to exploit and develop renewable energy to replace petroleum, the development of biofuels such as ethanol and biological diesel oil should be given high priority. Ethanol biofuel here means the ethanol fuel made from cassava, sugarcane, etc.

4.2.3. Factors Driving up the Demand for Cassava in China

4.2.3.1. Further Development of the Non-grain-made Biological Ethanol Fuel Industry

China's tough efforts to develop the non-grain-made biofuel of ethanol 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 tons of crude oil, ranking second in the world. In the same year China imported 119 million tons of crude oil, while it produced 181 million tons of crude oil. Clearly the crude oil produced at home 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, energetically. With increasing encouragement and support from the government, non-grain-made fuel ethanol should develop at an even faster pace.

4.2.3.2. Cassava: the 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-made 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. Additionally cassava can be planted with other crops since it does not compete with other crops for growing space. Hence, there is a high potential for the further expansion of cultivation areas. To a large extent the unit yield will be increased if the super cassava varieties and cultivating 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 higher ethanol productivity in terms of 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 (see Table 24).

Table 24: Comparison of Ethanol Production per Hectare of Different Crops

Crops	Annual Production of Primary Products (ton/hectare)	% of Sugar or Starch Content	Ethanol Productivity of Crop (litre/ ton)	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

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. 2006 saw the demand for maize increase by 9%. Propelled by a robust 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 the maize ethanol production costs were consequently higher than that of cassava ethanol. Table 25 shows that the maize ethanol enterprises suffered losses of 490 yuan per ton when no national subsidy was included and the value of the ethanol protein fertiliser was calculated. Meanwhile, the cassava ethanol enterprise enjoyed profits of 350 yuan per ton although no ethanol protein fertiliser was generated during the process of cassava ethanol production.

Table 25. Cost Comparison between the Cassava-made Ethanol and Maize-made Ethanol (Based on the average market price in Jan-July, 2007)

	Fresh Cassava	Maize
Raw Material Price (yuan/ton)	450	1500
Raw material Consumption（ton）	7	3.3
Raw Material Cost（yuan/ton）	3150	4950
Processing Fee (yuan/ton)	800	800
Dehydration Fee (yuan/ton)	100	100
Ethanol Production Cost (yuan/ton)	4050	5850
Sales Expense (yuan/ton)	100	100
Total Cost (yuan/ton)	4150	5950
Domestic Market Price (yuan/ton)	4500	4500
Value of Ethanol Protein Fertiliser (yuan /ton of fuel ethanol)	0	960
Actual Profit and Loss (yuan/ton)	350	-490
International Market Price (yuan/ton)	5050	5050
Actual Profit and Loss in the International Market (yuan/ton)	550	60

Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

4.2.4. Forecast of the Future Demand of Cassava in China

4.2.4.1. Fresh Cassava

China has an increasing market for fresh cassava due to its rapid economic development. Consequently its price has risen fast. Its average price in the main producing areas has risen from 300 yuan/ton in 2000 to 380 yuan/ton in 2005. According to the present processing capability for starch and ethanol, more than 8 million tons of fresh cassava is needed in the harvesting season (autumn and the winter). If 70% of the total production of fresh cassava is used as raw material, then more than 11 million tons of fresh cassava will be needed to meet this demand. Given the newly established and expanded projects, the annual demand for fresh cassava will come to 30 million tons.

4.2.4.2. Dried Cassava

The import quantity and value of dried cassava for China accounts for 50% 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 the import. Presently, some cassava factories located in Shandong, Jiangsu and Anhui have to depend on imported dried cassava as their production's raw material, because domestically produced fresh cassava and dried cassava fail to meet the domestic demand. For example, the production capacity of domestic cassava ethanol is about 1.36 million tons, requiring approximately 3.67 million tons of dried cassava. However, the total domestic fresh cassava was 179.5 thousand tons in 2006 which only met the demand of the domestic starch production.

4.2.4.3. Cassava Starch

The import volume and quota of cassava starch in China increased by 73.2% and 97.2% respectively in 2004, compared with 2000. Its import volume (Hong Kong's share included) and its import quota ranked first and second in the world. According to statistics released by Customs, China only produces 500 thousand tons of cassava starch and has to import 467 thousand tons, so there is big mismatch between supply and demand.

4.2.4.4. Denatured Cassava Starch

The total denatured starch production of all kinds in 2005 reached 0.6 million tons, including 0.2 million tons of denatured cassava starch. Demand for denatured cassava starch was about 1.8 million tons. With an underdeveloped productive force, China has 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 tons, and denatured starch from cassava will total 0.75 million tons, indicating that the shortfall between supply and demand of denatured starch from cassava will increase.

4.2.4.5. Cassava-made Ethanol

China is suffering from energy shortages. Gasoline consumption in 2005 was about 43.66 million tons. If 10% of gasoline is supplanted by fuel ethanol, then about 4.366 million tons of ethanol will be needed for cars. Supported by the national policies of non-grain fuel ethanol production, the newly-established cassava-made ethanol factories will continuously drive up the domestic demand for cassava. To be more specific, the demand for dried cassava from the newly established enterprises for cassava-made ethanol will approach 3 million tons a year.

4.3. Trade and Marketing of Cassava

4.3.1. General Situation

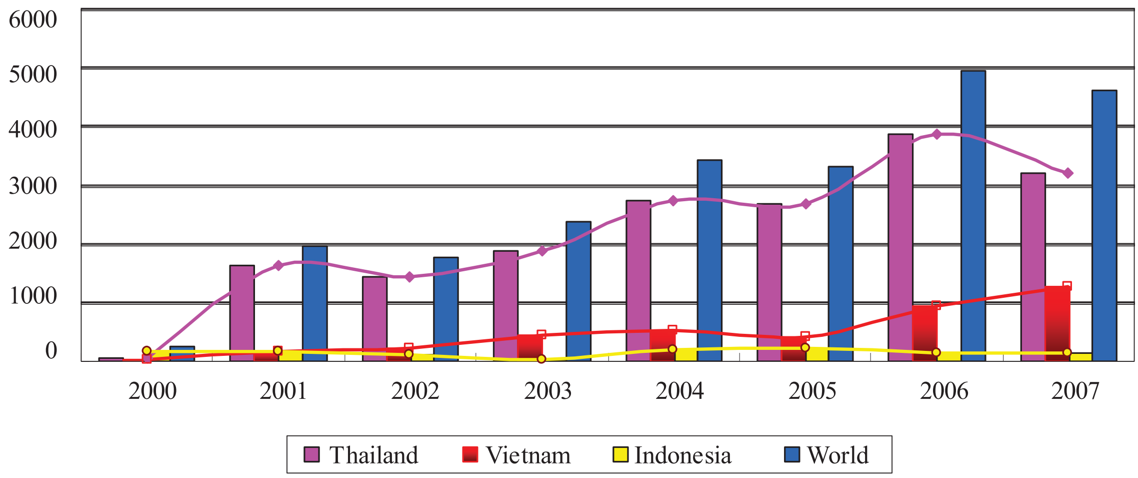
Presently China is the biggest cassava importer in the world, with more than 700 thousand tons of cassava products imported annually. Cassava used to be a traditional export crop of China. Since the 1990s the expanding domestic demand has resulted in cassava exports dropping. In 1998 cassava exporting ceased while the quantity of imports reached 300 thousand tons. 2001 witnessed a significant increase in imported cassava from the world. The total quantity of cassava imports increased 7.6 times compared to the previous year. Dried cassava took more than a 99% share of the total imported cassava.

More than 80% of imported dried cassava was used in cassava-made ethanol factories. Driven by a strong domestic demand, the dried cassava reached its historical peak in 2006. China imported 4.95 million tons of dried cassava in total, which increased by 48.7% compared with the previous year. However the quantity of cassava imports declined by 6.6% in 2007, as a result of the decreasing quantity of imports from Thailand.

One of the factors contributing to the small quantities of imported fresh cassava is that plants with fresh soil are forbidden to enter the country according to the Chinese Law on the 'Entry, Exit and Quarantine of Animals and Plants'. Usually fresh cassava carries soil so only a small quantity has been imported in recent years. Hence, only cassava starch factories in South

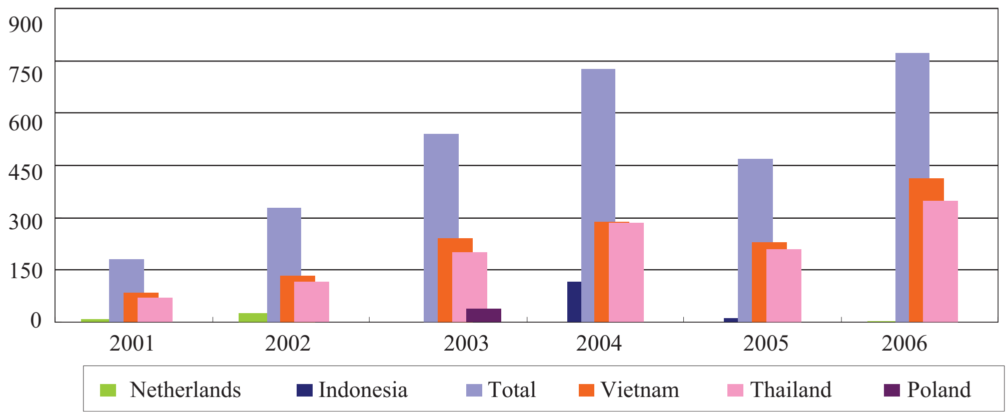
China can use fresh cassava as their raw material because their locations are close to the fresh cassava producing areas. Other starch factories in the North use maize as their raw material. It also explains the fast rise in imported cassava starch, indicating the increasing demand for processed cassava in China. In 2006 imported cassava starch reached 7.729 million tons, a rise of 65.4% compared with the previous year. Presently Vietnam and Thailand are the main cassava starch exporters to China.

Figure 14: Import Quantity of Dried Cassava for China from the World and Main Import Countries, 2000-2007 (Unit: thousand tons)



Source: China Custom

Figure 15: Import Quantity of Starch Cassava for China from World and Main Import Countries, 2001-2006 (Unit: 10,000 tons)



Source: China Customs

4.3.1.1. Major Import Sources of Dried Cassava

Thailand ranks number one in dried cassava exports to China. In 2006 the total dried cassava export quantity from Thailand was 3.864 million tons, 78.15% of the total cassava import quantity of China. With a total export quantity of 935.4 thousand tons, Vietnam is the second biggest dried cassava exporter to China and takes 18.92% of the total. Indonesia is third. However, in 2007 the total dried cassava import quantity declined by 6.58% compared to the

previous year. This was a result of the 17.12% decrease in dried cassava imports from Thailand, and a 3.91% decrease in dried cassava imports from Indonesia. In contrast, the importing quantity from Vietnam increased by 36.1%.

Table 26: China Dried Cassava Import Sources and Quantities (Unit: 10,000 tons)

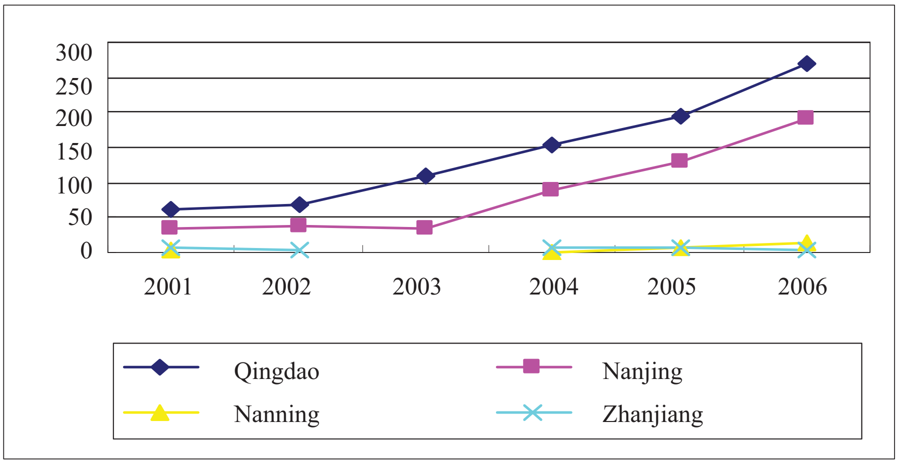
Partner Country	Ten Thousand Ton				% Share				% Change
	2004	2005	2006	2007	2004	2005	2006	2007	06/07
World	3438.586	3325.599	4944.562	4619.198	100	100	100	100	-6.58
Thailand	2734.389	2695.576	3864.203	3202.647	79.52	81.06	78.15	69.33	-17.12
Vietnam	518.469	401.758	935.401	1273.240	15.08	12.08	18.92	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 Import Ports of Dried Cassava from Thailand and Vietnam

Most dried cassava from Thailand entered into China from Qingdao in Shandong Province, and Nanjing port in Jingsu province. Figure 16 shows that the import value has maintained a constant increase since 2001. In 2006 the dried cassava import value of Qingdao and Nanjing took 95.5% of the total import value, while 60% went to Qingdao port. The latter was to meet the demand of the ethanol production in the major import dried cassava consumption Provinces, such as ShanDong, Jiangsu and Anhui Provinces.

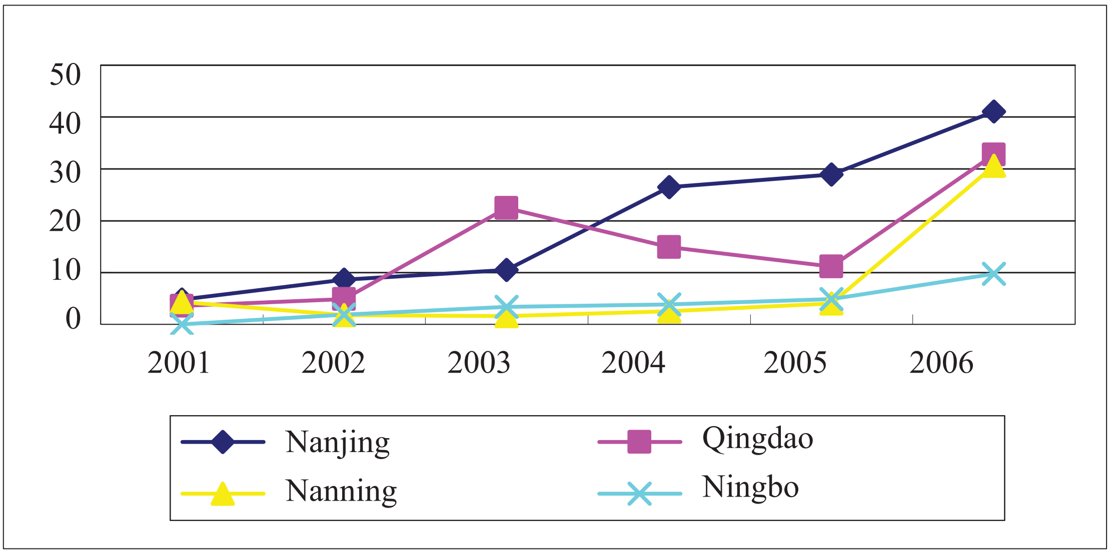
Figure 16: Major Import Port in China for Dried Cassava from Thailand (Unit: Million $US)



Source: China Customs

With 87% of the total dried cassava import value in 2006, Nanjing (Jiangsu Province), Qingdao (Shandong Province) and Nanning (Guangxi Zhuang Autonomous Region) are the major import ports of dried cassava from Vietnam. It is interesting to note that the import value increased constantly at the Nanjing port while the value fluctuated at the Qingdao port from 2001 to 2006. The dried cassava import value in Nanning rose sharply in 2006 to 6.6 times that of 2005.

Figure 17: Major Import Ports in China for Dried Cassava from Vietnam (Unit: Million $US)



Source: China Customs

To be more specific, the imported dried cassava is distributed to the sub-ports of the above-mentioned main ports. In 2006 Lanshan and Rizhao in Shandong Province, Lianyun port in Jiangsu province, and the coastal cities of Guangxi province proved to be the main distribution centres of dried cassava. Under the administration of Qingdao, Lanshan port was the biggest cassava import port, with an import quantity of 1.188 million tons and a value of US$144.128. This was an increase of 22.7% and 26.3% respectively compared with the previous year. Lianyun port, another sub-port of Qingdao, turned out to be the second biggest port for dried cassava imports. It reached US$1 million, the historical peak of import quantity, in 2006.

4.3.1.3. Procedure after Arrival at the Import Port and Problems

First of all, the method of the Draft Survey is applied to weigh the imported cassava. Then the cassava is packed into sacks and transferred from the ship to the warehouse by cargo truck. The cassava is then weighed for a second time. The difference between the empty and the full cargo truck is the cargo weight. 3500 tons of cassava can be discharged and transported into the warehouse each day.

Presently the problems of imported cassava are quantity shortage, live insects and a mustiness caused by simple packing. Usually an official fumigation certificate is requested for cassava exporters to prove that the fumigation has been done in the exporting country, to kill any infestations. However recent cases indicated that the vermin were still present in the imported cassava, even though the office fumigation certificate was provided. In January 2005 the LianYun Port Entry-Exit Inspection and Quarantine Bureau found large quantities of vermin in 5200 tons 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% of the 71 lots of imported dried cassava from Vietnam. Additionally, 4 out of 267 lots of Vietnam-exported cassava starch carried vermin

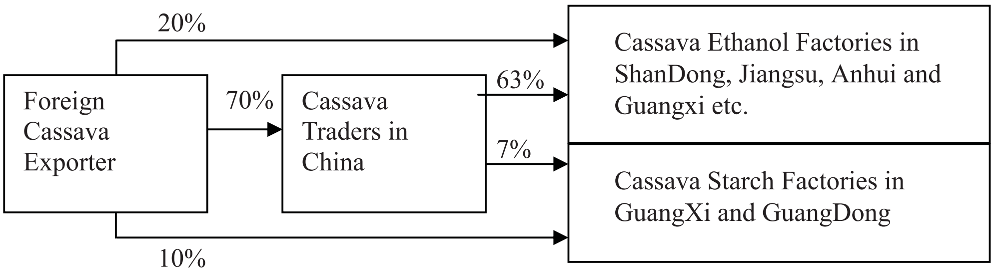
and the quantity of sulphur dioxide exceeded the allowed amount on another 4 lots, with a total quantity of 35 thousand tons and a value of US$ 684.9 thousand.

Improper packing methods might be another reason for the live vermin and mustiness. The dried cassava is usually packed 1-2 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. Mapping Routes from Import Port to the End Users

Figure 18: Cassava Mapping Routes from Import Port to the End Users



Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

Presently imported dried cassava is mainly used for ethanol production. As Figure 18 shows, 70% of the imported dried cassava was purchased by the cassava trading companies in China. Take Shandong Oriental Agriculture Products Trading Co. Ltd. as an example. The imported dried cassava value of the company reached US$42 million in 2005, and all the imported dried cassava was distributed to the ethanol factories in Shandong, Henan, Anhui etc. Only the giant ethanol factories imported directly from abroad, while the medium and small-sized ethanol factories preferred buying from the traders as it was less complicated and time consuming.

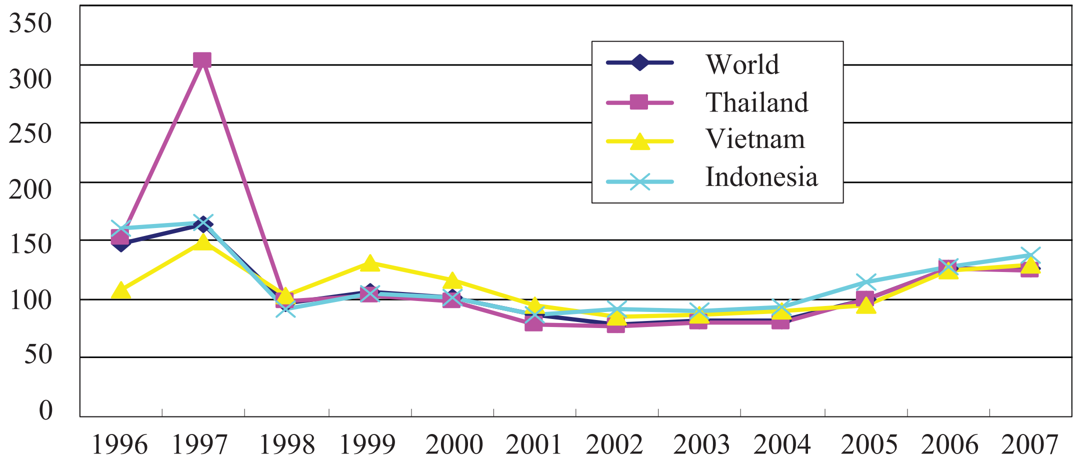
Cassava starch production accounts for only 8% of the total starch production in China. In addition, most of the cassava starch factories are located in Guangxi and Guangdong Provinces where fresh cassava is easier to acquire. Only approximately 17% of the imported dried cassava is used for starch production. Furthermore the port in Guangxi makes it more convenient for the starch factories to import directly from abroad.

4.3.3. Costs and Margins

4.3.3.1. Import Prices

Figure 19 clearly shows that since 2002, the FOB price of dried cassava has kept increasing. 2006 witnessed a sharp increase in the FOB price, rising by about 27% compared to 2005. The main factor contributing to the price increase was the expansion in demand for dried cassava for fuel ethanol production, both domestically and abroad.

Figure 19: China Dry Cassava FOB Price from Main Import Countries and World
(Unit: $/Ton)



Source: China Customs

4.3.3.2. Cost Structure of the Imported Dried Cassava (Thailand – China)

a) Transportation Costs

After arriving at the port in China, most of the dried cassava is transported by bus. This is because the transit time is shorter, and the unit cost of bus transportation for the light and space-consuming dried cassava is lower compared to train transportation. Transportation costs are the first concern for the ethanol factories as they weigh heavily on the low valued dried cassava. Normally ethanol factories located in different provinces will choose the closest port to purchase from, for cost saving purposes. If time allows, the dried cassava at Nanjing port will be transported by boat to the ethanol factories in Anhui Province, since the transportation fee is only 35yuan / ton- one third of the transportation cost by bus. The transportation cost details are as follows:

Table 27: Transportation Costs from Lianyun Port to the Ethanol Factories Destinations, 2007

Port	Destinations	By bus		By ship		Duration	
						By bus	By ship
		RMB/ ton	USD/ ton	RMB/ton			
Qingdao (Lanshan, Rizhao)	Shandong	￥60	$8	-	-	1day	-
Lianyun	Jiangsu	￥50	$6.7	-	-	1 day	-
Nanjing	Anhui	￥110	$14.7	￥35	$4.7	1day	5 days

** Average Exchange Rate in 2007: 1$ = 7.5RMB*

Source: Source: Survey by ASEAN Industrial Development Research Centre, FME, KUST

b) The 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 has been implemented for cassava imported from ASEAN countries. The VAT rate for imported dried cassava is 13%. The cost calculation of imported dried cassava is as follows:

Imported dried cassava price = (FOB price + Sea freight + Insurance) x Exchange rate x 1.13 + Port handling fee + Domestic transportation fee + others

Taking the average FOB price of imported dried cassava from Thailand in 2007 as an example, the final price of the dried cassava after arriving at ethanol factories located in Shandong Province from Lianyun port, the main dried cassava import port in China, was approximately 1860 yuan / ton. Obviously the FOB price, the selling price of the dried cassava exporters, played the most important role in the final price as it represented 80.7% of the total cost. Additionally the percentage of the operational costs, including port handling, fumigation and domestic transportation, reached 8.8% because dried cassava is a light commodity with a low value. Hence the ethanol factories, the end users of the imported dried cassava, will work hard to reduce the transit times and costs. The cost details can be found in Table 28.

Table 28: Cost Structure of the Imported Cassava from Thailand, 2007

Items	Cost	% of the total cost
FOB price ($ / ton)	$160	
Sea Freight and Insurance ($ / ton)	$40	
CIF Price at RMB/ ton*	￥1500（$200）	80.7
Import Duty (0%)	0	
VAT (13%)	￥195($26)	10.5
Price after VAT (RMB / ton)	￥1695($226)	
Port Handling Fee(RMB / ton)	￥80($10.7)	4.3
Domestic Transportation* (by bus, RMB/ton)	￥50($6.7)	2.7
Fumigation Fee(RMB / ton)	￥35($4.7)	1.8
Final Price of Imported Natural Rubber	￥1860($248)	100

** Exchange rate: 1 $ = 7.5RMB*

**The 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) The Cost Structure of the Imported Dried Cassava 2007 (Thailand – China)

Table 29 shows the cost structure of the ethanol factories in China. The cost of dried cassava represents 70-80% of the total production cost of the ethanol, indicating that the price of cassava plays a significant role in ethanol's final price. It also explains why more than 50% of the domestic cassava ethanol factories stopped their production at the end of 2007/ beginning of 2008. At that time the imported CIF price of dried cassava from Thailand reached as high as $230/ ton, and the cassava ethanol production cost increased to 5960 yuan / ton. The producers suffered a loss because the market price of ethanol was only 5050 yuan/ ton. Hence the quantity of imported dried cassava declined in 2007.

Table 29: Cost Structure of the Ethanol Factories, 2007

Cost Items	% of the 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 including the following:

a) The huge domestic demand driving the development of ethanol and fuel ethanol industries will lead to the future expansion of the cassava trade.
b) The intense competition and national macro-control policies on the domestic ethanol industry will lead to industrial reshuffling in the short run.
c) The 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 material.
d) The present industrial policies on ethanol production and trade policies on 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 the Downstream Industrial Policies on Natural Rubber Trade

As mentioned before, the national policies of the car and tyre industry have had a direct impact on the trade quantity and varieties of natural rubber. To be more specific, the policies which encourage the further development of the car industry will definitely drive up tyre production, and therefore demand for natural rubber. Hereunder are some of the present policy's guidelines for the car industry.

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 on the tyre-making industry focus more on structural optimising and upgrading. These policies have sent out strong signals that China requires more natural rubber suitable for high-end products, or radial tyre production. The related government policies are as follows:

a) The collective development of tyre-making enterprises is fostered in order to accomplish their structured optimising and upgrading.
b) By adopting macro-deflation policies and exerting influence on the automobile industry, a number of tyre-making enterprises, which are 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 April 1st 2006, the tax rate of diagonal tyres was lowered from 10% to 3% while radial tyres continued to be exempt from tax.

5.1.1.2. Influences from the Down Stream 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% in 2003. After China abolished the regulation on the import quota license and lowered the tax rate on imported tyres by 3%, 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 certain imported tyres is nearly the same as the price 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, consisting mainly of radial tyres used for medium and high quality cars.

In 2006 the State confirmed that the tax rebate for exported tyres had been lowered from 15% to 13%, a decrease of 2%. Since June 1 2007 China has lowered its export rebates concerning tyres and other rubber products from 13% to 5%. 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 benefits will definitely drive the tyre-making enterprises to seek natural rubber at a competitive price and 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% to 20%. In 2004 the natural rubber import quota system was abolished, but the Auto Import Permit License 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 AdValorem tariff of 20% and the specific tariff of 2600 yuan per ton. For natural rubber latex, the one with the lowest rate would be levied between the AdValorem tariff of 10% and a specific tariff of 720 yuan per ton.

The rubber import mode and proportion in China is as follows: normal trade 10%, processing trade 70%, small-scale border trade 10%, and 10% for transferred commodities in a bonded zone. Hence the processing trade, which took up 68% of natural rubber imports, adopted the method of processing with the supplied material which requires zero tariff. The border trade has to pay a 10% import tariff. The bonded zone pattern is normally applied by imported synthetic rubber, whose import tariff is 5%.

Table 30: The 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%, totally different from the 5% import tariff on synthetic rubber. When enterprises choose the import channel of natural rubber, the first option goes to the processing trade rubber with zero tariff, the second is to synthetic rubber, and a few choose normal trade. In recent years China's imports of synthetic rubber have increased rapidly. The import quantity in 2006 increased 19.2% compared to last year, and 72.6% compared to the year 2001. The proportion of synthetic rubber in normal trade increased from 45.7% to 64.2% (See Table 31).

Table 31: Import Quantity and Value of Synthetic rubber in China

Year	Quantity (thousand tons)	Value (Million USD)
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 the Downstream Industrial Policies on Cassava Trade

The demand for cassava is driven up 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 September 5th 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 programs would, in principle, be ruled out. The existing industrial policies would be readjusted, and all new and expanded corn further-processing programs would be subject to examination and approval of the relevant investment-managing department of the State Council. Meanwhile, the recording of corn further-processing programs 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 tons of liquid biofuel, including 5 million tons of ethanol fuel and 1 million tons

of biological diesel. New ethanol production programs, with a production of 4.2 million tons, 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 programs 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 September 1st 1999 onwards. The ethanol-making enterprises, which cannot comply with the related industrial policies and have a production of less than 30000 tons, 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 2006-2010 was outlined to eliminate the backward ethanol production of 0.101 million tons, 0.4 million tons, 0.444 million tons, 0.355 million tons and 0.3 million tons 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 return (13%) 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% for fresh cassava and 5% for dried cassava. Additionally, 13% of VAT will be collected in the import process. With the signing of China-ASEAN FTA and the implementation of EHP in 2004, a zero tariff policy was implemented for 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 U.S. sub-prime 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% in 2007 to 9.8% and 7.5% in 2008 and 2009 respectively (World Bank, 2008). The automobile-manufacturing and tyre-making industries will bear the brunt of the financial slowdown. The production of automobiles in China will decrease by more than 20%, and the annual increase rate for

automobile production from 2009 to 2015 is forecast to be between 5% and 10% (National Passenger Cars Association Report 2008). Also, the export volume and value of tyres made in China dropped by 4.6% and 22.1% respectively in the first half of 2008. Statistics from the Association of Tyre-making Industry also indicate that September 2008 witnessed 14 tyre-making enterprises operating at a loss, accounting for about 33.3% of all the enterprises. The storage of readymade products hit a record high, at 42.3%, which is an alarm bell regarding production surplus.

The relatively recessed demand for ethanol in the domestic market reduced the demand for cassava in 2008. The main reasons for this are as follows: a） The export tax rebate for ethanol was abolished in 2007; consequently the export volume of ethanol plunged; b) the tax rebate for chemical products was abolished in 2008, which triggered the export of chemical products to plummet and the sales of ethanol to slide; therefore, the sale of cassava was also impacted; c) during the preparations for the 2008 Beijing Olympics, provincial and city government departments toughened their inspection of projects concerning environmental protection; as a result, thousands of chemical factories and small-scale ethanol making factories were shut down in the east of China; and (d) the fact that the price of gasoline decreased by about 60-70% in the international market will consequently reduce the domestic and international demand for the replacement fuel, bio-ethanol, which is mainly produced from cassava.

The Chinese government has actively adopted counter-measures in the face of the global financial crisis, and has focused on domestic demand so as to facilitate the stable and fast development of its economy. As mentioned in the earlier analysis, every 1% increase of GDP is found to promote a 0.9% 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 momentum of steady growth. Besides, the Chinese automobile market is still in the development phase of its product life-cycle, and its annual growth rate of 5%-10% is regarded as robust in comparison to other countries. As for the Chinese tyre-making industry, on 17th November 2008 the Ministry of Finance promulgated the commodities and tax rate concerned with the raised export tax rebate for the third time in 2008. It decided to increase the export tax rebate for rubber made products, such as tyres, from 5% to 9% on 1st December 2008. The increased tax rebate means that the 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, one of the most important traditional festivals in China, 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-yield rubber plants. Training, centred on rubber-tapping techniques and standardised rubber cultivation, should be intended for the rubber-planting farmers so as 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 be focused on such tasks as the construction of a scientific and technological model park, reproduction and cultivation of seedlings, training concerning 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 planting areas.

c) To upgrade the small, scattered, all-inclusive traditional pattern of the preliminary processing of rubber, and expand the scale of processing factories. The key enterprises in the rubber processing industry should be fostered by means of consolidation, combining and reshuffling among enterprises, as well as the integration of small-scale enterprises.

d) To put the replaced rubber plants in rubber farms to the best use through comprehensive development. More effort should be given to the development of rubber-wood made 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 the 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 & Technology + Farmers + Production Base".

5.2.2.3. Regional Cooperation

a) To establish a sub-regional 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 sub-region.
c) To urge countries in the sub-region 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 sub-regions 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 sub-region, 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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Agricultural Trade in the Greater Mekong Sub-Region: The Case of Rubber in Lao PDR

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Contents

Currency Equivalents

1 USD = 8 580 kip
1 Yuan = 1250 kip

Abbreviations and Acronyms

ASEAN	The Association of Southeast Asian Nations
AFS	Agro Forestry System
AFTA	ASEAN Free Trade Area
ACIAR	Australian Centre for International Agricultural Research
APB	Agriculture Promotion Bank
Baan	Village
B/C	Benefit-Cost
CATAS	Chinese Academy of Agricultural and Tropical Sciences
CIAT	Centro Internacional de Agricultura Tropical
CSU	Collection and Sales Unit
DAFI	Development of Agriculture, Forestry, and Industry
DOA	Department of Agriculture
DOF	Department of Forestry
DAFEO	District Agriculture and Forestry Extension Office
EU	European Union
FRC	Forestry Research Center
GDP	Gross Domestic Product
GOL	Government of Lao PDR
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HHs	Households
IRR	Internal Rate of Return
IRSG	International Rubber Study Group
Lao PDR	Lao People Democratic Republic
LNB	Lao National Bank
LNCCI	Lao National Chamber of Commerce and Industry
MAF	Ministry of Agriculture and Forestry
NAFES	National Agriculture and Forestry Extension Service
NAFReC	National Agriculture and Forestry Research Center
NAFRI	National Agriculture and Forestry Research Institute
NGO	Non-Governmental Organization
NPV	Net Present Value
NSEDP	National Socio-Economic Development Plan
NTFP	Non-Timber Forest Products
NUOL	National University of Laos
PAFO	Provincial Agriculture and Forestry Office
R&D	Research and Development
RGAF	Rubber Growers'Association Fund
RRIM	Rubber Research Institute of Malaysia
RRIT	Rubber Research Institute of Thailand
RTWG	Rubber Technical Working Group
SADU	Small-Scale Agro-Enterprise Development in the Uplands
SDC	Swiss Agency for Development and Cooperation

SDT	Special and Differential Treatment
SIDA	Swedish International Development Cooperation Agency
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
VDC	Village Development Committee
VDF	Village Development Fund
VRGA	Village Rubber Village Rubber Welfare Fund
VRWF	Growers' Association
WTO	World Trade Organization

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1. INTRODUCTION

Lao PDR is a landlocked country, covering an area of 236,800 square kilometers. The country is predominantly mountainous, with 80 percent of its land surface consisting of hills and mountains rising 100 to 3,000 meters above the plains of the Mekong River. These alluvial plains range in elevation up to about 200 meters above sea level. The remaining 20 percent of Lao PDR land area is comprised 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. Lao PDR 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 recognized 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% relying on subsistence agriculture.[1]

Map 1: Map of Lao PDR

1.1. Significance of Agriculture

Lao PDR is among the countries whose economic systems are mainly based on agriculture. Indeed, agriculture is a vital anchor to the Lao economy especially in terms of output contribution, employment, and overall role in poverty reduction. The agriculture sector has the highest share of Lao GDP. In 2007, the country's real GDP growth was estimated at nearly 8%, with agriculture accounting for about 40 percent of the total nominal output and posting a nominal growth of 6% from the preceding year. A huge _75 percent to 80 percent of the Lao labor force has been employed in the sector.[2] The significance of agriculture particularly in poverty reduction efforts has been duly recognized by the government and accordingly reflected in key national plans. The country's National Socio-Economic Development Plan (NSEDP) 2006-2010 rightly noted that more than three-quarters of the Lao population live in rural areas and a large majority of these depend on agriculture for livelihood. It further

1 Linkham, et. al. (2005).

2 Figures were extracted from IMF (2008) and ADB (2008).

mentioned that as evidenced by past experience, increasing productivity in agriculture and improving the access to markets are critical for achieving further significant reductions in poverty over the medium term.[3]

Among Lao PDR's agricultural sub-sectors, rice production is the single most important activity. Rice contributes the most to agricultural output followed by livestock and other commercial crops. Such other major crops include maize, peanut, soy bean, and mungbean, among others. Unfortunately, agriculture is not a major export earner for the country. Traditional exports of Lao PDR have included woods, wood products, garments, and hydro-electricity. Agriculture's share of exports is very small. Most of agricultural output has been for domestic consumption and national trade.[4] This is despite Lao PDR having a comparative advantage in the production of rice, maize, peanut, soybean, mungbean, vegetables, some livestock (pigs, live cattle, buffalo), coffee, sugar cane, indigenous fruit, and plantation row wood. Examination of the tariff on agricultural items produced and exported by Lao PDR alongside its ASEAN partners has indicated that there have been areas where products have been placed on Lao PDR's Temporary Exclusion Lists (TEL) when the same products have been placed on the Inclusion Lists (IL) of the other ASEAN countries.[5]

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 cubic meters in 1990 to 734,000 cubic meters in 1998. Since then, however, the government reduced the annual harvest to 260,000 cubic meters in 2000/01 and 200,000 cubic meters in 2001/02, and further to 150,000 cubic meters for 2004/05 while at the same time promoting downstream processing. Tree plantation development, although strongly promoted by the government, is still in its early stage. Given favorable national conditions, it is however expected to play a much larger role in the future.

The forestry sector contributed 3.2 percent of GDP and 25 percent of the 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 likewise of great importance to employment generation in the country, and, 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 amongst those benefiting most. In tune, 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 terms of conserving Lao natural resources, forests in watersheds are essential for water and soil conservation, preventing and diminishing the risk or intensity of floods, drought and sedimentation, and improving the reliability and quality of water supplies for drinking, power generation, irrigation, navigation and fish production. Similarly, designated national

3 See the Lao PDR NSEDP 2006-2010.

4 This is with the exception of coffee. Coffee has been Lao PDR's primary agricultural export. Most of the coffee produced domestically has been exported.

5 Linkham, et. al. (2005).

biodiversity conservation areas and sustainable use of existing forestry projects are important together with the threatened or rare ecosystems and the plant and animal species they contain.

1.3. National Agriculture & Forestry Sector Strategy

To enhance GDP growth, the government's NSEDP 2001-2005 focused on the specific development of programs and targets involving the agriculture sector. It particularly stressed the need to develop appropriate technologies for upgrading yield and improve farming, production, processing, and marketing systems.[6] The prevailing NSEDP 2006-2010 likewise recognized the centrality of the agriculture sector especially in poverty reduction efforts. As its overall goal, it seeks to set off greater economic progress by primarily developing the agriculture sector with key specific focus on entirely eliminating the slash-and-burn cultivation practices.[7]

As mentioned beforehand, approximately 80% of Lao PDR's land surface consists of hills and mountains. Most of the country's provinces in the north still continue with the practice of "slash and burn" shifting cultivation. In view of this, the Lao government adopted a national policy aimed at eliminating all upland rice production under slash-and-burn shifting cultivation systems and substantially reducing the area cropped to upland rice. Non-shifting, more ecologically stable systems, with land management by villages and individual households, were to be introduced. The key development strategies have been to sustain the pace of the current momentum along the Mekong corridor while expanding the development process to the sloping lands. Research to develop appropriate technologies for integration into improved land use systems and mobilization of an effective extension system to disseminate them have been key components of the government's strategy in support of upland farmers during the transition period.[8]

From the point of view of the government, all development activities in the country are aimed at reducing poverty. They have optimistically targeted to reduce poverty by half in 2005 following the implementation of the NSEDP 2001-2005. What the poor need to survive is increasing investment in upland agriculture, particularly in agriculture diversification, livestock rearing, agro forestry and non-timber forest production. Agricultural diversification can help the poor farmers achieve food self sufficiency, secure their sources of income and finally help them escape poverty. To achieve these goals, the Lao government's macroeconomic policies have aimed to promote further economic growth by improving infrastructure, human resource and market facilities, among others. They also deemed as necessary the expansion of external economic cooperation with ASEAN countries as well as international organizations promoting natural resource sustainability. As member of ASEAN, Lao PDR is bound to further integrate itself into the regional economy and benefit from the larger market.[9]

The following four specific targets comprise the agriculture and forestry sector strategy of the country based on national policies:

6 Linkham, et. al. (2005).
7 See Lao PDR's NSEDP 2006-2010.
8 Linkham, et. al. (2005).
9 Ibid.

- Goal 1: Food Production
  - Increase agriculture & 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 which corresponds to 3.2 to 3.3 million tons of paddy rice by 2010
  - Increase quantity of food in the 47 poorest districts to the national level (350 kg per person 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 agriculture and forestry products to processing industries and the service sector
  - Increase export share of agriculture and forestry products to one-third (approximately US$1 billion) of the total export value of commercial and services sectors (US$3.48 billion) by 2010
- Goal 3: Stop Slash-and-Burn Cultivation
  - End of slash-and-burn shifting cultivation practices by 2010
  - Focus on 47 poorest districts; link to rural development, poverty reduction and environmental protection.
- Goal 4: Sustainable Forest Management & Balance between Exploitation, Utilization, and Protection / Conservation
  - Increase forest cover from current 41.5 percent to 53 percent (9 million ha to 12 million ha) of total land area by 2010

1.4. Agricultural Trade Policies

Lao PDR has taken initial actions in the move to comply with AFTA accession. Initially, the tariff cuts proposed by Lao PDR were of a too long duration as most agricultural commodities were excluded from tariff reductions. Tariff reduction across ASEAN, the effect will be to drive each country towards producing and exporting products that have competitive advantage. Phasing tariff early would acclimatize business and producers to increased competition.

As earlier mentioned, the country's traditional exports comprise of agricultural commodities, logs and sawn timber, wood and wood products, livestock and hydro-electricity. But, since 1999/2000, cash crops, particularly coffee, have be come important export products. With new foreign investment in the 1990s which help the expansion of export-oriented manufacturing (e.g. garments) Lao exports have, to some extent, become more diversified. Likewise, trade liberation in both Lao PDR and its trading partners has encouraged non-traditional exports. Besides, significant informal cross border trade has been occurring between Lao PDR and bordering countries and such has been hard to prevent due to difficult terrain, poor infrastructure, and poor law enforcement capacity.[10]

Lao PDR's top trading partner is Thailand. In 2007, about 36% of the country's total exports went to Thailand while a huge 71% of total Lao imports were Thai products. Other major trading partners of Lao PDR are Vietnam and China. Vietnam accounted for 11% and 5% of total Lao exports and imports respectively in 2007.[11] Key imports of Lao PDR are composed of

10 Government of Lao PDR (2001); Linkham, et. al, (2005).

11 Figures were based on the data presented in ADB (2008).

consumption good such as fuel, gas, electrical appliances, investment good such as machinery and equipment, and intermediate goods, especially raw material for garment industry. Despite efforts made to develop and diversify its export products, Lao PDR still has significant trade deficit, though this deficit has considerably decreased in the recent years. Trade balance was -US$142 million in 2007 compared with US$-349 million in 2004.[12]

1.5. Border Trade Policy

The government considers border trade as one of the most important factors for the economic development of the country. The government officially determined two border trade zones as focal points for border trade development. The first is located in Dansavanh village, sharing a border with Vietnam in Savannakhet province, located along Route 9, the east-west corridor of south-east Asia. The second is the Boten trade zone, sharing a border with Yunan province in China, and which is located in Luang Namtha province, 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.[13]

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 previously have no or difficult access to domestic markets. For these border points, members of “border trade clusters” can export and import all kinds of products necessary for production and consumption, under the list of goods permitted. At border points in non-remote areas, members of “border trade clusters” can export all their products and import inputs necessary for their production.[14]

2. METHODOLOGY

2.1. Study Site

Two provinces in Lao PDR were chosen for the case study on rubber production namely the northern provinces of Luang Namtha and Oudomxay. These provinces were selected by the Lao research team after reviewing the related literature, the data gap analysis and feedback from the first meeting in Vietnam.

2.2. Hypothesis

Development of the rubber industry is beneficial to Lao PDR and other GMS countries.

2.3. Research Questions

The research focused on the following concerns:

12 See also ADB (2008) for the raw data.
13 Leebouapao, et. al. in CDRI (2005).
14 Ibid.

- 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?

2.4. Data Collection

The task of collecting data for purposes of this study was governed by several imperatives. First, the team needed to review available literature on related topics. Second, 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. Third, 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 the relevant officials for consideration in the design of the project proposal.

The second stage consisted of data collection in and around the villages. In this regard, field visits and group discussions with selected participants were the chief strategies used.

The third stage involved a study trip to either China or Vietnam. Activities during the trip included field visits to farms, trade companies and factories on top of meetings with stakeholders in rubber trade.

The fourth stage dealt with data compilation and report writing. A workshop was held in Luang Namtha or Oudomxay province for the purpose of disseminating the most important findings of the research to and securing feedback from district, provincial and national officials and other stakeholders.

3. RUBBER

Lao PDR has been in the midst of a rubber planting boom. Strong market demand for latex and the presence of many private investors from China, Vietnam, and Thailand have triggered the sudden increase in rubber planting, 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 the NSEDP 2001-

2005, the production of industrial trees and crops, such as rubber, for export and distribution in the country have largely been increasing, Having won popularity, rubber trees have been extensively planted in the Provinces of Luang Namtha, Oudomsay, Bokeo, Khammouane, Champasak, Saravane, Sekong and Attapeu.[15]

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 long gestation period. However, it can also be intercropped during the years before tapping as well as placed within longer-term agro forestry systems (AFS). Because of this, rubber as part of an integrated farming system can be considered an ideal option in the uplands for reducing poverty and stabilizing shifting cultivation.

While there is an increasing number of smallholders now going into rubber growing, technical and market information for improved economic returns however 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 experienced an increase since the early 1990s, largely driven by the booming Chinese economy. Estimations predict that this demand will continue to grow, and that by 2020, world demand will be 50% higher than in 2003. With its growing economy, China's consumption is estimated to rise from 18% to 30% of the world's total production of rubber.[16]

This obviously presents possibilities for a country like Lao PDR, which borders China and has a climate which is fairly favorable for rubber planting, to increase its production of natural rubber. At the same time, challenges, both ecological and social, are particularly ubiquitous for the rural areas of Lao PDR which are rapidly transforming from predominantly subsistence-based agricultural systems to commercial production.

Although demand for rubber has been rising for several years, this does not necessarily mean that prices will continue to rise accordingly. World market price for natural rubber is strongly fluctuating and since rubber trees do not yield harvest until after five to eight years (depending on climate and variety), the investment is connected with considerable financial risks. Apart from the risks of uncertain market price, there is also a risk of climatic effects and pest destroying rubber plants. Yet, unlike other commodities, rubber seems to offer long-term prospect of economic return and flexibility in terms of 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 vaguely written 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 contract and its sanctity are still not well understood by both investors and farmers in Lao PDR. At times, contracts are not legally binding due to lack of jurisdiction.

15 See the NSEDP 2006-2010.
16 Burger and Smit (2004).

For the time being, information on rubber is scarce and scattered. There is no systematic information on rubber across Lao PDR including those on the areas where rubber is planted, by whom it is planted, the type of arrangements among the concerned parties, and production expansion plans. This problem presents a serious obstacle to assessing the social and ecological impact of rubber planting.

In addition to the lack of general information on rubber cultivation in Lao PDR, the quality of seedlings that are being introduced and where it is planted are of high importance. The earliest time one can detect the poor quality of seedling is after approximately six months from planting in the field. However, it might take up to several years when tapping begins that the quality of seedlings becomes obvious. Not having a standard for seedlings thus implies major financial risks for farmers especially if there is nothing in the contract that stipulates compensating for financial loss due to poor seedlings.

Rubber plantations in Lao PDR are primarily under monocropping system with first three years of intercropping with rice, maize, and pineapple. However, studies indicate that intercropping rubber with other crops in the longer term has potential to yield more income for farmers than long-term monocropping of rubber. Intercropping is particularly important for farmers to generate an income during the first couple of years when the latex is still not tapped. A study undertaken in China also shows that the actual rubber tree yields more when being intercropped than monocropped. Other benefits of intercropping are less erosion, income stability through diversification of crops and food security during the non-productive years of the rubber tree.[17]

To be able to gain understanding of the implications of rubber planting in Lao PDR (land, technical, socio-economic and regional perspective on rubber production) that and provide recommendations on how to achieve sustainable land use and financial progress for upland farmers, there is a need to review the current status of rubber plantation in Lao PDR and other GMS that spans the biophysical, socio-economic and policy dimensions.

Table 1: Rubber Plantation Areas in Lao PDR

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

Source: FRC (2006).

17 Linkham, et. al. (2008). See also Cheo (undated).

3.1. Production

3.1.1. Rubber Production in Northern Areas

The first rubber plantation in northern Lao PDR was planted in 1994 in Luang Namtha province. The objective of the rubber planting project in Luang Namtha was to solve the problems of the upland farmers and thus address the three goals of the Lao government for said farmers namely elimination of swidden systems, cessation of opium cultivation, and reduction of poverty. During the fifth conference of the provincial committee party, improvement of rubber planting was chosen to be prioritized to solve the poverty of people in the uplands. The objective was to increase the size of plantation areas to 20,000 hectares by 2010. Sometime in 2006, about 10,000 hectares were devoted to rubber in Luang Namtha.[18]

In 2000, three companies from China decided to invest in rubber production in Luang Namtha –Yunnan Local Product Import-Export Co. Ltd., Rubber Company Bejing Jinxianglian Co. Ltd., and Foreign Economic Commerce Co. Ltd. Sip Song Panna. In 2001, the Lao Foreign Economic Commerce Division executed Project Agreement No. 002. with Yunnan after approving the investment proposal from the latter. 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 rubber processing factory can produce 6,000 ton of rubber per year. The company also established rubber nurseries in 3 places (Na Lae District, Namtha District, and Meuang Sing) by using new clones from Yunnan including Yuyan 77-2 and Yuyan 77-4. A total of 2,020,000 rubber seedlings was distributed.[19]

In 2003, Sino-Laos Rubber Co. Ltd. planted rubber trees on 59 hectares of land in Oudomxay province. In 2004, plantation areas increased to 100 hectares. There were 2 rubber nurseries –in Hour District with 50,000 seedlings by Jianfeng Company and in Beang District with 1,000,000 seedlings by Sino-Laos Rubber Co. Ltd (Oudomxay). All rubber seedlings were imported from Yunnan, China and included clones Yuyan 77-2, Yuyan 77-4 and RRIM 600.[20]

In 2004, Sino-Laos Rubber Co. Ltd. established a rubber nursery in Bokeo Province and supported such with 3,000 rubber seedlings. Total plantation area in this nursery is currently 701 hectares.

18 Provincial Governor of Luang Namtha (2006).

19 Na Lae District received 220,000 seedlings, Namtha District, 1,500,000 seedlings, and Meuang Sing, 300,000 seedlings.

20 Sino-Laos Rubber Co. Ltd. et al. (2004).

Sino-Lao Rubber Factory, Luang Namtha Province

Table 2: Planting Arrangements

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

Table 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 labor 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 hectares of rubber trees in Khammuane province. Seedlings were imported from Thailand and Vietnam at a price of 7,000 kip/seedling. Resin is now collected from the planted rubber trees for export to Thailand.

In 1996, a GTZ project involved planting 114 hectares of rubber trees in Xangthong District, Vientiane, the capital of Lao PDR. Seedlings were imported from Thailand and resin is likewise now being collected from the planted rubber trees for export to Thailand.

In 2004, Sino-Laos Rubber Co. Ltd brought rubber clones Yuyan 77-2 and Yuyan 77-4 to nursery in Vientiane province in an amount of 200,000 seedlings. In 2006, the province executed an agreement with Lao-Thai Hua Rubber Co. Ltd granting 100 hectares of land concession for rubber planting.[21]

3.1.3. Rubber Production in Southern Areas

Since 1930, rubber tree planting is being carried out in Lao PDR. The first site was selected in Bachiang District, Champassak Province, about 9 to13 kilometers far from Pakse town on the road to Bolaven plateau. The planting area was in a 4-plot design and each plot was about 0.5 hectares. Local people call the rubber trees the *"cao-su"* trees. The villagers around these plantations previously tapped the resin (latex) just for fun and used them to trap the small animals, insects and birds. So far, nobody has paid attention to these trees as they are considered as less significant compared to some local tree species.[22]
In 1991, the Development of Agriculture, Forestry and Industry (DAFI) planted about 1,800 rubber trees for resin production. In the same year, a state program involved planting 13 hectares of rubber trees. Resin is now being collected from such trees. In 2006, Cao Su Dak Lak Company from Vietnam invested in rubber planting in the province, particularly in Bachieng District. Rubber plantation in the south is also widespread in other provinces including in Salvan, Sekong and Attapeu. The rubber clones were imported from Vietnam (RRIV-4) and Thailand (RRIM 600).[23]

3.2. Cultivation Practices

3.2.1. General Characteristics of Shifting Cultivation

As described by Gansberghe, in Laos, as in other countries where it is practiced, shifting cultivation basically 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 vegetation to regrow for a number of years. This is called the 'fallow period'. In the meantime, they grow crops on other new plots. In principle, the longer the duration of the fallow period, the better the crop.[24]

As further described by Gansberghe, there is significant diversity in the shifting cultivation systems in Lao PDR. Diversity factors include soil category, topography, altitude, rainfall, natural vegetation type, land tenure system, level of integration into the market economy,

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21 Sino-Laos Rubber Co. Ltd. et al. (2004).
22 Ketphanh, et. al. (undated).
23 FRC (2006).
24 Gansberghe (undated).

dietary habits, ethnic beliefs and traditions, local technical knowledge, level of conversion from shifting agriculture to sedentary agriculture, level of crop-livestock integration, and so on. What this diversity means is that most of these systems function under location-specific management and thus require location-specific alternatives for those willing to modify their systems.[25]

As mentioned by Gansberghe, two types of shifting cultivation systems are often distinguished in Laos namely rotational and pioneering. The former is the most common type in Laos. It involved 'established' swiddeners keeping their villages in the same place but shifting their cultivated plots according to a crop/fallow cycle. Under the pioneering system on the other hand, swiddeners move their whole village settlements from one site to another after several years, mainly because the nearby forest has become exhausted.[26]

The main cropping period for shifting cultivators, as pointed out by Gansberghe, is the wet season. A shifting cultivation plot is generally cultivated for one year without tillage but sometimes the same plots are planted for two or three consecutive years. When this happens, tools are then used for tillage before sowing. Upland rice is the main crop grown by Lao shifting cultivators. In [27]addition, several other crops are grown in smaller quantity such as

cassava, maize, cotton, yam, cucurbits, chillies, sesame, Job's tears and sweet potato. Shifting cultivators generally practice mixed or multiple cropping and agricultural diversity tends to be higher in shifting cultivation systems than on the sedentary farms of the lowlands.[28]

As earlier mentioned, the Lao government has included in its national objectives the complete elimination of slash-and-burn shifting cultivation. This has been the major reason for the decrease and other changes observed in shifting cultivation areas throughout Laos. However, there are other factors that 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 reconverted their shifting cultivation systems into sedentary agricultural systems, there are still many farmers who cannot completely reconvert their systems due to various constraints including limited availability of flat land, limited family manpower for more intensified forms of agriculture, limited technical know-how for growing wetland rice, ethnic traditions revolving around the rice cycle, and limited knowledge of crop science.[29]

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. Myint categorized two stages of the transition from subsistence production to production for the market. The first stage occurs 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 a spare-time activity. In other words, farmers change from being

25 Ibid.
26 Ibid.
27 Ibid.
28 Ibid.
29 Gansberghe (undated).

'part-time' to 'fulltime' producers for the market. The shift is accelerated by the improvement of infrastructure – especially transportations and communications – and the availability of markets. The transition from a subsistence economic system to total production for the market was classified by Fisk into four stages – 'pure subsistence in isolation', 'subsistence with supplementary cash production', 'cash orientation with supplementary subsistence', and 'complete specialization for the market'. The first stage occurs when farmers' consumption is entirely reliant on their own production and the final stage occurs 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's 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. On the other hand, 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 additionally 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.[30]

3.3. Production Costs

Overall, the life of rubber trees may be up to 100 years. But in economic terms, it is about 30 to 40 years starting from the first year of planting and until the harvest of the trees. Rubber trees provide latex between year 7 and 25. After that, the yield of latex decreases significantly. Therefore, the investment is calculated only for 25 years, and separated into periods of Year1, Year 2-6, and Year 7-25. The details are as follows:

Table 4: Prices of Tub-Lump rubber in the Year 2002-2007 in Luang Namtha Province

No	Year	Average (Kip/Kg)
1	2002	4,300
2	2003	4,500
3	2004	5,500
4	2005	6,500
5	2006	10,370
6	2007	10,625

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

3.3.1. Investment in Rubber Plantation in Year 1

The estimation of investment in rubber plantation in year 1 includes the costs of land clearing and preparation, planting materials, and maintenance costs as shown in the following table.

30 Manivong, et. al. (2009); Myint and Fisk as cited therein.

Table 5: Estimation of Investment in Rubber Plantation in Year 1

No	Items	Unit	Quantity	Prices(Kip)	Total(Kip)
1	Land clearing	Ha	1	1,000,000	1,000,000
2	Land preparation	Ha	1	1,500,000	1,500,000
3	Rubber seedling	seedling	500	5,000	2,500,000
4	Labor cost planting	seedling	500	500	250,000
5	Barbed wire	Roll	16	150,000	2,400,000
6	posts	Post	300	5,000	1,500,000
7	Fencing	Ha	1	700,000	700,000
8	Nails	Kg	2	10,000	20,000
9	Organic fertilizer	Kg	500	1,200	600,000
10	Pesticide	L	2	15,000	30,000
11	Chemical fertilizer	Kg	120	4,000	480,000
12	Costs for 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

For smallholder farmers who usually have family labor of 2 to 3 persons per household, the investment may be only for pesticide, rubber seedlings, chemical and organic fertilizer.

3.3.2. Investment in Rubber Plantation in Year 2-6

The investment from year 2 to 6 is all about maintenance of rubber plantation. The estimation of the investment in the following table is summed up and after that divided by 5 years in order to get the figure for each year. The details are in the table below.

Table 6: Estimation of Investment in Rubber Plantation in Year 2-6

No	Items	Unit	Quantity	Prices(Kip)	Total(Kip)
1	Costs for maintenance	Year	5	1,000,000	5,000,000
2	Organic fertilizer	Kg	5,000	1,200	6,000,000
3	Chemical fertilizer	Kg	925	4,000	3,700,000
4	Pesticide	Liter	10	15,000	150,000
5	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 Year 7-25

Expenditure during year 7-25 is more than the expenses during the first 6 years as the former includes the input costs of tapping. Inputs consist of tapping materials, chemical and organic fertilizers and pesticide as shown in the table below.

Table 7: Estimation of Investment in Rubber Plantation in Year 7-25

No	Items	Unit	Quantity	Prices(Kip)	Total(Kip)
1	Costs for maintenance	Year	19	1,000,000	19,000,000
2	Organic fertilizer	Kg	10,000	1,200	12,000,000
3	Chemical fertilizer	Kg	6,500	4,000	26,000,000
4	Pesticide	Liter	368	15,000	5,520,000
5	Costs for tapping	Day	2,280	30,000	68,400,000
6	Fungicide	Kg	570	10,000	5,700,000
7	Bowl/cup	piece	3,000	2,000	6,000,000
8	Tapping knife	Piece	18	30,000	540,000
9	Iron wire	Piece	3,000	100	300,000
10	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 late x for only 19 years.
2. Latex production yields 1,500 kg/year/ha (one rubber tree can give latex production of 3 kg/year/tree x 500 tree = 1,500 kg/year)
3. Income is 1,500 kg/year x 10,500 kip/kg = 15,750,000 kip/year (19 year x 15,750,000 kip = 299,250,000 kip)
4. Income from intercropping is around 1,800,000 Kip/year x 4 year = 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)

3.4.1. Background

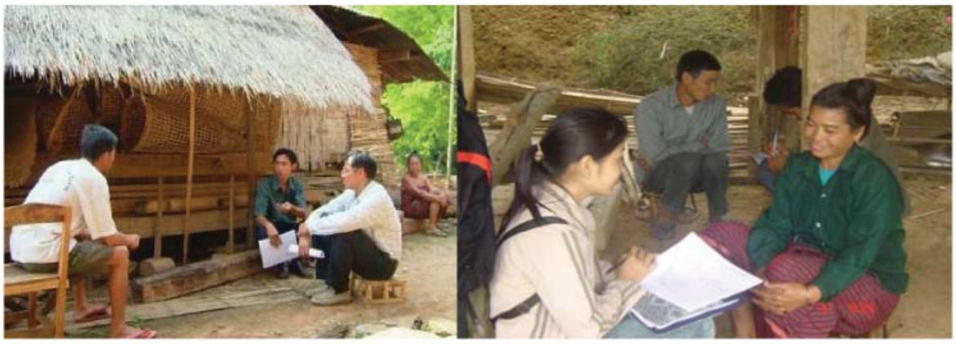
Baan Hat Nyao is a small village at the edge of the provincial town in Luang Namtha province. At the time of the survey conducted in 2008, there were 122 households in the village with a total of 146 families. The total village population was 964 people of which slightly over

half were females. As far as the socio-economic categorization of the village went, about 26 percent of the village households were considered as well-off, more than 50 percent were mid-level and almost less than a quarter were less well-off (see Table 10). There were very few households in the village that were in poverty. By definition, those in poverty would actually be the less well-off households, those who are destitute. This would constitute some families with basically little available labor such as a widow with small children, an elderly couple or a person who lives alone or is sick, etc.[31]

Table 8: Village Demographics

			Total	**Well-off**	**Mid-Level**	**Less well-off**
HHs	Man	Female	Popl	HHs	HHs	HHs
122	500	464	964	32	70	20

Source: Field survey 2008.



3.4.2. History

The village was established in 1975, the year of the founding of the Lao PDR. Most of the early families came from Pak Tha district of then Oudomxay province (now Bokeo province) and had settled in Luang Namtha in 1973 but up in the mountains. Later, other White Hmong families came in from Xieng Khwang province. In 1975, they moved down to the present site of Hat Nyao village in search of paddy rice land. From 1975 to 1980, more than 160 people died as villagers tried to adjust to the lowlands at a lower elevation than their mountainous villages. Because of the relative scarcity of anticipated potential paddy land, many households returned to the nearby mountains to practice shifting cultivation. During this period, the size of the village was reduced to a mere 17 households.[32]

Then in the latter part of the 1980s, various Hmong communities were encouraged to resettle in Hat Nyao village so its population began to gradually increase. This included Hmong refugees from Chins, who had relatives in Hat Nyao village and requested to be allowed to resettle; they made the move in January 1994. While sojourning in the Chinese agricultural collective, they cultivated rubber and thus gained much rubber experience over a fifteen year period.[33]

31 Alton, et. al. (2005).
32 Ibid.
33 Ibid.

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, 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.[34]

3.4.3 Rubber Production in the Village

Concerned families and the leadership in Hat Nyao saw rubber tree cultivation as compatible with their existing livelihood systems including opium poppy cultivation and the subsequent skills derived from bleeding poppy pustules. They felt that as an enterprise with its labor requirements for latex production it would be compatible with their work ethic and community organization. In addition, with the encouragement of the provincial government rubber was foreseen as an alternative to shifting cultivation and opium poppy cultivation.[35]

In 1997, land allocation was undertaken in the village. Totaling 4,604 hectares in terms of area, the land allocated to the village was classified into the following types: conservation forest, 700 ha; protection forest, 1,300 ha; agricultural land, 1,700 ha; forest plantation land, 700 ha; livestock feeding, 200 ha; and village location, 4 ha. Since then, households have cultivated upland rice, corn, cassava, chilies, vegetables and rubber trees on the village's agricultural land area. Theoretically, due to land allocation, they have cultivated these upland crops under shifting (swidden) cultivation in a rotational three-four year fallow. This upland crop use has resulted in very low yields due to low soil fertility and weed competition due to short fallow.[36]

It is difficult to determine how much of their agricultural land is used for upland rice cultivation under shifting cultivation, since village leaders de-emphasize this activity because of perceived non-compliance with the government policy on eradicating shifting cultivation. Thus, at least around 900 hectares of their designated village agricultural land is used for their subsistence rice and other food crops.[37]

By 1996, about 154,000 of rubber trees (342 ha) had been planted on older fallow land. The frost of December 1999 killed approximately 34,000 trees d (75.5 ha), leaving 12,000 trees (267 ha) alive. Tapping began in 2002 by 22 households. In 2003 and 2004, another 170 hectares were planted, bringing the total of plantation areas to about 437 hectares. These all had been planted on the 1,700 hectares of designated agricultural land. It is reported that in 2005 and 2006 another 200 and 100 hectares were targeted to be planted respectively. In 2008, rubber plantation areas totaled approximately 834 hectares, of which 334 hectares were already being tapped while the remaining 500 hectares are set to be tapped between 2013 and 2015. On average, there were about 470 of rubber trees per hectare.[38]

34 Ibid.
35 Ibid.
36 Ibid.
37 Ibid.
38 Ibid.

Table 9: Rubber Trees Planted in Hat Nyao

Year	Area Planted (ha)	No. of HHs
1994	94.30	60
1995	249.70	93
1996	342	102
2003	Planted an additional 170 (totaling 437 ha)	105
2004		
2005	Planted an additional 200	84
2006	Planted an additional100	92
2008	843 (tapped 334 ha)	122

Source: Alton, et. al. (2005)

The labor provided for rubber tree cultivation is mixed between household and hired labor. Obviously, less well-off households supply virtually all the labor required. If households can afford hired labor, they will at least hire them for slashing and burning of the bush fallow, terracing and planting of seedlings, and annual weeding. Family labor is usually used for nursery work, care and maintenance in the immature stage and for all tapping work since it is considered too delicate to have hired labor undertake.[39]

This hired labor is from neighboring villages, usually of other ethnic groups, e.g. Khmu, Akha, and Yao. The wage rate sometime in 2005 was kip 25,000-30,000/day for light work and kip 30,000-35,000/day for heavy work. There did not appear to be any hired labor shortages for the same period. All producing households in 1994-1996 received subsidized loans from the province for the cost of seedlings and some fencing. Each producing household received between kip 1-3 million in credit to plant rubber trees. The provincial funds were lent by the PAFO for rubber tree cultivation in 1994. The funds were used for seedlings and barbed

wire. As mentioned in Table 5 below, a total of Kip 12,873,340 was lent out at a 2 percent interest rate for a period of 15 years. At first these funds were handled by the PAFO. Then in the second year, 1995, Kip 10 million were given by the Agricultural Promotion Bank (APB). These funds were also supplied by the provincial government but through the APB at an interest rate of 7 percent for farmers and for a period of fifteen years.[40]

Table 10: Baan Hat Nyao Loans for Rubber Tree Cultivation in 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)

39 Alton, et. al. (2005).
40 Ibid.

3.4.4. Preferment of income

Tapping in Hat Nyao Village

A study by Alton, Bluhm and Sananikone41, estimated rubber yields based on actual yields in the first three years of tapping (2002-2004) in the rubber enterprises of six households in Hat Nyao village. The projected yield estimates for year 11-30 were adjusted from the RRIT production data for RRIM 600 to the average of 105 tapping days in Baan Hat Nyao. Note however that the estimated production data (maximum peak yield of 1,694 kg/ha.) for Hat Nyao village taken from RRIT estimates for northern Thailand did not factor in the environmental stress of the 650 to 700 meter elevation of Baan Hat Nyao rubber.[42]

Rubber sales in 2004 were limited to tub/cup lumps priced at ¥ 5.5/kg (US$ 0.69/kg) on the average. For future projections, the conservative price of ¥ 5.0/kg (US$ 0.63/kg) was used in the study. Raw rubber sheets and liquid latex had better net returns, but lack of information on the parameters prohibited reliable projections.[43]

It is conventional to include the sale of rubber timber at the end of the production cycle. While there was market in Sip Song Panna, there was none in Lao PDR yet at the time of the study. Timber sales from 70 m³/ha can amount to $2,450 or Kip 25,350,000 and branched

wood sales (for charcoal) from 130 m³ can amount to $1,300 or Kip 13,390,000. The study estimated that 140 laborers per day would be required to harvest this.[44]

In the scenario where 25% of the recommended fertilizer use is applied, the study found out that the returns to HH labor can reach Kip 123,476 (US$ 11.99), and the returns to all labor, Kip 111, 678/PD (US$ 10.84). Both of these were almost five times that of the wage rate at the time of the study. The returns to capital on the other hand were valued at approximately Kip 6.65 per Kip invested without HH labor and 2.73 Kip per Kip invested with all labor. With a discount rate of 20%, the net present value (NPV) of the income stream was estimated at Kip 6.3, the internal rate of return (IRR) at 8.63% 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

41 See Alton, et. al. (2005).
42 Ibid.
43 Ibid.
44 Alton, et. al. (2005).

enterprise would be considered feasible.[45]

Table 11: Revenues for Selected Crops

Crops	Yield (kg/ha)	Farm gate price (kip/kg)	Revenue/ha (kip)	Revenue/ha (USD)
Upland rice	1,500	1,000	1,500,000	146
Maize	3,000	700	2,100,000	204
Soy bean	800	2,500	2,000,000	195
Sesame	700	5,000	3,500,000	340
Rubber*	**1,300**	**6,500**	**8,450,000**	**822**

**This does not include investment during the first 7 years. Average income for the 30 years for rubber is estimated at approximately 645 USD/year.*

3.5. Trade in Rubber

At present, there is high demand for rubber and the market for rubber is expanding. Further demand and market expansion is seen in the next 10 years. However, it should be noted that the production cycle and the market for rubber is unstable or volatile. They have "boom & bust" cycles. Therefore, farmers need to have an appropriate mechanism to cope with price fluctuations, specifically with inevitable price crashes. Government support is vital to support farmers during periods of rubber price declines.46 Prices of rubber in Lao PDR, especially in Luang Namtha Province, have increased. Those rubber have been in the form of tub-lump rubber and were exported to China in 2002-2007.

3.5.1. Marketing Chains

Rubber is different from other commercial crops and needs a high degree of organization and institutional support at all levels. At the national level, this could include a national strategy integrating technical issues, extension, credit, transport, and marketing. In addition, in all rubber producing countries, there is a national coordinating committee which works closely

with all sectors related to the rubber industry. At the local level, smallholder farmer groups need to be organized by them and/or supported by the government in order to strengthen rubber cultivation, tapping, processing, and marketing.[47]

3.5.2. Costs and Margins

The costs of transporting tub lumps from a farm gate in Hat Nyao to the border gate are calculated as follows:

45 Ibid.
46 NAFRI et. al. (2006)
47 NAFRI et. al. (2006)

- Labor costs for transferring tub lumps from the farm gate to the track is around 20,000 kip per ton;
- The cost of transportation from farm gate to the border gate is around 150,000 kip per ton; with an income tax of 35%, middlemen have to pay tax of around 3,950,000 kip per ton;
- The tub lumps 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). Therefore, the cost of transporting 1 ton of tub lumps from farm gate to the border is around 4,120,000 kip but selling this 1 ton of tub lumps at the border gate could earn a profit of around 11,250,000 kip.

Given the higher returns, many middlemen (Lao and Chinese) prefer to buy the tub lumps from the farmers and bring such tub lumps from the farm gate to the border for them to sell rather than becoming rubber producers themselves. To illustrate this, a middleman buys the tub lumps from the farm gate at around 6250 kip/kg and sells them at the border gate at a higher price of 17,500 kip/kg. Due to high transportation and other associated costs, farmers have no choice but to sell their produce to middlemen.

3.5.3. Exports and Processing

Lao PDR has no rubber processing industry. Rubber is sold in the form of tub lumps which are coagulated rubber poured into a wash tub, 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. These tub lumps get contaminated with sand, dirt and small stones. Reportedly, if they are stored for more than a month their weight is somewhat reduced.[48]

Beginning in about June, the Collection and Sales Unit (CSU) goes to Sip Song Panna, usually to Mengla County to seek the best prices for their rubber. They go around to various factories to obtain bids. When the team was in the village in the latter part of November, it took three days for them to find the best offer of ¥5.3/kg. Then about two days later, two trucks came to transport the tub lumps to the factory. Households brought their tub lumps to the common ground of the village in push carts, in small carts pulled by motorcycles, and a couple of households used pick-up trucks. These tub lumps were weighed and recorded by the CSU. Based on these sales, the fees to be paid to the Rubber Growers' Association Fund (RGAF) is calculated. Then when the payments to households are made, this fee is then deducted and put into the RGAF. The CSU complains that the Chinese merchants always gripe about depressed prices when we know that world prices are stable or increasing. Villagers have no idea what world rubber prices are. Sometime in 2005, prices for this low quality lump rubber ranged from about ¥5.2 - 5.7/kg.[49]

Lao farmers are very much 'price takers' of whatever the Chinese merchants and traders offer. They are told that world prices are declining and many other stories in order to offer lower prices when they go to make arrangements for sale. Market information concerning world prices of rubber or even prices in China is virtually non-existent. A regular mechanism of announcing price information on a radio program or some other means is needed to notify

48 Alton, et. al. (2005).
49 Alton, et. al. (2005).

farmers about current prices. This could give the world, Chinese and Thai prices for the various forms of rubber.[50]

Lao farmers only utilize the Chinese market. Of course, this is the final market for most rubber in the region. However, once the NR3 is completed from Botène to Baan Huay Sai, Bokeo, and as rubber production increases in northern Thailand, prompting the establishment of more rubber processing factories, new marketing opportunities will be opened for Lao farmers.Thus, this alternative to selling to the Chinese should be considered. In addition, farm families should consider forms of rubber other than tub lumps, such as raw rubber sheets, raw liquid latex, and smoked rubber sheets.[51]

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 organizing production and marketing. However, the exact formation of these rubber growers' associations will be different for each village and ethnic group given their varying community organizations, cultures, customary rules and regulations, etc. It may be that these associations could eventually become cooperatives as was beginning to emerge in Isaan.[52]

3.6. Potential and Policies

3.6.1. Village Initiatives

The Village Development Committee (VDC) of Baan Hat Nyao prepared a plan for the province which included potential designated rubber tree cultivation land to be divided amongst producing households according to their available labor. It then 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 in other locations. These production units would also arrange for fencing around the perimeter of the large rubber tree field.

The province first arranged for low interest loans through the Lao National Bank (LNB) 29 and received about Kip 12 million for 1994. The individual household loans ranged from Kip 1-3 million with an interest rate of two percent per annum and a fifteen year pay back period. The 60 households mostly borrowed for the clearing of land, cost of seedlings, planting, and fencing. Then in the second year (1995), another loan was negotiated for about Kip 10 million;

however, it was not until January of the succeeding year that the funds were received at the same rate. Since the APB was administering it, the effective interest rate amounted to seven percent with a fifteen year pay back period.[53]

The seedlings from China were delivered in small amounts of 3-5,000 seedlings, and they were then distributed to the interested households – sometimes no more than 50 seedlings to each. Each village unit was responsible for managing the cultivation techniques.[54]

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50 Ibid.
51 Ibid.
52 Ibid.
53 Alton, et. al. (2005).
54 The cultivation technique consisted of digging holes 60 cm in diameter x 70 cm deep, and constructing a terrace/path of about 80 cm in width. See also Alton, et. al. (2005).

Regulations concerning production were written for the households to sign in agreement 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 these warnings, they could even lose their land. A series of resolutions was issued to address certain concerns as they arose.[55]

In 2001, the first tapping was undertaken experimentally amongst 6 to 7 households, but the real tapping began in 2002. In 2004, these rubber lumps sold for an average of about ¥5.5/kg. They were of low quality with a fair amount of dirt and small stones incorporated due to poor storage techniques.[56]

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 eight percent, of which 40 percent was used for the VDF and 60 percent was for the administrative costs of the VRGA. Later on, before the 2004 season, this was revised. It was agreed upon that a fee of ¥0.25 would be levied on each kilogram of rubber lumps sold (i.e. about 4% of the value). Of these fees, 60 percent would be earmarked for the VDF for people to borrow or use for community activities. Then the remaining 40 percent would be used for the administration of the Collection and Sales Unit (CSU), including remuneration to members for work.[57]

3.6.2. Government Strategies

Lao PDR is one of the poorest and least developed countries in East Asia. It has among the worst social indicators in the region. GNI per capita is low at aboutUS$500 per annum in 2006 and poverty headcount ratio is high, estimated at 33 percent in 2003.58 Poverty incidence in the rural areas is much higher and overall, the central parts of the country are generally better off in comparison with the South and North.[59]

As mentioned in the beginning, the 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/seeds including varieties of rubber trees. The government also has given foreign and local investors the opportunity to invest in rubber tree.[60]

The NSEDP 2006-2010 identified several means to develop the Lao rubber industry, the specific targets being the expansion of cultivation areas and increasing the volume of rubber exports. Primary among these means are greater investment in the construction of agriculture

55 Ibid.
56 Ibid.
57 Alton, et. al. (2005).
58 Figures were sourced from WDI CD-ROM (2008). GNI per capita figure was based on the Atlas method (current US$) while the poverty headcount ratio was at the national poverty line, percentage of total population.
59 Ketphanh, et. al. (undated).
60 Ibid.

infrastructure (more foreign investment needed to be lured into the country's rubber production), development of the domestic rubber processing industry, and establishment of more credit mechanisms accessible to rural communities.[61]

3.6.3. Rubber Research and Development Policy

The international workshop on rubber development, held in Lao PDR in May 9-11, 2006[62], highlighted four main imperatives where research and extension may play significant role, namely:

- The need to appropriately locate where rubber can be planted best 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; and
- 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 immediately resulted from the said conference. Its overall aim was to rationalize 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 considerations; and
3. Outline NAFRI and NAFES proposed future strategic directions or activities towards strengthening rubber R&D in Lao PDR.

In formulating the Rubber R&D Policy Thrust, the framework 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.

61 See NSEDP 2006-2010.

62 This three-day Workshop on Rubber Development in Lao PDR (Exploring Improved Systems for Smallholder Production) was organized NAFRI in partnership with NAFES and NUOL and with funding from SDC, SIDA and GTZ. It was attended by more than 200 participants from within Laos and the region. Its overall goal was to help Lao policy makers and agricultural officials at the national and provincial levels learn lessons about rubber development from experiences of other countries in Southeast Asia and South Asia. See NAFRI, NAFES and NUOL (2006).

Figure 1: Rubber R&D Policy Framework

National Development Goal

This is an official motherhood statement based on Lao PDR 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 are some constraints63 related to rubber planting in Lao PDR:

- Lack of knowledge of rubber variety selection;
- Lack of access to information sources and information exchange on rubber;
- Lack of knowledge of suitable rubber variety for specific areas;
- Lack of funds to expand rubber plantation;
- Violence against land use regulation;
- Conflict among permanent resident and migrants;
- Insufficient water and electricity for rubber processing in their villages;
- Lack of knowledge of latex storage and processing practice;
- Low bargaining power among villagers and traders;
- No agreement between Lao Government and Chinese Government on rubber trade;
- Large area of concession effected to land use planning and land allocation; and
- Research on rubber is still weak because rubber is a new issue for Lao PDR and of the lack of rubber experts;

Other relevant problems and constraints beset the country's agriculture trade in general. They include the following:[64]

- Narrow export base dependent on low value-added agricultural exports;
- The predominance of informal across border trade which make it difficult to identify the actual trade performance and the loss of the tax revenue from this activities;
- Lack of competitiveness of Lao's products in foreign markets, due to low quality standard;

63 These constraints were identified in Linkham, D. et. al. (2008).

64 These other constraints were identified in Linkham, et. al. (2005).

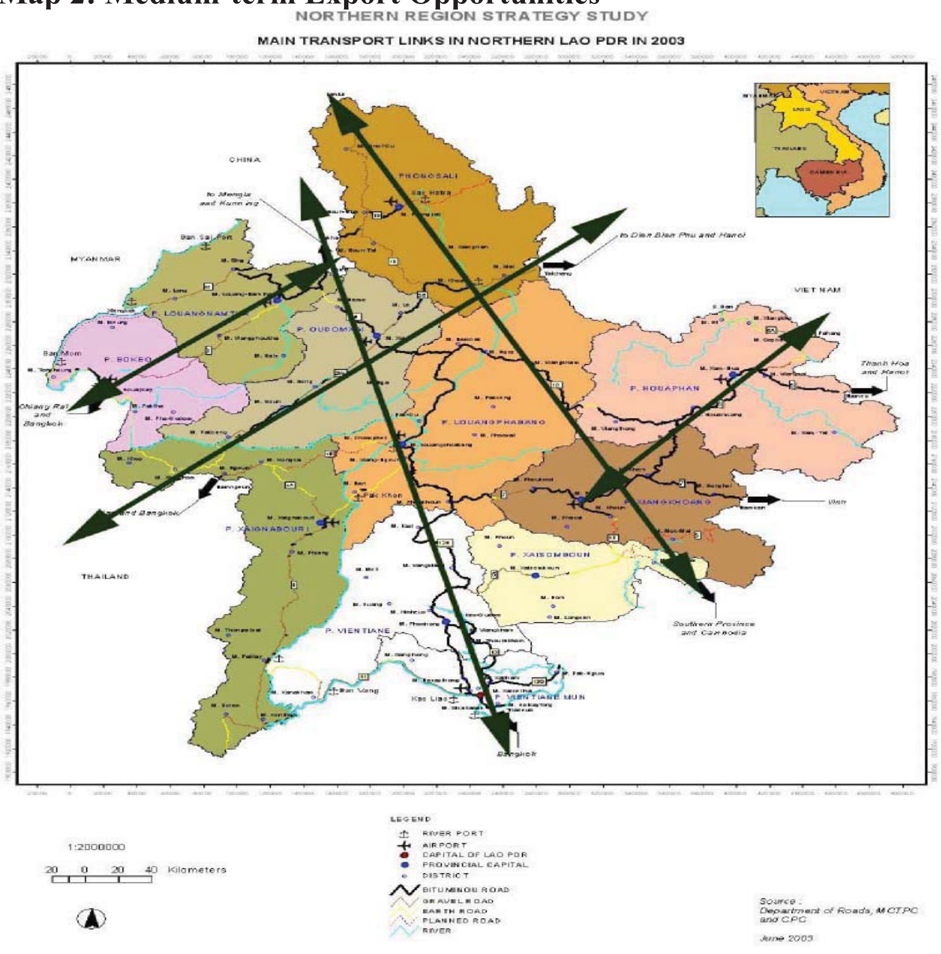
- Lack of sales promotion and incentives of export; and
- Ineffective law enforcement as a result of an underdeveloped legal framework

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

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

The Lao government is seeking to diversify traditional farming practices to adopt more stable production systems and needs to identify alternatives in upland areas that will maintain and improve household income levels. The country has become more outward looking as it seeks to gain advantage from the commodities in which it enjoys a comparative advantage.

Map 2: Medium-term Export Opportunities



EMERGING TRADE ROUTES:

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

3.8. Policy Recommendations and Conclusions

3.8.1. Policy Implications of the Research

Primary findings from this research could provide relevant information to concerned authorities at the central and provincial levels on the following:

- The exposure of villagers to economic abuse by foreign and local rubber investors or traders due to their lack of experience in bargaining and conducting any contract and poor knowledge in rubber know-how. This issue might be a source of financial leakages occurring from rubber tree development in the country if it is not taken into consideration by the government.
- The role of concerned local banks such as the APB in appropriately assisting Lao rubber smallholders in getting access to fairer loans and not being too abused by foreign companies. Absent this assistance, Lao smallholders would be poorer than before, which would be in contradiction to the government policy on poverty eradication.
- The risks of rubber mono culture, specifically its cumulative impacts on the daily lives of Lao smallholders living in the remote areas, as well as on environmental resource sustainability and the National Eco-Tourism Pilot Project Areas. As the northern part of the country is mostly mountainous with quite high slopes, rubber plantation areas would be highly exposed to mud sliding during heavy rain period, as it has occurred in neighboring countries. Moreover, rapid expansion of rubber at a large scale could affect the forested areas and their biodiversity.
- The costs and benefits of rubber tree plantation in the short and long term to Lao villagers and the Lao government. These costs and benefits have not been analyzed in greater detail yet.
- Non-readiness of the whole sector and society (local community, public and private sectors) in promoting rubber development in the country in a sustainable way, and how such could steadily contribute to poverty alleviation and environmental resource sustainability. Research on the appropriate rubber technology transfer is still at the infancy stage. The public trade sector has not been able to provide relevant information to local smallholders on the right foreign rubber markets and traders and train them on market negotiation. Relevant pieces of legislation have not been promulgated in order to ensure protection of the rights and benefits of Lao smallholders.
- Important role of Lao women in the rubber process. They have been playing remarkable involvement in generating their family income from their jobs in the rubber industry in addition to ensuring their families' food security and happiness (such as through taking care of their children and household duties).

3.8.2. Policy Considerations

Many regional experts emphasized that a number of considerations need to be taken into account when promoting rubber. These include the following[65]:

- 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 in order "not to put all eggs into one basket". This will 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 standardized contracts as currently in Lao PDR, there are unclear investment policies and guidelines. In addition, there is no monitoring of how contracts are implemented. The lack of supervision of contracts and concessions jeopardizes 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 to reflect the diversity of situations in Lao PDR and which respect ethnic groups' livelihoods and cultures.
- Existing land use plans must be respected to ensure that rubber is not being planted in conservation forests, village forests, or other areas not appropriate for rubber cultivation.
- Concrete guidelines and standards must be adopted to ensure transparency on contracts and that such contracts are economically, environmentally and socially beneficial.
- Policies related to rubber development must be enforced and their implementation monitored.
- The National Agriculture and Forestry Research Center (NAFReC) and Provincial Agriculture and Forestry Extension Services (PAFES) may consider conducting survey of the rubber research and extension needs of the northern, central, and southern provinces.
- A range of options, particularly AFS, for planting rubber should be considered by smallholders and those providing research and extension support.
- For poor farmers, mixed farming systems should be encouraged and such systems will require policy incentives and rewards for both smallholder and private investors.
- A clear priority should be given to developing adaptive research-extension programme for smallholder rubber development.

3.8.3. Strategic Options

In order to steadily develop rubber tree plantation in a sustainable manner, making sure that it contributes to poverty alleviation, halting opium puffy plantation, stabilizing slash and burn shifting cultivation and ensuring environmental resource sustainability, the following main strategic options must be taken into account:

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65 These considerations were identified in NAFRI, et. al. (2006).

- Farmers, both male and female, need to be trained in all aspects of para rubber tree cultivation practices, including : establishment, maintenance, tapping, processing, marketing, timber sales and negotiation. On processing, they should be made aware of the opportunities, costs, and returns of selling other forms of rubber with more value added, such as clean cup lumps, raw rubber sheets, raw liquid latex, and smoked rubber sheets. There also needs to be training on the formation of rubber grower association, which could potentially lead into a rubber cooperative or appropriate agro community to learn or practice to bargain and negotiate.
- There is a need for the APB to establish clear policies and appropriate measures to enable Lao farmers, such as rubber smallholders, secure loans with low interest and realistic period of grace.
- Local community-extension-technology transfer research interaction is vital. There is a feed forward of field level realities related to cultivation, harvest and sales - the opportunities, problems, and constraints - from the local community issues and needs to the extension system to the technology transfer researchers and local smallholders. In this regard, there has been the proposed experiment station in Luang Namtha representing the northern part, or in any NAFRI networks representing the central and southern parts of the country. They should be constantly feeding relevant field information concerning opportunities, problems and constraints into the technology transfer research program. Technology transfer could rely on China, Thailand, Vietnam or Indonesia, such as on intercropping, high yield varieties, and prevention of adverse environmental impact (i.e. mud sliding and deterioration of soil quality which should be urgently addressed).
- Grant of land concession to foreign and local investors for rubber tree plantation at a large scale should come after due consideration of the benefits and costs of rubber tree plantation and conduct of environmental impact assessment.
- A network mechanism providing information and timely advice regarding movements in world rubber markets and other related matters has to be set up in order to minimize financial leakages and abuse in the rubber sector.
- Relevant pieces of legislation that ensure the rights and profits of Lao rubber smallholders, including security of land tenure, must be promulgated.
- The involvement of Lao women in the rubber process must be promoted and developed as appropriate through such means as capacity-building.
- More cost-benefit and cost-effectiveness analyses on rubber tree development in the country must be undertaken.

3.8.4. Other Recommendations

Other recommendations that could be considered are as follows:

- Create a Rubber Technical Working Group (RTWG) at NAFRI that shall be tasked to further study and develop the summary outline of activities into action plans with time frame and funding requirements;
- Conduct a rubber multi-stakeholders' 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 the MAF;
- With WTO accession, ensure preferential treatment for Lao rubber under the Special and Differential Treatment (SDT);
- Regarding AFTA, ensure the preferential treatment for Lao rubber within ASEAN;
- Strengthen our market position in China;
- Encourage investment on production on production capacity;
- Diversify production from natural rubber to value added rubber related products
- Continue the provincial fund program across the country;
- Improve access to finance (i.e. micro-finance, ODA and government budget) of smallholders;
- 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 center in Provincial Trade and Industry Office;

3.8.5. Conclusions

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, labor, seed supply, bud wood, equipment and other inputs, and, most importantly, rubber 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 Lao PDR. Therefore, though the Chinese market will continue to drive demand for rubber, Lao PDR will need to closely follow the production of rubber in China and assess trends in rubber production systems.[66]

It may be that Lao PDR is seen by the Chinese as a strategic, albeit small, producer of rubber with abundant land resources, cheap labor, and a more favorable climate. Yet the Lao productive capacity pales in comparison to Thailand or Viet Nam, and technically Lao PDR has yet to reach even the most elementary level of knowledge about rubber.[67]
Rubber production seems to be good for long-term income generation because rubber is a priority product for Lao PDR and it can be a stable income source for the farmers and the national economy alike. 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 said industry and capturing 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.[68]

66 Linkham, et. al. (2008).
67 Linkham, et. al. (2008).
68 Ibid.

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Annex

Annex 1: Existing and Planned (2010) Rubber Plantation in Lao PDR

No	Province	Rubber planted area (ha)	Plan for rubber planting (ha)	Investors
1	Phongsaly	13	14.000	-
2	Luang Namtha	8,770	20.000	SINO-LAOS RUBBER CO. LTD (China)
3	Bokeo	701	15.000	SINO-LAOS RUBBER CO. LTD (China)
4	Oudomxay	4,530	20.000	SINO-LAOS RUBBER CO. LTD (China)
5	Xayaboury	66	50.000	JPBPG (China)
6	Luang Prabang	2,467	2.000	-
7	Vientiane Province	100	10.000	JPBPG (China)
8	Vientiane Capital	130	-	-
9	Bolikhamxay	1,026	-	-
10	Khammuane	1,447	-	-
11	Savannakhet	243	-	-
12	Salavan	1,418.8	19.840	Cao Su Dak Lak Company (Vietnam)
13	Champasak	6,719	13.000	Cao Su Dak Lak Company (Vietnam)
14	Sekong	100	10.000	Cao Su Dak Lak Company (Vietnam)
15	Attapeu	500	10.000	Cao Su Dak Lak Company (Vietnam)
16	***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 yield / Wind resistance	4.56
CATAS	Reyan 93-114	Cold resistance	-
	Haiken 1	High yield / Wind resistance	-
	Wenchang 217	High yield / Wind resistance	3.60
	Wenchang 11	High yield / Wind resistance	3.63
	Dafeng 95	High yield / Wind resistance	5.20
	Haiken 2	High yield / Wind resistance	5.89
Yunnan	Yuyan 77-4	High yield / Cold resistance	2.65
Yunnan	Yuyan 77-2	High yield / Cold resistance	3.46
Yunnan	Yuyan 277-5	High yield / Cold resistance	6.4

Source: CATAS (2006)

Agriculture Trade Study within the Greater Mekong Sub-region: Thailand Case Study

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A Project of the Development Analysis Network (DAN)
Cambodia, Vietnam, Laos, Thailand and China

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Contents

Abbreviations and Acronyms

ADS	Air-dried rubber sheets
ANRDC	Animal Nutrition Research and Development Center
TTDI	Thai Tapioca Development Institute
BAAC	Bank for Agriculture and Agricultural Cooperatives
DAN	Development Analysis Network
DMC	Dry Matter Content
EHP	Early Harvest Program
FTA	Free Trade Agreement
GMS	Greater Mekong Sub-region
HYV	High Yielding Variety
IJV	International Joint Venture
IRSG	International Rubber Study Group
ITRO	International Rubber Organization
JTEPA	Japan-Thailand Economic Partnership Agreement
Lao PDR	Lao People's Democratic Republic
MoAC	Ministry of Agriculture and Cooperatives
MRA	Mutual Recognition Agreement
N-P-K	Nitrogen, Phosphorous, and Potassium
OAE	Office of Agricultural Economics
ORRAF	Office of Rubber Replanting Aid Fund
RSS	Ribbed Smoke Sheet
RRIT	Rubber Research Institute of Thailand
STR	Standard Thai Rubber
TSR	Technical Specified Rubber (TSR)

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1. Introduction

Poverty alleviation is one of the major goals for all countries in the Greater Mekong Sub-region (GMS). This goal could be achieved through agriculture trade which is crucial to poverty reduction and rural development. Although trade in the sub-region has shown an increasing trend over the years as a result of trade and development cooperation among members, GMS countries are still at different stages of development. While Thailand, China and Vietnam have large commercial agricultural sectors, Cambodia and Laos are still at the early stage of development. There is still a huge potential for agricultural trade to be further expanded in the sub-region. To achieve this goal, appropriate policies need to be implemented.

In the GMS, cassava and rubber are emerging as important commercial crops for industrial purpose due to a continual increase in demand for such products as raw materials used domestically and internationally. Both crops have high potential in generating considerable income for farmers, and thereby help alleviate poverty. As a leader and successor in production and trade in cassava and rubber in the region, Thailand is expected to be a key player in regional efforts aiming to realize said potential.

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

The report is organized as follows: Section 2 describes the research design, sampling strategy, data collection and data analyses. Section 3 covers the production side of both crops, including production trends, production costs, and productivity. The section also discusses potential and constraints of production and its opportunities. Section 4 and section 5 focus on trade and marketing aspects of cassava and rubber respectively. 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 agricultural trade can be best promoted in the sub-region. Data used in the study were from both primary and secondary sources. Primary sources of data were gathered through a field survey done by interviewing relevant participants in the rubber and cassava production and trade chain. The secondary data sources included literature review and information obtained from various related government and non-government sources. While the secondary data were used in the development of research design and provided important additional information for the study, 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 provinces, 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 district, Dan Kun Tod district, and Mueng district (20 farmers from each district) in Nakhon Ratchasima were randomly selected for interviews using structured questionnaires. For rubber, 40 farmers from Kirirut nikom district and Don sak district (20 farmers from each district) in Surat Thani were randomly selected for interviews. Information collected from the questionnaires included farmer characteristics, production practices, production cost, income, and farmers' perspectives of commodity production and trade. The study also included interviews of traders, processors and exporters at different stages in the marketing chain by using rapid marketing appraisal method.[1] All data were analyzed using both descriptive and statistical methods.

3. Production

3.1. Cassava

3.1.1. Production

Cassava was first introduced in Thailand in the Southern part as intercrop in young rubber plantation. Cassava, at that time, was only processed into starch and sago exclusively for domestic consumption. When a rubber tree has fully grown and ready to produce latex, cassava could not be grown anymore because of insufficient sunlight in the field. Cassava was eventually phased out from the Southern part of Thailand. Later on, it was reintroduced in the Eastern part of the central plain where the present cassava boom in Thailand originated from. After the World War II, Japan demanded a large amount of raw materials and started to import cassava starch from Thailand. The eastern landscape of Thailand, covered with sandy soil and lacking irrigation, has become a promising land of growing cassava. However, the cassava planted area has expanded and shifted from the central plain to the Northeastern part of Thailand as the European demand for cassava products has risen. As of now, about 55.2% of cassava planted area is located in the Northeastern part of Thailand, 30.2% in the Central plain, 14.6% in the North, and none in the South.

Currently, cassava is one of the major crops in Thailand, in addition to rice, rubber, sugarcane, maize, and palm oil. In 2007, with nearly 1.2 million hectares, Thailand produced about 26.4 million tons of fresh cassava roots valued at about 857 million dollars at farm value. Despite some declining periods, aggregate area for and production of cassava increased in the past four decades (Figure 1). This increasing trend in cassava harvested areas and production in Thailand can be divided roughly into three periods as follows:

1) *Period 1961-1989*: on average, Thailand experienced a high growth rate of 9.9% annually for production in this period. The rapidly increasing trend was due to the growth of demand in export markets for dried cassava chips and pellets. The products served as animal feeds in the Western Europe. Harvested area reached its peak at 1.6 million hectares with the total cassava production of 24 million tons in 1989.
2) *Period 1990-1998*: Harvested area started to decline during this period. Production also gradually declined in response to the reduction in harvested area. The declining trend was

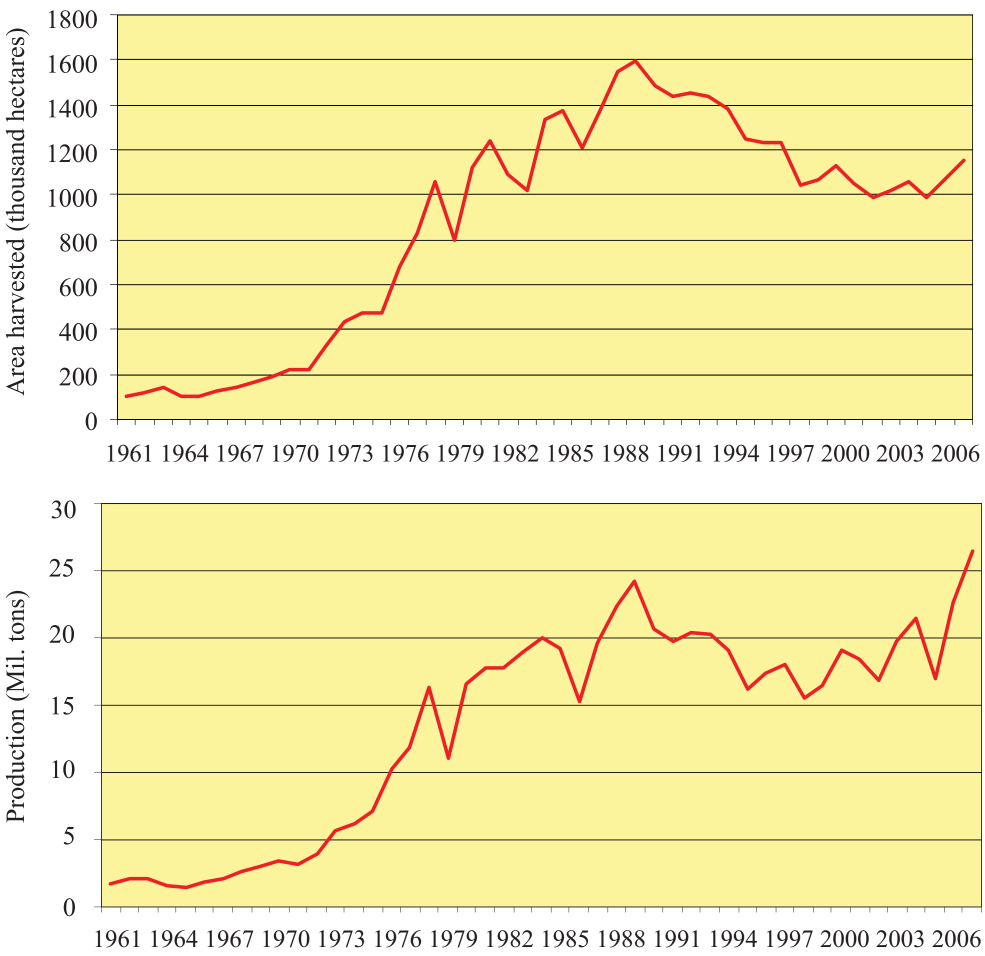
1 Rapid appraisal is a less structured data collection method aimed at supplying needed information in a timely and cost-effective manner (Kumar, 1993).

driven by the implementation of EU Common Agricultural Policy (CAP).[2]

3) *Period 1999-present*: in response to CAP, a national agricultural policy aiming to reduce planting and increase yields has been employed in Thailand. As a result, harvested areas declined at the beginning of this period and became steady at around one thousand hectares. However, they eventually increased again due to higher demand for cassava chips from China.

The high growth rate of production observed during the period 1961-1989 was due to an expansion of planting area but not an increase in yield (Table 1). The reason is that the cassava variety planted in Thailand, at that time, was the local variety whose average yield was quite low, about 14 tons per hectare. Expansion of planting area was the only way to increase production. During 1990-1998, Thailand struggled to find new export markets to replace the EU, resulting in reduction in harvested area and production. Fortunately, it was partially compensated by a growth in starch production and increasing demand for cassava chips in China later on (Howeler, 2006).

Figure 1: Cassava harvested area and production in Thailand, 1961-2007



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

2 The EU Common Agricultural Policy (CAP) reform in 1992 reduced subsidies for the agricultural sector in the EU, resulting in a reduction of cereal's price in the region.

Total cassava production in 2007 went back to the peak level in 1989 with only two-third of the harvested area at that time. Noticeably, the growth rate of production was much higher than that of harvested area during this period, implying that the yield was rising. The high growth rate of yield in the past ten years was mainly due to utilization of new high-yielding varieties and adoption of improved cultivation practices (Howeler, 2006).

Table 1: Average annual growth rate (%) in cassava harvested area, production and yield in Thailand, 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 being used as a staple food crop to a secondary product and a raw material for the processing industry, while rice has remained a staple food crop for the country. After being harvested, cassava roots are needed to be processed to lengthen their ordinary short life. The cassava roots can be processed into various products. The most common forms 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 the continuing high demand from the EU. Until recently, starch was likewise a dominant product as Thailand used about over 50% of its annual cassava roots to produce cassava starch (Table 2). Almost half of the starch production is destined for domestic use, and the rest is for export. Apparently, cassava chips still play significant role in cassava production, as about 80 per cent of its production is set to export, and the rest is used in domestic animal feed industry. Currently, pellets are produced primarily for export. There is no domestic usage of pellets because cassava chips are cheaper source of raw materials for the animal feed industry.

Table 2: Estimated production and use of cassava roots in Thailand, 2003/2004

Unit: thousand tons

	Fresh root*		Dry products				
			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

*Note: * means equivalence to fresh roots. Numbers in parenthesis is in percentage.*

3.1.2. Cultivation practices

The majority of cassava farms in Thailand are small-sized farms. There is no large-scale plantation established in Thailand due to the prohibition of large accumulation of land.[3] The data from our survey in 2008 show that cassava planted area per farm ranges from 0.5 to 56

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).

hectares. The average cassava planted area is 7.6 hectares; however, the most common farm size is 1.6 hectares. Half of the farmers own their farmlands. In addition to their own lands, some farmers rent lands to grow cassava. The average size of the surveyed family is 4.8 members per household, of which about 2 members or about 40 percent of family members are engaged in cassava farming activities. Of the household members engaged in farming activities, 94% are in working age. Ninety percent of cassava growing households are in debt, mostly having borrowed money for investment in agricultural sector. 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 fertilizers at the beginning of the crop season. Farmers are expected to pay off at the time of harvesting by selling fresh roots back to the processors.

As mentioned above, majority of the cassava planted areas are in the Northeast where drought is experienced and no irrigation exists in most areas. Therefore, cassava planting in Thailand is generally rain-fed. Production practices are partially mechanized. As for land preparation, plowing and row preparing are completed by using machinery, either owned or rented by the farmer, to save labor time and cost. There is no use of animals in any farming practice. Transplanting is still manual however. Cassava is raised by planting stem cuttings. These cuttings are obtained from the stems of plants aged at least 10 months with 2.5-3.5 cm thickness. Spacing between rows is about 80-100 cm, as recommended by local officials from the MoAC, but some farms might space less than the recommended size. Along the row, the plants are spaced 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 findings of this study, high-yielding varieties (HYV) are planted in all farms. The most common HYV used in the surveyed farms are Huaybong 60, Kasetsart 50, and Rayong 72. Weeding is still done by hand simultaneously with the use of herbicides. There is no evidence of using pesticides for cassava in Thailand, since cassava is not seriously afflicted with pests or diseases. Currently, cassava is fertilized to maintain the soil fertility. Ninety three percent of surveyed farmers apply fertilizers, either chemical or organic. Fertilizers are applied 2-3 times for a crop year at an amount of 312.5 kg per hectare per time. There is no right formula of N-P-K (Nitrogen, Phosphorous, and Potassium) used in the farm. Farmers rely on their experience in the field or advice from officials, fertilizers salesman, or neighbors.

Basically, in Thailand, cassava can be planted all year long. However, most cassavas are planted early in the rainy season (April to May), but only a few are planted late in the season as in October. Normally, in order to get the highest starch content in the root, cassava should be harvested when it reaches 10-12 months old. Therefore, most farmers in Thailand start harvesting from December to February. Before harvesting, stems are cut off in order to be used for subsequent planting or sold. The stems are bundled and safely kept for up to 3 months. Harvesting the roots is done by using a tractor to loosen the tubers from the soil. Once the tubers are exposed, the tubers are pulled out manually. The tubers are cut by machete and loaded into trucks and then are transported to the processors. This process, for a ton of tubers per day, requires one worker.

3.1.3. Production costs

Production costs of cassava are divided into fixed costs and variable costs. The fixed costs consist of land rent, depreciations and interests. The variable costs consist of material costs and

labor costs. From the survey of 60 households, the average production cost for one hectare was US$ 458.9 in 2006/2007 crop year (Table 3). With an average yield of 20.8 tons per hectare and average fresh root price of US$ 46.7 per ton, the average gross income was US$ 969.5 per hectare. This leaves the estimated profit for farmer at US$ 510.6 per hectare per year. However, if the opportunity cost is taken into account, the total production cost for one hectare would be US$ 578.6. The additional cost is attributable to family owned inputs such as land and labors.

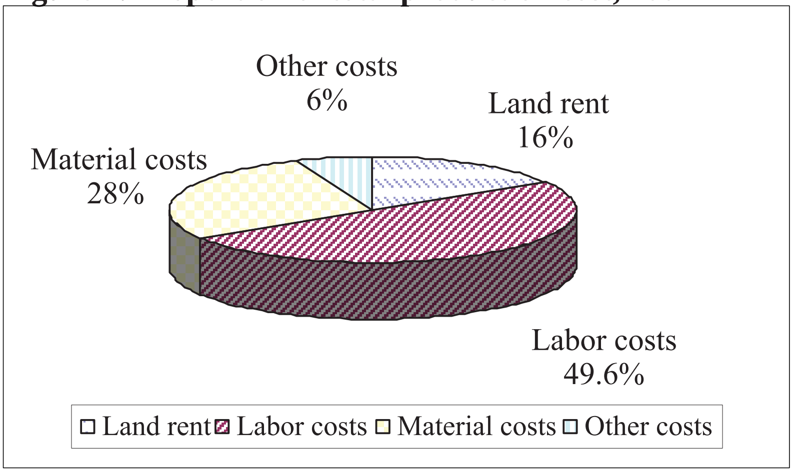
Table 3: Production cost of cassava, 2006/2007

List	Production cost (US$/Ha)		
	Purchased input	Family input	Total
Land rent	46.2	48.9	95.1
Labor cost			
Land preparation	79.7	20.6	100.4
Labor for transplanting	29.7	3.2	33.0
Labor for caring[1/]	44.8	14.6	59.4
Labor for harvesting	93.8	0.4	94.3
Seedling	27.8	31.9	59.7
Fertilizer	78.0	0.1	78.1
Pesticide	23.1	0.0	23.1
Others (interest, depreciation)[2/]	35.7	0.0	35.7
Total cost	458.9	119.7	578.6
Yield (Tons/Ha)	20.8	-	20.8
Average price (US$/Ton)	46.7	-	46.7
Gross revenue at farm gate (US$/Ha)	969.5	-	969.5
Profit	510.6	-	390.9
Production costs (US$/ton)	22.1	-	27.8

Note: 1 US$=34.51 Baht in 2007
1/ Labor of caring includes weeding, fertilizing, pesticide.
2/ Estimation by Office of Agricultural Economics
Source: Author's calculation based on data from the TDRI survey 2008

Like most agricultural products, the production of cassava is labor-intensive. In 2007, labor cost accounted for about 47.6% of the total production cost, followed by material costs at 28%, and land rent at 16% (Figure 2).

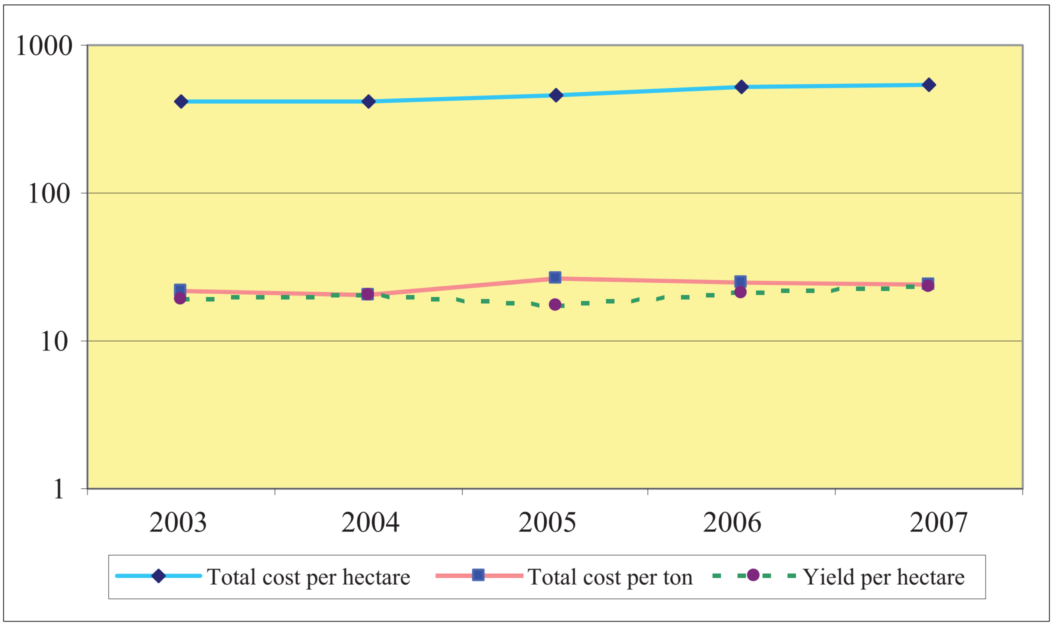
Figure 2: Proportion of total production cost, 2007



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 3). In spite of the increase in costs of production per hectare, the production cost of cassava roots decreases. This implies an increase in efficiency of cassava production, as Thai farmers can produce more cassava at the same cost.

Figure 3: Changes in cassava production cost per ton, production cost per hectare, and yield, 2003-2007



Note: Graph is plotted in logarithmic scale to ease up the comparison.
Calculated at fixed exchange rate of 1 US$=34.51 Baht.
Source: Author's calculation based on data from the Office of Agricultural Economics

3.1.4. Productivity

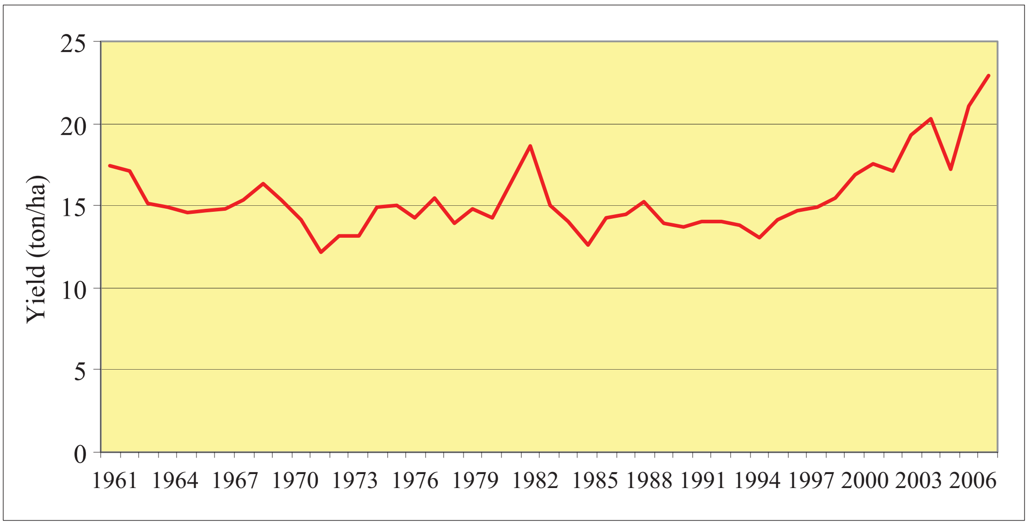
Productivity of agricultural products is simply the yield or production per harvested area. According to the Office of Agricultural Economics, the national average productivity for cassava roots in Thailand was 22.92 tons per hectare in 2007. Overall, cassava roots productivity have a slightly increasing trend with fluctuations over the years. In the last decade, the trend was very obvious (Figure 4). Evidently, the yield increased from about 14 tons/ha in 1995 to 23 tons/ha in 2007, a fifty percent increase. Nevertheless, there was a huge drop of productivity in 2005. This was largely due to an unexpectedly short rainy season, resulting in a severe drought in the Northeastern part of Thailand, which as pointed out earlier has the largest cassava planting area in Thailand.

Besides the 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 as follows:

- Cassava variety: High yield variety (HYV) gives a higher DMC than the local variety.
- Harvesting age: normally, the DMC of the root is highest when the cassava plant is about 10-12 months of age.

- Harvesting season: the DMC is higher during the dry season (November-April), and lower in the rainy season (May-October).
- Agronomic condition: fertilizer slightly reduces the DMC of the root, but increases yield.

Figure 4: Cassava productivity in Thailand, 1961-2007



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

For processed cassava products, the productivity depends very much on quality of inputs and the starch content in the roots. For example, a higher starch content of the roots would reduce drying time for making cassava chips and yield more dried chips. Normally, one ton of fresh roots produce 450 kg of chips, 440 kg of hard pellets or 250-300 kg of starch. It is also observed that technology used in cassava processing has not changed much over time. According to the survey, higher technology is achievable but comes with really high cost compared to the amount and quality of products. To ensure the quality of roots, some processors, usually starch factories, measure the starch content at selling points.

3.1.5. Potential and policies

Both domestic and international demands for Thai cassava products are on the increasing trend. In the past few years, cassava trade volume in the world market was positively affected by the continuous increase in the oil price, which forced many countries into using more of alternative fuel. In China, several factories are using cassava for the production of ethanol. Among ethanol raw materials, cassava has relatively high potential for being used in ethanol production in China because its production needs less land and is less costly than maize and sugarcane. With the rapid growth of alcohol and ethanol industries in China, the demand for dried cassava is estimated to reach 11-11.5 million tons by 2010, with an annual increase of 12-15%. It is also estimated that the gap between cassava demand and supply in China is as large as 7-7.5 million tons in terms of dried cassava. This gap could be filled by imported dried cassava or cassava starch (Department of Foreign Trade, 2006). Evidently, limited domestic production of and high demand for cassava in China had caused the increase in the country's import of dried cassava and starch from 2001 to 2007, at the average annual rate of 27% and 36% respectively. In 2007, China imported 2.6 million tons of dried cassava in total together with 0.25 million ton of starch from Thailand, amounting to 316 million dollars and 70 million dollars, respectively

(Table 4). Recent implementation of the Early Harvest Program (EHP) under the ASEAN-China Free Trade Agreement also favors the import of cassava from Thailand.

The domestic demand for Thai cassava is only about 25% of the total production. Nonetheless, the domestic demand for cassava tends to keep increasing as a result of several factors. First, since the decline in export of cassava pellets to the EU, the domestic use of cassava for animal feeding in Thailand has been encouraged in order to compensate the decline. The implementation has been very limited until the Animal Nutrition Research and Development Center (ANRDC) of Kasetsart University and the Thai Tapioca Development Institute (TTDI) have decided to actively promote the use of cassava as animal feed though various means such as seminar, workshop, TV media, etc. (Kanto and Juttopornpong, 2002). Now, prime quality or clean cassava chips are produced by many cassava processors. A substantial portion of the production is used for animal feeding, as the use of cassava for animal feeding is widespread among farmers.

Table 4: Thailand's cassava export to China by type

Quantity : thousand tons
Value : million U.S. dollars

		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: The Customs Department of Thailand

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

4 Cassava starch can be roughly categorized 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.

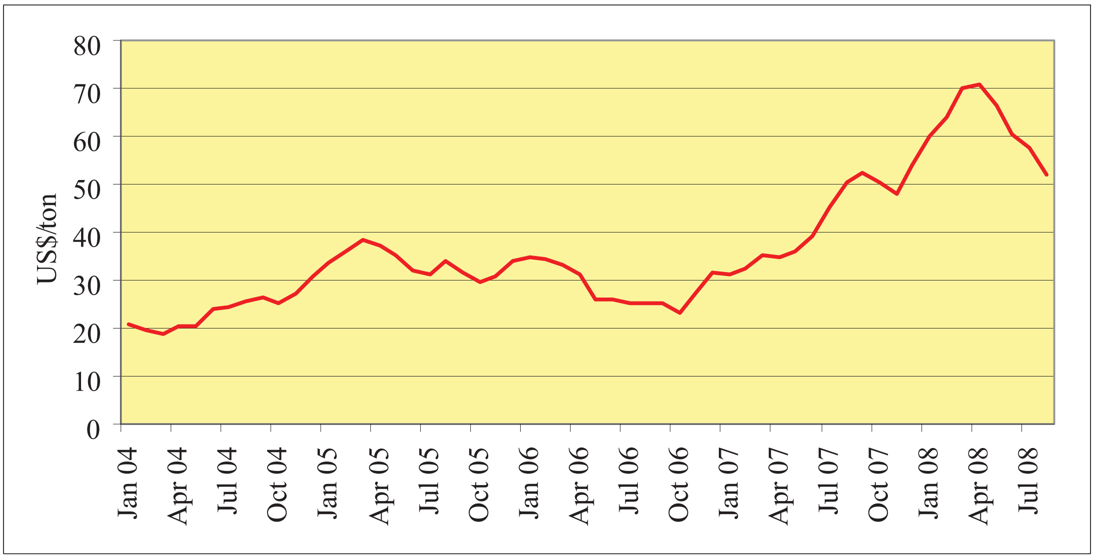
Lastly, with high crude oil prices, cassava has emerged as a commercially viable feedstock for energy production. In 2000, Thailand was one of the first countries in Asia to launch a package of energy policies to reduce its dependency on energy import. Renewable energy is to be developed in the long run as the main strategic plan (Suksri et al., 2007). Bio-fuel, especially bio-ethanol and bio-diesel, are the main renewable energy targets in Thailand. The bio-ethanol will be combined with regular gasoline to form an "E10", also known as "Gasohol".[5] As of now, bio-ethanol in Thailand is mainly produced from molasses and cassava. Gasohol usage is promoted through managed price difference; gasohol's price is artificially set at 0.06 U.S. dollars per liter lower than regular gasoline's price. This artificially lowered price of gasohol induces a higher demand. The difference is formed by an exemption tax on ethanol. A special funding rate for oil fund[6] is also set on gasohol, which is less than half of that collected from regular gasoline. According to an estimation by the MoAC, ethanol consumption will increase as regular gasoline usage increases from 0.3 million liters per day in 2005 and 1 million liters per day in 2007 to 3 million liters per day in 2011. As a result, the demand for cassava is expected to keep rising in the future. Nonetheless, the potential increase in usage of cassava roots as raw material for ethanol has raised some concerns about how such can compete with and possibly reduce the supply of cassava to domestic flour and pellets producers (Bangkok Post, 2008). With government's full support, at least 25 ethanol producing plants are scheduled to open in the next few years. The total ethanol output is expected to be about 7.8 million liters a day which requires about 15 million tons of fresh cassava roots 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. Recognizing the importance of cassava, the Thai government plays an important role in supporting cassava farmers by initiating various forms of interventions. Farmers usually harvest at the same time in the beginning of harvesting season. As a result, the price is usually low at this time. To encourage farmers to harvest cassava in a more timely manner, a price insurance scheme is applied to prevent oversupply in the market at the beginning of the season as well as to help alleviate fluctuations in income derived from farming. The insured price under Thailand's cassava price insurance scheme was at US$ 39 per ton in April 2007. The price intervention policy has worked fairly well as aiding tools for farmers due to the continuous fluctuation in the cassava price. There was significant rise in farm price during the 2007 crop year. Average farm price increased from US$ 30 per ton in early 2007 to US$ 70 per ton in April 2008, the highest price yet (Figure 5). High price and strong demand encourage farmers to expand planting area of cassava in the next crop year by substituting the planted area for maize and sugarcane with such. It is projected by the OAE that cassava production will reach 30 million tons in 2009.

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.

6 The Oil fund is collected by Thai Government and used to maintain domestic detail price levels by subsidizing the difference between actual cost and actual selling price.

Figure 5: Monthly average farm price of Cassava in Thailand, 2004-2008



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

3.1.6. Constraints and opportunities

The following constraints and opportunities were identified during the study.

Constraints

- **Production cost.** Cost of cassava production tends to rise because of the increasing land rent, wages, and material costs, especially chemical fertilizers.
- **Poor information related to the market.** Normally, cassava farmers are not in a position to negotiate the price. They generally take whatever prices offered by traders or processors. This problem is commonly experienced in all agricultural sub-sectors.
- **Soil deterioration due to low fertility.** Soil fertility in farmland is deteriorating because farmers grow cassava continuously in the same land without adequate fertilization. Moreover, most cassava farms lack soil conservation practices. This could affect farm productivity in the long run.
- **Lack of marketing management and planning.** Most surveyed farmers do not have a marketing plan for selling cassava. The majority of cassava is usually harvested at the same time, around December to February, causing oversupply in the market and driving the price down. Due as well to the short life of harvested cassava, farmers tend to receive undervalued price.
- **Lack of proper care.** Cassava is a drought resistant crop that needs minimal care. Thus, farmers do not pay much attention to nurturing the plants. This can affect the quality of cassava roots. With proper care, the roots could possibly be improved. Consequently, this could add value to the products and raise farmers' income.
- **Low-technology drying yards.** Processing for drying yards is mainly nature dependent. Sunlight is mostly required in the production process, thus such process is subject to the risk from uncertain weather conditions.
- **Inconsistency of government's policy towards ethanol and cassava production.** Currently, 45 ethanol plants have been granted permissions to manufacture ethanol in

Thailand, of which 30 have planned to use cassava as raw material. So far, 11 of the 45 factories are already in operation, but only one factory actually uses cassava as raw material while others use molasses or sugarcane in their production. This is due to the recent rapid rise in the price of cassava. Farm cassava prices were US$ 60-75 per ton in early 2008, pushing the cost of producing a liter of ethanol to approximately US$ 0.64 which is far above the ethanol price set by the government, US$ 0.52 per liter. The price was much lower compared to the ethanol price set at US$ 0.75 per liter in 2003-2004.[7] As a result of the high price of cassava, the plant using cassava in its production temporarily stopped running during the first quarter of 2008.

Opportunities

- **Wide use of HYV.** HYV is widely accepted by farmers**.** All cassava planting areas now use HVYs developed by Rayong Field Crops Research and Kasetsart University. This would raise farm productivity and production.
- **Expansion in forward linkage industries.** The domestic market for cassava products continues to grow. The demand for cassava chips is going up, influenced by their promotion by the government as feed in the livestock industry, while the rising demand for starch is in response to the expansion of the starch forward industries such as sweeteners, seasonings, textiles, papers, etc.
- **China's economic expansion.** China has built up its economic strength by investing heavily in manufacturing industries and facilitating foreign trade. This has required more raw materials for industrial uses. Cassava products from Thailand have high potential in China's market as versatile raw inputs.
- **ASEAN-China FTA.** The tariff elimination on China's imports of cassava in 2003 from Thailand under the ASEAN-China FTA has stimulated the trade in cassava between Thailand and China.[8] In terms of value, cassava chips export to China almost doubled between 2003 and 2004. Similarly, cassava starch export increased from 24 thousand tons in 2003 to 129 thousand tons in 2004 and the export value increased threefold over the same period (Table 4). Currently, China is the largest export market for Thai cassava.
- **Price incentive.** The price of cassava reached its highest level in history in 2008. Planted area is expected to expand next year following the continuing rise in price. The price is also expected to stay high due to higher demand for cassava domestically and internationally. Planting areas of other crops have increasingly been turned into planted areas of cassava. In addition, more workers from other sectors have moved into the agriculture sector.

3.2. Rubber

3.2.1. Production

The first rubber tree came to the Southern part of Thailand around 1900s from Malaya. Since then, rubber breeding was publicly introduced to people in the south. In 1908, the plantation of rubber expanded to the eastern part of Thailand. However, at that time, the rubber plantation pattern was still integrated plantation, so-called rubber forest, where local plants were grown

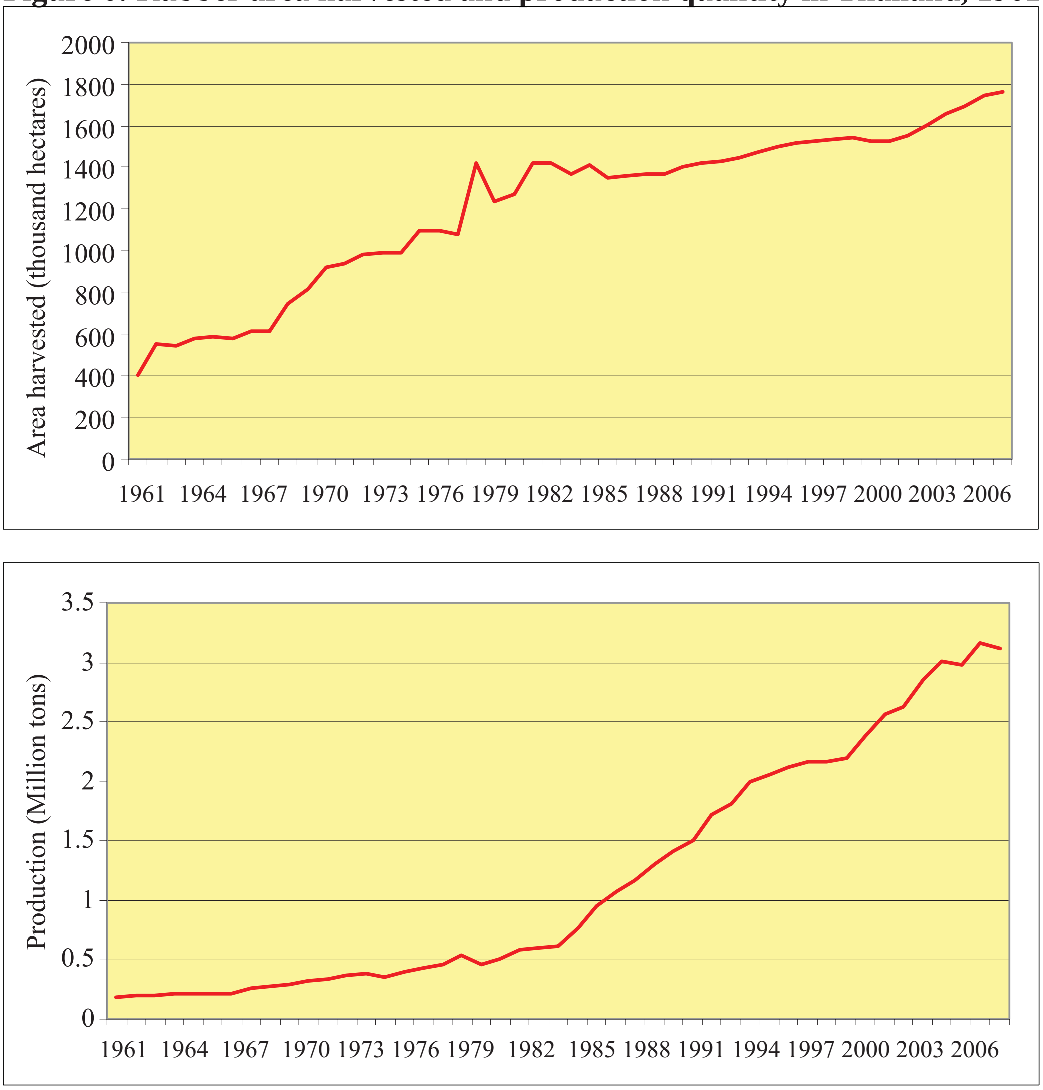
7 The same exchange rate was used to convert prices in 2004 and 2008 for comparative purposes.

8 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.

along with other fruit trees. Realizing the potential of rubber, the Office of Rubber Replanting Aid Fund (ORRAF) under the MoAC was established in 1960 to promote rubber planting by virtue of the Act of Rubber Replanting Aid Fund.. The rubber plantation pattern in Thailand began to change from integrated plantation, which gives low productivity, to a rubber monoculture system utilizing HYV (Sayamol et al., 2007). Rubber became the major economic plant for farmers in the Southern and Eastern parts of Thailand for many years and began to spread to other parts of the country. Currently, planted area in the Southern part of Thailand accounts for about 72.4% of the total planted area; those in the Northeastern part and the Central plain account for 13.9% and 11.1% respectively; and areas in the North. account for only 2.6%.

Presently, the national production volume of rubber is about 3 million tons a year with 1.8 million hectares of harvested area. The total production value is about US$ 6 billion at farm value. Aggregate area for rubber has been on an increasing trend with some minor setback around 1980. Rubber production rose at an average annual growth rate of 5.5% during the last two decades (Figure 6).

Figure 6: Rubber area harvested and production quantity in Thailand, 1961-2007



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

Thailand became the world's largest exporter of natural rubber in 1991, overtaking Malaysia and Indonesia, and has continued to be in the position ever since, thanks to the replanting program by ORRAF. Major export markets are China, Japan, Malaysia and the United States. Most of the rubber produced is exported. Only about 10 percent of all the rubber produced in Thailand is used for domestic consumption (Table 5).

Table 5: Natural rubber production of Thailand, 1999-2007

Unit: thousand tons

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, concentrated latex, etc. These primary products are raw materials used in the production of downstream products such as vehicle tires, rubber gloves, rubber bands, elastic rubber, etc. Ribbed Smoke Sheet (RSS) had been a dominant product in the country for many years. There has been a transition in natural rubber production structure in recent years. In 1999, RSS production accounted for over 50 percent of the country's natural rubber production (Table 6). This domination started to change later on. While the country continued to produce RSS at about 1 million ton every year, the production of block rubber and concentrated latex doubled during the past 10 years as these products offered buyers relatively higher standard. In 2007, block rubber production surpassed RSS production, thus making block rubber the leading primary product. There are many grades of block rubber in Thailand, but the most common grade is STR 20 (Standard Thai Rubber).

Table 6: Natural rubber production by type, 1999-2007

Unit: thousand tons

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 tree is a perennial tropical plant which can live very long. In general, rubber tree in plantation can live around 32 years, 7 years in an immature stage and 25-30 years in a productive stage. Smallholdings make up most of the rubber plantations in Thailand, accounting for 93% of all rubber plantations (Somboonsuke et al., 2007). According to the rubber survey conducted by the study team in 2007, on average, the size of rubber farmers-owned planted area was 3 hectares (the sizes ranged from 0.5 to 15.7 hectares) at least as of the time of the survey. Each farmer owned, on average, about 2 plots, 2.1 hectares in each plot. The average surveyed family size is 3.9 members per household. Of the household members engaging in farming activities, 68% were in working age. Seventy two percent of the rubber households were also in debt. BAAC was the main source of loan for the rubber farmers.

Rubber plantations are located in newly cleared forest or rubber replanting. Good drainage and suitable soil are required for rubber planting. Planting system depends on the land topography. Rectangular system with planting lines is suitable for flat lands, while planting in undulating land should be done in rows across the slope along contour lines (Albarracin et al. 2006). Land preparation is mechanized, but transplanting is manual. Rubber tree can be planted by polyclonal seeds, budded stumps, and poly-bag planting. Poly-bag planting now has become popular because it is easier, saves time, and provides earlier yield. Poly-bag planting is available in local rubber breeding farms. From the survey, the most common HYV used by farmers was RRIM 600, which is extensively promoted by the ORRAF. A planting hole is generally 50 cm x 50 cm x 50 cm in size. Spacing between rows is about 6-8 meters, and spacing between plants in a row is 2.5-3 meters, depending on land conditions. The planting density is around 375 to 470 plants per hectare. According to the survey, some plantations intercrop with bananas, vegetables or mangosteens when rubber trees are still too immature to generate extra income for households. Weeding is recommended, especially for the first year of planting. Weeding is done by hand, machines, applying herbicide, or a combination of those. Fertilizer is applied once or twice a year during rainy season.

According to the Department of Agricultural Extension, rubber trees are ready for harvesting once the trunk attains a girth of 50 cm when measured at 150 cm above ground level. Usually, the trunk reaches the appropriate size at year seven. Tapping is preferably performed in the early morning because the trunk produces more latex at that time (Rayong, 2003). Tapping system recommended by officials is one half spiral cut with every other day tapping (1/2S d/2). However, most of the surveyed farmers use the tapping system of one third spiral cut with 3 days tapping followed by 1 day rest (1/3S 3d/4). The reason is that one half spiral cut is a long cut which is not easy to perform. Moreover, alternative daily tapping would generate less income due to fewer tapping days. Labors used in rubber plantations are from the surrounding local areas and mostly paid on the basis of percentage of sales, usually 40-50 percent depending on the negotiation with the owner, irrelevant of the official minimum wage rate.

3.2.3. Production costs

Production costs of rubber can be divided into two types. The first type refers to the costs incurred when the rubber tree is immature (young rubber) and not ready to produce latex yet. This period usually runs from the first to the sixth year of rubber planting. The period might be

only 5 years in some regions, depending on soil and weather conditions. The major cost items in the first year of planting are land preparation and seedling . On the other hand, the main cost incurred in the second to the sixth year is associated with caring. Based on the data for 2006/2007 gathered from the survey , the production cost of young rubber is 288.1 U.S. dollars per year on average, excluding family inputs (Table 7). There is no land rent, since most of the surveyed farmers own land.

Table 7: Production cost of rubber, 2006/2007

List	Production cost (US$/Ha)		
	Purchased input	Family input	Total
Year 1-6			
Land rent (per year)	0.0	78.2	78.2
Land Preparation			
Land clearance	316.9	0.0	316.9
Plow	104.0	0.0	104.0
Seedling	246.0	0.0	246.0
Labor cost			
Labor for transplanting	6.2	54.7	60.9
Labor for caring (per year)1/	55.6	57.1	112.7
Fertilizer (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

List	Production cost (US$/Ha)		
	Purchased input	Family input	Total
Year 7-25			
Labor for caring (per year)	42.5	39.3	81.8
Labor for harvesting (per year)2/	842.9	0.0	842.9
Fertilizer (per year)	163.9	0.0	163.9
Pesticide (per year)	17.5	0.0	17.5
Tapping equipment	120.0	0.0	120.0
Others (interest, depreciation)2/	139.4	0.0	139.4
Total cost	1,326.1	39.3	1,365.4
Yield (Ton/Ha)	1.7	-	1.7
Production cost (US$/ton)	774.3	-	797.3

Note 1 US$=34.51 Baht in 2006/2007
1/ Labor of caring includes weeding, fertilizing, pesticide.
2/ Estimation by Office of Agricultural Economics
Source: Author's calculation based on data from the TDRI survey 2007

The second type of costs refers to the costs incurred when the rubber tree is producing latex, usually starting from the seventh year of the tree's life. The productive life of the rubber tree is normally 18-25 years, depending on tapping methods. Again, based on the 2006/2007 data gathered from the survey, the average production cost is approximately US$ 1,326.1 a year . The major component of the production cost during this period is labor cost, particularly the cost of labor employed in harvesting. With a yield of 1.7 tons per hectare, the production cost per ton is about US$ 774.3. Interestingly, most of production cost during this period is the cost of purchased inputs, while costs of family inputs are minimal. Moreover, it should be noted that the production cost varies from time to time as a result of variation in the harvesting cost.

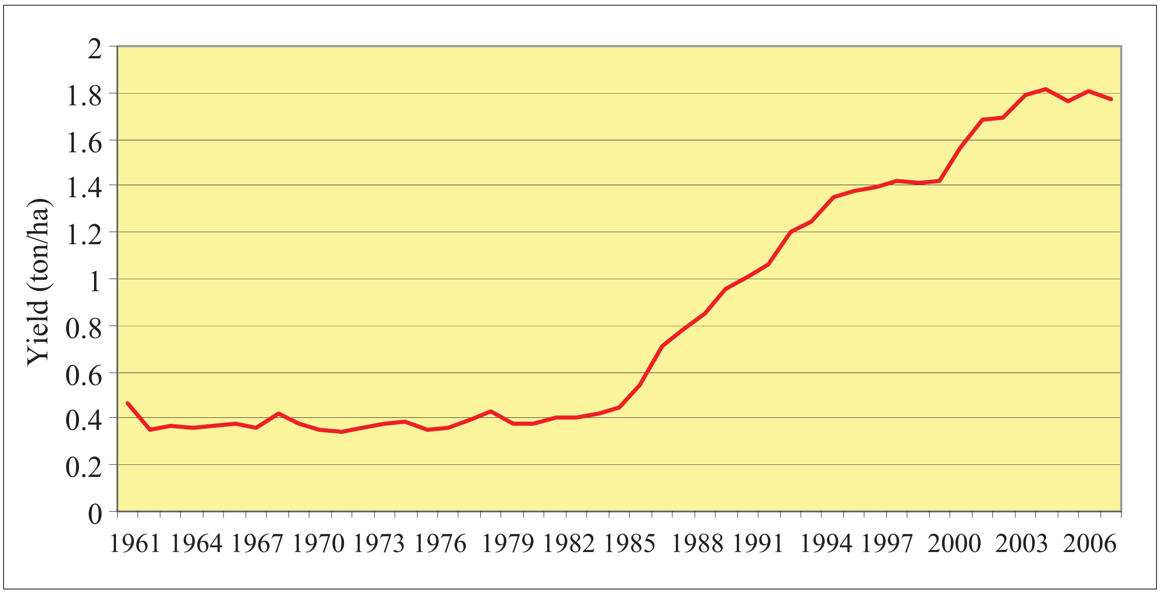
The wage of rubber tappers is associated to the share of revenue from selling the latex, ranging from 40%-50% of the revenue, depending on locations and skills of tappers.

Generally, rubber farmers have three options after harvesting: selling fresh latex; processing field latex into air-dried rubber sheets (ADS) before selling; and selling their rubber residues or cup lumps. Compared to the case of the fresh latex, the production of ADS and cup lumps involves additional costs. To produce air-dried rubber, the farmers incur additional processing cost of US$ 156 per ton. In the case of cup lumps, the farmers incur addition cost related to chemicals used in the process of preparing cup lumps.

3.2.4. Productivity

According to the OAE, the national average productivity (yield) of natural rubber in Thailand was 1.77 tons per hectare in 2007. Overall, the productivity of natural rubber has been significantly increasing over the years (Figure 7). The yield has been quite stable at about 0.4 tons/ha during 1960s. Until early 1980s, the yield started to rise at very high growth rates. This was a result of the promotion of newly HYV and proper farming practices by ORRAF in the past decades, accompanied with the suitable climate in the Southern and Eastern parts of Thailand.

Figure 7: Rubber productivity in Thailand, 1961-2007



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

3.2.5. Potential and policies

Rubber product is an important component of many products in the manufacturing sector. At present, natural rubber production in Thailand is about one third of the world production. Thailand is the world's largest rubber exporter; about 90% of the production is exported. The International Rubber Study Group (IRSG) forecasts a 4.4 percent annual growth rate of the world rubber consumption between 2007 and 2009. The rise in global consumption of rubber is a consequence of the economic expansion in emerging markets such as China, together with the rising crude oil price. The rise in the crude oil price results in an increase in the production

cost of synthetic rubber, a substitute of 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 markets of many raw materials, the natural rubber market is influenced by the continuingly growing demand from the People's Republic of China. Presently, China can produce only 600,000 tons of natural rubber which is obviously not sufficient for its exceptionally high demand (Table 8). In 2007, China's natural rubber import volume increased to 1.55 million tons which is almost double the volume in 2000. Since 2003, China has surpassed the United States as the largest rubber importer (Table 9). China 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 growing needs in the automobile industry and newly-built roads linking provinces in China.

Table 8: World rubber producer by major countries

Unit: thousand tons

	2000	2001	2002	2003	2004	2005	2006	2007
Thailand	2,346.4	2,319.6	2,615.1	2,876.0	2,984.3	2,937.2	3,137.0	3,063.0
Indonesia	1,501.1	1,607.3	1,630.0	1,792.2	2,066.2	2,271.0	2,637.0	2,797.0
Malaysia	927.6	882.1	889.8	985.6	1,168.7	1,126.0	1,283.6	1,201.0
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	**6,764.0**	**7,332.0**	**7,337.0**	**8,033.0**	**8,756.0**	**8,892.0**	**9,686.0**	**9,893.0**

Source: International Rubber Study Group, 2008

Table 9: World rubber import by major countries

Unit: thousand tons

	2000	2001	2002	2003	2004	2005	2006	2007
United States	1,191.6	972.1	1,110.3	1,077.0	1,143.6	1159.2	1,003.1	1,018.4
Japan	801.5	713.3	771.8	791.8	800.7	848.6	885.9	849.0
China	820.4	943.3	914.7	1,149.6	1,205.9	1,329.2	1,505.6	1,547.0
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	2,035.6	1996.7	1,959.2	2,088.7	2,233.8	2,284.2	2324.6	2,437.0
Total	**5,430.0**	**5,201.0**	**5,322.0**	**5,700.0**	**5,978.0**	**6,254.0**	**6,352.0**	**6,497.0**

Source: International Rubber Study Group, 2008

Similar to the trends in production, there has also been a transition in the structure of natural rubber export from Thailand to China in recent years. In 2003, Chinese import of block rubber (or technical specified natural rubber[9]) dominated that of smoked sheet rubber (Table 10). Many tyre manufacturers in China presently prefer block rubber as raw material for producing tyre because block rubber is cheaper than RSS. Moreover, RSS are produced by farmers and graded visually by experience traders. The quality of RSS is inconsistent. By contrast, block

9 Technical specified natural rubber or block rubber was introduced in Thailand in 1968. In Thailand, 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 with significant volume in the rubber market.

rubber is manufactured by factories and graded according to its properties. Block rubber can be made with specified property for the particular usage.

Table 10: Thailand's rubber export to China by type

Quantity : Thousand tons
Value : Million U.S. dollars

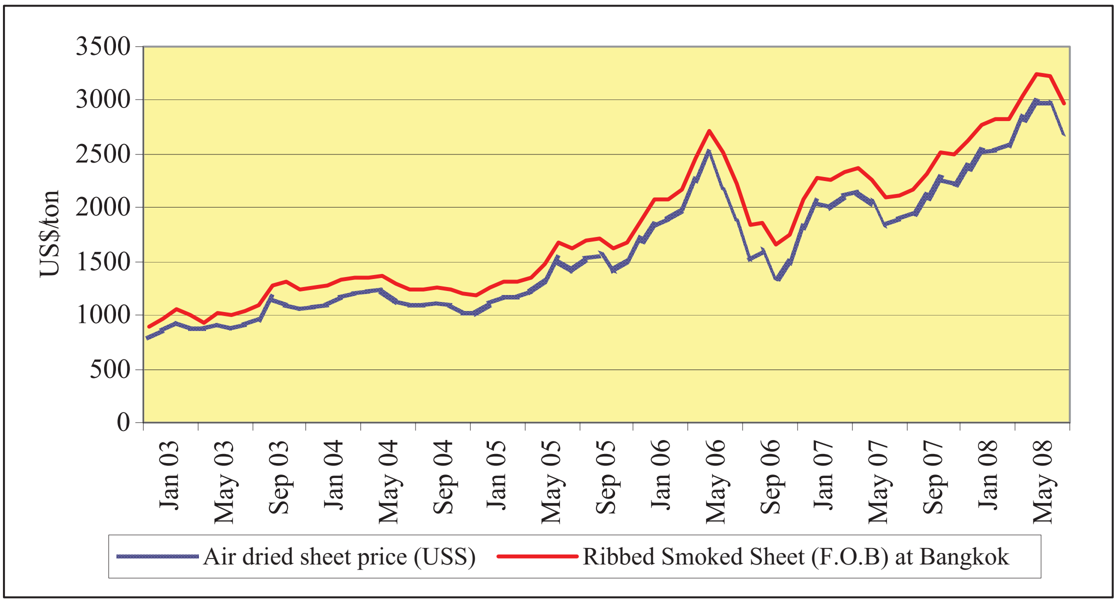
		Rubber concentrated latex	Smoked sheet grade 3	Block rubber (TSNR)
Year	HS code	4001100	4001210	4001292
2001	Quantity	63.6	252.0	172.5
	Value	30.2	137.5	93.8
2002	Quantity	55.7	272.5	168.1
	Value	31.4	192.4	118.3
2003	Quantity	99.7	312.4	294.5
	Value	79.1	312.2	287.2
2004	Quantity	124.1	224.3	281.9
	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

Although in response to higher demand, China expects domestic rubber production to reach 780,000 tons by 2010, the availability of suitable land for rubber planting in China is too limited to grow enough rubber. For this reason, China adopts policies encouraging investment in rubber plantation business in neighboring countries such as Lao People's Democratic Republic (Lao PDR) and Myanmar. Currently, the area of rubber plantations with Chinese investment is around 1,333 hectares and is expected to expand even more in the near future. However, the plantations are expected to start producing latex only in the next six years. Therefore, in the short run, it is likely that Thailand could still play an important role in serving the huge demand of China.

As noted earlier, only ten percent of Thailand's total rubber production is used for domestic consumption. Most of rubber production is used in the process of producing other products such as tyres and tubes for cars, motorcycles, medical gloves, and rubber bands. Thailand's rubber product industry has been largely growing in response to the international and domestic rising demand. The price of rubber in the local and international markets has been on an increasing trend, despite some temporary downturns (Figure 8).

Figure 8: Average monthly price of rubber, 2003-2008



Source: Office of The Rubber Replanting Aid fund

The ORRAF has encouraged farmers to grow rubber by using recommended varieties and agronomy to increase rubber productivity. The rubber plantation owners are provided about US$ 2,000 per hectare to fund replacement of local varieties with HYV. The replanting fund is collected from rubber exporters at the rate of US$ 40 per ton of rubber exported.

Recently, the government launched a 3-year rubber planting promotion project, from 2004 to 2006, known as the "One Million Rai Project". The project aimed to establish new rubber plantations –48,000 hectares in the Northern region and 112,000 hectares in the Northeastern region. The government supported the farmers with 563 seedlings per hectare and arranged 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 tons per year. This is expected to meet the estimated rise in world demand for rubber, at 300,000-400,000 tons each year (Dailynews, 2007).

3.2.6. Constraints and opportunities

The following constraints and opportunities were identified during the survey.

Constraints

- **Lack of skilled tappers.** There is a lack of skilled labor, particularly rubber tappers. Inappropriate ways of tapping could lead to low productivity and damage to the rubber tree. High demand for skilled labor drives up the wage, resulting in higher cost of production.
- **High cost of other factors of production.** The production cost is high as a result of the rise in price of fertilizers. Fertilizers, rubber varieties, and chemicals are in short supply.

Opportunities

- **Area expansion in the North and Northeast.** Following the government project to promote rubber planting in the north and northeastern region, it is expected that the country's rubber production will increase to serve the growing demand for rubber from China. Farmers in the North and Northeast would also receive the benefits for selling rubber products as alternative crop.
- **Timber production.** Rubber wood produced from old rubber trees is increasingly becoming significant as a source of extra income for farmers. Presently, 80% of Thai rubber wood is exported, mainly to China and Vietnam; the rest is being used in Thai furniture factories (Albarracin, 2006).

4. Trade in Cassava

4.1. Cassava

4.1.1. Marketing chains

The structure of the cassava market channel in Thailand is illustrated in Figure 9. The roles of each marketing chain player and relationships with other players are explained below.

Farmers

Cassava farmers sell all of their fresh cassava roots either directly to the cassava processors or indirectly through the local middlemen or the truckers. Fresh roots are sold and quickly delivered to factories on the same day of harvesting because they are perishable. Farm trucks or six-wheel trucks are used for delivering fresh roots from farms to factories. The trucks can deliver up to 10 tons per trip. The distance from farms to factories is normally less than 50 kilometers. Transportation cost is paid by farmers, unless they sell products to the middlemen. In some cases, some processors might cover the transportation cost in order to provide an incentive for farmers to sell their products when the market supply is low.

Middlemen/Truckers

The middlemen collect cassava roots from farmers and deliver roots to processing factories located in either the local or other provinces. In the past, farmers usually used the service of middlemen to deliver fresh roots to the factories. As a result of improved transportation and infrastructure however, farmers now choose to deliver fresh roots to the factories by themselves in order to get full factory gate price without deductions from middlemen. Currently, there exist truckers who are also operating as middlemen. They offer not only transportation services but also harvesting services to farmers who do not have the time and tools for harvesting by themselves. The truckers pay farmers a lump sum amount per size of harvesting area.

Processors

The cassava factories can be categorized, by finished product, into chipping factories, pellets factories, and starch factories.

Chipping factories, also known as drying yards, are typically small scale enterprises. Generally, they are located closely to cassava farming areas. The factories employ simple equipment such as choppers, tractors, and trucks. The trucks containing fresh roots from farms are first weighed upon arrival at the drying yards. The trucks then dump the fresh roots to the floor and are weighed again. The weight of fresh roots is the difference between the outcomes of the two weighing. Thereafter, the roots are transferred to the choppers by tractors. Then, chopped roots are moved to dry on cement floor and spread out manually by a rake. Drying chips normally takes 2-3 days on sunny day (it will take longer if there are rains.). During drying, chips must be turned frequently by a special tractor to ensure consistent drying. After being dried, chips normally lose weight approximately 50-60 percent. Therefore, to produce 1 kg of chips, about 2.00-2.50 kg of fresh roots are required, depending on the starch content in the roots. Cassava chips are either exported (directly or through exporters) or sold to pellets factories for further processing. Ten-wheel trucks are used to deliver cassava chips to exporters or sea ports. Transportation cost depends on distance and product weight.

Pellets factories are developed from chipping factories to improve the shape and size of cassava chips. Moreover, cassava in a pellet form causes less air pollution than cassava chips which contain more dust. Inputs for pellets factories are mostly cassava chips and some cassava waste from starch factories. Cassava chips price is set in relation to the export price of pellets in Bangkok. Transportation process for pellets is the same as that of cassava chips.

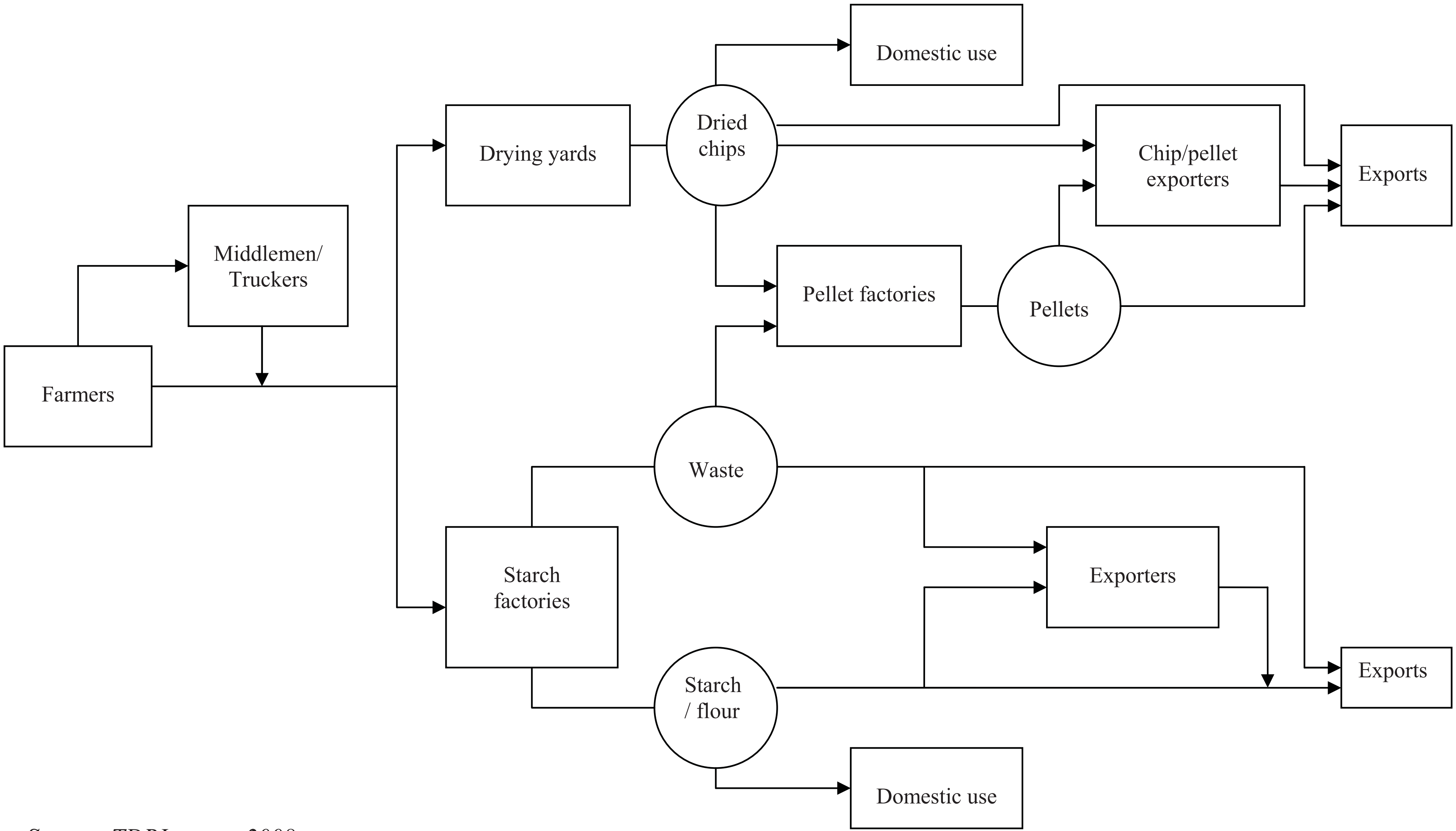
The starch factories are usually medium to large scale enterprises. Farmers deliver fresh roots to nearby factories or the ones offering the best price by farm trucks or six-wheel trucks. The roots will be weighed in the same way as they were weighed in chipping factories and then checked for quality (measuring the starch content). The price will be deducted if the starch content is below the level agreed. Some starch factories compensate for the transportation cost of the farmers or truckers. The production process of the starch, from the roots to the starch, only takes 45-60 minutes. The flour will be packed in various sizes according to customers' orders. Domestic distribution from the factories to customers relies on ten-wheel trucks. The starch for export will be packed into 20-feet container (from an international carrier) and then delivered by trains[10] or trailers to the Bangkok port and Laem Chabang port for loading into cargo ship. The process must not exceed 5 days, according to the requirement by carriers. Transportation cost depends on distance and product weight.

Exporters

Most starch factories also export by themselves as discussed in the previous section. Therefore, the exporters discussed in this section mostly refer to the chips/pellets exporters or traders. Exporters are located mostly in the central region close to the sea port. The role of exporters is mainly to collect chips/pellets from processing factories and store them in storages. To save on transportation cost, exporters will stock the products until they reach the exact amount, usually at 1,500 tons. Exporters then transport the products to the port through waterway by bulk carriers. Transportation cost depends on distance and product weight.

10 Only for some factories in Nakhon Ratchasima.

Figure 9: Marketing channel of cassava in Thailand



Source: TDRI survey 2008

4.1.2. Costs and margins

Information on costs and margins were gathered from stakeholders in marketing chains. It should be noted that some information are not available. Therefore, some of the figures stated below are approximation of the real values. Since most farmers in the survey deliver the fresh roots directly to the processors, for simplicity, the study assumes no middlemen in the marketing chain. This section discusses costs and margins for only two cassava products; cassava chips and cassava starch, as they are the major export products of Thailand. The transportation costs provided in the tables are the costs of a single trip. The distance from factories to farms ranges from 0-50 kilometers. The distance from the factories to the exporter is 260 kilometers (Nakhon Ratchasima to Bangkok).

Cassava Chips

Cassava chips' marketing costs and margins, from the farmers to the port of shipment, are shown in Table 11.Based on the data gathered from the survey, on average, the farmer bears the production cost of US$ 50.69 to produce fresh roots equivalent to a ton of chips. The farmer selling fresh roots to the drying yards at US$ 129.90 incurs a margin of US$ 79.21, which can be divided into transportation cost (US$ 12.67) and profit (US$ 66.54). For drying yards, it sells chips domestically at US$ 151.18, leaving a margin of US$ 21.27 to them. The margin for the drying yards can be divided into labor cost, fuel cost, transportation cost, profits, and others. The export price (F.O.B) of cassava chips is US$ 170, leaving the margin of US$ 18.82 to the exporters. Overall, the marketing costs for the whole chain consist of transportation, labor, fuel, handling, etc. These costs vary from one agent to another along the marketing chain. For example, the transportation cost for farmers is US$ 12.67, while it is US$ 9.05 for the drying yards.

Noticeably, the cost of producing fresh root equivalent to one ton of chips is only about 30% of the export price. That leaves about 70% of the marketing margins to the whole chain of cassava chips. It is also observed that the farmers have the largest margin and receive the highest profit compared to the drying yards and the exporters.

Table 11: Marketing costs and margins for cassava chips

Unit: US$/ton of chips

Descriptions	**Total**	**Percentage**
Production costs	**50.69**	**29.82**
Farmer margin	**79.21**	**46.59**
Transportation 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**
Labor	3.02	1.78
Fuel/Electricity	2.41	1.42
Transportation 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 &export fee	11.53	6.78
Profit	7.30	4.29
Export price (F.O.B)	**170.00**	**100.00**

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

Table 12 provides a summary of marketing margins for cassava chips. The gross marketing costs for cassava chips accounted for 70.18% of the export price (F.O.B) as mentioned above. The net marketing margin[11] is US$ 39.50 which is 23.23% of the export price. Of all the marketing costs, the transportation cost is the highest, followed by handling and export fees.

Table 12: Marketing margins for cassava chips

Unit: US$/ton of chips

Margins	**Total**	**Percentage***
Transportation cost	21.73	12.78
Labor	3.02	1.78
Fuel/Electricity	2.41	1.42
Handling & 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

Cassava Starch

Cassava starch is sold domestically and exported as pointed out earlier. The analysis in this section is divided into two cases, one for domestic consumption and another for export.

11 The gross marketing margin is the difference in the final price and the cost. The net marketing margin is the gross marketing margin which is deducted all the profits for each agent along the chain. The net marketing margin reflects the true marketing costs along the chain.

Cassava starch for domestic consumption

According to the data gathered from the 2008 survey, the marketing costs and margins of cassava starch along the marketing chain starting from farmers to domestic consumers, are shown in Table 13, and a summary of the marketing margin is in Table 14. To produce fresh roots equivalent to one ton of starch, farmers spend US$ 98.97 on production. The factory price is set at US$ 253.62. Therefore, the farmers get the margin of US$ 154.65 which is more than a half of the factory price. Farmers receive profit of US$ 129.90, about 50% of selling price. The cost of producing fresh roots equivalent to one ton of starch is only about 28% of the domestic price, leaving the rest for marketing costs. For the starch factory, it sells starch domestically at US$ 353.05 per ton of starch, leaving the margin of US$ 99.43 to the starch factory. The starch factory's margin consists of labor cost, fuel cost, transportation cost, profit and others. The fuel and electricity costs are US$ 27.16, the highest cost for the starch factory margin, followed by the transportation cost.

Table 13: Marketing costs and margins for domestic cassava starch

Unit: US$/ton of starch

Descriptions	**Total**	**Percentage**
Production costs	**98.97**	**28.03**
Farmer margin	**154.65**	**43.80**
Transportation 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**
Labor	10.56	2.99
Fuel/Electricity	27.16	7.69
Transportation 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

The gross marketing margin for domestic cassava starch is US$ 254.07 which accounts for 71.97% of domestic price. After the deduction of net profits of US$ 140.62, the net marketing margin is US$ 113.46 or 32.14% of the domestic price. The farmer's margin is almost double compared to the starch factory. Overall, transportation is the highest cost, followed by fuel/ electricity and labor.

Table 14: Marketing margins of farmer for domestic cassava starch

Unit: US$/ton of starch

Margins	**Total**	**Percentage***
Transportation cost	36.81	10.43
Labor	10.56	2.99
Fuel/Electricity	27.16	7.69
Handling & 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

Cassava starch for export

Cassava starch for export is delivered to the warehouse at the port either by trains or trucks. The marketing costs and margins of cassava starch from the farmers to the port of shipment for export by means of train are shown in Table 15 and its marketing margins are summarized in Table 16. Meanwhile, the marketing costs and margins of cassava starch from farmers to the port of shipment for export by means of truck are shown in Table 17, and its summary is in Table 18**.**

The farmer's margin for exported cassava starch is the same as that for domestic consumption but starch factory margin is slightly different. Starch factory margin for exported cassava starch also includes handling and export fee and has slight difference in transportation cost. The transportation cost for train is slightly lower than that for truck. The transportation cost for the starch factory is US$ 13.58 by means of train, while the transportation cost is US$ 18.11 by means of truck. It is notice that the total margin of the starch factory is the same whether transported by truck or train. Therefore, the choice in transportation method only affects the profit incurred to the factory with other things being equal.

Table 15: Marketing costs and margins for export cassava starch (by train)

Unit: US$/ton of starch

Descriptions	**Total**	**Percentage**
Production costs	**98.97**	**26.82**
Farmer margin	**154.65**	**41.91**
Transportation 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**
Labor	10.56	2.86
Fuel/Electricity	27.16	7.36
Transportation cost	13.58	3.68
Others	38.93	10.55
Handling & export fee	4.83	1.31
Profit	20.33	5.51
Export price (F.O.B)	**369.00**	**100.00**

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

Table 16: Marketing margins for export cassava starch (by train)

Unit: US$/ton of starch

Margins	**Total**	**Percentage**
Transportation cost	38.32	10.39
Labor	10.56	2.86
Fuel/Electricity	27.16	7.36
Handling & 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

As a result, the net marketing cost of cassava starch by means of train is 32.46% of the export price. while the marketing cost of cassava starch by means of truck is at 33.69%. The net marketing cost of cassava starch by using train is a little bit higher due to the difference in costs between the two means of transportation. This implies that railway is the better mode of transportation compared to the road. In Thailand, most products are transported domestically by road, followed by inland waterways and coastal (Table 19). Train transportation has the least usage in Thailand, although it is the most efficient way to transport products in many countries. It should be noted that transportation costs are still the highest among other costs in the marketing margins for export cassava starch.

Table 17: Marketing costs and margins for export cassava starch (by truck)

Unit: US$/ton of starch

Descriptions	**Total**	**Percentage**
Production costs	**98.97**	**26.82**
Farmer margin	**154.65**	**41.91**
Transportation 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**
Labor	10.56	2.86
Fuel/Electricity	27.16	7.36
Transportation cost	18.11	4.91
Others	38.93	10.55
Handling & export fee	4.83	1.31
Profit	15.80	4.28
Export price (F.O.B)	**369.00**	**100.00**

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

Table 18: Marketing margins for export cassava starch (by truck)

Unit: US$/ton of starch

Margins	**Total**	**Percentage**
Transportation cost	42.85	11.61
Labor	10.56	2.86
Fuel/Electricity	27.16	7.36
Handling & 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

Table 19: Domestic transportation by mode of transportation 2003-2006

Unit: tons

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

Source: Thailand's Ministry of Transport

4.1.3 Constraints and opportunities

The following constraints and opportunities were identified during the survey.

Constraints

- **Road transportation.** Transportation of cassava domestically is mainly by road which is a more costly means of transportation than other alternatives such as rails or waterway. However, an efficient rail transportation system is not yet developed.
- **Weight loss due to transportation of cassava chips.** Cassava chips are transported by truck in bulk to the port of shipment and unloaded as bulk cargo for transport to their destination. With this transportation method, a weight loss is inevitable. Cassava chips can be carried in closed containers to prevent the weight loss from chips transport but the cost is relatively high and not worth the shipment value.

Opportunities

- **Many buyers**. There are many cassava buyers scattered around planting areas all over the country. According to the Thai Tapioca Development Institute, there are currently over 800 drying yards, 68 starch factories, and 63 pellet factories, nationwide. Competition for cassava roots by these buyers can raise the price for farmers.
- **Good road conditions.** The road network in Thailand is in relatively good condition, especially when compared with those in most of neighboring countries. This results in fast and convenient transportation. Good road conditions also facilitate trade between the farmers and the processors and reduce the marketing margins.
- **Small amount of traders along the marketing chain.** Less traders along the marketing chain diminish the marketing margins usually caused by middlemen along the chain, and thus raise farmer's revenue**.**

4.2. Trade in Rubber

4.2.1. Marketing chains

The structure of the rubber marketing channel in Thailand is depicted in Figure 10. The roles of each marketing chain participant and description of their relationships and transactions with other participants are described below.

Farmers

Farmers sell their products in the form of air-dried sheet (or raw sheet), fresh latex, cup lump, and scrap rubber, depending on their expertise. Most farmers sell raw sheets because of price incentive. However, cup lumps have become more popular in some areas because it is easier to make, saves time, and receives higher demand from related industries. Air-dried sheet is categorized in 5 grades with the first grade being the best quality. In Thailand, the most common sales are the third grade because the higher grade sheets require extra care in the production

process, and the price for the lower grade sheets is unattractive. The farmers sell products to local traders, co-operatives or central rubber markets, depending on production quantity and market accessibility.

Rubber Co-operatives

Rubber co-operatives in Thailand are established by the Department of Agriculture of MoAC in order to assist members (farmers) in buying rubber at a fair price and resolve underpricing by the middlemen. It also provides knowledge to members regarding how to increase the value added of rubber products. The overall objective of rubber co-operative is to raise farmers' income. Members transport fresh latex to co-operative by motorcycles or pick-up trucks. Members' products could be auctioned at central rubber markets or sold directly to processors. Currently, there are about 700 co-operatives nationwide, each with 100 members. However, farmers prefer selling their products to traders or central rubber markets because of strict rules and delay in payment by co-operatives.

Traders

There are many levels of traders. Local traders are bigger buyers who collect rubber from farms, community traders, and auction point, then sell the collected rubber to the processors. Community traders consist of travelling traders and village traders[12] scattered around the production areas. These traders collect rubber from the farmers for sale to the local traders or central rubber markets. In some cases, the community traders sell directly to the processors. In this part of the chain, trade volume is small.

Central rubber market

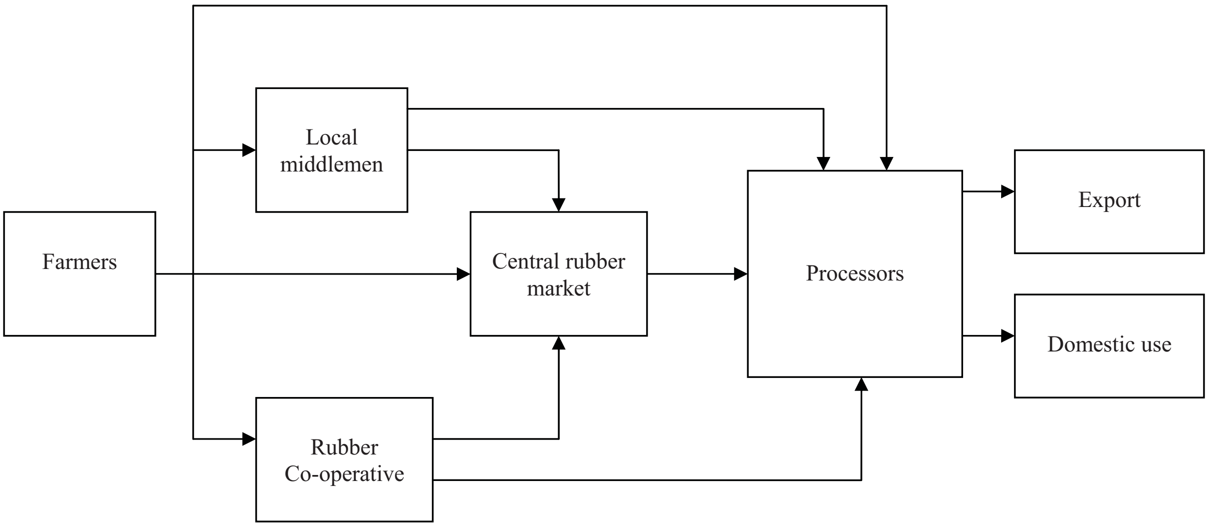
Rubber central markets in Thailand are established and developed by the Rubber Research Institute of Thailand (RRIT). There are 3 central markets in the south, in Hat Yai district, Songkla province, Surat Thani province, and Nakhon Sri Thammarat province. Rubber trading in central rubber markets is restricted to rubber sheets only, and rubber is traded by price bidding. Besides being the rubber trading centers, the central rubber markets also provide marketing information such as rubber prices.

Processors& Exporters

Processors obtain raw rubbers from the local traders, the large-scale rubber farmers, and the rubber central markets for processing into primary products. Rubber primary products are RSS, block rubber (also known as technical specified rubber or (TSR), concentrated latex, skim block, crepe, etc. Most of the raw materials, 94 percent specifically, are purchased locally through the local traders. The rest is purchased from the central rubber markets.

12 A travelling trader is a trader operating door-to-door at farm level, usually using motorized 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.

Figure 10: Marketing channel of rubber in Thailand



Source: TDRI survey 2007

Majority of the rubber products are exported in their primary forms such as STR, block rubber, RSS, skim block, ADS and concentrated latex. In the southern part of Thailand, transportation routes and methods by which rubber is transported from the factories to the exporting points are illustrated in Figure 11. The transportation modes include trucks, trains, and ships. For other regions, the transportation method is mainly using trucks to bring the goods to the port of shipment, either in Bangkok or the Eastern seaboard.

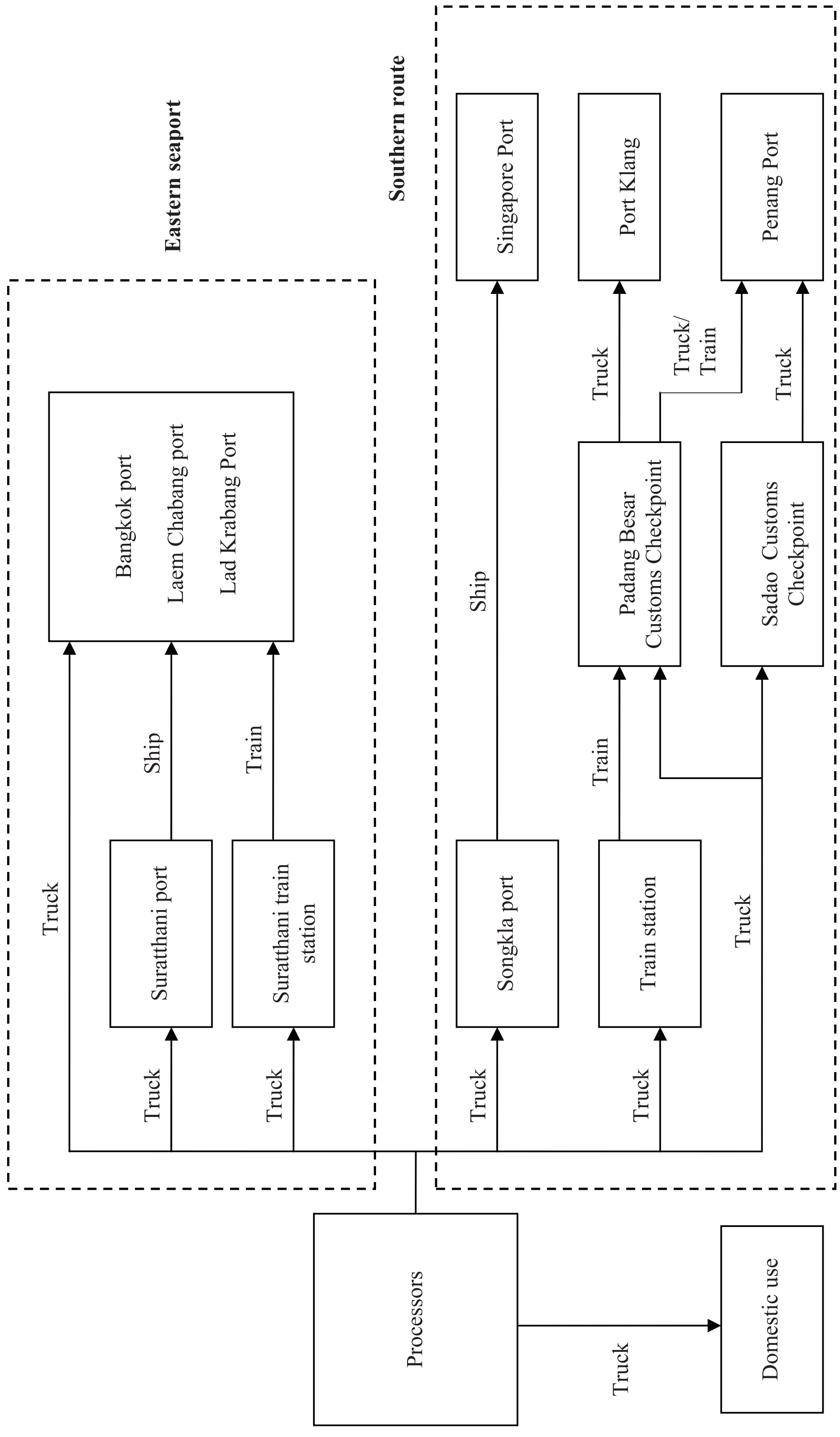
In the case of exporting to China, a major export destination, most of the rubber products are exported through various sea ports and customs checkpoints. The sea ports are the Bangkok port, the Laem Chabang port, the Lad Krabang port, and the Songkla port. Customs checkpoints are the Padang Besar customs checkpoint and the Sadao customs checkpoint. The pathway chosen by the exporters depends on the location of the processing factories and cost of transportation. The exporters generally choose the route which minimizes the costs of transportation and time.

Most factories in the lower southern part of Thailand prefer the Southern seaports and checkpoints to the Bangkok port and Eastern seaports since their location is in close proximity to the exporting point in the south, thus lowering the transportation cost. For the southern route, processing factories transport their rubber products to the Songkla port and customs checkpoints either by trucks, trailers, and trains. In the case of the Songkla port, products are loaded in the containers and transported by trucks or trailers to the port. The containers are carried by feeder ships to the Singapore port where they are loaded into bigger vessels heading to the export destination. In the case of the Padang Besar customs checkpoint, the containers are transported either by trucks and trailers or trains to the checkpoint and then to the Penang port by trains. In the case of the Sadao customs checkpoint, the containers are transported by trucks or trailers to the checkpoint and then to the Penang port by trucks through the expressway.

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 11: Transportation routes and methods of rubber export in Southern part of Thailand



Source: TDRI survey 2007

4.2.2 Costs and margins

The information on costs and margins were gathered from stakeholders involved in the marketing chain. It should be remembered that some information are unobtainable therefore the figures demonstrated below are approximations of the real values. The profit data, for example, are unobtainable due to company secrecy as well as some other costs. Accessible information is recorded accordingly, while the rest of the cost is put in “Other costs”. Block rubber production in Thailand uses air dried sheets (USS) and cup lumps as raw materials. The proportion between USS and cup lumps determines the quality of block rubber. In this study, for simplicity, the proportion is assumed to be 25% of USS and 75% of cup lumps. This proportion will be used to calculate the production costs and the average farm price.[13] Two marketing channels are compared, the case of Penang port and the case of Bangkok port. The distance between farms to middlemen’s buying points ranges from 2-56 kilometers. In the case of Penang port, the transportation cost is calculated by setting the distance equal to 232 kilometers (the official distance from Nakhon Si Thammarat to Padang Besar). In the case of Bangkok port, the transportation cost is calculated by setting the distance equal to 650 kilometers (the official distance from Surat Thani to Bangkok).

Block rubber

Block rubber from southern part of Thailand are exported through several ports. In this study, Bangkok port and Penang port were chosen as they are the two leading ports for rubber export. The marketing costs of block rubber going to the Penang port, based on the data gathered from the 2007 survey are shown in Table 20, and a summary of the marketing margins is shown in Table 21. Similarly, the marketing costs of block rubber to the Bangkok port is presented in Table 22, and the summary of the marketing margin is in Table 23. Farmers spend US$ 845.35 to produce rubber latex equivalent to one ton of block rubber. The production costs in both cases are the same, accounting for about 33% of the export price. Farmers sell their products to the middlemen and receive the average price of US$ 1,698.48 for rubber products equivalent to one ton of block rubber. That leaves US$ 853.12 to farmer’s margin and US$ 839.54 to farmer’s profit. As for middlemen, they spend only transportation cost and labor cost of US$ 21.12 and US$ 6.04 respectively. With the selling price to the factory at US$ 2,248.42, middlemen receive the gross profit of US$ 522.78. Notably, the reason why the gross profit for the middlemen at this stage is remarkably large is that there exist multiple levels of middlemen along the block rubber marketing chains from farmers to factory.

13 At the time of survey, USS farm price at the office is US$ 2,314.7 per ton and cup lumps price is US$ 2,226.3.78 per ton. With the 25:75 proportions, the average farm price for block rubber is US$ 1,698.48 per ton of block rubber.

Table 20: Marketing costs and margins for Block rubber to Penang port

Unit: US$/ton of block rubber

Descriptions	**Total**	**Percentage**
Production costs	**845.35**	**33.63**
Farmer margin	**853.12**	**33.94**
Transportation cost	13.58	0.54
Profit	839.54	33.40
Average farm price	**1,698.48**	**67.57**
Middlemen margin	**549.94**	**21.88**
Labor	6.04	0.24
Transportation cost	21.12	0.84
Profit and Others	522.78	20.80
Average farm price at office	**2,248.42**	**89.45**
Processor margin	**265.16**	**10.55**
Labor	15.09	0.60
Fuel	27.16	1.08
Transportation cost	17.35	0.69
CESS	42.25	1.68
Profit and Others	163.32	6.50
Export price (F.O.B) to Penang	**2,513.58**	**100.00**

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

Table 21: Marketing margins for Block rubber to Penang port

Unit: US$/ton of block rubber

Costs and Margins	**Total**	**Percentage**
Transportation cost	52.05	2.07
Labor	21.12	0.84
Fuel	27.16	1.08
CESS	42.25	1.68
Others	1,525.65	60.70
Gross margin	**1,668.23**	**66.37**

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

Rubber factory produces and exports. The study compares the costs and margins related to two exporting routes. For the Penang port route, the export price (F.O.B) of block rubber is US$ 2,513.58. That leaves the margin to factory at US$ 265.16. The transportation cost is US$ 17.35. For the Bangkok port route, the export price (F.O.B) of block rubber is US$ 2,521.12, a little higher than that for the Penang port route. The factory margin is US$ 272.71, and the transportation cost is US$ 25.65.

It is clear that the factory margin in the case of the Bangkok port is higher than in the case of the Penang port. This is due to the higher export price at the Bangkok port. However, when taking into account the transportation cost, holding other things equal, the profit in the case of Penang port is slightly higher than that in the case of Bangkok. It is obvious that the marketing costs in the route to Bangkok port should be higher due to longer distances. Another reason is that the transportation method in the upper route uses truck/trailers while the route to Penang port uses train which comparatively offers lower cost. Lastly, it should be noted that among the costs in marketing margins for block rubber export in both routes, transportation costs still have the highest proportion.

Table 22: Marketing costs and margins for block rubber to Bangkok port

Unit: US$/ton of block rubber

Descriptions	**Total**	**Percentage**
Production costs	**845.35**	**33.53**
Farmer margin	**853.12**	**33.84**
Transportation cost	13.58	0.54
Profit	839.54	33.30
Average farm price	**1,698.48**	**67.37**
Middlemen margin	**549.94**	**21.81**
Labor	6.04	0.24
Transportation cost	21.12	0.84
Profit and Others	522.78	20.74
Average farm price at office	**2,248.42**	**89.18**
Processor margin	**272.71**	**10.82**
Labor	15.09	0.60
Fuel	27.16	1.08
Transportation cost	25.65	1.02
CESS	42.25	1.68
Profit and Others	162.57	6.45
Export price (F.O.B) at Bangkok	**2,521.12**	**100.00**

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

Table 23: Marketing margins for Block rubber to Bangkok port

Unit: US$/ton of block rubber

Costs and Margins	**Total**	**Percentage**
Transportation cost	60.35	2.39
Labor	21.12	0.84
Fuel	27.16	1.08
CESS	42.25	1.68
Others	1,524.89	60.48
Gross margin	**1,675.77**	**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 with the replanting aid fees at a progressive rate, approximately US$ 40 per ton of rubber exported. Nonetheless, the tax burden are often passed on to traders and then ultimately falls upon farmers**,** resulting in lower farm price for farmers
- **Poor cooperation among farmers.** Rubber farmers sell their products independently. They are not organized as a group to utilize their marketing power to acquire higher price for rubber.
- **Multiple levels of traders**. Rubber products are being traded and transported by many levels of traders before they reach the factories, especially in some inaccessible areas. The trader in each level would collect marketing margin of its own. Prices received by farmers in these areas are therefore lower than the average farm price due to the higher marketing margins along the chains.

- **Logistics.** There are several logistic problems in rubber.
  - **Partial disorganization in logistics services**. The information regarding the logistics system and supply chain is not fully integrated and this leads to higher transaction costs**.**
  - **Inefficiency and insufficiency in train transportation.** Train transportation is sometimes delayed due to unreliable train schedule. The train rolling stocks are also old and inadequate. These affect transportation costs and customer confidence.
  - **Underutilization of Thai Ports**. Rubber products in the southern part of Thailand are mostly transported by train to the ship ports in Malaysia or Singapore, instead of using the nearby Songkla port as the freight cost from the Songkla port to China doubles the freight cost at the Penang port to China (Prachachat, 2008).[14] This is due to low import shipments from China via the Songkla port, resulting in shortage of packing containers for exports.

Opportunities

- **Advantage of Air-dried sheets.** ADS could be stored without a reduction in value until sold. This gives farmers opportunities to maximize their profits by extending or postponing the time to sell products and receiving reasonable prices. Moreover, producing ADS creates value-added for rubber.

5. Conclusions and policy recommendations

5.1. Conclusions

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

Constraints in cassava production and marketing are production cost, poor information related to the market, soil deterioration, lack of marketing management and planning, low quality, low technology, uncertainty of government policy towards ethanol production and road transportation. Lack of skilled labor and high production cost are the main constraints to rubber production while tax incidence, poor cooperation among farmers, multiple traders and high logistics costs are the problems in rubber marketing.

5.2. Review of existing policies

The agriculture sector has maintained its importance in the Thai economy as forty percent of the workforce is employed in this sector. Cassava and rubber are among Thailand's top products in terms of production value. There is no doubt that the government policies implemented from the past up until now have lead to the success in production and trade of both crops in the present time.

14 The freight transportation service, 20-feet container, from the Songkla port to China costs 400 U.S. dollars, while the freight service from the Penang port to China costs only 200 U.S. dollars.

5.2.1 Cassava

Production policies

The centerpiece of a government program to improve cassava productivity was the introduction of higher-yielding cassava varieties, developed from crosses between local and Latin American germplasm. The program first released Rayong 1 variety in 1975 and many important varieties later on. Currently, the use of the improved cassava varieties is spread out to nearly all of the country's cassava planting areas, producing over 20 tons of fresh roots per hectare.

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

There has been an attempt to register cassava farmers so that the government could keep track of their number and set up a system to efficiently manage cassava production and help reduce price fluctuations. However, the farmers in Thailand often alter the crops that they grow in accordance with crop prices. This caused a failure in implementing the policy. The policy was canceled later on.

The government has also been promoting the use of cassava in the production of ethanol by offering tax reduction incentives for ethanol production. Recently, the Cassava Development Committee is established by the MoAC in order to promote the production of cassava. The committee is responsible for cassava development such as determining the measures for product development and processing and providing consultation related to product development.

Marketing and price policies

The prices of cassava products have been fluctuating due to seasonality and volatility in world demand. This in turn has affected the price of fresh roots and farmers' revenue. When there exists an excess of cassava production, farmers are likely to receive low farm prices causing incomes to drop. The government has taken a number of measures to stabilize the price and help mitigate the adverse effects on farmer's income. The mortgage scheme for cassava is such a policy to absorb the excess supply from the market, especially in the beginning of the season.

5.2.2 Rubber

Existing government policies for rubber are as follows:

Production policies

Rubber plantation has been promoted through several policies as stated below.

- Rubber zones have been assigned and farmers are to be registered according to the assigned zone.
- Research and development in rubber varieties and cultivation practices are encouraged by the government.

- The central rubber market has been established as an auction market to serve both farmers and private sectors. They sometimes implement rubber market interventions by the government such as the mortgage scheme.

Finance policies

The populist Rubber Plantation Project has been developed to help Thai rubber farmers financially. The project aims to provide access to credit for rubber farmers who lack the resources needed for their plantation. Rubber farmers who choose to grow rubber in the National Forest Reserve farms were granted a certificate that can be used as collateral to take out their loans. Moreover, the ORRAF also provides a welfare fund of US$ 2,000 to each rubber farmers who require rubber replanting and replacing the local varieties with the new HYVs.

Marketing and price policies

Similar to all agriculture products, rubber prices are volatile. The International Rubber Organization (ITRO) was established by agreement among three countries, Thailand, Malaysia and Indonesia, the world's largest rubber producers. The main objective of the ITRO was to raise the rubber price for farmers in the three countries.

5.3. Recommendations of new policies

Based on the findings of this study, cassava and rubber have high potential in trade among GMS countries. However, there are still several constraints that have to be overcome. The following new policies are recommended:

5.3.1. Production and marketing

- Prior government measures and policies on both crops mostly emphasized on development of products in primary forms. As the country exports 90% and 75% of its rubber and cassava production respectively as raw material, Thailand is in a position where it depends too much on foreign markets. Changes in foreign policies could have much effect on the country production and the price. Although the price in recent years has been on an increasing trend, there is no guarantee that the price will not fall again as what frequently occurred in the past. Government should promote the development of domestic linkage industries for both cassava and rubber to induce demand and create additional value for the concerned products. Also, there should be a governmental body tasked to monitor and support the development of the linkage industries.
- Searching for new international markets is recommended to expand trade and reduce the risk of relying on few major markets. Through bilateral agreements, country could attract new markets for the cassava and rubber industries.
- Most farmers often harvest at the same time, in the early harvesting season or when the price is attractive. To avoid excess supply, there should be some forms of co-ordination among farmers in the community, such as joint farm planning.
- The rise in price of chemical fertilizers causes higher production costs. There should be a promotion for the use of organic fertilizers because they are cheaper and environment friendly.
- Adequate irrigation systems should be developed to prevent the production damage in times

of drought and for some areas with insufficient waters, especially for cassava, since cassava planting is mostly rain-fed.

5.3.2. Regional cooperation

There are several opportunities for cooperation among the countries in the region.

- An exchange or sharing of expertise among the countries in the region should be encouraged to improve the efficiency in production. For example, Vietnamese has an expertise in rubber tapping, while Thais are specialized in small farm management.
- Foreign direct investment should be encouraged in Thailand as Thailand possesses abundant sources of raw material. It could be in the form of International Joint Venture (IJV) for Thai to receive technology transfer.
- There should be an agreement on product standards or a mutual recognition agreement (MRA). This would improve the quality of products, reduce obstacles due to non-tariff measures, and facilitate trade among countries.

5.3.3. Logistics

- Logistic systems should be more integrated, especially the information system, to reduce high transportation cost and save transport time.
- Both cassava and rubber products are mostly exported through seaports, especially the Eastern and Bangkok seaports. Southern seaports should be developed to be able to support the large amount of export, instead of depending on neighboring ports such as those in Singapore or Malaysia.
- To support the rubber production in the North and cassava production in the Northeastern region, there should also be development in water transportation in the northern route to China.

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Agricultural Trade in the Greater Mekong Sub-Region: Case Studies of Cassava and Rubber in Vietnam

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Contents

Abbreviations and Acronyms

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
DAN	Development Analysis Network
DFID	Department for International Development
DRC	Domestic Resource Cost
IFPRI	International Food Policy Research Institute
GMS	Greater Mekong Sub-region
GSO	General Statistics Office
HYV	High Yielding Variety
Lao PDR	Lao People's Democratic Republic
PRA	Participatory Rural Appraisal
S&T	Science and Technology
VND	Vietnamese Dong

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1. Introduction

Vietnam is an integral part of ASEAN and the GMS, the latter encompassing the countries, Thailand, Vietnam, Cambodia, Laos and China. Vietnam is, at the same time, a transitional country in which many economic processes are shifting and under reform. During the last two decades, Vietnam has undergone economic "renovation" and achieved substantial economic growth before slowing down recently. Although industrialization has been speeded up, agriculture is still a major source of livelihood for majority of the population.

As other countries in the GMS, Vietnam has low economic departure. Although achievements in economic growth and poverty reduction are unarguable[1], the economy is still small in scale and facing many difficulties. Agriculture, rural areas and the farmers seem to be well behind the pace of economic development. The poor are concentrated in the rural areas of Vietnam and the average income gap between rural and urban areas is widening. An intuitive question is why 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 to this question 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 in the value chains of agricultural products and each of them gets different levels of benefits. In a national as well as a regional context, a pro-farmer value chain for agricultural products should be promoted.

As part of the overall GMS' research, this research on the case of Vietnam also has the main development objective of increasing the efficiency of agricultural trade "in a manner that contributes to improvements in rural development and poverty reduction". By improving marketing efficiency toward a pro-farmer value chain, incentives would be created for improving agricultural production. The specific questions in the "inside-the-border" context are as follows:

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

The answers to the above questions could be used as "inputs" to a broader comparative analysis for a larger context of making comparisons among five countries in the GMS region. In Vietnam, to promote international trade in general and the trade with GMS countries in particular is of special concern. It seems that a huge trade potential has still not yet been explored. The lack of production and market information exchange among GMS countries seems to be the major cause for that gap.

In this research on the case of Vietnam, two commodities namely cassava and rubber were selected for in-depth analyses. Cassava was chosen due to the fact that the crop is a very good cereal substitute for rice – the main staple in Vietnam as well as in almost all other GMS countries. Cassava is also one of the few important food crops in Vietnam. In addition to rice

1 The poverty rate was improved from 34.44% in 1995 to 14.8% in 2007 (estimated) (Statistical Yearbooks from 1996-2007 – GSO)

and maize, cassava has been used to fight hunger during off-season period. The crop is also an important feed for livestock in many parts of Vietnam especially in mountainous areas. Recently, cassava has proved to have another important use in starch industry and thus has become a good cash crop in some regions of Vietnam as well. In the GMS' context, cassava is an important food crop in the region, making it meaningful to be compared among countries. Studying the value chain of cassava in Vietnam, Cambodia as well as in other GMS countries could help reveal the real comparative advantages of each country for the crop.

Rubber was selected to be analyzed in this research due to its emergence in recent years. This is partly due to increasing natural rubber prices in the world market resulting in relatively large benefits for the country‘s agricultural exports. The largest importer of natural rubber is also a GMS country, that is China with its huge market demand. The large part of Vietnam's rubber exports go to China and rubber now is considered as a crop for alleviating poverty in many provinces of Vietnam. The crop has become a good source of employment and income for the rural people and of foreign exchange for the country, especially of the southeast region of Vietnam (Ho Chi Minh City, Tay Ninh, Binh Duong, Binh Phuoc, Dong Nai, Ba Ria Vung Tau, Ninh Thuan and Binh Thuan). Since 1995 up to now, rubber has always been the third or the second largest agricultural export commodity in Vietnam[2] 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 a relatively high level of USD 1.25 billion.[3] Rubber is also a very important agricultural crop in Thailand (the largest rubber producer in the world) and Laos. Therefore, it could be said that in the GMS context, rubber could act as a good agricultural crop to be analyzed for the benefit of the GMS region.

2. Methodology

Following the value chain approach, the study traces the subject products from production to final consumption. Exploring the value chain, according to the 'broad' approach, entails looking at the complex range of activities implemented by various actors (primary producers, processors, traders, service providers, etc) along the chain starting from the production system of the raw materials and moving onto the linkages with enterprises engaged in trading, assembling, processing, etc.[4] It is therefore essential that the approach does not only examine the activities of a single actor but of all the actors/stakeholders along the value chain. Although one can go backward or forward in a value chain approach, it is often that primary production or farming is used as the starting point. At this initial phase of investigation, farm-gate costs and margins are analyzed to assess the benefits accruing to farmers.

In tracing the products, the approach examines what is going on among the actors in a chain, what keeps these actors together, what information is shared, how the relationships among actors are evolving,[5] etc. It means that for the same product, there may be many different value chains tracing different paths of products. The key issue here is that a representative value chain should be selected for the analysis.

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2 after rice and coffee
3 Information from the MARD web-site
4 ADB (2007)
5 ADB (2007)

At the most basic level, the value chain is depicted by a map linking the economic actors participating in the production, distribution, marketing, and sales of a particular product. In such "maps", the cost structure, margins and other factors involved in the value chain are presented. The details representing each stakeholder in each section of the map are often collected via direct or focus group interviews, PRAs, secondary data or a combination of these tools. The key linkages among actors/stakeholders of the value chain are really important for the analysis. In these linkages, the interactions between various stakeholders are described and evaluated.

Regarding the distributional aspect, the value chain analysis is an efficient tool for identifying the distribution of benefits among the actors in the chain. For each actor, his/her benefits are determined via the analysis of margins and profits. As a result, who benefit the most and the least can be identified. Also, , the policy impacts of benefit distributions among actors of the value chain can be analyzed. Each item of cost or benefit can be affected differently by different policy options. The effects of improvements on or "upgrading" of different aspects (such as quality, product design, etc…) on the benefits received by each actor can also be evaluated. In addition, the value chain analysis also reveals the structure of relationships and coordination mechanisms among the actors. This is the governance aspect of the value chain. Recommendations for pro-poor policies can be drawn from the results of the analysis. In principle, the value chain analysis does not require a large number of observations for each stakeholder. The more important thing 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 due to the fact that cassava outputs come in many different forms. In general, four main activities included in the chain are: (i) production of cassava root; (ii) processing; (iii) trading of cassava root and starch; and (iv) end-uses of starch and processing by-products. On the other hand, the main actors participating in the cassava value chain in Vietnam include: (i) producers; (ii) traders; (iii) processors; (iv) wage employees; (v) end-users, and (vi) related institutions. These actors differ by region in terms of number, scale, activities, importance, income, scope of business, development orientation, etc. Therefore, these differences result in variation in costs, benefits, margins, market governance, and linkages among actors in different regions.[6] In this research, the primary data for cassava were 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 were collected from 3 processing and exporting enterprises in Phuoc Vinh commune (Chau Thanh district), Thanh Bac and Thanh Binh communes (Tan Bien district). In addition to the primary data collected in the study sites, secondary data were also gathered for the analyses of cassava production and trade. The survey was undertaken to collect information of the 2007 season.

Secondary data for rubber were obtained from various sources while the primary data were basically from the survey undertaken in 2008 by a team consisting of staff of the Faculty of Economics of the University of Agriculture and Forestry, Thu Duc district, Ho Chi Minh city. The specific means used were group survey of 5 small farm holders and interview survey of 5 rubber sap collectors. The important secondary data were from two state rubber companies,

6 (ADB & DFID, 2005)

Phuoc Hoa and Dau Tieng in Binh Duong Province. Although the sample sizes were small for different actors in the value chain, they were selected to be representative of their groups.

3. Production

3.1. Cassava

3.1.1. Production

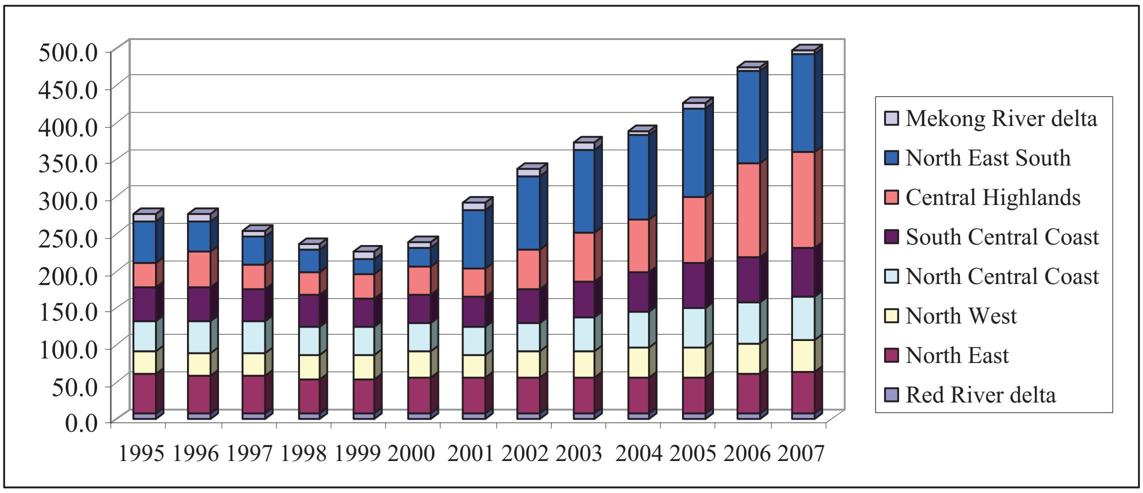
Vietnam is the 12th largest cassava producer in the world. Cassava production plays a significant role as one of the important food crops, especially in remote and mountainous areas of Vietnam. Cassava products are originally intended for food and animal feeding. In the last decade, thanks to the development of processing industry, a large amount of cassava products is used as raw materials in starch processing factories in food processing, paper, pharmaceutical and bio-fuel industries.

In Vietnam, cassava crop is cultivated in almost all provinces of the country, but it varies among regions and even among provinces. Mountainous provinces in the North, the Central Coastal regions, the Central Highlands and the Southeastern provinces are the main regions of cassava cultivation whereas Red River Delta and Mekong River Delta have a very small amount of cassava planted areas, accounting for less than seven percent of total cassava planted area in 1995 and three percent of the total cassava planted area in 2007 (GSO, 2008).

Cassava production development over the past twelve years can be divided into two periods: (1) from 1995 to 2000 and (2) from 2001 to 2007.

The first period shows a downward trend in cassava cultivated areas in most of the provinces. In 1995, the whole country had 277.4 thousand hectares of planted cassava, in which Gia Lai had the largest area of grown cassava (15.8 thousand hectares), followed by Quang Nam, Tay Ninh, Thanh Hoa, Son La, Dong Nai and Nghe An, successively. This area however decreased by 14.3 percent in 2000, equivalent to 39.8 thousand hectares in absolute level. Annual growth rate of total cassava areas in the period of 1995 to 2000 for the country as whole was -3.05 percent. It can also be seen that the North East South region experienced the biggest decline in the proportion of cassava uncultivated areas (-56.3 percent over this period or -15.25 percent of the annual growth rate) over the period 1995-2000. This level was nearly four times higher than the average for the whole country. It was a direct result of the huge decline in Tay Ninh province (up to -94.5 per cent), and Binh Phuoc province (-83.6 percent) over the same period. The South Central Coast region likewise experienced a decline, of -19 percent specifically from 1995 to 2000.

Figure 3.1: Cassava planted area 1995-2007

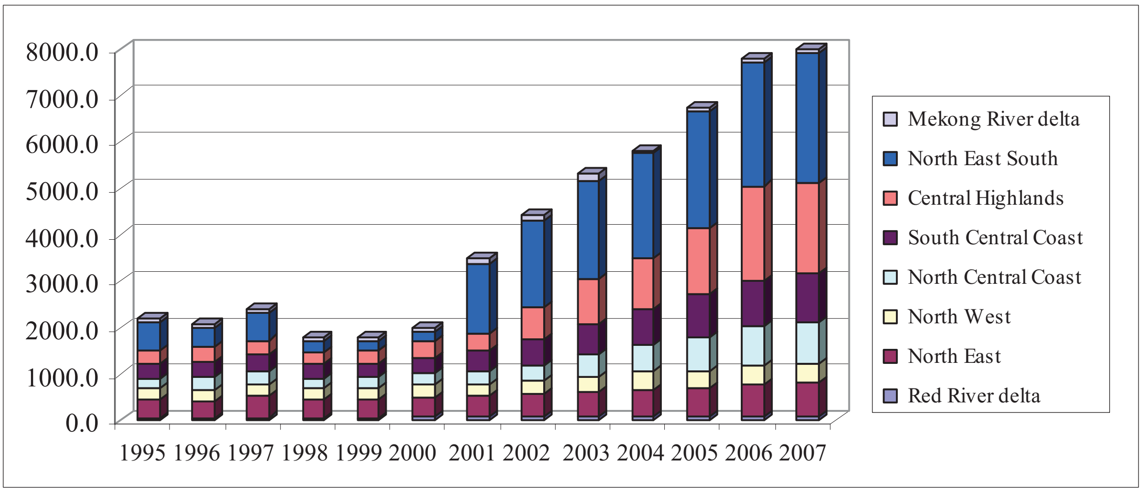


Source: Calculated from GSO statistical data

There has clearly been an upward trend in cassava production in the latter period (2001-2007). Cassava demand has considerably increased as starch products in some industries such as paper industry, food processing industry and bio-fuel industry, resulting in the high price of fresh cassava roots and starch. Cassava, thus, has been recently regarded as an industrial crop with high comparativeness, no longer a pure food crop. Areas, yield and output of cultivated cassava increased more rapidly from 2001 to 2007, compared to the period 1995 – 2000.

In 2007, total area of planted cassava was 70 percent higher (9.25 percent of the annual growth rate) than that in 2001 on average. There is a big disparity in the growth level among different regions and different provinces, however. Central Highlands is the region that had the highest growth rate of cassava cultivated area (246.4 percent or 23.01 percent per year on average) over the said period. On the contrary, the other regions experienced lesser growth, specifically under 9 percent per year on average. The gap between the highest and the smallest rates was very big, approximately 15 times over the period of 2000-2007, while the Central Highlands remained the annual growth rate as high as 23.01 percent, the North East gained the annual growth rate of 2.53 percent. The rapid increase in cassava areas of the Central Highlands can be explained by some main reasons, namely: (1) high price of cassava products in current years, (2) it is well known that this region has a rich nutrient soil resource, which is favored by industrial plants including those dealing with cassava and (3) there are up to five processing factories in this region. Yet, actual cassava areas of some provinces have generally exceeded their planned areas. For example, in 2007, the actual area of cassava in Dak Lak province has exceeded planned areas by13,040 ha. .Similar to the case of Dak Lak, planned area for cassava production in Phu Yen province is only 9,500 ha until 2010. In reality however, its cultivated areas has already reached 13,200 ha, nearly 4,000 ha or over 42 percent more than the total planned area (Khanh Phuong, 2008).

Figure 3.2: Cassava production 1995-2007



Source: Calculated from GSO statistical data

In relation to cassava production, as a consequence of the downward trend in cassava planted areas in the period 1995-2000, the total volume of cassava production decreased from 2211.5 thousand ton in 1995 to 1986.3 thousand ton in 2000, reflecting a negative annual growth rate of 2.13% over the period. The negative annual growth rate of cassava production was particularly experienced in two regions namely North East South region (-18.65%) and Red River delta region (-3.04%)

In the period 2001-2007, thanks to the increase in cassava planted areas and especially the increase in cassava yield due to the introduction of High Yielding Varieties (HYV), cassava production sharply rose. In 2001, total cassava output was only 3509.2 thousand tons; however, in 2007, it reached 7984.9 thousand tons. Total output growth was 127.5 percent over seven years or 14.69 percent per annum on average. There were changes in the rank of regions. For instance, the North Central Coast region jumped to the fourth from the sixth, while the South Central Coast region went down from the second to the third. In terms of provinces however, there was not much change in the top ranking. Tay Ninh remained the the leading province, followed by Gia Lai, Binh Phuoc, Kon Tum. Exceptionally, Dak Lak, Binh Thuan, Nghe An and Yen Bai provinces quickly rose to the high ranks. The most prominent province is Dak Lak. It was nearly in the bottom rank with only more than 50 thousand tons in 2001 but had about 400 thousand tons in 2007.

Table 3.1: Average annual growth rate (%) in cassava harvested areas, production and yield in Vietnam in the period 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 among regions and some provinces, as determined by local characteristics of land, climate and traditional customs in each area.

Most cassava fields are ploughed once in the mountainous regions, while in delta regions, they are ploughed twice before harvesting. However, just about a half of cassava areas is harrowed. This land preparation is usually carried out by hand or by animals, especially in some provinces such as Tay Ninh, Binh Phuoc, Binh Duong, Lam Dong and Dong Nai it is done by tractors (Kim, 2008).

Cultivation is usually done at the beginning of the rainy season to take advantage of the rains enhancing land moisture. However, in few provinces like Tay Ninh province, 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 however, stems are stored in order to develop stakes. Stakes require more complex preservation as stake storage time remarkably depends on the harvesting time and the planting time of the next crop. The stake storage may take less than one week or even more than 12 weeks so that identifying an efficient storage duration is fairly difficult.

There are two main methods of planting cassava, namely (1) horizontally planting stakes and (2) vertically planting stakes. The former method is more popular than the latter, it accounting for 68 percent of the total in the South and 76 percent of the total cassava planted area 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, however, is applied mainly in the Central Coastal regions and the Central Highlands to take advantage of both methods.

The density of cassava planting population is significantly determined by the characteristics of the soil. The thicker the soil, the wider is the spacing of rows and of the plants in a row and the less are the stakes. Conversely, the poorer the soil, the closer is the spacing and the more are the stakes. The standard spacing is 50-100 cm and 50-100 cm in monoculture. Nevertheless, cassava crop can also be planted in an intercropping system. The system potentially has higher effectiveness in terms of supporting farmers' income and improving soil fertility. According to ADB (2008), the cassava – peanut intercrop creates the highest profit, about 3 times higher than the profits from monoculture. It also results in about 0.75 times less dry soil loss than the one experienced in monoculture system. Some main crops could be good choices in the intercropping system including maize, peanut, black bean and mungbean. However, the intercropping system is still not popular in Vietnam, the proportion of cassava planted area that is practiced intercropping system in total cassava planted area was accounting only for 10 percent in the North and 30-40 per cent in the South (Kim, 2008) and this can be explained by traditional habits and customs of Vietnamese farmers.

Another cultivation practice that should be paid attention to is in relation to soil nutrient. Cassava crop is still able to grow even in poor soil and not much affected by diseases and insects. However, it requires a lot of good fertiliser in order to be highly productive. Unfortunately, compared to the other crops, farmers normally choose chemical fertilisers of lower quality for cassava as a result of limited resources.

Harvesting time is a determinant of cassava productivity and quality. If cassava is harvested too early, then starch content will be low, leading to low yield. The highest starch content can be harvested 10 – 12 months after planting.

Currently, new high-yielding seed varieties such as KM94, KM 140, KM 98-5, KM98-1, KM98-7, and SM937-26 are commonly applied across the whole country. About 75 percent of the total cultivated areas of cassava use HYV (Kim, 2008).

3.1.3. Production costs

To estimate cassava production cost, Tay Ninh province, the largest cassava production in Viet Nam was chosen to be surveyed. A field survey was undertaken in the provincial districts of Hoa Thanh and Tan Bien, of which, a number of farmers/cassava producers together with collectors, processors and exporters were interviewed. In each district, one commune is selected —Truong Dong and Tan Phong communes respectively. Totally there were 60 households interviewed and those households were evenly distributed among districts and communes.

In terms of production, cassava does not need many inputs as compared to other crops. Overall expenditure for each ha of cultivated cassava in 2007 season was VND 9557 thousand or USD 597, of which the largest proportion (as much as VND 4376 thousand or nearly 50 percent of total production costs) was for purchasing chemical fertiliser. Before, farmers rarely use fertiliser for cassava production. The introduction of HYV however came along with the need to use chemical fertilisers.

In Vietnam, by virtue of the implementation of the Land Law, farmers are allocated cultivated land without any fee by the State and are awarded land use certificates for that given land as well as different rights to the land such as transfer, exchange, lease, collateral, heritage and land venture. As seen on the table on production cost, land rental row is empty. This implies that farmers used given land for cassava cultivation and spent nothing for land rental.

Table 3.2: Cost, revenue and profit margins for average cassava production by farmers in Tay Ninh province (estimated by the data of 2007 season)

No	Items	Amount per ha		Amount per tons of fresh cassava root		Item percentage in total cost (%)
		In thousand VND	In USD	In thousand VND	In USD	
I	Total cost	9557.65	597.35	358.56	22.41	100.00
1	Land rental	0.00	0.00	0.00	0.00	0.00
2	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
3	Cassava stem	549.04	34.32	20.60	1.29	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
4	Labor cost	2777.06	173.57	104.18	6.51	29.06
	Labor for transplanting	436.32	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
	Labour for weeding	490.49	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
	Labor 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
5	Manure	977.89	61.12	36.69	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
6	Chemical fertilisers	4376.19	273.51	164.17	10.26	45.79
7	Pesticide	4.60	0.29	0.17	0.01	0.05
8	Irrigation fee	140.17	8.76	5.26	0.33	1.47
9	Others	20.06	1.25	0.75	0.05	0.21
	Purchased	20.06	1.25	0.75	0.05	0.21
II	Revenue (selling price)	23212.84	1450.80	870.84	54.43	
III	Profit margin	13655.19	853.45	512.28	32.02	142.87

Source: The authors' estimations from the surveyed data.

Labor cost had the second biggest share of cassava production cost, it accounting for nearly 30% of the total production costs and of which the labor cost for harvesting was the largest (almost half of the total). This huge labor cost for harvesting was however not accompanied by enhancement in cassava yield. This implies that reducing harvesting cost would lead to more profit from cassava production.

Despite the high production cost, each ha of growing cassava still brings more than USD 853 of profit to farmers or 143% profit margin compared to production cost.

Table 3.3: Cost, revenue and profit margins for traditional cassava variety production by farmers in Tay Ninh province (estimated by the data of 2007 season)

No	Items	Amount per ha		Amount per tons of fresh cassava root		Item percentage in total cost (%)
		In thousand VND	In USD	In thousand VND	In USD	
I	Total cost	13488.57	843.04	429.18	26.82	100.00
1	Land rental	0.00	0.00	0.00	0.00	0.00
2	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
3	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
4	Labor cost	4791.43	299.46	152.45	9.53	35.52
	Labor for transplanting	480.00	30.00	15.27	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
	Labour for weeding	2042.86	127.68	65.00	4.06	15.15
	Purchased	1871.43	116.96	59.55	3.72	13.87
	Self-supplied	171.43	10.71	5.45	0.34	1.27
	Labor 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
5	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
6	Chemical fertiliser	6525.71	407.86	207.64	12.98	48.38
7	Pesticide	0.00	0.00	0.00	0.00	0.00
8	Irrigation fee	80.00	5.00	2.55	0.16	0.59
9	Others	0.00	0.00	0.00	0.00	0.00
II	Revenue (selling price)	29628.57	1851.79	942.73	58.92	
III	Profit margin	16140.00	1008.75	513.55	32.10	119.66

Source: The authors' estimations from the surveyed data.

In terms of cassava varieties, farmers are now using both traditional and HYV but tend to grow more HYV cassava instead of the traditional variety. Although traditional cassava root can get better price than the HYV cassava root in the market, growing traditional cassava needs more inputs such as labor and fertiliser, thus resulting to less profit. Among the 60 interviewed households, there were only 3 households still growing traditional cassava. Total cost of traditional cassava production per ha was VND 4023 thousand or USD 251 higher than that of HYV cassava production. Labor costs were VND 4791 thousand and VND 2729 thousand for traditional variety and HYV respectively.

Growing one ha of traditional cassava can bring profit of VND 16140 thousand or USD 1000 to farmers. Based on the total production cost, the profit margin reached 119%.

Table 3.4: Cost, revenue and profit margins for HYV cassava production by farmers in Tay Ninh province (estimated by the data of 2007 season)

No	Items	Amount per ha		Amount per tons of fresh cassava root		Item percentage in total cost (%)
		In thousand VND	In USD	In thousand VND	In USD	
I	Total cost	9465.20	591.57	356.59	22.29	100.00
1	Land rental	0.00	0.00	0.00	0.00	0.00
2	Land preparation	715.29	44.71	26.95	1.68	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
3	Cassava stem	554.90	34.68	20.91	1.31	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
4	Labor cost	2729.69	170.61	102.84	6.43	28.84
	Labor for transplanting	435.29	27.21	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
	Labour for weeding	453.98	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
	Labor 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
5	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
6	Chemical fertiliser	4325.64	270.35	162.96	10.19	45.70
7	Pesticide	4.70	0.29	0.18	0.01	0.05

8	Irrigation fee	141.58	8.85	5.33	0.33	1.50
9	Others	20.53	1.28	0.77	0.05	0.22
	Purchased	20.53	1.28	0.77	0.05	0.22
II	Revenue (selling price)	23061.95	1441.37	868.84	54.30	
III	Profit margin	13596.76	849.80	512.24	32.02	143.65

Source: The authors' estimations from the surveyed data.

As seen in the above table, growing HYV cassava brought a profit of VND 13596 thousand or USD 849 for each cultivated ha which was fairly lower than that of cultivated traditional cassava. The reasons were: (i) for smaller area of traditional cassava, farmers had more money and labor to invest in fertiliser and labor input than that of HYV ; (ii) the market price of traditional cassava is much higher than that of HYV cassava. Setting the profit margin against the total production cost, the ratio for HYV cassava growing was 143.65%, much higher than the ratio of 119.66% for growing traditional cassava.

Table 3.5: Cost, revenue and profit margins for cassava production by farm size less than 1 ha in Tay Ninh province (estimated by the data of 2007 season)

No	Items	Amount per ha		Amount per tons of fresh cassava root		Item percentage in total cost (%)
		In thousand VND	In USD	In thousand VND	In USD	
I	Total cost	10,585.55	661.60	370.35	23.15	100.00
1	Land rental	0.00	0.00	0.00	0.00	0.00
2	Land preparation	978.28	61.14	34.23	2.14	9.24
	Purchased	865.44	54.09	30.28	1.89	8.18
	Self-supplied	112.83	7.05	3.95	0.25	1.07
3	Cassava stem	838.24	52.39	29.33	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
4	Labor cost	2,809.22	175.58	98.28	6.14	26.54
	Labor for transplanting	482.62	30.16	16.88	1.06	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
	Labour for weeding	1,186.90	74.18	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
	Labor for harvesting	1,139.71	71.23	39.87	2.49	10.77
	Purchased	1,139.71	71.23	39.87	2.49	10.77
	Self-supplied	0.00	0.00	0.00	0.00	0.00
5	Manure	918.79	57.42	32.14	2.01	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

6	Chemical fertiliser	4,857.86	303.62	169.96	10.62	45.89
7	Pesticide	23.40	1.46	0.82	0.05	0.22
8	Irrigation fee	103.61	6.48	3.62	0.23	0.98
9	Others	56.15	3.51	1.96	0.12	0.53
	Purchased	56.15	3.51	1.96	0.12	0.53
II	Revenue (selling price)	23,212.84	1,450.80	870.84	54.43	235.14
III	Profit margin	12,627.29	789.21	500.49	31.28	135.14

Source: The authors' estimations from the surveyed data.

Taking comparison of production costs by farm size, the advantage of economies of scale can be easily seen. Expenditure for growing cassava in farm size less than 1 ha is VND 1279 thousand, higher than that of farm size over 1 ha. Production cost for one ton of fresh cassava root produced by farm size over 1 ha is VND 15 thousand, cheaper than that of cassava root produced by farm size less than 1 ha. Consequently, profit margin for each ha of growing cassava were VND 13906 thousand and VND 12672 thousand respectively for farm size over and less than 1 ha.

Table 3.6: Cost, revenue and profit margins for cassava production by farm size over 1 ha in Tay Ninh province (estimated by the data of 2007 season)

No	Items	Amount per ha		Amount per tons of fresh cassava root		Item percentage in total cost (%)
		In thousand VND	In USD	In thousand VND	In USD	
I	Total cost	9,306.38	581.65	355.41	22.21	100.00
1	Land rental	0.00	0.00	0.00	0.00	0.00
2	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
3	Cassava stem	478.35	29.90	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
4	Labor cost	2,769.20	173.07	105.76	6.61	29.76
	Labor for transplanting	425.00	26.56	16.23	1.01	4.57
	Purchased	393.14	24.57	15.01	0.94	4.22
	Self-supplied	31.86	1.99	1.22	0.08	0.34
	Labour for weeding	923.61	57.73	35.27	2.20	9.92
	Purchased	287.58	17.97	10.98	0.69	3.09
	Self-supplied	32.68	2.04	1.25	0.08	0.35
	Labor for harvesting	1,406.86	87.93	53.73	3.36	15.12
	Purchased	1,406.86	87.93	53.73	3.36	15.12
	Self-supplied	0.00	0.00	0.00	0.00	0.00
5	Manure	992.33	62.02	37.90	2.37	10.66

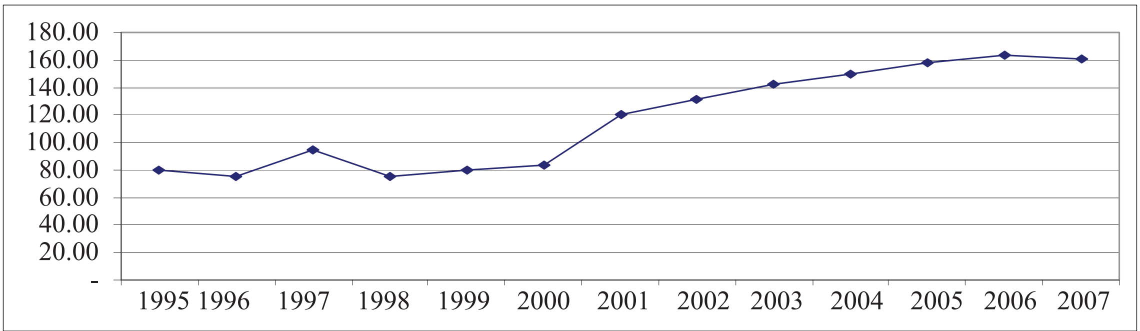
	Purchased	992.33	62.02	37.90	2.37	10.66
	Self-supplied	0.00	0.00	0.00	0.00	0.00
6	Chemical fertiliser	4,258.45	266.15	162.63	10.16	45.76
7	Pesticide	0.00	0.00	0.00	0.00	0.00
8	Irrigation fee	149.10	9.32	5.69	0.36	1.60
9	Others	11.24	0.70	0.43	0.03	0.12
	Purchased	11.24	0.70	0.43	0.03	0.12
II	Revenue (selling price)	23,212.84	1,450.80	870.84	54.43	
III	Profit margin	13,906.46	869.15	515.43	32.21	145.02

Source: The authors' estimations from the surveyed data.

3.1.4. Productivity

In terms of cassava yield, there was a small increase in the 1995-2000 period, from 79.72 quintal/ha in 1995 to 83.6 quintal/ha in 2000, or only just 0.95 quintal/ha of annual growth level. It was therefore offset by the great decline in the area of grown cassava, leading to a considerable decrease in cassava output from 2211.5 thousand tons in 1995 to 1986.3 thousand tons in 2000, equivalent to -10.2 percent over the whole period.

Figure 3.3: Cassava yield 1995-2007



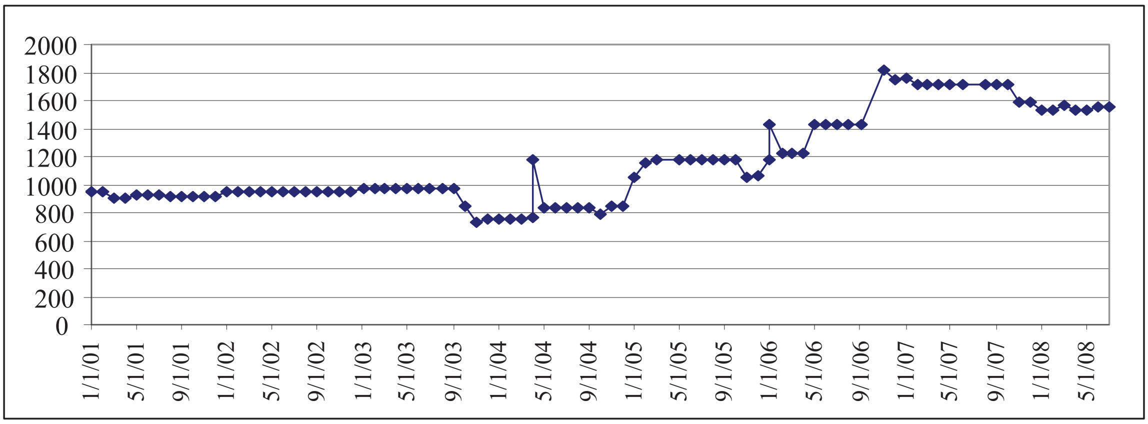
Source: Calculated from GSO statistical data

In contrast to the previous period, cassava yield gradually went up in the 2001-2007 period along with the increase in cultivated areas. Growth rate of cassava yield was 101.53 percent over the whole period. On average, annual growth rate was 6.01 percent. This increase resulted from the adoption of new high yielding seed varieties by farmers, but increasing rates were different among regions and provinces. The highest rate was found in the North Central Coast region (8.86 percent per year on average). Meanwhile the Northwest is the region that had the lowest growth rate of yield with only 3.07 percent increase. These trends were mainly driven by cassava yield changes in some provinces in these regions. Nghe An province, located in the North Central Coast, surprisingly reached the highest annual yield growth of 22.73 percent whereas the lowest rates of less than 0.4 percent per year were experienced in Binh Phuoc and Binh Duong provinces (0.32 percent and 0.24 percent respectively) in the North East South region.

3.1.5. Potential and policy

Developments in the global cassava sector clearly indicate the high potential of cassava production in the near future. Demand for cassava as materials in some industries such as paper, food, pharmaceutical and bio-fuel, etc. industries is going up. Cassava production and consumption are estimated to increase as revealed in some researches. According to FAO (2003), total demand for cassava is expected to increase annually by 1.4 per cent until the year 2010, from their levels in 1999. Furthermore, net cassava exports were forecasted to rise by 2.5 percent over the same period. Estimates by Hershey and Howeler also indicate that total cassava utilisation will go up by 1.7 percent per annum during the period 1993-2020 (Hershey and Howeler, 2001). Along with this increase, higher prices of cassava fresh roots are also expected to rise.

Figure 3.4: Monthly price of cassava fresh root from Jan 2001 to July 2008 (VND/kg)



Source: Calculated from GSO statistical data

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 more than VND 10 million per hectare per annum in Yen Bai province (Van Thong, 2008). In some areas, the profit earned from one hectare of cassava production is about VND 14 – 15 million per year or even more. As a result, farmers are irresistible to the profit of cassava crop. Furthermore, cassava crop has high adaptability to many types of soils, even poor or unfertile soils. An expansion of its production would naturally occur if it continues to provide more benefits to farmers. An advantage of cassava production development is that so many large and modern starch processing factories are in operation or being constructed in the country with 5360 thousand tons of cassava fresh roots per year of total design capacity. Thus, there is a great room available for cassava production development, presently satisfying only 75 percent of total design capacity. Moreover, a large number of hectares of nutritional soils located mainly in the Central Highlands and North East South region. is still able to cultivate or to change to grow cassava.

These potentialities and opportunities are regarded as signals for a boom in the cassava production of Vietnam in the near future.

3.1.6. Constraints and opportunities

In term of constraints, some farmers have been using some new high-yielding varieties of cassava and applying some new cultivation techniques like the intercropping system; yet, a large number of farmers is still using traditional techniques and habits in producing cassava. Besides that, slow adoption of new varieties and improved technologies is found among a large number of producers. The more development there is, the more danger comes from the bad habits. Low yield, erosion and degrading of soil fertility are direct negative impacts of these bad practices. Besides, starch processing generates serious environmental pollution, especially in small firms which usually lack the technologies and equipment for treating liquid and solid waste from the processing. Another limitation is that cassava areas in many provinces have exceeded the planned and established land for production. This poses a big problem as the development progress has not been under control, leading to an imbalance in the social economic development of these provinces. In addition, prices of cassava products often fluctuate and highly depend on the world market so that it is difficult to forecast the prices. In addition, there always exists a considerable gap between the demand for and the supply of cassava production in Vietnam. Recently, the most serious constraint for the sector is the shortage of cassava raw materials. Many processing factories have experienced lack of materials, no more than 60 percent of their capacity in use resulting in a waste of resources in the industry in particular and in the whole country, in general. Another problem is that farmers could hardly access processing factories mainly due to high transportation and delivery cost, disciplinary quality controls and cumbersome administrative procedures. Thus, farmers must sell products through more intermediaries at a price that is much lower than that if they sold directly to these large processors.

In terms of opportunities, in the last decade, HYVs cassava such as KM60, KM94 and KM98 were introduced. HYVs are increasingly being adopted by farmers. This would increase cassava productivity and thus production. In addition, there is a trend of increasing cassava planting areas as farmers tend to shift from other crops to cassava due to the higher profitability of growing the latter. Recently, the cassava market price has been high and exceeded farmer's expectations. For example, in late 2008, the price of cassava fresh root in Tay Ninh province was as high as 1300 VND/kg (equivalent to 81 USD per ton), allowing farmers to earn 12 to 15 VND million of profit for each planted cassava area. Cassava demand is high in the domestic market as most cassava processing factories are short of raw material. As mentioned earlier, some factories have been operating around 60 percent of their processing capacity due to lack of cassava. Some cassava processing factories commit to offer a floor price for cassava as well as strengthen the linkage contract between them and the farmers. In the international market, the demand for cassava has also increased, especially from China market. As a WTO member, Vietnam's foreign trade policy is more facilitated; therefore, it would be easier for Vietnam's cassava and cassava products to expand in 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 southeast and central highland regions. Recently,

natural rubber has come to play an important role in Vietnamese agriculture as it has provided jobs and incomes for the rural people and foreign exchange for the country.

In terms of planted area of rubber tree, Vietnam is the fourth-largest producer in the world, just behind Indonesia, Thailand and Malaysia. In the 1995-2007 period, Vietnam reached the highest annual growth rate of rubber tree planted area at 5.2% while the annual growth rate of rubber planted area in the world as a whole was only 1.8%.

Table 3.7: Vietnam in world rubber production

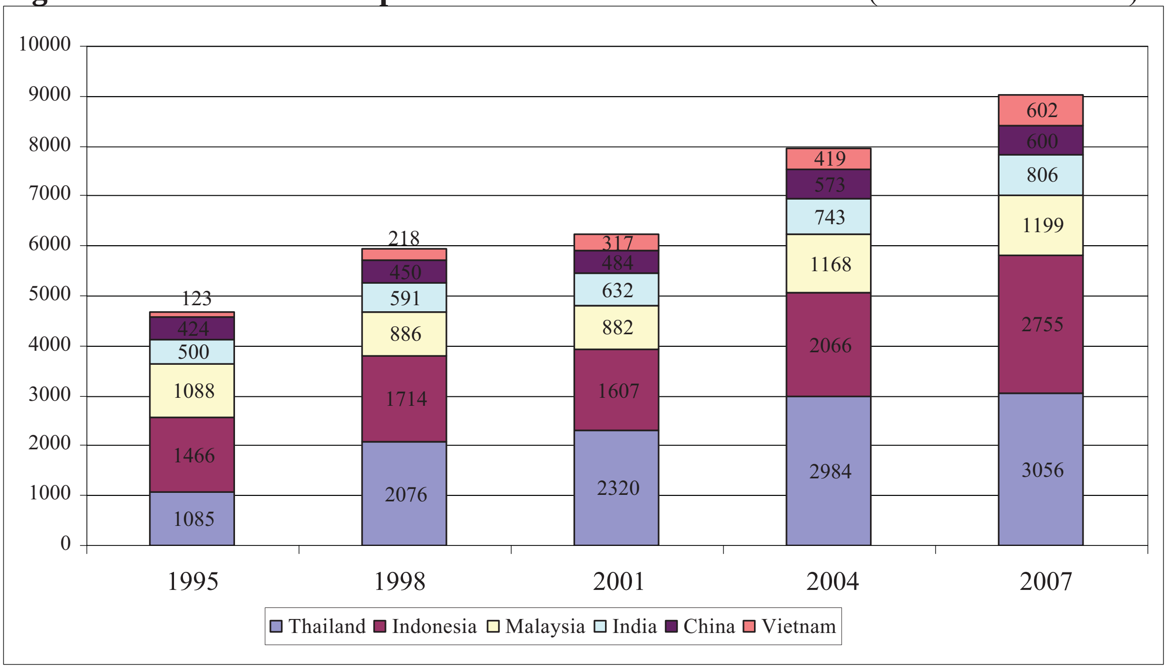
Unit: thousand hectares

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: FAOSTAST, 2008

In terms of natural rubber production, six selected countries accounted for 90% of the total natural rubber production in the world. Vietnam ranked 4th and 5th in terms of revenue and production respectively.

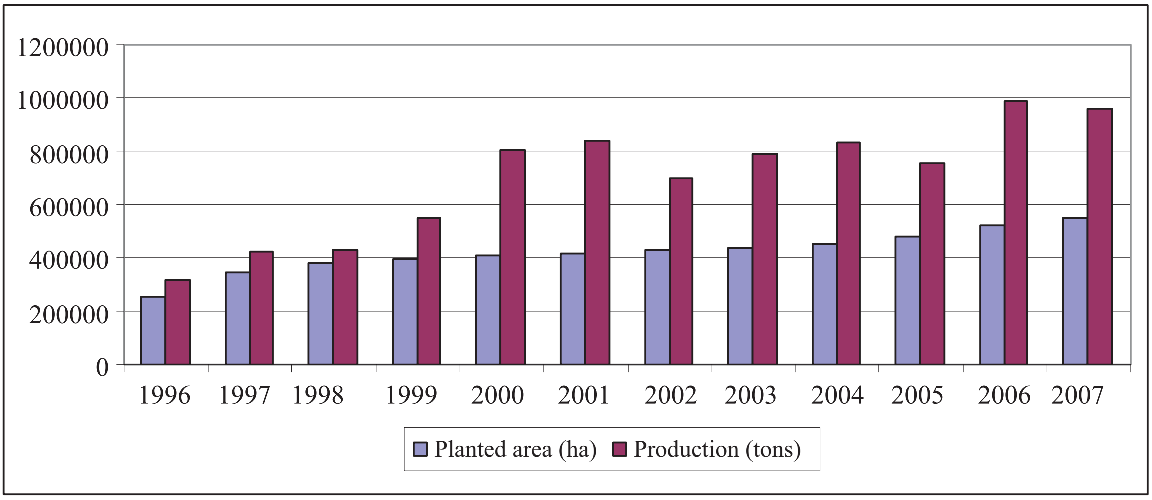
Figure 3.5: Natural rubber production of six selected countries (Unit: thousand tons)



Sources: ANRPC

Thanks to the rapid increase of rubber area especially in the last decade, Vietnam had the highest annual growth rate of natural rubber production in the world at 14.1% in the 1995-2007 period.

Figure 3.6: Natural rubber production in Vietnam 1996-2007

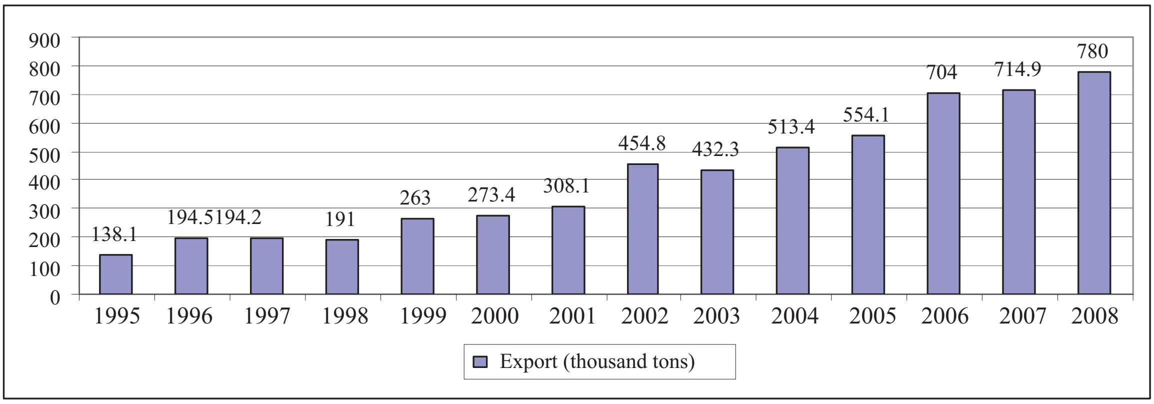


Source: Calculated from MARD data

It can be seen that the planted area of rubber tree continuously increased during the 1996-2007 period at an annual growth rate of as high as 14.5%. The total rubber tree area in 2007 was double that in 1996. Most of the rubber trees are concentrated in the southeast region as mentioned earlier. In 2007, the area of planted rubber in this region was 371 thousand ha or 67.5% of the total rubber tree area of the country.

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

Figure 3.7: Export of natural rubber in Vietnam in 1995-2008 period (Unit: Thousand tons)



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

The export volume of natural rubber continuously increased through the 1995-2008 period at an annual growth rate of 14.7%. Rubber export value reached about 1.8 billion USD in 2008.

3.2.2. Cultivation practices

In Vietnam, rubber is mainly produced by state farms. In terms of rubber planted area, State farm accounted for around 70%), and the small farm holders account for only about 30%. The rubber small holderr are just developed in recent years. State farms are supported by the state in terms of land, credit and technology. However, management is a problem for state farms. 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. Also, state farms gain the economy of scale, more than 10 000 ha. Farm holders have incentives to work, but have some problems in terms of limited land, difficulty in accessing credit and technology (variety selection for example).

Small farm holders have been established in recent years when the government allowed private farms to occupy some larger areas of land, particularly with the issuance of the Land Law in 1993. Small farm holders have suffered some problems in planting rubber. They plant rubber based mainly on their own experiences or learning from their neighbors and relatives. They do not have enough information to aid them in selecting the good varieties; they mainly get varieties from the local people or by themselves. Because the lifetime of rubber is too long (about 25 years), it is very difficult for them to change the variety that they already planted. Fertilizer is also a problem for small farm holders, they mainly use chemical and rarely apply organic fertilizers. The small farm holders usually harvest once over two days and 9 months per year.

3.2.3. Production cost

Rubber is a perennial tree and it takes 5 years from planting time to the first exploitation for rubber sap. Rubber can be tapped for rubber sap for 20 years. Therefore, the initial investment is depreciated during the whole production cycle of rubber tree. The average cost and profit margin of rubber production can be estimated as below.

Table 3.8: Cost, revenues and profit margins for the rubber sap production in Phu Giao district, Binh Duong province (estimated based on data of 2007-2008 season)

			Amount/ha (VND)	Amount/ton (VND)	Amount/ton (USD)
Depreciation of the rubber tree's initial investment			29,957,160	226,948.18	14.18
	Cost for the first year		8,291,560	62,814.85	3.93
		Land preparation	2,660,000	20,151.52	1.26
		Seeding	1,461,960	11,075.45	0.69
		Manure	176,000	1,333.33	0.08
		Chemical fertilizer	1,920,000	14,545.45	0.91
		Planting labor cost	475,200	3,600.00	0.23
		Weeding	598,400	4,533.33	0.28
		Other cost	1,000,000	7,575.76	0.47
	Cost for the second year		5,416,400	41,033.33	2.56
		Chemical fertilizer	3,696,000	28,000.00	1.75
		Other chemical	20,000	151.52	0.01
		Weeding	374,400	2,836.36	0.18
		Weed killer	446,000	3,378.79	0.21
		Plough fallow land	880,000	6,666.67	0.42
	Cost for the third, fourth and fifth years		16,249,200	123,100.00	7.69
		Chemical fertilizer	11,088,000	84,000.00	5.25
		Other chemical	60,000	454.55	0.03
		Weeding	1,123,200	8,509.09	0.53
		Weed killer	1,338,000	10,136.36	0.63
		Plough fallow land	2,640,000	20,000.00	1.25
Operation cost for harvesting			646,800,000	4,913,960.11	307.12
		Manure	18,400,000	139,791.07	8.74
		Chemical fertilizer	43,200,000	328,205.13	20.51
		Labor cost for harvesting	563,760,000	4,283,076.92	267.69
		Knife	6,800,000	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	4,799,091.7	299.94

Source: Calculated from the survey data.

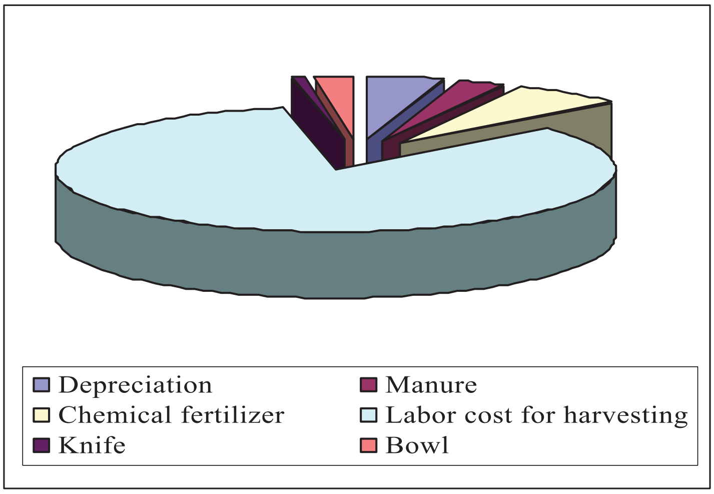
On average, initial investment of the rubber tree is estimated at around VND 30 million per ha (equivalent to USD 1,870 per ha). This amount is depreciated during 20 years of exploitation of rubber sap (each year USD 93.8). It is noticeable that during the first 5 years from planting rubber trees, no income is expected from young trees. Therefore, farmers have to seek for income from other crops instead.

For the primary stage of planting the rubber tree, the cost for seeding is VND 1,461,960 per ha or USD 0.69 per ton of rubber sap. The cost for chemical fertilizers is VND 16,704,000 per ha

or USD 7.9 per ton, thus accounting for the biggest proportion (55.76%) of the total cost of the initial investment.
The cost of maintenance and harvesting is estimated at VND 646,800,000 per ha or USD 307.12 per ton for the whole production cycle of 20 years. This accounts for nearly 96% of total production costs. In particular, labor cost for harvesting is VND 563,760,000 per ha or USD 267.69 per ton. It accounts for 83.31% of the total cost of rubber production for the entire 20-year period, the largest share . Chemical fertilizer has the second largest share of total production cost. The cost of purchasing chemical fertilizers is VND 43,200,000 per ha or USD 20.5 per ton for the whole production cycle. This constitutes 6.38% of the total production costs. The cost of manure is more or less similar to the cost of bowl for collecting rubber sap, accounting for 2.72% and 2.16% of the total production cost respectively.

In sum, the total rubber production cost is VND 676,757,160 per ha or USD 321.3 per ton of rubber sap for the whole production cycle. When the average price per kg of average quality rubber sap is VND 9,940, the margin per one ha of rubber tree is VND 631,595,340 or USD 299.9 per ton of rubber sap. Thus, the average profit that small farm households can earn is about 93.35% of the total production cost.. This is a good profit for rubber farmers or producers. It is more obvious when there is a high market demand for and consequently high price of rubber export.

Figure 3.8: Structure of rubber sap production cost



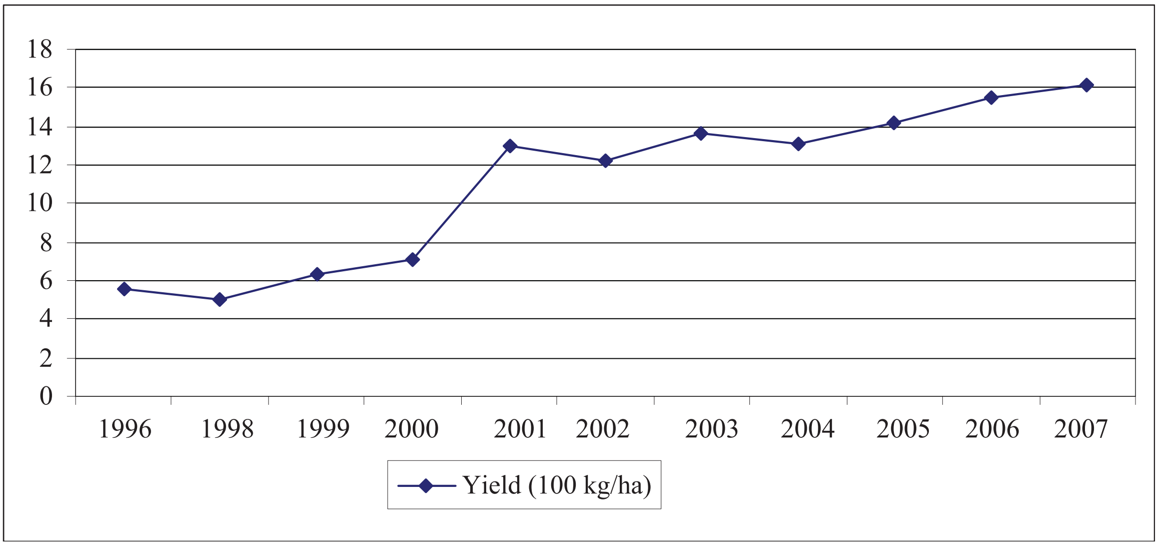
Source: Calculated from the surveyed data

The total depreciation cost of the initial investment in rubber production accounts for 4.4% of total production cost while, as pointed out above, harvesting cost accounts for 95.6%. Likewise mentioned above, labor cost for harvesting accounts for a huge 83.3% of total production cost. As harvesting rubber is a labor-intensive work, from slotting the rubber tree to collecting rubber sap, it seems not so easy for rubber producers to reduce labor costs. As labor cost for harvesting rubber sap is a main part of production cost, when the market price of rubber sap increases, farmers hire more labor to harvest rubber sap and when the market price of rubber sap decreases, farmers hire less labor to harvest rubber sap, even stop to harvest..

3.2.4. Productivity

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

Figure 3.9: Rubber productivity in Vietnam, 1996-2007



Source: Calculated from the GSO data

The average productivity of natural rubber in Vietnam during the 1996-2007 period increased remarkably, especially since 2001. In 2007, the natural rubber productivity reached 16.1 quintal per ha, triple than that in 1996. The southeast region does not only have the biggest concentration of rubber tree areas but it also achieved the highest level of rubber productivity (17.1 quintal per ha in 2007).

3.2.5. Potential and policies

Growing rubber tree 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 Central Highland region, rubber tree ranked the second best in profit and cost ratio, next to cashew. In terms of return per ha of crop cultivation, rubber tree also ranked second, next to coffee. In terms of investment, rubber production needs relatively low input while bringing in high profit rates.

The Vietnam natural rubber has good competitiveness as its Domestic Resource Cost (DRC) is only around 0.48. In addition, the demand for natural rubber in international market is high. Around 64% of Vietnam natural rubber is exported to the neighboring country - China. Therefore, exporting companies can enjoy the advantage of lower transportation costs.

Rubber tree production in particular and rubber industry in general can benefit from government policy. The development planning of rubber industry was approved by the Prime Minister on 5 February 1996. This is the legal framework for the development of rubber industry in Vietnam. In addition, according to Decision number 2855 QD/BNN-KHCN dated 17 September 2008,

rubber tree is recognized as a multi-purpose tree. Thanks to that new concept, rubber tree now can easily be planted in forestry land. Recently, rubber planting was expanded to the Northern mountainous area and even Vietnam has been able to invest in growing rubber tree in Lao PDR.

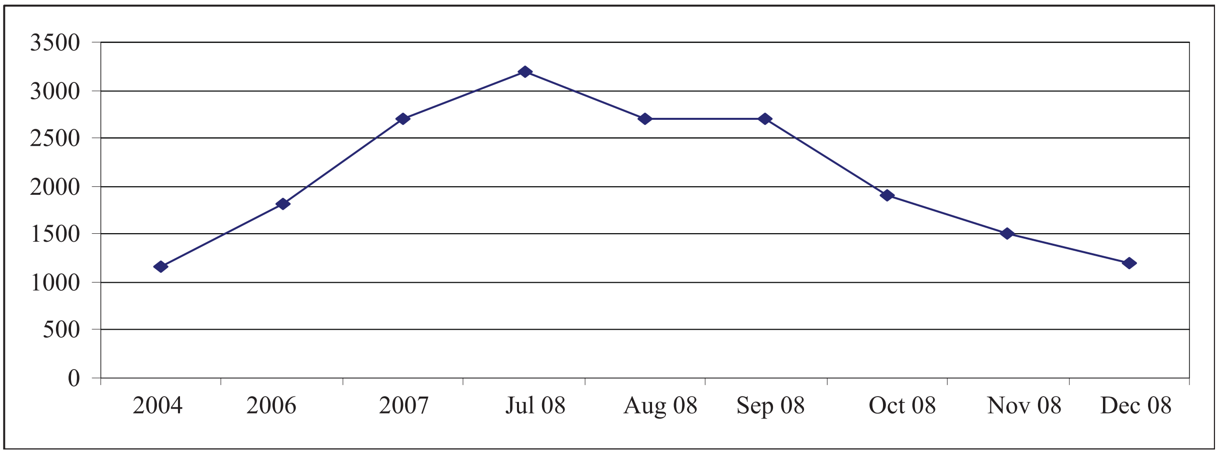
3.2.6. Constraints and opportunities

Land for planting rubber in Vietnam is now limited. It has become more and more difficult for Vietnam to expand rubber areas. Growing rubber tree in slope land is not only costly but also more risky.

At present, rubber in Vietnam is mainly produced by state farms. As alluded to earlier, state farms have comparative advantage in terms of economies of scale, credit, technology and human resource, but similar to most other state company, their working incentives are very limited. Besides that, the state farms are facing a management problem. Weakness in business management at the state farms often leads to low effectiveness, economic efficiency, and competitiveness. While small farm holders have great working incentives, they too suffer from such problems as limited technology and land, dependence on state processing companies and being more vulnerable by price and import demand fluctuations in the world markets.

Also mentioned above, rubber production is labor intensive with the cost of labor accounting for the largest part of the total production cost. The labor cost for harvesting specifically accounts for 83% of the total cost. The higher demand for labor in harvesting season would increase the cost, consequently affecting rubber growers' benefit.

Figure 3.10: Export price of Vietnam natural rubber (USD per ton)



Source: Calculated from data of the Vietnam Customs Office

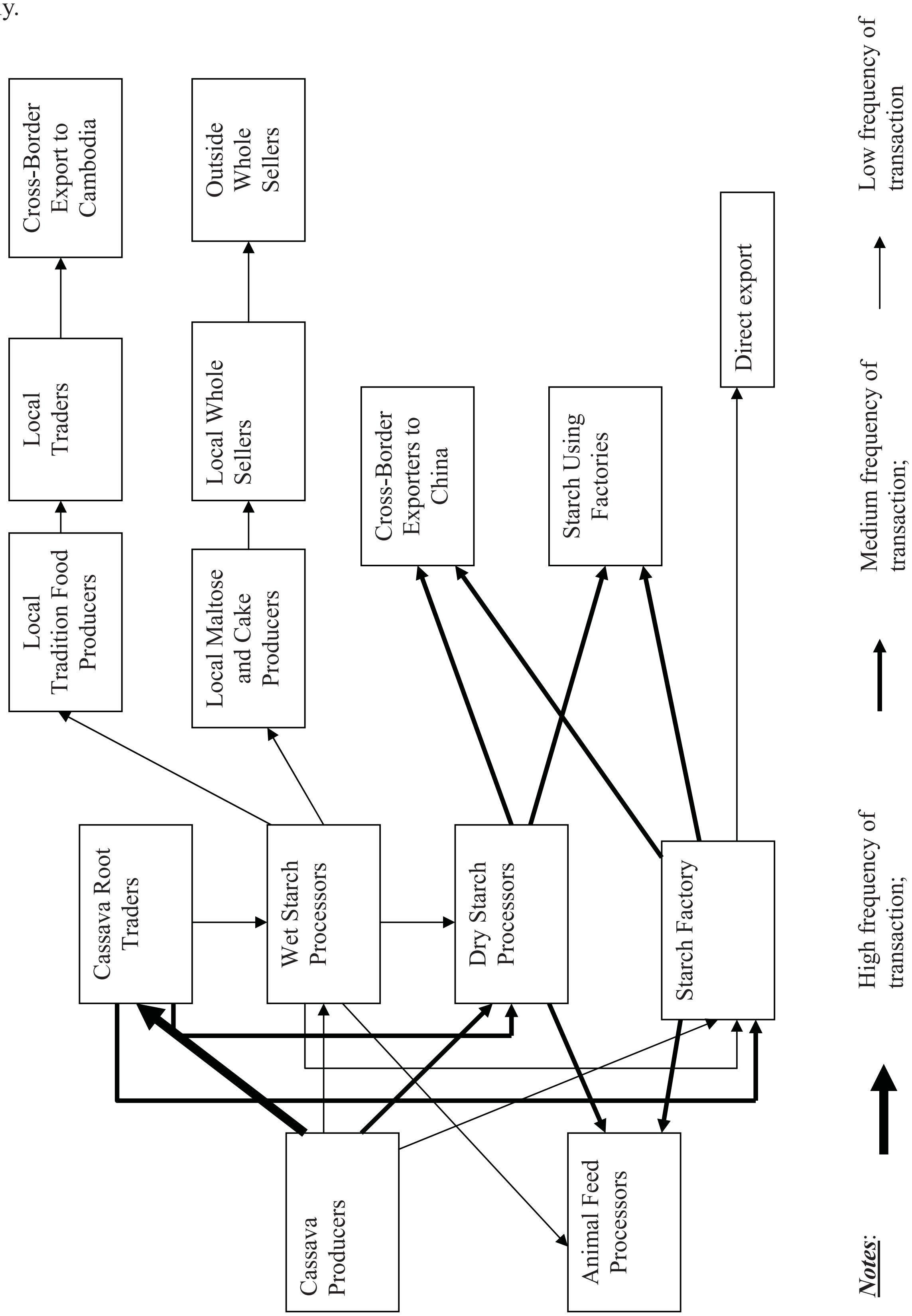
Rubber prices in the international market highly fluctuate. For instance, from July to December 2008, the export price of Vietnam natural rubber decreased sharply from 3200 USD/ton to 1200 USD/ton

In terms of opportunities, small farm holders have a room to improve their rubber productivity and quality. In addition, the development of S&T especially technology for seeding and

technique for exploiting rubber sap would create favorable conditions for enhancing intensive farming, reducing business cycle and increasing economic efficiency of the rubber industry.

Local and international markets for final products have huge demand that Vietnam can supply.

Figure 4.1: Marketing chain of Cassava in Tay Ninh province



4. Trade in cassava

4.1. Marketing chains

A typical marketing chain of cassava in Tay Ninh province is presented in Figure 4.1. It can be seen from the Figure that this marketing chain is in fact relatively complicated. The major quantity of cassava is first sold to cassava root traders by the farmers. The product then goes to wet starch processors. The wet starch processors can either sell cassava starch to animal feed processors or dry starch processors, or starch factories. This is not the only way that cassava is sold however. Cassava growing farmers in some cases sell their products directly to wet starch processors or even starch factories. Similarly, the cassava root traders sometimes sell a considerable amount of cassava roots directly to the starch factories.

Another "channel" that the wet starch processors often follow is to sell their products to local traditional food producers or local maltose and cake producers. From this stage, the local traditional food producers sell the products to local traders and cross-border exporters to Cambodia which ends one of the "branches" of this value chain. The local maltose and cake producers sell their products to local whole sellers and then outside whole sellers. This is the end of another "branch" of this value chain.

However, substantial cassava is sold to cross-border exporters to China by the dry starch processors and this ends the third "branch" of cassava marketing chain in Tay Ninh. The 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 just one of the gradients 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 directly their products to the world market.

Therefore, it can be said that the marketing chain of cassava in Tay Ninh is really complicated. This is also the usual situation in other provinces though the level of complexity is different. The frequency of transactions in cassava trading can also be seen in the Figure by looking at the thickness of the arrows showing the corresponding relationships among actors. The quantity of exported cassava in Vietnam 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 were basically shown in the previous subsection of "production costs". As seen in Table 3.2, the total costs per ton of fresh cassava reached VND 358,560 on average for the 2007 season. The farm gate price paid by the cassava collectors in Truong Phong and Tan Phong communes was VND/ton 870,840 for the same season. Therefore, profit margin was VND/ton 512,280 (or USD 32.02) for the farmers in the aforementioned communes, accounting for around 143% of the total costs of cassava production there. Although this percentage is relatively high, the absolute profit value is not very high compared to other crops. Another fact is that average cassava output for a household is not high leading to moderate profit from cassava.

4.2.2. Middlemen

The middlemen or collectors of cassava in the study areas were also interviewed about their costs and margins of cassava trading. The average estimations are presented in Table 4.1.

Table 4.1: Cost and margins of cassava collectors in Tay Ninh province

Unit: VND/ton

No.	Cost Items	Average cost per ton of fresh cassava		
		VND	USD	Percentage on total costs
I	Selling price	1081967.0	67.6	104.5
1	Material Inputs	870838.9	54.4	84.1
2	Transportation cost in input buying	85680.7	5.4	8.3
3	Other costs	1559.8	0.1	0.2
4	Managerial costs	0.0	-	0.0
5	Loss	0.0	-	0.0
6	Transportation cost	76191.7	4.8	7.4
7	Transportation cost in selling	817.5	0.1	0.1
II	Total costs	1035088.5	64.7	100.0
III	Profit margin	46878.5	2.9	4.5

Exchange rate: VND 16000/US$;

Source: Estimated based on the survey data in Tay Ninh province

As farmers mainly sell their products (cassava) to the collectors, the farm gate prices for farmers are actually costs of input materials for the collectors. This can be seen in Table 4.1 in which the input materials are the major part of the total costs for the collectors. For one metric ton of fresh cassava, the collectors paid around VND 870,840 (or USD 54.4) per ton to the farmers and this cost accounted for 84.1% of the collectors' total cost per ton of fresh cassava. The second largest cost for the collectors is transportation cost in purchasing inputs. This cost for the interviewed collectors accounted for 8.3% of the total cost (USD 5.4 per ton). The two other items of transportation costs are transportation costs in general and transportation costs in selling the produce. These two items takes 7.5% of the total costs for an average cassava collector. Other costs including transaction costs are minor.

The collectors sell their products to primary processors and, according to the derived results seen in Table 4.1, the selling price on average was VND 1,081,967 (or USD 67.6) per ton. The cassava collectors get a profit margin of VND 46,878 (or USD 2.9) per ton. It seems at first that the collectors have a very "thin" profit rate (with only about 4.5% of the total costs). However, the absolute profit value for each collector is not that less. This is due to the fact that the collectors often buy much higher quantity of cassava and thus their profits are expected to be much higher than it seems as well.

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 4.1 are costs of input materials for the processors. The detailed information on costs and margins of primary processors are provided in Table 4.2.

Table 4.2: Average cost and margin per ton of fresh cassava after primary processors in Tay Ninh province

No.	Cost items	Average cost per ton of fresh cassava		
		VND	USD	Percent
I	Average price	1388905.6	86.8	
II	Complementary products	90775.6	5.7	
III	Selling price (total product value)	1479681.0	92.5	
1	Material Inputs (cassava)	1081966.9	67.6	75.9
2	Labor	52377.2	3.3	3.7
3	Electricity and water	37959.2	2.4	2.7
4	Transportation	60786.9	3.8	4.3
5	Rent machines	38974.0	2.4	2.7
6	Wrapping	37085.0	2.3	2.6
7	Storage, management	2411.4	0.2	0.2
8	Transaction	3416.1	0.2	0.2
9	Loss cost	26804.9	1.7	1.9
10	Transportation cost	76617.6	4.8	5.4
11	Depreciation cost	6581.1	0.4	0.5
12	Other costs	0.0	0.0	-
	Total costs	1424980.4	89.1	100.0
IV	Average profit margin	54700.8	3.4	3.8

Exchange rate: VND 16000/US$;

Source: Estimated based on the survey data in Tay Ninh province

Many kinds of costs are incurred by the primary processors of cassava. The costs of transportation, labour, electricity and water fees, machine rent, wrapping, depreciation and others are all included in the cassava processing production. The input material accounted for 75.9% of the total cost while total transportation costs took up 9.7%. Other considerable costs are labour, electricity and water and wrapping costs with each accounting for around more than 2%-4%. All the other costs could be considered as “minor” including storage, management, transaction costs, loss, etc.

The final outputs of cassava primary processors include two types of products. One type goes further to the exporters and the other type includes complementary products (sub-products). These products are derived from the processing process. Therefore, the value of final products

of processors should be the total value of these two kinds of products. For a ton of processed fresh cassava, this total value is VND 1479681 (USD 92.5) per ton, resulting in a profit margin of VND 54,700 (USD/ton 3.4) per ton. The margin looks very thin with around 3.8% of the total costs. Similarly to collector, however, the absolute profit value for processor is not that less. This is due to the fact that the processor often buy a huge quantity of cassava and thus their profits are expected to be much higher than it seems as well.

4.2.4. Exports

The exporters are the last stakholder in the marketing chain. They buy the products from primary processors and thus once again, the selling prices for processors are also the input material costs for exporters. The structure of costs and margins of cassava exporters in Tay Ninh is presented in Table 4.3.

Table 4.3: Average cost and margin per ton of fresh cassava for exporters in Tay Ninh province in 2007

No.	Cost Items	Average cost per ton of fresh cassava		
		VND	USD	Percent
I.	Total revenue	1544625.0	96.5	
II	Total cost	1451768.7	90.7	100.
1	Cost of goods sale	1388906	86.8	95.7
2.	Transportation cost in selling	52388.1	3.3	3.6
3.	Transaction cost in selling	10475.0	0.7	0.7
III	Average profit margin	92856.3	5.8	6.4

Exchange rate: VND 16000/US$;
Source: Estimated based on the survey data in Tay Ninh province

For exporters, the cost of goods sale is VND 1388906 (USD 86.8) per ton, accounting for 95.7% of the total costs. The second cost item for exporters is transportation costs in selling products which account for 3.6% of the total costs. Other cost is minor, namely transaction cost, accounting for 0.7% of the total cost.

In contrast to primary processors, exporters have relatively good profit margin. For each ton of cassava products, the exporters in Tay Ninh get an average profit of VND 92866.3 (US$ 5.8). The profit margin rate is relatively high, at 6.4% for the 2007 season. The cassava exporters often buy and sell a large amount of cassava products. Therefore, the absolute value of their profits is also not as small as in the case of other stakholders...

4.3. Constraints and opportunities

As the demand for cassava and cassava-derived products is increasing, the opportunities for cassava expansion are good. Cassava is not only used for food purposes. In contrast, it can also be used for producing starch which is an input for many other industries. Cassava can be grown in many provinces of Vietnam and does not require fertile land. Therefore, the crop has a potential to expand. However, the problem is that we need to address its constraints as well

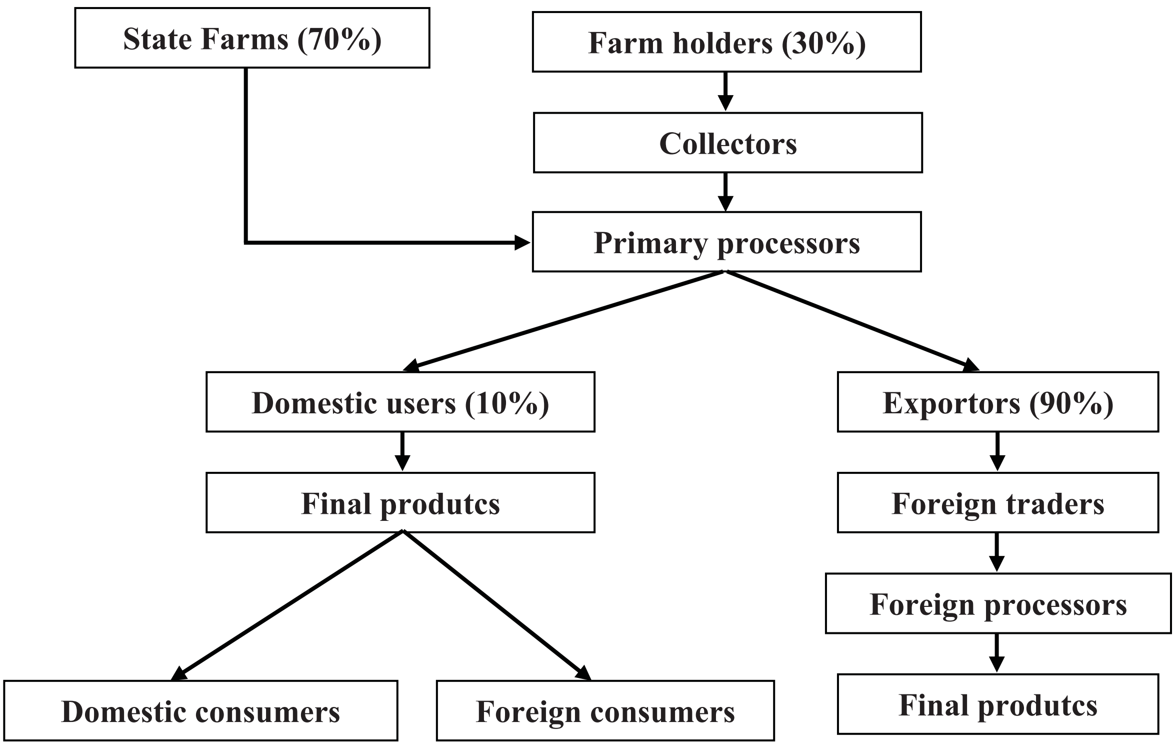
so that the expansion secures efficiency.

The constraints for cassava farmers were already analysed in a previous subsection and thus we just mention further constraints along the marketing chains. First, cassava is a low value product and its market prices including both the world market and domestic market prices fluctuate substantially. This can change much the profit margins for different stakeholders in the marketing chain. Farmer and small processors are those most vulnerable to these fluctuations. Second, the starch and starch-used 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 the farmers and small processors.

5. Trade in rubber

5.1. Marketing channel

Figure 5.1: Rubber marketing channel



Source: Authors.

The marketing channel of rubber is shown in Figure 5.1. 70% of rubber in Vietnam is produced by state farms and the other 30% is produced by small farm holders. The state farms belong to state rubber companies together with exporting processing factories and local processors of final products. State farms provide rubber sap to processing factories for processing and exports. Small farm holders on the other hand sell their rubber sap to private collectors and the collectors in turn will sell rubber sap to the processing factories of state rubber companies in the concerned region. 90% of rubber as primary product is exported and the remaining 10% is provided to local companies for production of final products that will

in turn be sold in local or overseas markets. Thus, due to historical reasons, non-state farm holders produce only a small share of rubber. It is difficult to increase that quickly because of land limitation. That 90% of rubber is exported show that Vietnam loses value-added. The lack of markets and technology may be reasons for that.

5.2. Costs and margins

5.2.1. Farm-gate price

After harvesting, farm holders sell their rubber to collectors in the region daily. There are some collectors in the region, and the market is almost in perfect competition. Farm holders have a right to select collectors. The price is rather competitive. It is determined in two steps. First, collectors measure the degree of rubber by burning rubber sap and then weighing. The price per degree is determined by the market, but the problem is the measurement of the degree. Since collectors know more than farmers, cheating may happen in this activity. In general, farm holders get payment once a week.

Table 5.1: 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. Collector

After collecting rubber sap from farm holders, collectors add some preservative chemicals and then sell them to factories within a few hours. During the harvesting season, each collector gets about 14000 kg per day. The costs, revenues and profit margin of rubber collectors are estimated in Table 5.2 below.

Table 5.2: Cost, revenues and margins for the rubber sap collection (estimation is based on data of 2007-2008 season)

		Amount/ton (VND)	Item percentage on total cost
Deprecation of warehouse		2,962.96	0.03
	Family's warehouse	1,111.11	0.01
	Hired 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
Labor cost		39,777.78	0.40

	Family labor	7,925.93	0.08
	Hired labor	31,851.85	0.32
Chemical expenditure		10,615.45	0.11
Other maintenance cost (bag)		772.88	0.01
Transportation cost		52,833.33	0.53
Other cost (load and unload)		10,333.33	0.10
Total cost for collecting		117,747.59	1.17
Rubber sap purchasing from farmer		9,940,000.00	98.83
Total cost		**10,057,747.59**	**100.00**
Revenue		**10,167,200.00**	**101.09**
Margins		**109,452.41**	**1.09**

Source: Calculated based on surveyed data

Costs during collection include cost of purchasing rubber sap, depreciation of warehouse, labor cost and cost of utilization, chemicals, energy, fuel for transportation, maintenance, etc. The cost of purchasing rubber sap accounts for almost 99% of the total; therefore, collectors can have as little as only 1.09% of the total production cost in profit margin. Although the collector appears to only have a thin margin, with the big quantity of rubber sap he collects each day, he actually can still earn higher profit than farmers.

5.2.3. Processing

After harvesting, rubber is processed into different products. The major rubber product is SVR3L that contributed 56% of all kinds of processed rubber products. As mentioned above, rubber is mainly processed by state companies. At present, Vietnam has 32 rubber processing factories whose capacity can process all rubber production in Vietnam. Processing technology in Vietnam is rather high. Seven processing companies in the southeast region have obtained Certificate ISO-9002. Table 5.3 show costs of processing in Phuoc Hoa Rubber Company. In order to get one ton of rubber, the company has to pay 2 175 000 VND (or 135.2 USD). Unlike the small rubber producers who have to sell all rubber sap to collectors who then sell them to state companies for processing, the state companies in rubber industry are in charge of all the stages, from tree planting to sap harvesting, processing and exporting. Therefore, it is not necessary to make a good distinction in calculation of the profit margins at each of these stages.

Table 5.3: Costs for rubber production, processing and marketing, Phuoc Hoa Rubber Company in 2007

Items			1000 VND/ton	USD/ton
I. Production cost			***18,537.00***	***1,151.37***
	Fertilizer		1,857.00	115.34
		Chemicals	1,810.90	112.48
		Manual	46.6	2.86
	Other materials		238.90	14.84
	Labor cost		11,119.80	690.67
	Common cost		5,321.3	330.52
		Depreciation	917.60	56.99

		Rubber tree	729.80	45.33
		Tax	517.00	32.11
		Other	3,886.60	241.40
II. Processing cost			***2,176.5***	***135.19***
	Materials		600.80	37.32
		Energy	369.6	22.96
		Other materials	231.30	14.37
	Labor costs		699.90	43.47
	Common costs		875.70	54.39
III. Marketing costs			***2,800.30***	***173.90***
Total cost			23,513.80	1,460.46
Selling price			34,506.30	2,143.20
Margins			10,992.50	682.74

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

As seen in Table 5.3, the cost of processing one ton of block rubber is USD 135.2 or equivalent to 9.26% of the total cost. In the cost structure for rubber processing in this company, materials including energy accounted for 27.6% while labor cost share was up to 32.2%. Surprisingly, the common cost accounted for as high as 40.2% of total processing cost. If counting all common costs from the previous and latter stages (i.e. the common costs in producing rubber sap, cost for processing and marketing), these costs account for only 38.26% of total costs.

5.2.4. Exporting

The ten largest importing countries of 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% of such exports go to China. Vietnamese rubber has a share of about 20% in Chinese rubber imports. Thailand is leading in exporting rubber to China Malaysia is a rubber exporting country, but it imports rubber from Vietnam for re-export, the reason being that Malaysia has better market for exports than Vietnam has.

Table 5.4: Vietnam rubber export 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

For Vietnam rubber export destinations, China is seen as the most important market, especially for primary rubber. The next important rubber importing markets are, in order of importance, the Republic of Korea, Taiwan, and Germany (accounting for 4-5 percent of market share each). According to the Ministry of Industry and Trade, as the international market for rubber becomes more promising, the Vietnamese government set higher targets for increased rubber exports and market diversification. Though China still remains Vietnam's biggest rubber importer, it is expected that the country will no longer be the only large destination for the product exports.

Table 5.5: Vietnam‘s export of natural rubber by grades in 2007

Grade	Quantity (Ton)	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‘s news letter dated 25/01/2008.

Vietnam has produced more latex grades (TSR3L, TSRL, TSRCV and TSR5) than other producing countries. Table 3 shows the export volume and value of natural rubber by grade in 2007 of which the quantity of latex grades accounts for 50.1% but the value of these grades accounts for 54% due to higher price.

It is not easy to separatly calculate the cost and revenue for export stage only. The resaon is, rubber companies are conducting all activities from producing rubber sap to processing as a whole process, therefore, it is not easy to clear cut cost for each stage of production, especially to divide common cost. Take an example of the Phuoc Hoa Rubber Company as is shown in Table 5.3 that, the company has USD 682.7 for each ton of rubber produced in 2007 season.

5.3. Constraints and opportunities

Constraints

In Vietnam, rubber is mainly produced by state farms. As seen, the state company is now facing restructuring and management problems. Rubber product also has to carry very high common cost (up to 38.3% of total cost). This leads to not only reducing the company's profit margin but also lowering the competitiveness of Vietnam rubber in international market.

In Vietnam rubber industry, the products are mainly SVR3L and latex and they are sold to local companies (10%) as intermediate input for producing tyres, medical equipments, etc., and to foreigners as exports (90%). Vietnam loses the value-added to foreign importers and processors.

Although Vietnam rubber is expanding to 45 international destinations around the world, China is still the biggest importer of natural rubber from Vietnam due to its high demand for the product. The heavy dependence on China market, where market uncertainty and price fluctuation are extremely high, is a big threat for Vietnam rubber industry

Rubber industry is labor intensive. The costs of labor hiring count for a large part of the total production costs (especially in rubber sap production). Therefore, wage increase in the labor market would have negative impact on the margin and competitiveness of rubber production.

The major rubber product is SVR3L. It contributes 56% of all kinds of processed rubber products. However, according to the Vietnamese Ministry of Trade, demand for SVR10 and SVR 20 in the world market is very high so Vietnam should process more these products to meet such demand.

Backward and undeveloped logistics lead to high cost for export. In Vietnam, logistic cost in general is high, accounting for nearly 20% of GDP or 50% of total export value.

Opportunities

There are a number of opportunities for rubber industry in Vietnam. These opportunities come both from international and domestic conditions. First, as a WTO member, Vietnam can enjoy MFN on tax and lower fees at WTO member markets (such as China, Taiwan etc), avoiding unfair price competition. With market expansion and diversification, Vietnam rubber can access international market more easily and get better prices. Secondly, as a member of the ASEAN protocol for rubber, Vietnam can benefit from the enhanced cooperation among members in terms of exchanging education, expert, information, research, seedling as well as developing rubber products industry. Third, local and international markets for final products have huge demands that Vietnam can supply. This is why rubber has became a crop helping poverty reduction in many parts of the country and rubber areas can be expanded even to the North of Vietnam. Fourth, price and export volume of primary products can increase and this again helps farmers stay with rubber crop longer and Vietnam can have more exchange earnings.

6 Conclusions and policy recommendations

6.1. For cassava

- As exporters have more advantages and benefit a large part of the cassava profit margin in the value chain, the only way to help farmers and small processors in the marketing chain is to create more favorable conditions for farmers such as low interest credits, agricultural extensions, better market access, etc.
- The collectors (or middlemen) still play an active role in the value chain when the processors

or exporters cannot or are not willing to buy cassava from the farmers directly. This situation seems to happen at least in the medium term. In any case, the government can have relevant contract policies so that farmers and the collectors can form a good "union" by virtue of good contracts in which the benefits of both farmers and collectors are ensured and stabilized.

- 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 their real economic efficiency needs to be examined in comparison with the efficiency of other crops.
- The development of starch and starch-use industries should also be considered together with environmental concerns. Those businesses with relatively modern technologies are encouraged and vice-versa.

Some policies which adoption should be speeded up immediately are recommended as follows:

- ✓ Identifying an appropriate strategy for research and development of cassava in Vietnam;. besides cassava area expansion, Vietnam should focus on choosing a suitable cassava cultivation;
- ✓ Designing feasible policies for research, investment and marketing in the cassava value chain to enhance cassava productivity, reduce losses of farmers from market shocks and increase producers' income;
- ✓ Collecting, creating and developing high yield varieties with high quality in order to improve cassava productivity;
- ✓ Disseminating cultivation techniques and encouraging cultivation practices of intercrops such as cassava-peanut, cassava-bean to increase farming income and reduce dry soil losses;
- ✓ To address the current situation wherein there is an imbalance between planned and cultivated area of cassava (an excess in cultivated area) and to achieve sustainable development of cassava crop, planned and established zones for growing cassava crop should be announced widely and transparently;
- ✓ Encouraging cassava farmers to establish their own associations or cassava cooperatives, and linking them thru contracts with starch processing enterprises to expectedly attain the highest economic returns and lowest environmental cost for both parties; and
- ✓ Not opening or constructing new processing factories due to the fact that under design processing capacity has been exceeded cassava production and area.

6.2. For rubber

Natural rubber industry in Vietnam has significant contributions to Vietnamese economy in terms of providing foreign currency and profit for producers, processors and exporters; creating jobs and incomes for rural people; and contributing revenue for the government budget. However, the natural rubber industry suffers some constraints and has some opportunities that must be considered.

Some policies that should be speeded up immediately are recommended as follows:

- ✓ State companies and government institutions must have support to small farm holders in terms of technology, credits and stable land policy.
- ✓ The 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.
- ✓ The government should support enterprises in enhancing product quality, registering and protecting of the product brand names. Activities for trade promotion programs should soon be organized.
- ✓ Enhancing research to move the Viet Nam rubber industry from mainly producing primary raw rubber to more processing of final products in order to increase export value .

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Appendices

Questionaires

I. Private Rubber Farmer

Code:………..

1. Household information

Labor

Number of family members::………….. Number of labors (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

Fertilizers

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/..............

Plating Labor:
Number of hired labors: ....person days/ha, wage: ....dong/person day
Number of family labors: ....person days/ha

Watering
Source of water:...................................
Cost of watering: ....

Weeding
Number of hired labors: ....person days/ha, wage: ....dong/person day
Number of family labors:..........................person days/ha

Other costs
....
....
Any problem of the first year investment:
....
....

Second year investment

Fertilizers:
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 labors: ....person days/ha, wage: ....dong/person day
Number of family labors:..........................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 ....

Fertilizers:
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 labors: .... person days/......ha, wage: ....dong/person day
Number of family labors:..........................person days/......ha

Harvesting
Number of hired labors:...........................person days, wage: ....dong/person day
Number of family labors: ....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:..................

II. Private Rubber Collector

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...
....0

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 ....

Labor:

Number of hired labors:...........................persons, wage: ....dong/person month
    other payments: Clothes ...., food ...., bonus ....
Number of family labors: ....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: [ ]

III. Questionaire For Household

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						
Labor costs							
Labor for planting	Pers-day						
Labor for weeding	Pers-day						
Labor for harvesting	Pers-day						
Manure	kg						
Fertilizer	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						
Labor costs							
Labor for planting	pers-day						
Labor for weeding	Pers-day						
Labor for harvesting	Pers-day						
Manure	kg						
Fertilizer	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:

IV. 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: ____________(tons)

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 fertilizer 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?
   ______________________(tons)

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?______________(tons)
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: tons

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?

V. Processors

Quest type:

Sequential No:

		Code
PROVINCE		
DISTRICT		
COMMUNE		
INTERVIEWEE		
NAME OF BUSINESS		
ADDRESS OF BUSINESS		
NAME OF RESPONDENT		
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? ___________ (tons)
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 labors do you have?_______________
C3. List number of hired labor by working time

#	Type of labor	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 labor 2. Can not mobilize 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? _________________(ton)
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 fertilizer 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	Labor	
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	Labor	
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	Labor	
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	Labor	
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?______________(tons)
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?______________(tons)
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: tons
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 EQUIPMENTS

H1. What is the total current value of equipments 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 modernization of your equipments compared to other processors? ____
1. Modern 2. Normal 3. Out of date 4. No ideas

VI. 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 labor	No. female	No. male	Average salary (VND/month)
1	Temporary			
2	Full-time			

1. Processing capacity (tons 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	Labor	
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	Labor	
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	Labor	
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	Labor	
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?______________(tons)
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?______________(tons)
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: tons

AGRICULTURAL TRADE IN THE GREATER MEKONG SUB-REGION

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