Chapter 2

Production and Distribution Environment of Natural Rubber Farmers

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Chapter 2

Production and Distribution Environment of Natural Rubber Farmers

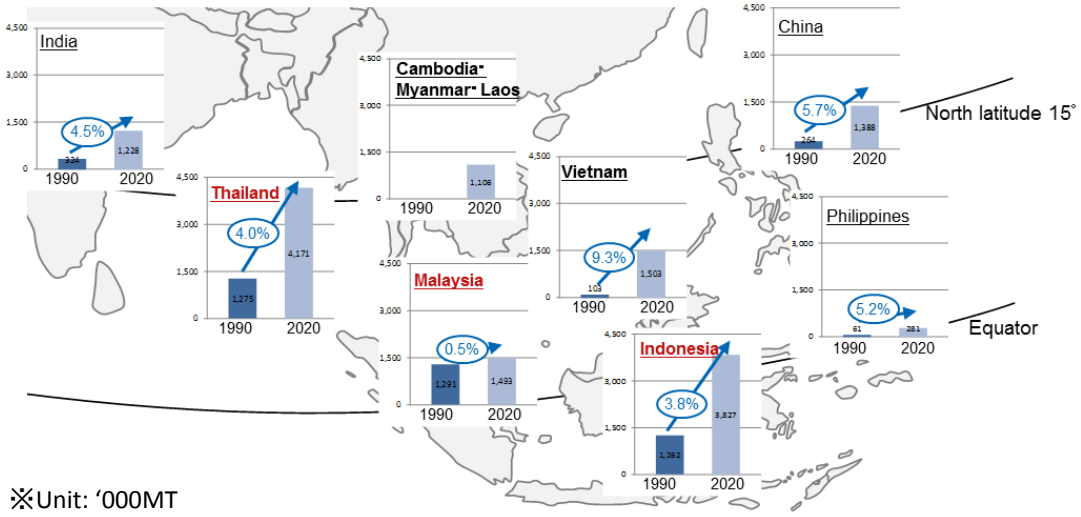
2.1 Production Environment of Farmers

2.1.1 Analysis of productivity and cost comparing Thailand with Indonesia and Malaysia

a) General rubber production trends and the oversupply issue in Thailand and the region

The majority of NR farmers in Thailand are smallholders. As shown in Figure 2-1 and Table 2-1, of production yields, Thailand has high productivity at around double that of Indonesia and Malaysia. Malaysia has more high technology but has many extensive farms in order to maximise business profitability and this has pushed average productivity down. Meanwhile, Indonesia has made little progress in using high yielding clones and its low technology tapping technique has also led to low productivity.

Figure 2-1: Main production countries of NR and trends in production volumes



※Unit: '000MT

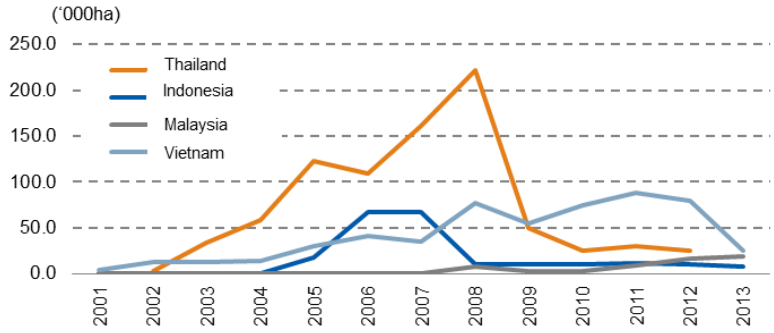
Source: NRI prepared based on IRSG Statistics Data.

Table 2-1: Main production countries of NR and trends in production volumes

		Thailand	Indonesia	Malaysia
Qualitative index (CY2011base)	Production vol. ['000 MT]	3,394	2,982	996
	Growth(08-11,12-20)	3.3%、2.2%	2.7%、3.0%	1.0%、4.3%
	Total are ['000 ha]	2,322	3,437	1,233
	Growth(08-11,12-20)	-1.3%、0.2%	0.2%、0.4%	0.0%、1.5%
	Yield [kg/ha]	1,426	681	837
	Growth(08-11,12-20)	0.4%、2.0%	-6.0%、2.8%	-0.6%、2.8%
	Estate ratio	9.6(2004) ⇒ 9.6(2010)	15.1(2004) ⇒ 15.6(2010)	9.9(2004) ⇒ 6.3(2010)

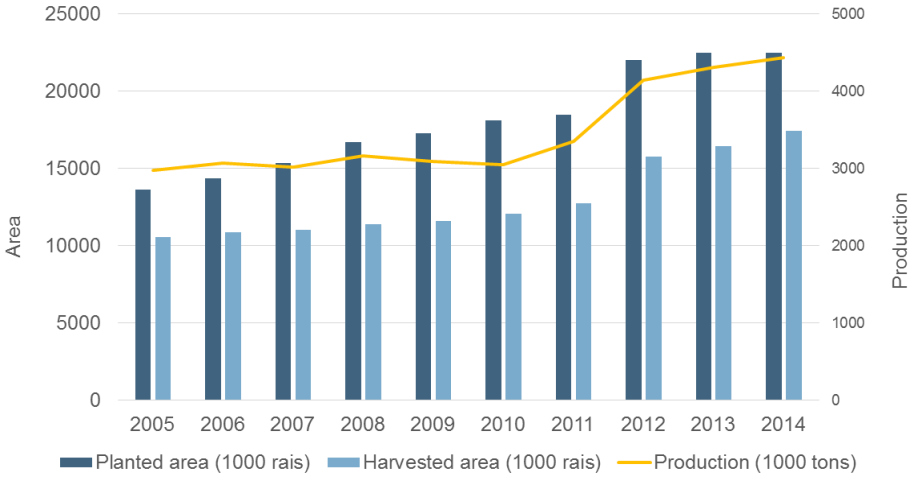
Source: NRI prepared based on IRSG Statistics Data

Figure 2-2: New farm development areas in main production countries



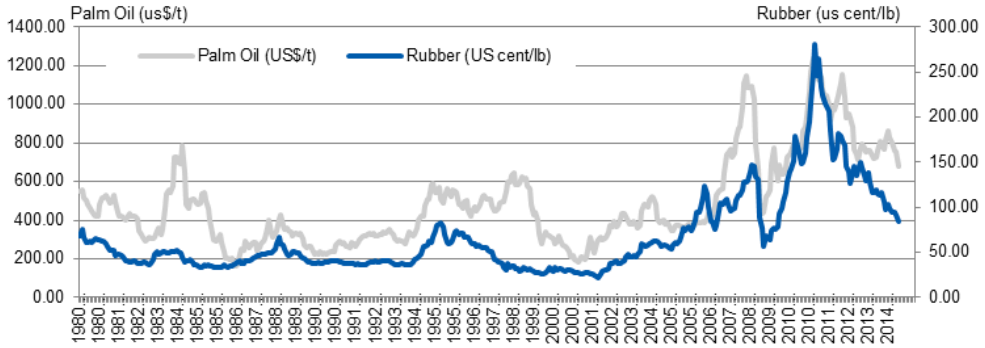
Source: IRSG

Figure 2-3: Para rubber: Areas and production, 2005-14



Source: Agricultural Statistics of Thailand, 2014

Figure 2-4: Price trends of NR and palm oil



Source: IRSG

Table 2-2: Rubber production increases and adjustments by major producing countries

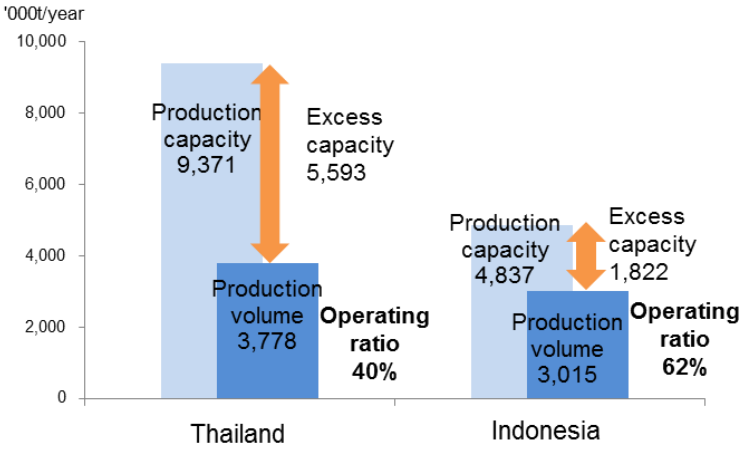
Thailand	✓ Since 2002, new farms have been actively developed even in northeastern of Thailand above north latitude 15° . However, there is small room for new development, so forecast that it is difficult for extra. ✓ As rubber price is declining in recent years, government encourages replantation of existing farms and changing to palm, and proceed the production adjustment
Indonesia	✓ Since 1980, palm production has been driven all over country. The estates change from rubber farms to palm farms. ✓ When rubber price was high in around 2008, there was return to rubber, but when price decrease, they change to focused on palm again.
Malaysia	✓ There is ratio development to focused on palm (around 80-90%) and rubber (around 10%) with a focus on large estates. ✓ There is no production adjustment activity. However, willingness to increase rubber production is declining due to price decrease. ✓ Smallholders have land ownership problem as barrier, so it is difficult to increase production of rubber farm.

Source: NRI prepared based on IRSG Statistics Data

The overcapacity issue has also affected the downstream level. Figure 2-5 shows the operating ratio of processing factories in Thailand compared with those in Indonesia. This implies that in Thailand, NR processing factories have lower factory utilisation ratios and thus have less price bargaining power versus buyers compared with Indonesia and others.

Figure 2-5: Operating ratios of processing factories in Thailand/Indonesia

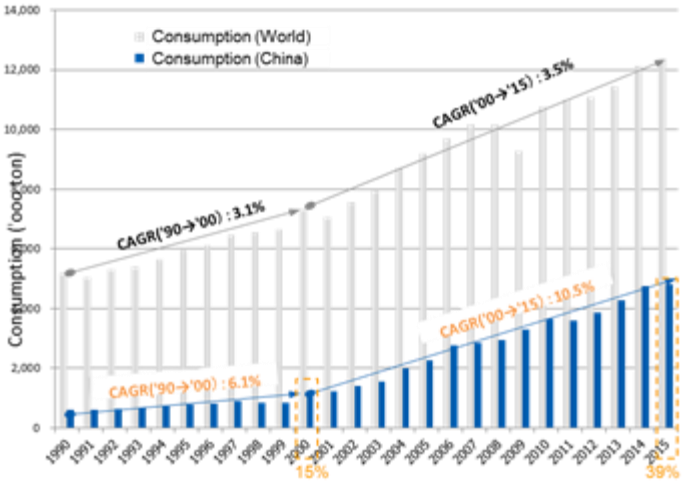
(2012 actual data)



Source: NRI

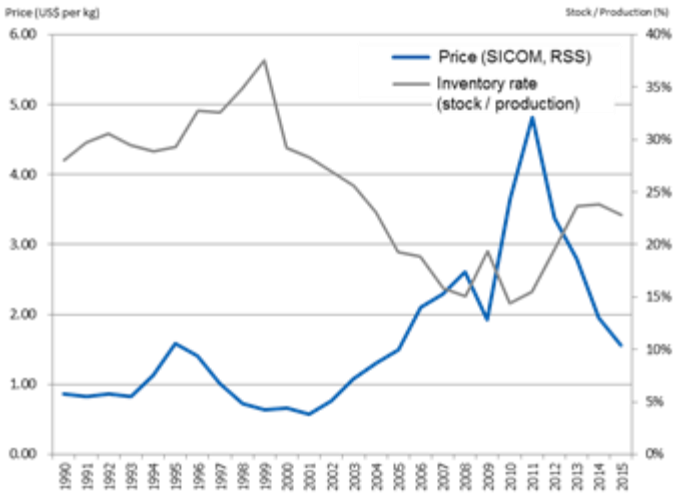
The reason behind the rapid increase in NR production in Thailand and the subsequent rise of oversupply is largely attributable to the "China factor". As shown in Figure 2-6, China's consumption of NR has increased rapidly since the early 2000s due to the rapid motorisation of the country, entailing an increase in both vehicle and tyre production. Not surprisingly, the country's share of global demand jumped from 15 percent in 2000 to 39 percent in 2015, making it the largest NR user country. This sudden sharp rise in Chinese demand contributed to the soaring NR price from 2005 to 2012, while the drop in demand from China since 2012 has produced the reverse effect, namely the rise in global NR inventory levels and the subsequent decline in NR prices as shown in Figure 2-7.

Figure 2-6: Trends in NR consumption prices



Source: IRSG statistics

Figure 2-7: Trends in NR inventory levels

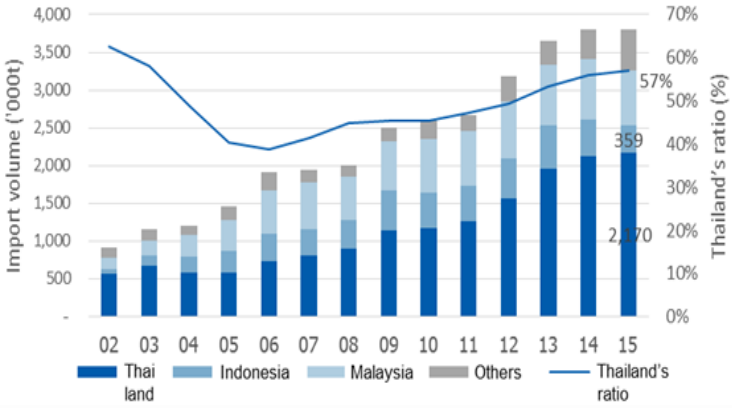


Source: IRSG statistics

Thailand has benefitted considerably from the "China boom", as demonstrated by the country's high share in China's NR imports in Figure 2-8, steadily increasing to reach 57 percent in 2015. Likewise, the share of Thailand's NR exports going to China also increased to reach 58 percent in 2015, in sharp contrast to Indonesia, where dependence on China was only 13 percent in the same year. However, Thailand's share of Japan's NR imports declined

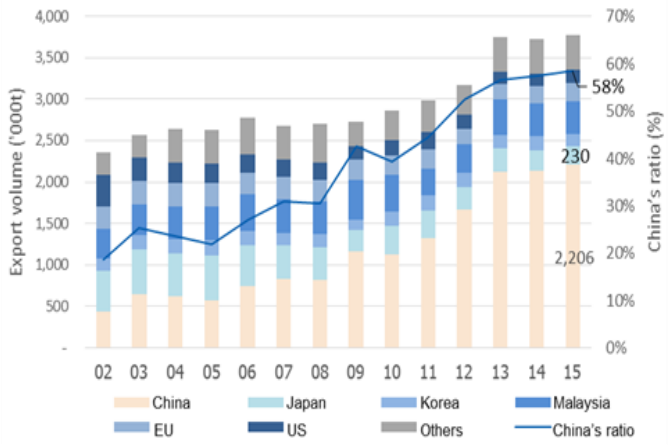
and was overtaken by Indonesia in the mid-2000s, as shown in Figure 2-9, the reasons for which are discussed in the following section. Thailand's high dependence on China in turn aggravated the impact of slowing demand from China on Thailand's NR farmers and processors compared with other NR producer countries, as discussed later.

Figure 2-8: Trends in China's import volumes by country



Source: IRSG statistics.

Figure 2-9: Trends in Thailand's export volumes by country



Source: IRSG statistics.

2.1.2 Structure change of Thailand's NR production

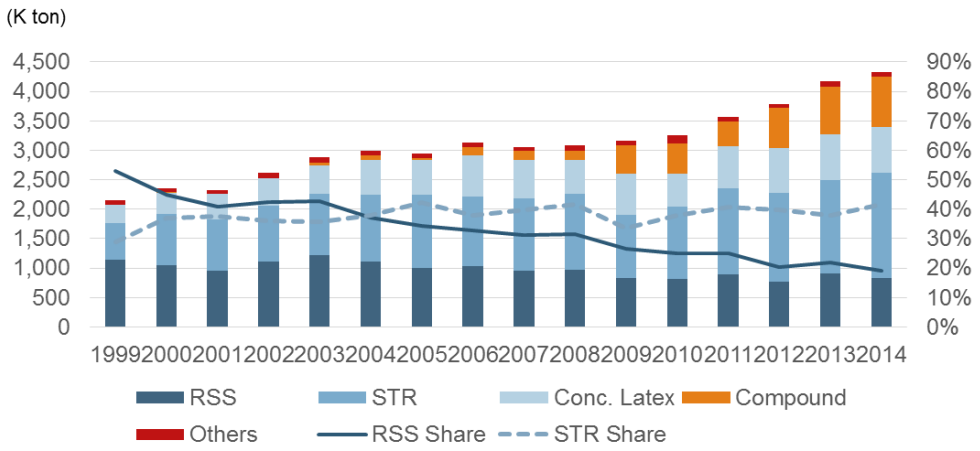
Thailand has traditionally been the largest producer of RSS (Ribbed Smoked Sheets) in the world and, until recently, it was the dominant NR product in Thailand. The quality of RSS from Thailand has achieved the highest level in the region, thanks to close cooperation between Thai processors/ exporters and Japanese tyre makers in the 1960s and 1970s, who were the world's largest NR users at the time and provided technical advice to Thai NR suppliers. Since then, it has been common for Thai farmers or tappers working on farms to process USS (Unsmoked Sheets) from latex using simple rolling press machines at their farm sites and supply USS to collectors who in turn sell to midstream processors for smoking to make RSS. Farmers who can afford to buy machines prefer to sell USS than latex, as the USS price is higher than latex, and also as it can be kept and stored when the selling price is low.

From 1990s onwards, the Thai government subsidised farm cooperatives to set up smoke facilities in order to expand grassroots level production of RSS. This reflected its policy of empowering and improving the status of smallholders through the development of cooperatives.

In sum, the success of Thailand in becoming the global hub of RSS production is attributable to demand-side factors, as well as to supply-side factors; the former coming from Japanese tyre makers who required high quality RSS, and the latter coming from Thai NR producers, who improved quality to cater for their users' requests. The dominance of smallholders among NR producers and the government policy of targeting smallholders also favoured the production of USS/RSS, which required highly labour-intensive processes and less investment for processing, in contrast with TSR or concentrated latex, which require high investment from large-scale processors.

However, the structure of rubber production has undergone major changes from the mid-2000s, as shown in Figure 2-10.

Figure 2-10: Rubber production trends in Thailand (1999-2014)



Source: Rubber Research Institute Department of Agriculture

Changes in the supply of NR are described below.

First, RSS is no longer the dominant NR product, as its production share decreased from more than 50 percent in the early 2000s to less than 20 percent in 2014.

Second, TSR (Standard Thai Rubber), the Thai standard of TSR (Technical Standard Rubber), has become the largest product, with its share increasing from 30 percent to over 40 percent in the same period. If the "compound" is included in STR, its share reaches over 50 percent, as the "compound" is a derivative product from STR, mixed with a small percentage of synthetic rubber to avoid import duties in China, which protects NR producers from NR product imports. Processors/exporters mix 1 percent of emulsion SBR with NR to make a "compound" to avoid import duties in China. However, in 2015, the Chinese authorities raised the content level of synthetic rubber to 10 percent and so the share of compound is expected to plummet.

Third, the share of concentrated latex also increased in the period, as the global demand for gloves and other sanitary rubber products expanded.

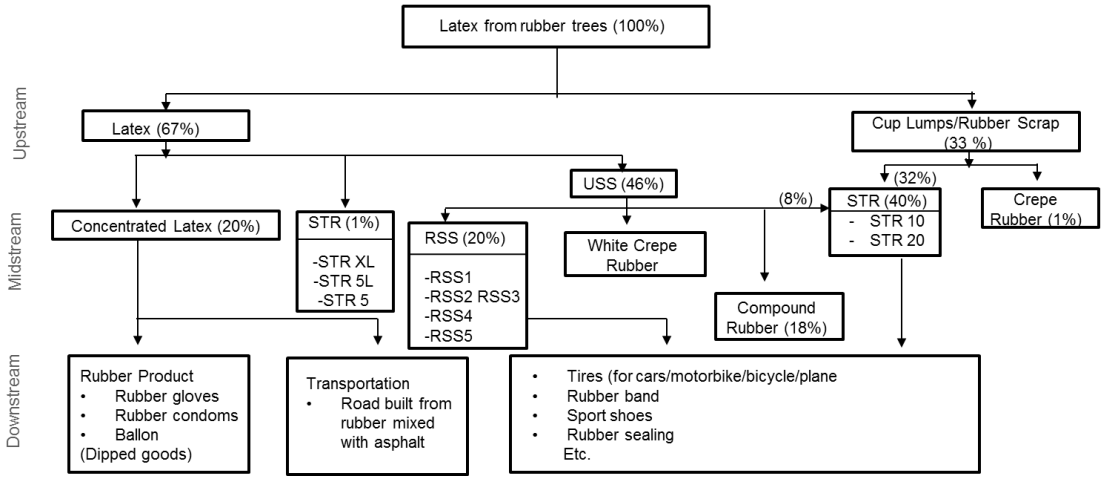
The increasing share of TSR in the downstream industry has also impacted the upstream industry of NR production, as shown in Figure 2-11 in the structure of NR production from the viewpoint of the total supply chain. Latex is still the largest upstream product comprising 67 percent of the total, more than two-thirds of which is processed to USS. This is followed

by cup lumps which makes up the rest, at 33 percent, nearly 100 percent of which is processed into STR.

As shown in Figure 2-12, reflecting an increase in TSR production in the downstream stage, cup lumps have increased by more than fourfold in the past 15 years from 8 percent to 33 percent, while latex has declined to around two-thirds of total production.

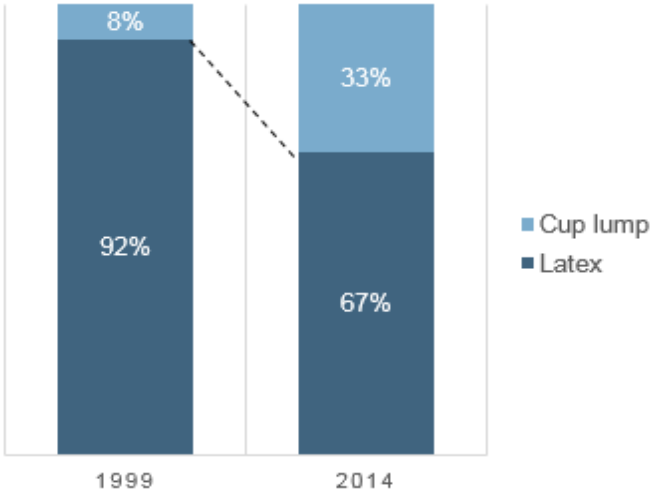
USS is still the largest product in the mid-stream, as it can be used for both RSS and STR, comprising 46 percent of mid-stream products. One half of USS volume is processed into RSS and the other half is mixed with cup lumps to be processed into TSR and make "compound".

Figure 2-11: NR supply chain structure in 2014



Source: Central Market

Figure 2-12: Production by upstream products

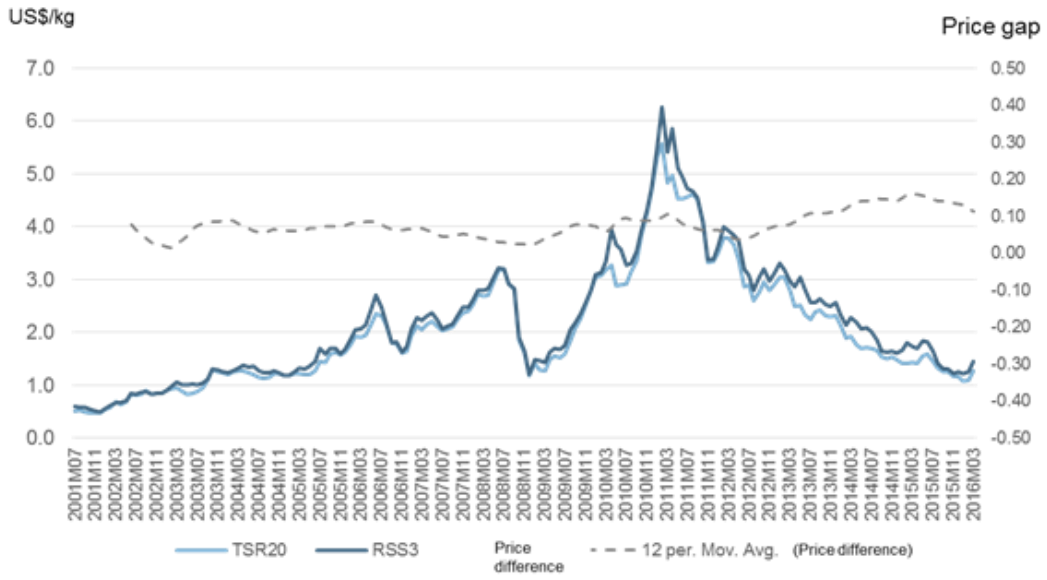


Source: Central Market

2.1.3 The “China factor”: Demand factor

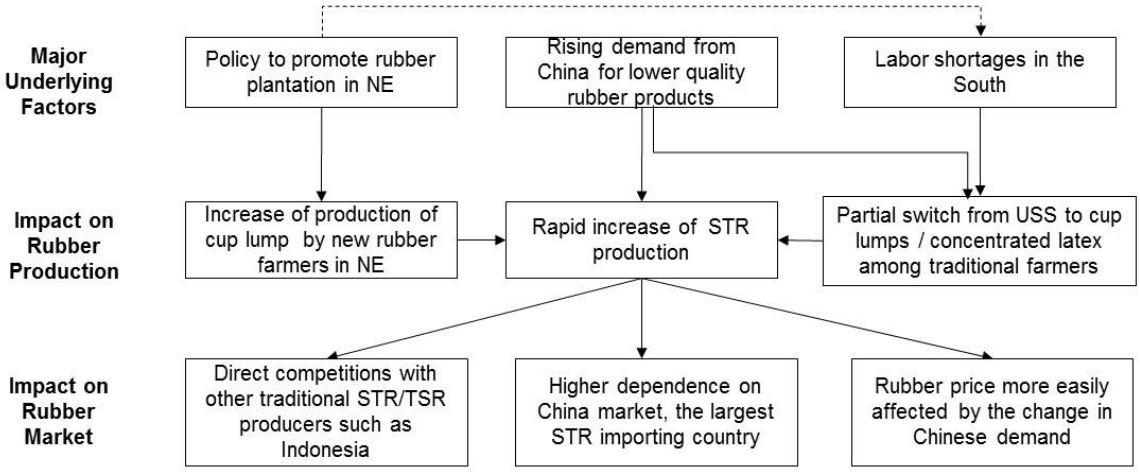
The recent hike in the production of TSR in Thailand is attributed to several factors. First, and most importantly, is the “China factor”. This has played a critical role in the transformation, as China uses mainly TSR as a cheaper tyre material, while traditional export destinations such as Japan and Europe use more RSS, which has higher quality but more expensive, at around 10 percent more than TSR, as shown in Figure 2-13. Second, there has been an increase of NR production in non-traditional NR producing regions, such as the Northeast, which mostly supplies cup lumps for TSR. Third, but less important, the lack of labour in the South may have accelerated conversion from latex to cup lump to a certain extent, as the region is dependent on foreign migrant workers. In sum, the rapid increase in TSR production has developed hand-in-hand with Thailand’s deeper dependence on the Chinese market.

Figure 2-13: Price of NR ($/kg, SICOM)



Source: World Bank

Figure 2-14: Major factors affecting NR production structure and market



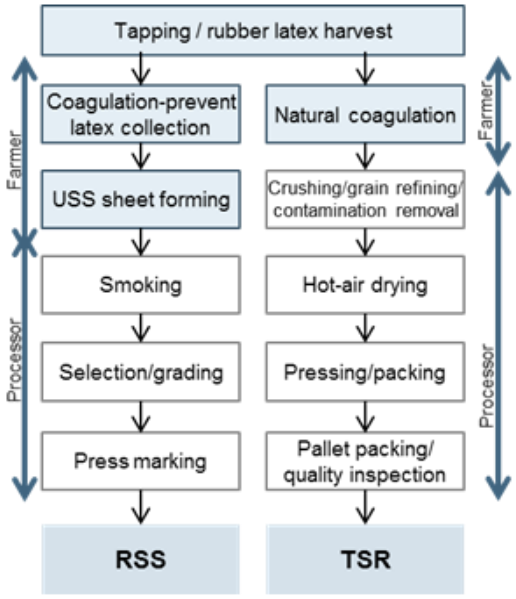
Source: NRI

It is important to understand the difference between RSS and TSR, as explained below.

RSS, a more traditional NR processing method, is costlier in nature as it uses more labour in latex collection, USS sheet making, and quality checking in each process. RSS is higher quality, as manual labour during sheet making and quality checking helps to reduce impurities at each stage of the process.

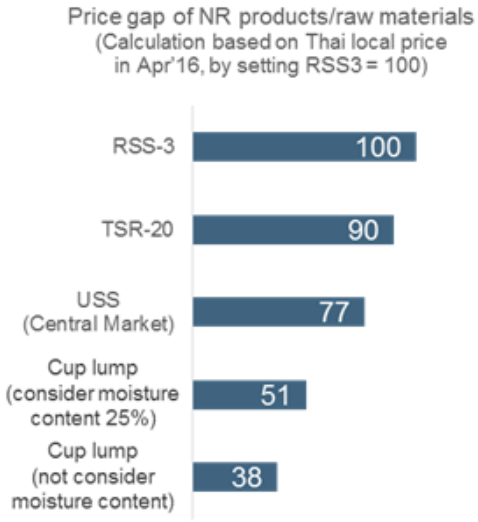
Meanwhile, TSR, a more recent mechanised technology, uses cup lumps as its NR material, which has more impurities than field latex, and uses machines to reduce impurities (dirt and ash). Although TSR can save costs through labour-saving technologies, it still has a higher level of impurities. In Thailand and elsewhere, STR20 (equivalent to TSR20), a mid-quality grade, is the dominant product, accounting for more than 95 percent of TSR exports.

Figure 2-15: NR processing



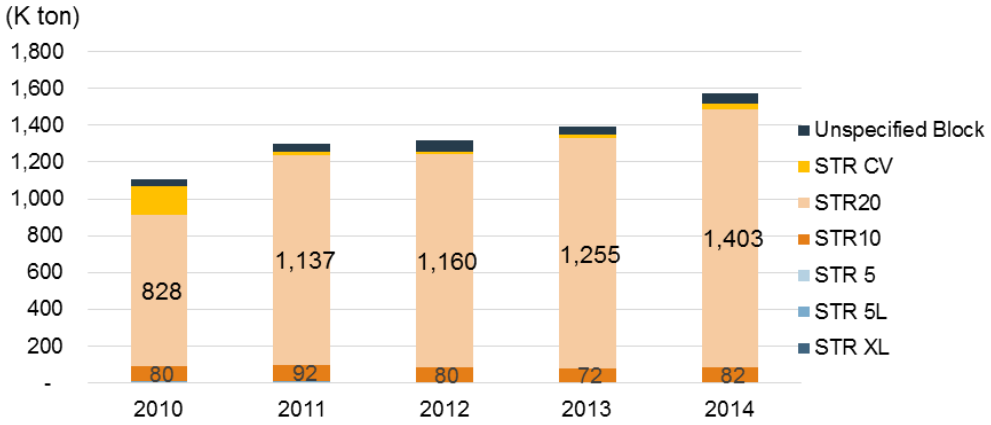
Source: NRI

Figure2-16: TSR/RSS price gap



Source: NRI

Figure 2-17: Exports of STR (TSR), 2010-14



Source: Rubber Research Institute Department of Agriculture

Table 2-3: Comparison of STR (TSR) characteristics

Parameters	STR-CV	STR-L	STR-S	STR-10	STR-20	STR-50
Dirt content,%wt, Max	0.05	0.05	0.05	0.10	0.20	0.50
Ash content, %wt, Max	0.60	0.60	0.50	0.75	1.00	1.50
Nitrogencontent,%wt, Max	0.60	0.60	0.50	0.60	0.60	0.60
Volatile matter % wt, Max	0.80	0.80	0.80	0.80	0.80	0.80
Initial wallace plasticity Po, Min	-	30	30	30	30	30
Plasticity Retention Index (PRI Min	60	60	60	50	40	30

Source: Various sources.

- Thailand export trends by rubber product

Table 2-4 indicates that dependence on the Chinese market differs by product, as TSR has the highest dependence at 63 percent, while RSS and concentrated latex are around 30-35 percent.

Thailand's share of world TSR trade has increased as a result of increases in its exports to China using its advantage of geographical proximity.

Thailand's dependence of concentrated latex exports to Malaysia is high, as the country is the largest producer of rubber gloves in the world. However, RSS has less dependency on any particular country, and is more widely spread across various major destinations, such as China, Japan and US.

Table 2-4: Thailand's export trends by rubber product

Product	RSS	STR	Concentrated latex
Thailand Share in world export (2014)	28.6%	30.7%	34.2%
Annual growth of world imports (2014)	-8%	-8%	-6%
Annual increase of the world share of Thailand (2014)	- 6.5%	3.3%	- 3.2%
Major export destination (2014)	China:29% Japan:20%(revise) US: 10%(revise)	China:63%	Malaysia: 49.9% China:30%

Source: Trade Map, International Trade Center

2.1.4 New NR production in the Northeast and changes in the South: Supply factor

Another factor behind the increasing share of TSR is attributed to the supply factor, the increase in production in the regions outside the South, such as the Northeast and other areas that mainly grow cup lumps to be processed as TSR.

Traditionally, the South has always been the largest producer of NR, as the climate there is best suited for growing rubber trees. Also, since the inception of ORRAF in 1960, the replanting policy to replace aging trees with high yielding clones was mainly focused on the South—a relatively underdeveloped region at the time—achieving huge success and converting the region into a rubber monoculture.

The dominance of the South in NR production continues today but, as shown in Figure 2-18, since 2013, the harvested area in South has decreased from 70 percent to 66 percent, while the area of Northeast region has increased to nearly 20 percent. This is the result of several factors. One is the saturation of rubber planting area in the South, which accounted for 80 percent of total farming area (Jocelyne Delaurue, 2011) by the mid-1980s. The other reason is the recent policy to promote rubber plantations in the Northeast to reduce poverty in that region. The Northeast has traditionally been harvest areas for rice and tapioca and is less well suited to growing rubber. However, governments since the 1990s have promoted rubber as an alternative cash revenue for farmers through the extension of low interest loans and the distribution of clones better suited to the Northeast.

Particularly during 2004-12, the government implemented a populist rubber policy to encourage farmers to harvest rubber as a means of diversifying farmers' revenues and to benefit from rising rubber prices at that time. Farmers in the Northeast were also more

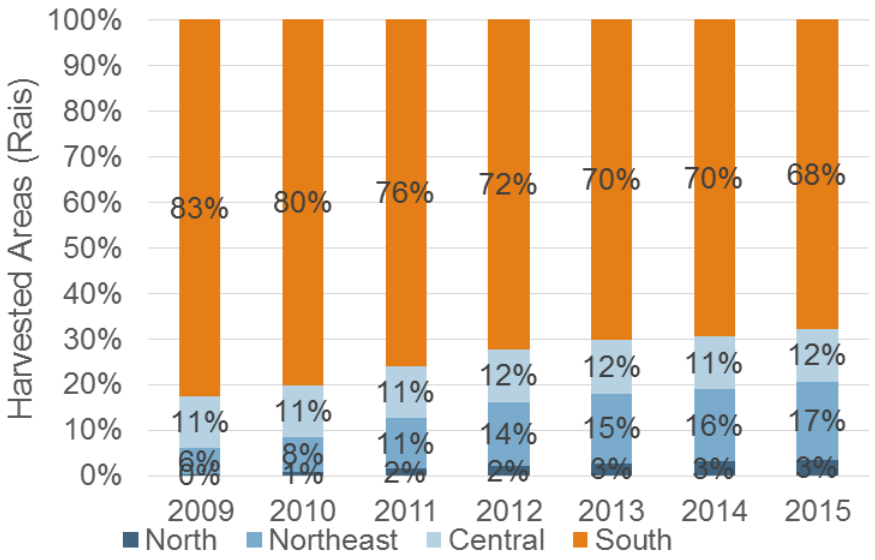
interested in rubber due to rising prices and many who worked as migrant workers tapping in rubber plantations in the South returned home to start in their own rubber plantations.

Table 2-5: The government's major policies in the Northeast

Year	Major policies in Northeast
1989-1991	➢ Farmers started rubber plantation since 1989 since people from south came to Northeast to plant as the sample. ➢ Then Government began to have an important role since 1991 by providing rubber seeds and production factors such as fertilizer.
1997	➢ rubber price rose and more farmers were interested to plant rubber
2004-2007	➢ Government had project to provide rubber seeds 1 million rais (all over Thailand).
2009	➢ government supported in providing production factors for 800,000 rais

Source: Interviews in Nongkhai

Figure 2-18: Rubber's harvested areas in Thailand, by region

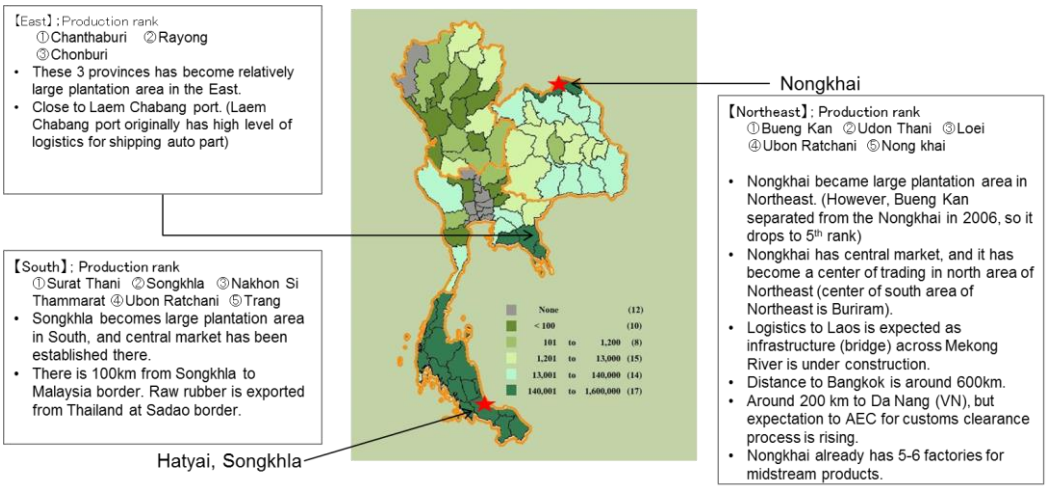


Source: The Thai Rubber Association

- The field survey in major rubber plantation areas

The major rubber plantation areas are located in three regions, namely the South, the (Central) East and the Northeast. A field survey was conducted in the major rubber plantation areas in two regions: in Hatyai in the South and in Nongkhai in the Northeast, as shown in Figure 2-19.

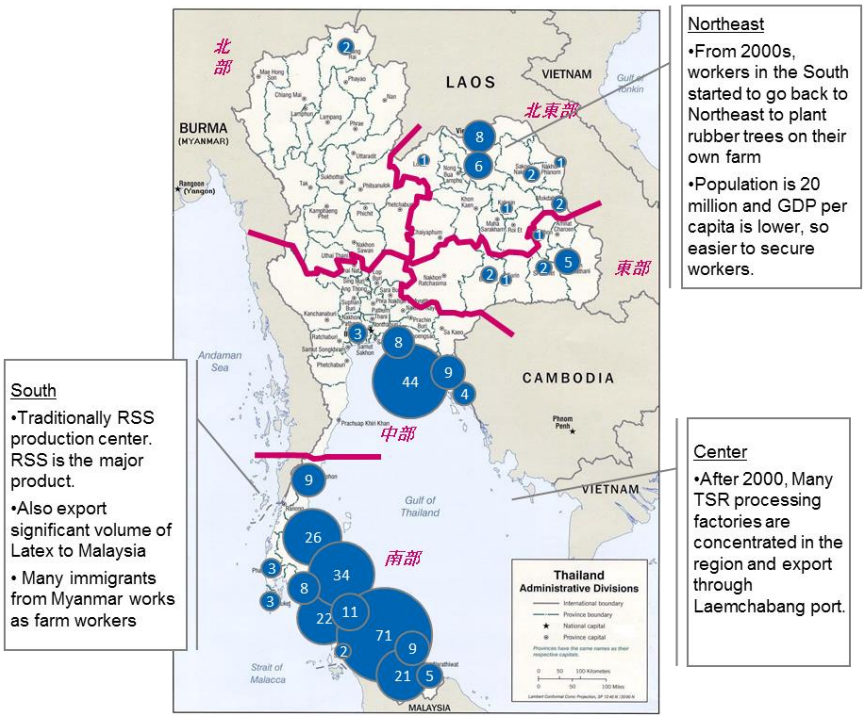
Figure 2-19: Rubber plantation areas in each region in Thailand



Source: Agriculture census

Figure 2-20 demonstrates that many companies from the South set up TSR processing plants in the Northeast, which encouraged production of cup lumps in the region.

Figure 2-20: Major locations of NR processing factories and regional characteristics



Source: Various sources

Table 2-6 shows the types of NR producers in the South compared with the Northeast. Table 2-6 indicates that cup lumps for TSR processing have spread mainly in the Northeast, while the spread to the South is limited, as the region is a traditional producer of USS/RSS. With the increase in demand for concentrated latex in recent years and the South's proximity to Malaysia, incumbent rubber farmers in the South have been converting from USS/RRR to latex suppliers.

Table 2-6: The type of NR producers in the South compared with the Northeast

	USS/RSS	Cup Lumps	Concentrated latex
South	• Incumbent small farmers (latex, USS) • Cooperatives (USS/RSS)	• Limited spread to incumbent farmers	• Incumbent small farmers converting from USS/RSS • New investors in farms
Northeast	• Virtually None: No incumbent farmers	• NE Tappers retuning home from the South • Traditional Farmers of rice/tapioca, converting to rubber plant	• Virtually None: No incumbent farmers

New entrants/ or conversion from incumbent farmers

Incumbent producers

Source: NRI Field Survey

2.1.5 A comparison of characteristics of rubber farmers between the Northeast and the South

According to Table 2-7, Northeast farmers mainly make cup lumps, while they make very little RSS/USS, due to several factors mentioned below:

- Northeast farmers have lower skills in rubber sheet making, as the majority have only recently started their rubber plantations.
- Northeast farmers are usually multi-crop farmers, unlike the farmers in the South who are mono-crop farmers, and would rather produce cup lumps, which need less frequent collection and less processing after collection.
- There are few factories or collectors in the region that makes RSS, so demand for RSS is low.
- Recently, demand for TSR has increased rapidly due to strong demand from China.

Table 2-7: Characteristics of Northeast rubber farmers compared with the South

	Northeast	South
Experience in NR	Short (started harvesting from early 2000s)	Long (since 1950s)
Major products	Cup lumps	USS/RSS
Area	10 rai	8-12 rai
Mixed harvesting with other crops	High (traditionally harvested rice, tapioca)	Less (traditionally relied on rubber crop only)
Development of cooperatives	Limited (only consolidate cup lumps for bidding)	More developed (RSS smoke facilities promoted by ORRAF)

Source: Interviews in the South and NE

2.2 Issue of competitiveness of Thai rubber products

According to interviews with users as illustrated in Table 2-8, mainly Japanese tyre makers, Thailand has a strong advantage in USS/RSS due to its long experience of making the product. There are few competitors, as Indonesia, the second-largest producer of NR, concentrates on TSR. RSS is easier for Thailand to differentiate from other countries, as the competitive factors of USS/RSS are not only cost, but also quality and supply chain management from upstream to mid-stream. The latter is supported by a unique close and extensive network of farmers, cooperatives and collectors.

However, when it comes to TSR, the competitive landscape is completely different. Thailand is losing its competitiveness to Indonesia, which has now become the largest TSR producer. Although Thailand remains the largest exporter of TSR to China, its position is declining relative to Indonesia in other markets such as Japan. The background of Thailand's loss of competitiveness in relation to Indonesia in TSR is attributable to two factors. First, Thailand has CESS levied on the NR export price, while Indonesia has no CESS. Since 2005, Thailand has raised CESS to THB 5 (US$0.14), from THB 2 (US$0.06), which has resulted in a greater price difference between the Thai and Indonesian products. Second, the labour cost in Thailand is higher than in Indonesia by 10-40 percent depending on the region. Comments and evaluation of Thai NR products by users are shown below. These demonstrate that some expectation gaps are occurring between Japanese major users and processors, with regard to price, quality and delivery. Moreover, Thai processors may need to improve their differentiating factors, such as adding special attributes to make it easier to process for users, in order to compete with Indonesia more effectively.

Table 2-8: Evaluation of Thai NR products by user

Product	Evaluation of Thai product by users	Comparison with Indonesia
RSS	■ RSS of Thailand has established d good reputation since long time ago and has strong competitiveness ■ RSS is hand made by farmers who take out dirts/foreign particles by hand and make it to sheet one by one so requires much skilled labor but can make good quality . ■ Sheets are gathered and pressed as a block of 150g and then shipped to downstream manufacturers. ■ We do not accept the view that Thai rubber competitiveness is comparatively low because the majority of farmers are small scale farmers and thus product quality is not uniform . ■ On the contrary, it is precisely because the producers are small scale farmers, they can supply USS. ■ RSS requires much manual labor process, which is hard to be replaced by mechanization, and has limited	■ Indonesia produces few USS/RSS and so cannot compete with Thailand in RSS
STR	■ STR uses cup lumps collected from farmers which are put through industrial process for product transformation , requiring few manual labor process compared to RSS. ■ Quality of STR depends on the ■ It is therefore difficult to ■ The production scale is much higher than RSS> ■ STR uses machine to get rid of foreign particles so its rubber quality grade is quite low so much that it is more popular among Chinese and Thai local tyre maker. ■ Thai STR and Indonesia SIR used different production process but do not result to have much quality difference.	■ STR from Thailand is around 5 cent / kg higher than SIR from Indonesia ■ Thai price premium partly derives from CESS which collects around 3-4 cents / kg and also from labor cost difference, as labor cost in Indonesia is around 70-90% of Thai cost . ■ Quality-wise, Thailand was better than Indonesia before but the gap between the two is quickly reduced due to quality improvement from Indonesia side. ■ Delivery from Indonesia is more stable as there is no dry season

Source: Interview from Japanese tire makers in Thailand

Below is a cost analysis by supply chain of the product.

The cost of TSR has dropped below the production cost of rubber according to farmers in the Northeast. The production cost of Thai rubber mid-stream products is around THB 45 to 50 per kg, higher than the market price, which fell to THB 30 to 40 per kg in early 2016.

According to interviews with users and industry experts, the upstream product cost in Thailand is not so different from other developing counties such as Indonesia and Viet Nam, since the clone seeds, climate and soil properties are relatively similar in these countries.

Regarding production costs, although the tapping cost may be higher than other developing countries, this may be easily offset by the higher skills of tappers and higher yields from the rubber plants. The cost differences may arise more from the processing costs at the mid-stream to downstream levels, as Thai labour costs are higher than those in neighbouring developing countries, especially for TSR, as processing is not a simple labour process, involving pressing into blocks, cutting and scaling. As for USS/RSS, this requires greater skill for sheet making and therefore is more advantageous for Thailand, which has more skilled labour.

The large global supply of TSR and new competition from developing countries has contributed to the sharp price decline of TSR products and this has affected the price of other rubber products, such as USS/RSS.

Table 2-9: Competitiveness of Thai rubber products

	Upstream	Mid stream	
Product	**Field latex/ cup lump**	**TSR/ STR**	**USS/RSS**
Production cost competitiveness	Not different among major producing countries (higher tapping labor cost of Thailand offset by higher yield and higher tapping skills)	Thailand higher labor cost may be disadvantage for TSR/STR due to simple skills needed However, proximity to China, major market of TSR/STR, give advantages for Thailand	Competitive due to higher skills for sheet making However, problem of labor shortages in the South may affect its competitiveness in future.

Source: Interviews and field survey

2.2.1 Mechanisation to improve productivity

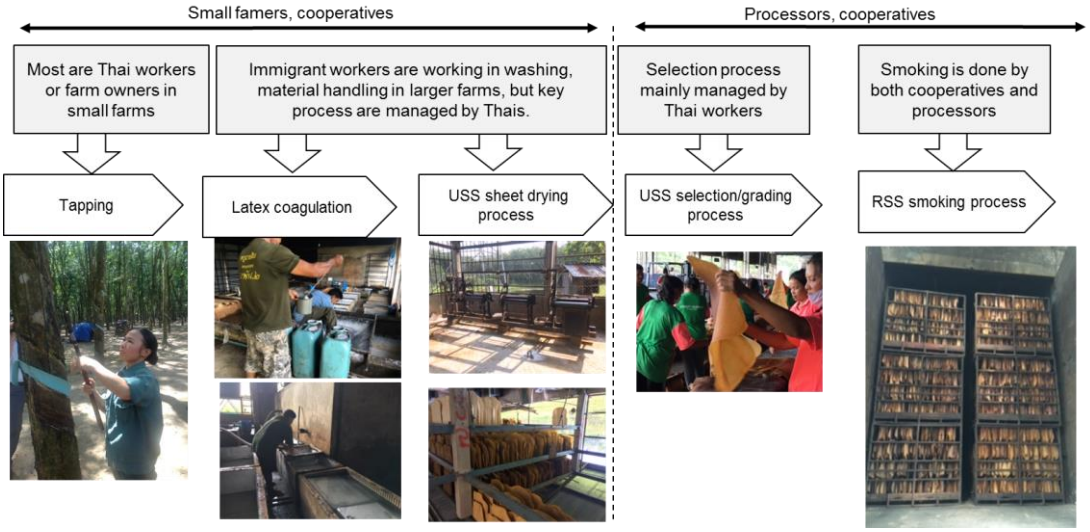
In this chapter, we will look closely at major NR products, such as RSS, TSR and concentrated latex, and their respective processes, and then analyse the possibility of applying further mechanisation to improve productivity in the upstream to mid-stream levels. We also look into crepe rubber, a niche product, which could be promoted in the Northeast as a more value-added intermediate product from cup lumps.

2.2.1.1 RSS processing process

As shown in Figure 2-21, Thailand has traditionally been the largest producer of USS/RSS. Thai rubber farmers in the South have actively undertaken mid-stream processes from tapping to USS making, which require a minimum level of mechanisation in the processing, such as sheet pressing.

As traditional Thai rubber farmers already use sheet pressing machines and RSS/USS uses a relatively simple mechanised process, there is little scope for any further mechanisation at the farm level.

Figure 2-21: RSS processing process



Source: Central Market

2.2.1.2 TSR processing process

Figure 2-22 illustrates the mechanised process of TSR. It indicates that TSR typically has more mechanised or semi-automated processes, such as washing/ milling /crushing process, and requires large-scale investment in equipment and land. It is thus mostly undertaken by large-scale mid-stream producers/exporters.

Since small scale farmers mainly provide cup lumps to large processors and the prospects for them to participate in the mid-stream process are low, there is little need to support mechanisation for farmers producing TSR.

Figure 2-22: TSR processing process

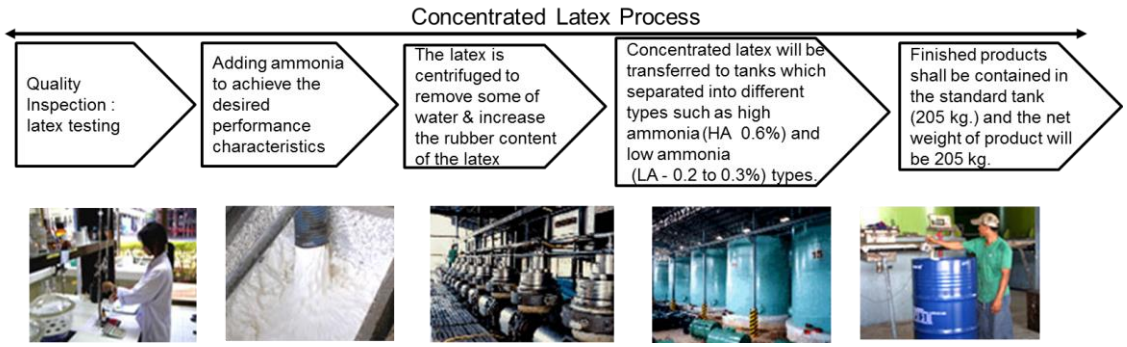
Source: Thai Hua Rubber.

2.2.1.3 Concentrated latex process

As shown in Figure 2-23, for concentrated latex the product also requires more investment, at about THB 10 million, or US$286,000, compared with RSS. Also, due to the requirement for large-scale investment and a network with overseas buyers, concentrated latex processing is mainly undertaken by processors/exporters. Moreover, it is difficult for small-scale farmers who collect latex for concentrated latex to enter the mid-stream process.

Consequently, there is not much need to support mechanisation for farmers to produce concentrated latex.

Figure 2-23: The process of making concentrated latex



Source: Thai Hua website; Chemionics Corporation website

As summarised in Table 2-10, the requirement for further mechanisation in the mid-stream process is rather limited for major NR products. USS/RSS is labour-intensive and cannot be mechanised further, while TSR and concentrated latex are already mechanised for large-scale production and so smallholder farmers and cooperatives have little chance to participate in the mid-stream process.

Table 2-10: Summary of rubber production requirements in upstream and mid-stream

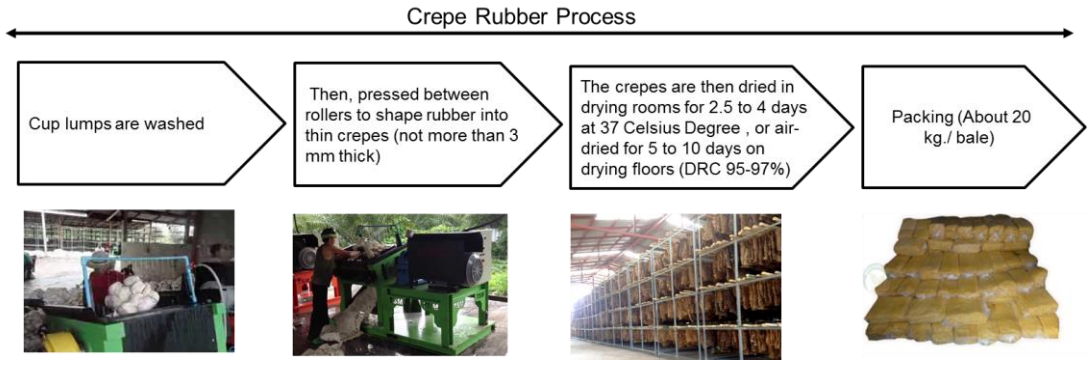
		Upstream		Midstream		
		Field Latex	Cup lumps	RSS/ USS	STR	Concentrated latex
Major producers		Small farmers (South)	Small farmers (NE)	Farmers (USS) , Cooperatives(RSS) Processors/ exporters	Processors/ exporters	Processors/ exporters
Production cost	CAPEX	Minimum; bucket, tapping tools, coagulant, etc	Minimum; bucket, tapping tools, coagulant, etc	Medium: investment for sheet rolling machine	High: Investment for mechanized process	High investment ; centrifuge and latex storage space(286K US$)
	OPEX	Labor cost: higher due to collection needed every 2 days.	Labor cost: lower due to collection needed every 8 days.	Medium: Cost of production (USS) : 5 Baht/kg 7-8 persons needed for USS process	High: High energy cost (electricity for machine and water for cleaning/ crushing process)	
Price (FOB. BKK on Apr 1)		Medium: 40-41 Baht/kg	Low: 21 Baht per kg	High :USS 44.15 Baht/kg, RSS: 54.7Baht/kg	Medium: STR 20: 48.7 Baht/kg	Medium; 43.5 Baht/kg
Labor issues		Skilled workers required for tapping	Easier to get workers as it requires less skills	Labor shortage of skilled workers	Less skilled worker as process is mechanically controlled	Less skilled worker as process is mechanically controlled
Level of mechanization		-	-	Low scale	High scale	Medium scale
Requirement for further mechanization		-	-	- Very limited as labor intensive by nature	- Already highly mechanized	-Already mechanized

Source: Result from field survey and RAOT

2.2.1.4 Crepe rubber process

Crepe is a crinkly lace rubber, obtained when coagulated latex or any form of field coagulate (tree lace, shell scrap, and earth scrap, etc.) is processed through rollers (a rubber crepe machine) and the resultant material air dried at ambient temperature. The manufacturing process of crepe (Estate Brown Crepe) is shown in Figure 2-24. The characteristic of crepe rubber is its light colour, as it does not undergo smoking or any heat treatment process, but instead is air dried. The highest grade of crepe rubber, such as PLC1, has a very light colour and is ready for application to exterior parts, such as footwear soles. Sole crepe, a dried and cut product from PLC, is used especially for footwear soles. Crepe rubber as a final product is not directly used for making tyres, which do not require any specific colour, while crepe from cup lump is widely used as an intermediate product to process SIR (Specified Indonesia Rubber) in Indonesia.

Figure 2-24: Crepe rubber process



Source: Rubber Economics Magazine

There are different types of crepe rubber depending upon the type of raw materials, as follows:

Table 2-11: Major types of crepes

Product type	Characteristics	Major application	Equivalent TSR grades
Pale Latex Crepe (PLC) & Sole crepe	Higher grade as processed from field latex, resulting to few impurities (dirt, etc) and to light color suited for application to exterior (Footwear., etc) Premium price will be added to lighter color grades. TheFour different grades of PLC available in the market are; PLC 1x, PLC 1, PLC 2 and PLC 3	Footwear, injection bottle caps	PLC1=TSR - 3CV PLC=TSR5
Technically Specified Crepe Rubber	Techinically specified, rather than visually specified.	Medical, Engineering, Retreading, Automobile and Footwear	TSR5 &TSR3
Estate Brown Crepe (EBC)	Cup lumps and other higher grades of field coagulum are used for making EBC.	Cycle tires, Footwear, etc.	TSR50

Source: Thomson rubber website, interview result from Tire makers

According to the field survey in Nongkhai, one of the major NR production centres in the Northeast, farmers and cooperatives there have shown a strong interest in producing crepe rubber for the following reasons;

a) Crepe rubber can be processed from cup lumps, which Northeast farmers mainly produce.

b) Crepe rubber has a higher value than cup lumps, thanks to its lower impurity content and low DRC; the crepe rubber price is around 30 percent higher than cup lump.

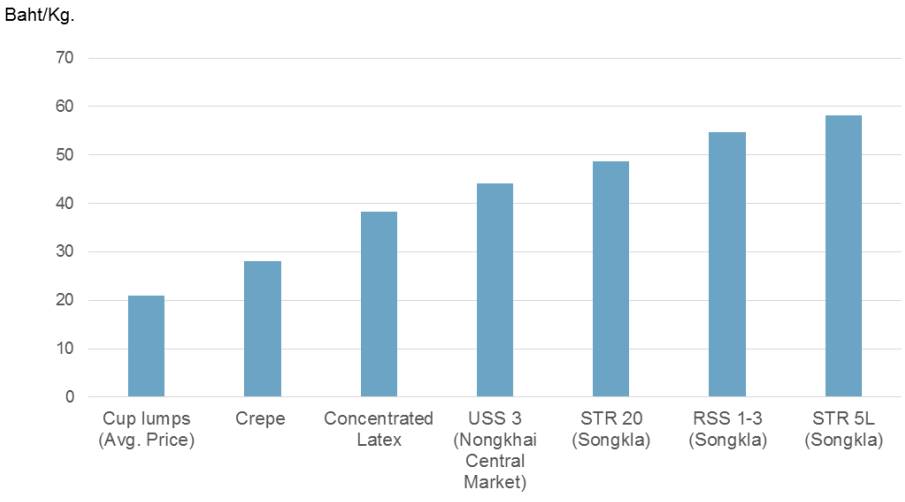
c) The investment required for processing crepe lumps is around THB 3 million (US$85,000), which is lower than other NR products, such as TSR and concentrated latex.

Table 2-12: Crepe rubber process

	Cup lump for STR	Crepe Rubber
Process	➢ Few process involved for farmers	➢ More processing for crepe making at farmer level
Investment for middle stream	➢ Beyond capacity of farmers or cooperatives for investing STR processing	➢ 3 million baht (85,000 US$) for crepe making machine
Farmers bargaining power	➢ Many farmers have disadvantages in Dry Rubber Content (DRC) measurement as collectors like to lower the price by lower the percentage of DRC than it should be	➢ Crepe rubber sheets have no water, it helps to avoid taking advantage from collectors.
Traceability of farmer origin	➢ Difficult due to mixing cup lumps from different farmer origins at the factory	➢ Easier due to semi-finished product processed at farmer site
Price	➢ Cup lump price ;21THB (0.71USD) in Nongkhai on Apr 6th ➢ Around half of USS price	➢ Crepe price is 28 THB price (9.8ThB), higher than cup lump more than 7 THB (0.02US$)

Source: Field survey at Nongkhai, 2016

Figure 2-25: Average price of rubber, by type (April, 2016)



Note: *Cup lump price is only available at Nongkhai Central Market

** RSS price is average price of RSS 1-3

Source: RAOT website and Central Market

2.3.1. Minimum labour cost, employment of immigrant workers, industrial relations in farms

2.3.1.1. Status of rubber workers' incomes

A field survey was conducted in Hatyai to understand the impact of the NR price decline on livelihoods, and the industrial-relations of workers and farm owners, as summarised in Table 2-13.

Farmers in the South are generally divided in two groups; medium-to-large farmers over 50 rai or 8 ha, and smallholder farmers with less than 50 rai or 8ha. Farmers owning more than 50 rai or 8 ha usually hire workers for tapping and processing USS and distribute 40 percent of their revenue to workers, while keeping the remaining 60 percent. Many of the workers in large farms come from Myanmar and Lao PDR, and there is long tradition of utilising migrant workers in the rubber industry since the 1990s, when the issue of labour shortages was problematic in the South. The labour shortage became more critical when migrant workers from the Northeast returned home to plant their own NR in the 2000s. Usually, large farmers also plant other crops such as oil palms, and have other businesses, so their revenue is less affected by the decline in NR prices. Medium farmers also hire workers from outside and share revenue with their workers.

Typical smallholder farmers of 15 rai or 2.4 ha usually tap rubber trees by relying on family members and neighbours, and do not depend on outside workers. In this case, family members keep 100 percent of the revenue. The revenue of smallholder farmers is THB 1,000-1,200 or US$29-34 (THB 100 = US$2.86), basing on the current NR price,

It is often pointed out that farmers in the South have been more severely affected by the decline in NR prices than those in other regions, as they are mono-culture farmers and must buy basic staples from the market, while farmers in the Northeast plant staple foods such as rice and other cash crops, including tapioca, fruit and vegetables. Farmers in the Northeast also plant and tap trees using family members, so they can avoid revenue outflows to outside workers.

Many farmers in the South are heavily indebted, as they bought luxury durable goods such as cars and motorcycles when the NR price was high. Despite this, they can survive with some support from other family members who work outside farming.

The status of workers is far more serious in the South. Most of them come outside the farming community and they have little other support. Tappers usually work in pairs and a

pair makes US$15 per sheet per day, or around THB 875-1,050 in total revenue, of which THB 350-400 is shared with workers. Consequently, revenue per worker is THB 175-200, much lower than the minimum wage of THB 300. Workers receive few forms of social welfare and usually live in cramped conditions with their families in small cottages provided by the farm owner inside the rubber plantation area. Many workers work under a patron-client relationship, with the farm owner lending money to their workers and recovering these debts through deductions made to the workers' revenue shares.

According to a tapper interviewed in the South, workers are demanding an increase in their revenue share following the price decline, but there has been no response as yet from farm owners. Some workers are leaving the farms to find better jobs elsewhere.

Table 2-13: Status of income of farmers and rubber workers by size of farm

Size of Farm	Area	workers (tapping/USS)	Revenue share	Revenue	Revenue Assmution
Small	15 rai (2.4ha)	Family members or neighbors	Farmers:100%	Farmer:1000～1200 THB/day per household	2.5kg / rai x 15 rai =37.5kg
Medium	15-50 rai (2.4-8ha)	ouside workers	Farmers:60% Workers:40%	Farmer: 1200～2160 THB/ day Worker: 175～200THB/ day (per worker)	2.5kg / rai x(15～50) rai =37.5～125kg
Large	>50 rai (>8ha)	ouside workers, foreign migrants	Farmers:60% Workers:40%	Farmer: >2160 THB/ day Worker: 175～200THB/ day (per worker)	2.5kg / rai x 50 rai =125kg

Source: Field Survey in Hatyai (Feb 2016)

2.3.1.2 Life of rubber farmers (results from a field survey) as shown in Table 2-14

- The price decline has adversely affected the lives of farmers through declining incomes and increasing debt levels, although not to such an extent that they have fallen into destitution.
- Facing plummeting incomes, some small-scale farmers have opted to find other sources of income by having family members work outside of the farm.

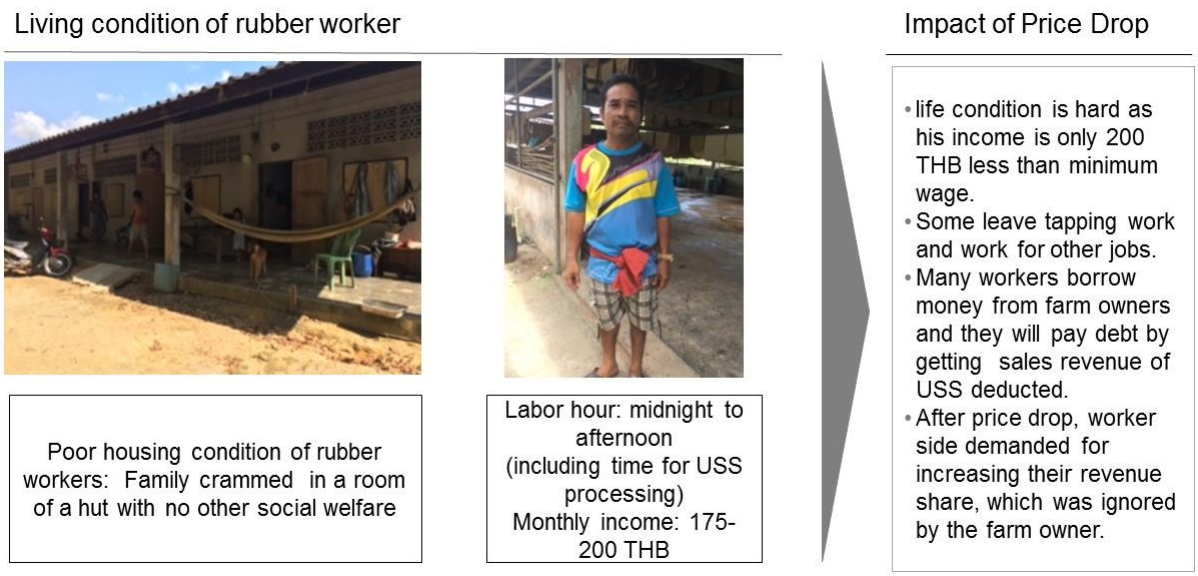
Table 2-14: Status of small-scale farmers' incomes

Topic	Answers
Farmer profile	• own rubber plantation (10 rais) • Hire no workers, only household workers (himself and his wife • Production : 60 kg/day
Impact of NR price drop	• It affected him in terms of the decreasing of income to pay for installments car and other expenses, but he does not suffer much from falling price as he has another job as an employee of rubber processing company.
Relation with buyer	• normally he will sell latex to collectors. (not sell to cooperatives because they give lower price such as 35 Baht) • Collectors will give higher price (Gap 2-3 Baht). • Some people who do not hurry to get cash will sell to cooperatives
Evaluation of NR policy by government	• Most of policies are short run solution so there are not useful. • He wants government to do anything which can increase price (60 Baht is acceptable) and not interested in other subsidies

Source: Field Survey in Hatyai (Feb 2016).

2.3.1.2.1 Living conditions of rubber workers

Figure 2-26: Status of rubber workers



Source: Field Survey in Hatyai (Feb 2016)

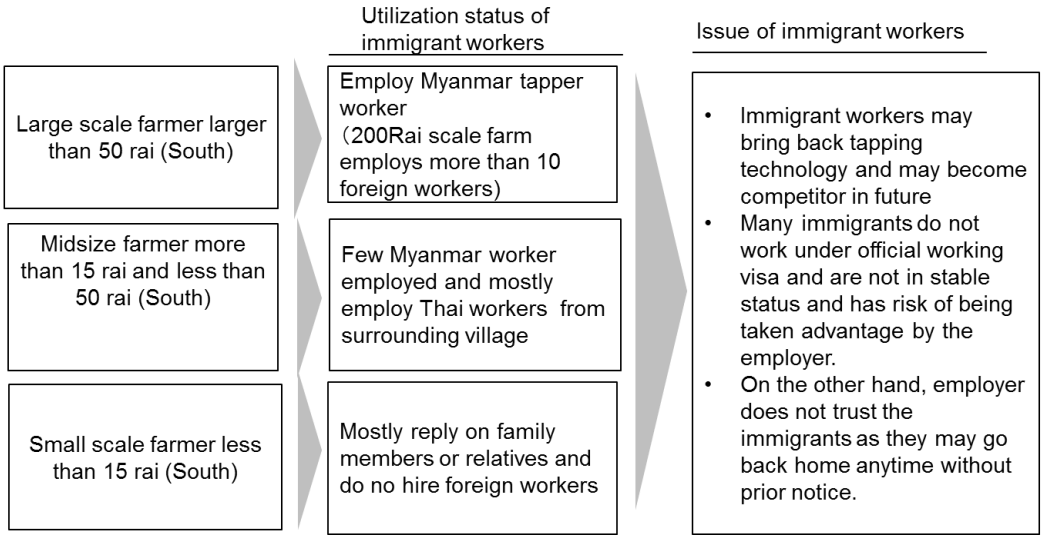
2.3.1.3 Utilisation of foreign migrant workers

As stated earlier, migrant workers from Myanmar started to arrive from the late 1990s. They are usually employed by large-scale farmers as tapping workers, while medium-scale farmers employ Thai workers and small-scale farmers rely on family members work and employ no

workers. In the mid-stream level of RSS, many foreign workers are employed in non-essential processes, such as washing USS, material transport and packing. Key processes such as USS quality checking, controlling smoke facilities and final shipping are usually managed by Thai workers. TSR uses more migrant workers than RSS, as it involves fewer skilled processes.

In sum, foreign migrant workers are already utilised extensively, especially in the South, and further dependence on foreign migrant workers will hinder the industry's competitiveness. Indeed, it could jeopardise the advantages that Thailand already has, as these migrant workers may go back to their own countries to plant rubber and could compete with Thai rubber farmers in the future (Figure 2-27).

Figure 2-27: Utilisation status of foreign migrant workers



Source: Field Survey in Hatyai (Feb 2016).