

Upgrading Thailand's Rubber Industry: Opportunities and Challenges

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I. Introduction

Thailand has achieved remarkable sustained growth over an extended period, building on a natural resource base, driven by low-cost labor coming out of rural areas, supported by high levels of capital investment (prior to the 1997 Asian Financial Crisis), and facilitated by effective economic institutions. Thailand's growth has been strongly market- and outward-oriented, with the private sector playing a central role in responding to international market opportunities, to a large extent through an impressive expansion and diversification of manufactured exports. The results included a dramatic reduction in poverty, and increase in the quality of life as measured by most non-economic indicators. All in all Thailand achieved a notable combination of sustained rapid growth, macroeconomic stability, economic diversification, and declining poverty—until the Asian Financial Crisis of 1997-1998. The Asian Financial Crisis eroded but did not erase Thailand's gains from growth and development; and the economy generally recovered.

Since the Asian Financial Crisis, Thailand's economic performance has been moderate; and there are concerns that Thailand has fallen into the “middle-income country trap” (Figure 1). Even prior to the Asian Financial Crisis there were indications that Thailand was losing comparative advantage in low-wage sectors, and there were underlying weaknesses in mid- and higher-technology processes and products. Thai firms, unlike enterprises in East Asia (e.g., the

Republic of Korea and Taiwan), seem not to have used their low-cost advantage to build the necessary capabilities to compete on the basis of increasingly higher levels of skills, technology, and knowledge.

Thailand's natural rubber (NR) sector mirrors both the country's impressive growth *and* the limitations on that growth. Thailand is the world's largest NR producer and exporter, employing around one million families or up to six million people, and is the third largest source of export revenues (after electrical and electronics or E&E, and autos).¹ But the rubber sector also embodies the more general challenge facing Thai industry of *upgrading* – raising value added efficiently based on innovation and linkages among (Thai) firms. Most Thai rubber production goes to exports of raw or semi-processed rubber, not downstream, rubber-based products such as for example auto parts. Yet such manufactured products, which incorporate more technology and require more local inputs, generate higher revenues than semi-processed rubber.² Therefore because the Thai rubber industry is unevenly developed, it is not generating the skills, linkages and revenues Thailand requires to sustain growth and development over the longer term.

The challenge facing Thailand is to develop effective strategies for upgrading the rubber industry, especially in the face of market instability, changing role of China, and growing competition from countries, such as Vietnam, India and Indonesia. What initiatives and institutional changes are needed from government? From the private sector? And how can government-business collaboration contribute to addressing this challenge?

¹ Dept. of Export Promotion cited in Suparat Sirisuwanangkura, "Thai Automotive Industry," presentation to IRTEC Conference 2012, Kuala Lumpur, Oct. 12-12, 2012.

² See for example "Need to change focus from raw rubber to value-added products," *The Nation* July 18, 2011.

II. Overall structure of the Thai economy³

It is useful to place the rubber industry and the challenge in the broader context of the structure of the Thai economy. On the production side, industry—and in particular manufacturing—dominates the Thai economy. Manufacturing has grown and diversified significantly over the years, while agriculture’s share of gross domestic product (GDP) has declined appreciably, and the services sector has changed little compared with 1975 (Annex, Tables 1 and 2). Transformation of the structure of the Thai economy differs noticeably from other economies in the region, particularly in East Asia where the services sector’s role as a share of GDP grew as they developed.

On the demand side, Thailand has pursued an export-led development strategy. The economy’s openness and heavy reliance on foreign trade is reflected in the fact that trade in goods and services equaled 133.4% of GDP in 2012, with exports accounting for 73.4% of (nominal) GDP. In 2009, Thailand was the world’s 19th largest exporter and 17th largest importer of goods; and the 16th largest exporter and 14th largest importer of commercial services (WTO 2010). In particular, it is manufactured exports with high import content that have been driving Thailand’s economic growth (Annex, Tables 3 and 4). Therefore, it is the challenge of sustaining the growth of manufactured exports, and the related performance of Thai enterprises -- including finding ways to add value in particular product markets, such as rubber - - that will shape to a large extent the economy’s growth and development over the longer term.

Thailand’s exports have increased significantly in both sophistication and diversification since the early 1990s. The share of agriculture-related primary products and resource-based industries fell dramatically, while manufactured exports—including textiles, engineering, electronics, and automotive products—have grown considerably (Annex, Table 5). Within manufactured exports, electronics and electrical products—led by computers and parts—

³This section is based on Abonyi, G. 2013. *Thailand Private Sector Assessment (Revised)*. Prepared for the Asian Development Bank (ADB) Thailand Resident Mission (TRM), Bangkok.

and automotive products dominate. The relative attractiveness of Thailand as a production base for manufactured exports is reflected in its growing share of world exports over the past years, driven primarily by the dramatic increase of automotive exports and electrical and electronics products.

Thailand's export mix, however, is misleading as a reflection of the capabilities of Thai firms. Although products exported have increased appreciably in sophistication over time, the tasks involved in producing those products—the production processes—have not increased significantly in sophistication and complexity. Although there has been progress in Thai enterprises moving up the value chains of key industries into more sophisticated tasks such as research, design, and product development, in general, production-related tasks of Thai firms remain concentrated in assembly and relatively lower skill and technology manufacturing processes.⁴ Furthermore, Thailand has significant unexploited opportunities in using its existing resource endowments for developing higher value added activities, as reflected in the case of the rubber industry.

III. Assessing Thailand's Performance in the Rubber Value Chain

A. Rubber Value Chain: Evaluating the strengths and weaknesses of NR in Thailand requires that we examine the industry through the various components of the rubber "value chain." A value chain "describes the full range of activities...required to bring a product or service from conception, through the different phases of production, delivery to final consumers, and disposal after use."⁵ Figure 2 provides a simplified picture of the rubber value chain.

⁴ See for example Doner, R.F. 2009. *The Politics of Uneven Development: Thailand's Economic Growth in Comparative Perspective*. Cambridge University Press, Cambridge; and Abonyi (2013), op cit.

⁵ Raphael Kaplinsky, *Globalization, Poverty and Inequality* (Polity, 2005: 101).

B. Upgrading: As noted above, upgrading generally refers to raising value added efficiently based on innovation and linkages among local (Thai) firms. We can expand this definition as follows:⁶

1. *value added* (product upgrading): new forms of existing commodities that add value in terms of the market price they command; localization of commodity processing; new downstream, rubber-based manufactured goods; expanding to new (related) sectors;
2. *efficiency*: ability to produce at export levels of price, quality and delivery
3. *innovation*: more efficient processes, functions and diverse products
4. *linkages*: downstream manufacturers incorporate local upstream and midstream products; intermediates (e.g. chemicals, carbon black) and capital equipment locally developed and produced
5. *Thai benefits and contributions*: higher margins for unprocessed commodities; more production by local firms

C. Key Players: Strengthening any value chain requires contributions from and coordination of key institutions. As one scholar noted, "to get prices....(and)...policies right, you need to get institutions right." Similarly, it has been found that perhaps the critical factor in the success of enterprise *clusters* is the effectiveness of cluster-related institutions.⁷ Who then are the key players in the Thai rubber industry? To what extent and in what ways do they work together?

1. There is no effective, high-level oversight body, even something like the Cane and Sugar Board operating within the Ministry of Industry (MOI). There have been a number of coordinating bodies proposed over the years, such as a National Rubber Authority or a Rubber Products Institute, but none of these developed any authority and influence. This is also reflected

⁶ This draws on Gibbon, Peter. 2001. "Upgrading Primary Production: A Global Commodity Chain Approach." *World Development* 29:2, 345-363; and Doner (2009).

⁷ *Clusters* are defined here as a group of enterprises in the same or related value chains whose activities and performance are interdependent; involving cooperation in some form, and task-related linkages.

in the weakness of the various “Master Plans” for rubber. In the words of one university-based researcher, these Master Plans are a dream (“Master Plan baen faan”).

2. There are multiple ministry interests and competencies related to the sector. The most important government agency dealing with rubber, the Ministry of Agriculture and Cooperatives (MOAC), focuses largely on upstream development - farms. The Ministry of Industry, which in principle has responsibility for the downstream - factories (e.g. production of rubber-based manufactured goods), has had limited interest and involvement in the promotion of downstream rubber production to date. The Ministry of Commerce cares most about exports. The result is general neglect of potential links between downstream and upstream. As one industry official noted, “Thailand is the only country with two rubber plans: One from the MOAC and one from the MOI.” A notable example of these coordination problems was the failure of an effort to develop a “Rubber City,” a sort of rubber-based cluster. Another involves conflicts between ministries, including the Ministry of Finance, with regard to price support schemes in times of falling rubber prices.

3. There are problems of resource shortage and coordination within the MOAC. The Ministry’s Rubber Research Institute of Thailand (RRIT), a key source of R&D, has suffered from funding shortages and personnel gaps. Also, there has been overlap between the RRIT and the Office of Rubber Replanting Aid Fund (ORRAF). Furthermore, there are multiple types of cooperatives – some naturally emerging, some supported by ORRAF, some supported by the Dept. of Cooperatives, and some supported by the Dept. of Agricultural Extension.

4. There are also coordination problems and differing interests within the private sector. Overall, the Thai Rubber Association, representing upstream interests is the most influential. Exporters are also active and influential. Neither of these two is especially focused on linkages with and upgrading of downstream rubber products firms. The politically weakest of the private sector associations, representing domestic Thai producers of rubber manufactured goods such as tires, is the group pushing the hardest for linkages and support for technology upgrading.

Given the above, the upstream sector is the most politically influential part of the rubber value chain. This reflects both the strength of the large processing / exporter groups and the leverage of the large number of small farmers who dominate Thailand's rubber cultivation.

As described below, Thailand's generally fragmented institutional picture contrasts with the situation in Malaysia, where the Malaysia Rubber Board, although weaker than in the past, has been an effective coordinator of up-, mid- and downstream interests.

None of the preceding should be taken to imply that Thai institutions are in fact weak. Thailand's rubber institutions are especially strong in 1) expanding production by raising yields and increasing lands under cultivation, through the efforts of ORRAF and the RRIT; 2) ensuring a fair return to the farmers through the establishment of Central Markets by the RRIT; and 3) facilitating exports through coordinated linkages with foreign buyers. The weaknesses relate to creating and sustaining the emergence of a competitive rubber-based manufacturing industry (downstream linkages).

D. Upstream - Thailand's Strengths: Thailand has been especially successful in the upstream sector: The country is the world's leading producer and exporter of NR, with production capacity of 3.1-3.2 million tons/year.⁸ Most of this production has occurred in the South, which accounts for around 11 million rai (2.7 million hectares) out of a total area of around 17 million rai, followed by the Northeast with 3 million, the East with 2 million and the North with 600,000 rai. Several factors help explain Thai upstream success, especially as Thailand began producing rubber some 20-30 years after Malaysia, the traditional leader.

Perhaps the most important factor has been the country's impressive ability to improve rubber yield (or output).⁹ Key contributors to this type of upgrading were government agencies, especially the Office of Rubber Replanting Aid Fund (ORRAF), which led smallholders (who

⁸ Chakarn Saengruksawong, Soontorn Khamyong, Niwat Anongrak, and Jitt Pinthong (2012), "Growths and Carbons Stocks of Para Rubber Plantations on Phonpisai Soil Series in Northeastern Thailand," *Rubber Thai Journal* (1), p. 2

⁹ On yield, see UNCTAD, FAOSTAT database.

account for the majority of Thai rubber production) in replanting; a Rubber Research Center, which helped develop new, high-yielding clones, agricultural extension services; and Japanese tire producers anxious to improve the quality of inputs. This yield increase reflects greater efficiency in planting and latex collection.

A related factor has been the impressive degree of upstream value chain organization ensuring the transfer of raw materials from smallholder/farmer to processor, exporter and end user. As seen in Figure 3, this organization involves the private sector, especially large processor/exporter groups, but also government and government-sponsored organizations, including cooperatives and central markets. Note that this value chain, including central markets, has resulted in an expansion of information, bargaining power, and thus margins, for Thai farmers.

Thailand has a human resource advantage over competitors. Thai farmers tend to engage in more diversified activities than their Indonesian and Malaysian counterparts, and they generally exhibit relatively high levels of management and technical skills.¹⁰

Politics have helped too. The Thai government hoped that better rubber production would help to weaken widespread communist insurgency in the South (e.g. in the 1970s). Also, global development institutions, such as the World Bank, wanted to ensure a stable, growing supply of rubber as a strategic raw material. Finally, the millions of smallholders (not large estates) who produce the majority of Thai rubber constitute a significant political force, especially when rubber prices fall. Thai officials note that "rubber is a political crop" (*yang pharaa baen pheut kan muang*).

Thailand has the advantage of expanding production area, especially in the Northeast, which has roughly 2.65 million hectares still available for rubber production. Expansion to the Northeast, Thailand's poorest region, is also politically popular. This is reflected in pledges to

¹⁰ UNCTAD Secretariat, "Marketing Structures in Malaysia, Indonesia and Thailand."

increase rubber production in the Northeast and North by one million rai per year for several years.¹¹

The ability to expand production is especially important in light of predictions of growing global demand for rubber. Although global demand and production are presently balanced at roughly 10 million tons, forecasts are for a global rubber shortage as demand is predicted to reach 14.35 million tonnes while production is forecast at 12.5 million tons in 2020.¹² Key to expanding demand is China, whose need for automobile tires has made it the world's largest consumer of natural rubber (Figure 4).¹³

E. Upstream - Thailand's Challenges: In addition to its great success, Thailand faces some potential difficulties in the upstream sector.

While demand is forecast to grow in the long term, shorter-term prices are more volatile (Figure 5).¹⁴ Until 1999, rubber prices were somewhat stabilized by an International Rubber Agreement (INRA). But this situation ended with the dismantling of the INRA (when Malaysia, Sri Lanka and Thailand withdrew). As a result, farmers face frequently shifting prices, especially as these smallholders lack fixed-price, forward contracting arrangements and easy access to the increasingly liquid commodity exchanges in Singapore, Shanghai and Tokyo.¹⁵ Falling prices have resulted in frequent demonstrations by politically important farmers,

¹¹ See for example, "Stampede to join rubber farm scheme," *The Nation*, Feb. 16, 2011, which describes "Hundreds of thousands of people and farmers based in the North and Northeast..." scurrying "to apply for rights to rubber farming under a government permission" (sic). See also "Rubber industry welcomes CP involvement: Sapling Shortages curbing expansion," *Bangkok Post*, June 27, 2011.

¹² Achrra Pongvutitham Petchanet Pratuangkrai, "Need to change focus from raw rubber to value-added products," *The Nation*, July 18, 2011 12:00 am

¹³ China's share of global NR consumption rose from 9% in 1970 to 33% in 2011 (Rubber Statistics Bulletin, IRSG - International Rubber Study Group).

¹⁴ See for example, Petchanet Pratuangkrai, "Spiralling rubber prices a cause for concern," *The Nation*, Jan. 24, 2011.

¹⁵ See UNCTAD (?), *Commodity Atlas: Natural Rubber*, pp. 34-35.

resulting in government commitment to price support schemes rather than improved efficiency and diversification.

Higher prices can create problems. First, speculation on rubber prices as well as retaining domestic inventories to keep prices high can lead to a dangerous bubble. Second, high natural rubber prices can help farmers, but increase costs for downstream users. Third, reliance on growing demand from China has led to complacency about upgrading by reducing pressure on political leaders to support the development of mid- and downstream sectors.

Thailand's NR producers face two types of competition. One is from new rivals, especially Vietnam and India. The second is from synthetic rubber, whose price depends significantly on the cost of its petroleum base.¹⁶ (The only products relying solely on natural rubber are aircraft and truck tires due to NR's resistance to heat build-up; auto tires are mainly concerned with abrasion resistance, which is a benefit of SR.)

F. Upstream - Malaysian Weaknesses and Responses

Weaknesses: Malaysia lost its dominant position in NR production and export to Thailand in the 1980s due to a number of factors, including falling yields, a reduction in land devoted to rubber (due to a growth in palm oil), and an ageing population of rubber farmers. As a result, it has been forced to become a significant importer of liquid latex to support its downstream producers.

Active Response: In response to these problems, Malaysia is attempting to raise production through new, high-yielding clones and through mechanization and automation, such as an automated rubber tapping system (ARTS) and low-intensity tapping.

¹⁶ The substitutability of synthetic for natural rubber depends in part on economic factors, such as price, but also on technical properties. For example, because it is waterproof, NR is best suited for use in surgical and medical examination gloves and condoms, although even here synthetics have been used. NR is also extensively used in aircraft tires, due to its resistance to heat build-up, whereas auto tires are mainly concerned with abrasion resistance, which is a benefit of synthetic rubber (See UNCTAD Secretariat).

G. Midstream - Thailand Lags Malaysia

Midstream Products: The midstream mainly involves the processing of NR from rubber trees into several kinds of products used by downstream producers.

1. latex concentrate (for "dipped" rubber goods such as condoms and gloves)
2. sheet rubbers (used especially for tires)
3. technically specified rubber TSR / "block rubber" (used especially for tires)
4. "specialty rubbers"

Thai vs. Malaysia: Thailand's export success reflects the extensive number of local firms processing rubber from trees into smoked sheet, latex compound, and block rubber (see Figure 2). But Thailand's has lagged Malaysia in several areas.¹⁷

1. Thailand's smoked sheet is not of the highest grade.

2. Thailand has lagged in the development and production of block rubber that, in large part because it allows easier inspection and more standardization, is used more extensively and benefits from more rapidly rising prices.¹⁸ Indeed, block rubber was "invented" by Malaysian government researchers in the mid-1960s in a clear example of upgrading. Thailand copied this innovation, but Thai exports of block rubber exceeded the more traditional smoked sheets only in 2006,¹⁹ and according to a 2009 study, its quality still needs improvement.²⁰

3. Thai latex quality is reportedly inferior to that of Malaysia and often not sufficient for use in surgical gloves.

4. A further example of Malaysia's investment in innovation is the development of expodized natural rubbers that are chemically modified to produce higher value added with significant environmental sustainability and other benefits. In this clear instance of product

¹⁷ Unless noted, the information in this section comes from interviews in Thailand and Malaysia, and from Somsak (2009).

¹⁸ Somsak (2-2).

¹⁹ www.rubberthai.com/statistics.

²⁰ Somsak (2009: 5).

upgrading, Malaysia's goal is to transform natural rubber from a commodity to an advanced polymer.

5. The preceding reflect the much more extensive investment in rubber-related R&D in Malaysia than Thailand. And rubber is symptomatic more generally of Thailand's lagging investment in innovation. (Annex: Table 5.; Fig. A1)

H. Downstream: Products, Linkages and National Firms -- Thailand Lags

Malaysia

Downstream Products: Natural rubber is a key input into a number of important manufacturing sectors, ranging from tires, to hoses, to threads, to condoms and gloves (Fig. 6). Thailand has performed well in a number of downstream areas. It is the world's number one producer of condoms, a very significant exporter of rubber gloves, and well ahead of Malaysia in tire exports.²¹ But Thailand lags Malaysia in some important areas.

In general, Malaysia is the world leader in developing the downstream part of the rubber value chain. Malaysia leads not only in medical glove production but also in related technological innovations. It was Malaysian government researchers, working with local firms, who developed the product and process innovations needed to respond to protein allergies that threatened to destroy the industry. Based on these innovations, the country established a national label - the "Standard Malaysian Glove" - that involves high standards for barrier protection and elements believed to cause allergic reactions. To the extent that such innovations have come to Thailand, they have often done so through Malaysian firms setting up operations in Thailand.

Malaysia has also expanded its production of engineering applications for natural rubber, such as high-damping natural rubber bearings for the seismic protection of bridges and buildings.

²¹ Based on UN Comtrade data.

Malaysia's performance contrasts with Thailand's failure to promote rubber-based manufactures with significant potential, such as elastic and rubber bands, construction equipment, road materials, medical products, mattresses, toys, and tractor tires.²²

Domestic Linkages: Most of Malaysia's rubber, (close to 90%), especially its latex, is consumed by the country's downstream producers. By contrast, roughly 90% of Thai NR is exported, despite the fact that earnings from semi-processed rubber are much less than those from manufactured goods. Malaysia is also well ahead of Thailand in the development and production of capital equipment for downstream producers (e.g. new assembly lines for glove producers). A 2009 report concluded that in Thailand, "Most machinery and equipment for rubber products still have to be imported."²³

Domestic Firms: The top producers / exporters / innovators of medical gloves and rubber-based engineering products in Malaysia are locally owned and managed. This contrasts with Thailand, where the large number of local (Thai) rubber product manufacturers is relatively small. Consider tires, which consume some 50% of domestically produced Thai rubber used in the country's downstream sector. There are 15 tire producers in Thailand, of which half are Thai and the rest foreign. Yet the foreign firms generate 80-90% of the industry's income.²⁴

IV. Conclusion: Strengthening the Thai Rubber Industry

The rubber value chain in Thailand is unevenly developed: quite successful and robust upstream but weaker as we move to the mid- and downstream segments. Parallel to this

²² This is the major conclusion of Somsak Tambunlertchai, "Khronkan Siksai Sakayaphaab Kan Phalit Phalitphan Yang Nai Prateet" ("Thailand Report on the Potential of Rubber Products" (Economics Dept., Thammasat University submitted to the Rubber Research Institute, Dept. of Agriculture, MOAC, 2552 / 2009),. Note also that although automotive tires are a key source of demand for rubber, that demand is limited by the fact that passenger car tires are comprised of roughly 50% filler, 20% synthetic rubber, and only 15% natural rubber.

²³ Somsak (2009: Intro, p. 5).

²⁴ "Need to change focus from raw rubber to value-added products," *The Nation*, July 18, 2011.

unevenness is the role of local, Thai firms and the importance of technology. Moving from upstream on down, local firms become *less* important and technology *more* important. Thus, a key source of the industry's weaknesses is the fact that:

The extent of technology transfer from foreign investors has ...been limited. Research and development activities are few and there is a lack of laboratories equipment as well as manpower for product quality inspection...Dearth of R&D in rubber product industry. Labs necessary for R&D, product and raw material testing are still lacking...(The industry)...also suffers from lack of supporting industries (Somsak 2009: Intro - 5).

Paradoxically, the very success of the upstream rubber sector seems to have constrained the development of a downstream industry. This is mirrored in the institutional structure of the rubber value chain, and in the focus of domestic politics and policy. The auto industry reflects the paradox of the challenge. While Thailand is the leading exporter of rubber and its auto/auto parts industry is the second largest in manufactured exports, Thai producers of rubber-based auto parts are weak. They complain that Thai rubber gets exported to China and comes back to Thailand as inexpensive Chinese auto parts. This raises to Thai producers the cost of rubber, the key -- and abundant -- raw material; and at the same time creates for them a much tougher competitive environment.²⁵

With an expected growing global market for rubber (upstream), particularly in China, a key challenge relates to mindsets: to get the attention of policy makers and the private sector to see both the threat and the opportunity of extending Thailand's rubber value chain downstream. The operational challenge then is for government and the private sector to work together to create a globally competitive downstream rubber-based Thai manufacturing cluster.

²⁵ "Need to change focus from raw rubber to value-added products," *The Nation*, July 18, 2011.

ANNEX

Table 1 Overall Shares of Production Sectors, 1975–2012
(% share of GDP)

	1975	1985	1995	2005	2008	2009	2010	2011	2012
Agriculture	24.78	19.08	9.02	9.01	8.68	8.83	9.16	8.30	8.63
Industry	21.57	24.32	41.16	41.43	41.83	42.31	40.84	42.96	41.14
Services	53.64	56.60	49.82	49.56	49.49	48.87	50.00	48.74	50.23

Source: NESDB.

Note: Industry included Mining and quarrying, and Manufacturing.

Table 2 Closer Look at Production Sectors: Manufactures dominate
(% share of GDP)

	1990	1995	2000	2005	2008r	2009p	2010p1	2011	2012
Agriculture	13.55	9.40	10.30	9.02	8.83	9.16	8.30	8.63	8.36
Manufacturing	<i>27.81</i>	<i>32.58</i>	<i>36.44</i>	<i>38.88</i>	<i>40.13</i>	<i>38.59</i>	<i>40.76</i>	<i>38.99</i>	<i>39.19</i>
Construction	5.99	6.24	2.54	2.43	2.18	2.24	2.22	2.11	2.13
Wholesale and retail trade	17.38	17.56	15.78	14.05	13.67	13.95	13.29	13.52	13.36
Banking	8.68	7.15	2.79	3.53	3.69	3.93	3.93	4.45	4.45
Services and others	26.59	27.07	32.15	32.09	31.51	32.14	31.50	32.31	32.50

Source: NESDB.

Table 3 Dependence on Exports with High Import Content
(% share)

	1980	1990	1995	2000	2005	2008	2009	2010	2011	2012
Private consumption	66.42	56.51	54.19	54.61	55.05	52.45	53.27	51.73	52.33	52.41
Government consumption	11.70	8.75	7.86	9.32	9.00	9.33	10.15	10.00	10.09	10.19
Private investment	20.43	32.84	32.92	12.61	17.60	16.82	14.96	15.77	16.87	18.16
Public investment	9.06	5.81	8.90	7.48	5.95	5.38	5.70	5.16	4.70	4.81
Change in inventory	0.71	1.05	1.45	0.86	2.00	1.35	-2.43	0.81	0.16	0.93
<i>Exports of goods and services</i>	21.35	36.09	46.90	65.48	66.66	72.90	65.37	69.46	75.92	73.42
Imports of goods and services	29.66	41.05	52.23	50.37	56.27	58.24	47.03	52.94	60.09	59.93

Source: NESDB.

Table 4 Exports – Dominated by Manufactures
(% share)

	1992	1997	2002	2007	2008	2009	2010	2011	2012
Agriculture	20.59	13.99	10.44	9.86	11.33	10.80	11.14	13.05	10.32
Manu-agriculture	9.95	8.47	7.48	6.17	6.59	7.40	6.84	7.85	7.91
<i>Manufacturing</i>	<i>66.97</i>	<i>72.27</i>	<i>76.15</i>	<i>78.36</i>	<i>75.28</i>	<i>76.30</i>	<i>76.82</i>	<i>73.15</i>	<i>75.09</i>
Minerals and fuels	1.44	2.73	2.95	4.67	6.60	5.50	5.20	5.95	6.68
Others	1.04	2.53	2.98	0.95	0.20	0.00	0.00	0.00	0.00

Source: Ministry of Commerce.

Table 5 Thailand's Comparative Research and Development Spending
(as % of GDP)

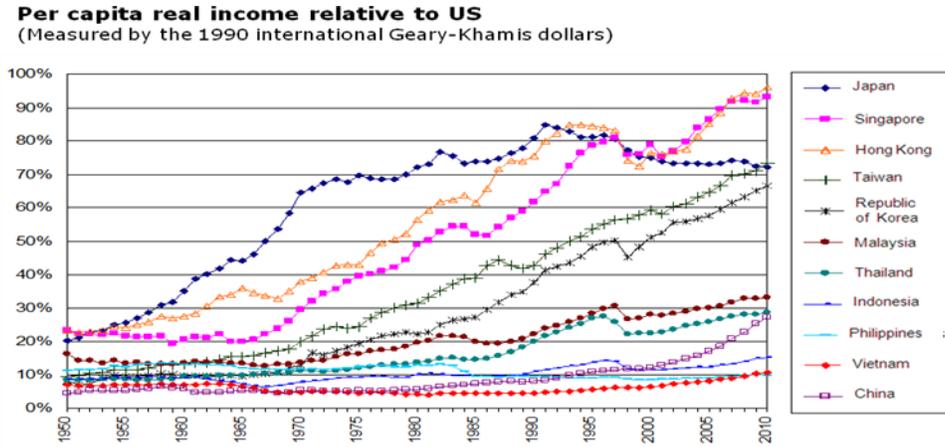
	1996	1998	2000	2002	2004	2006	2007	2010	2011
Japan	2.8	3	3	3.2	3.2	3.4	3.4	3.39	3.67
Republic of Korea	2.4	2.3	2.4	2.5	2.8	3.2	3.5	3.22	3.74
Singapore	1.4	1.8	1.9	2.2	2.2	2.3	2.6	2.25	2.20
PRC	0.6	0.7	0.9	1.1	1.2	1.4	1.5	1.44	1.97
India	0.6	0.7	0.8	0.7	0.7	0.8	0.8	–	
Malaysia	0.2	0.4	0.5	0.7	0.6	0.6	–	0.64	0.63
Thailand	0.12	–	0.3	0.2	0.3	0.2	–	0.2	0.25

PRC = People's Republic of China.

Source: Based on World Bank Malaysia Economic Monitor (2010, Table 3.7, p. 81) and Oxford Business Group (2011).

http://en.wikipedia.org/wiki/List_of_countries_by_research_and_development_spending

Figure 1 Thailand: Trapped in middle income?



Source: Ohno (2011), presentation at ADB Annual Meeting, 6 May.

Figure 2. Natural Rubber Value Chain

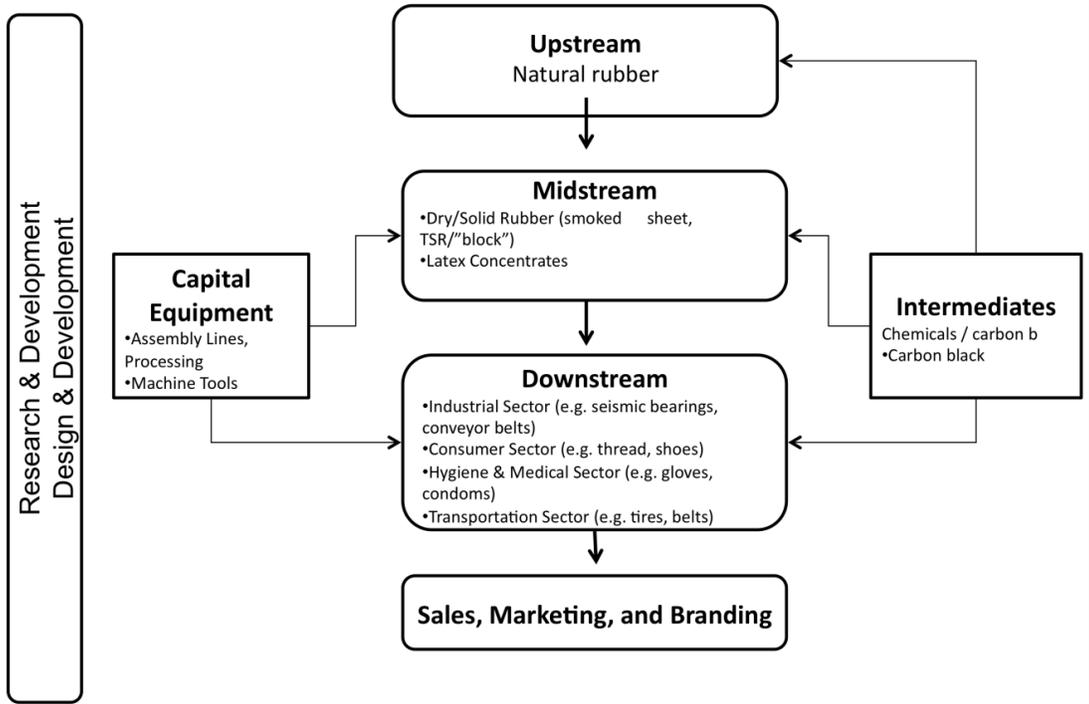


Figure 3. Rubber Value Chain in Thailand's Lower South

Source: Dept. of Economics, Thammasat University

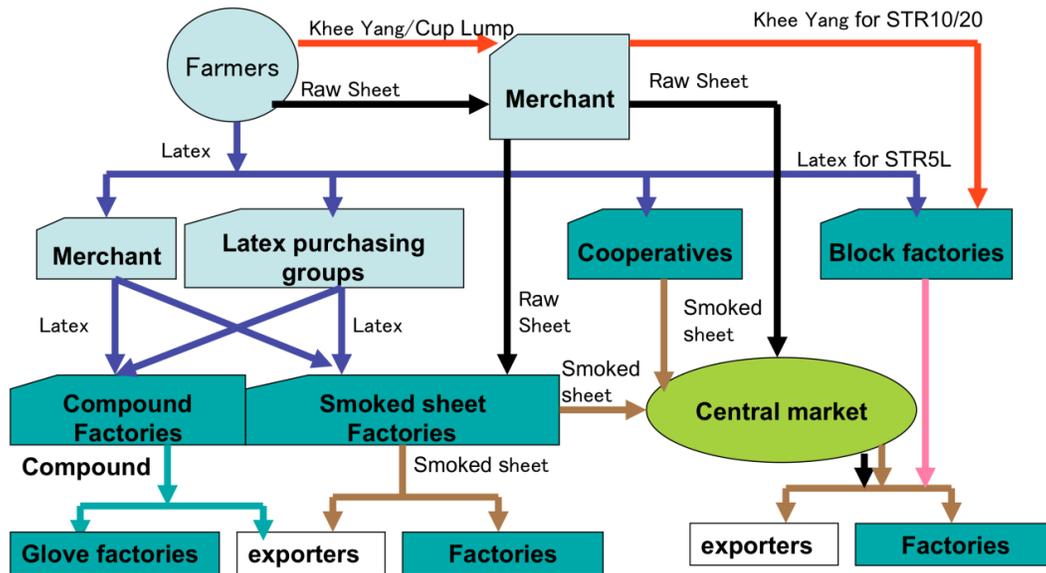


Figure 4. Global Rubber Consumption

<http://unctad.org/infocomm/anglais/rubber/market.htm>

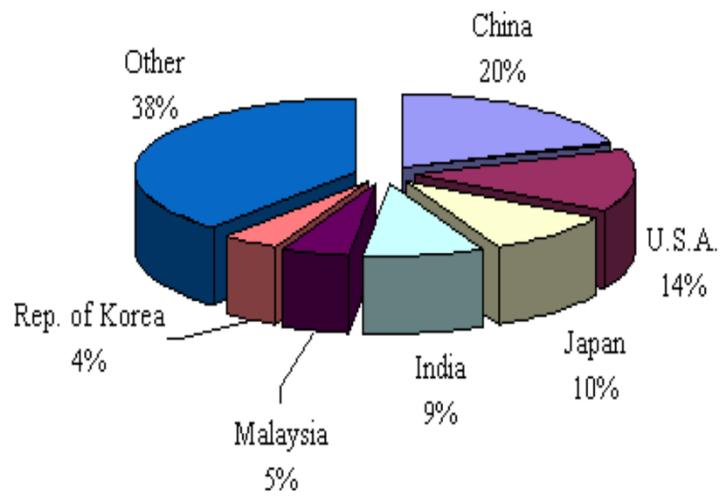
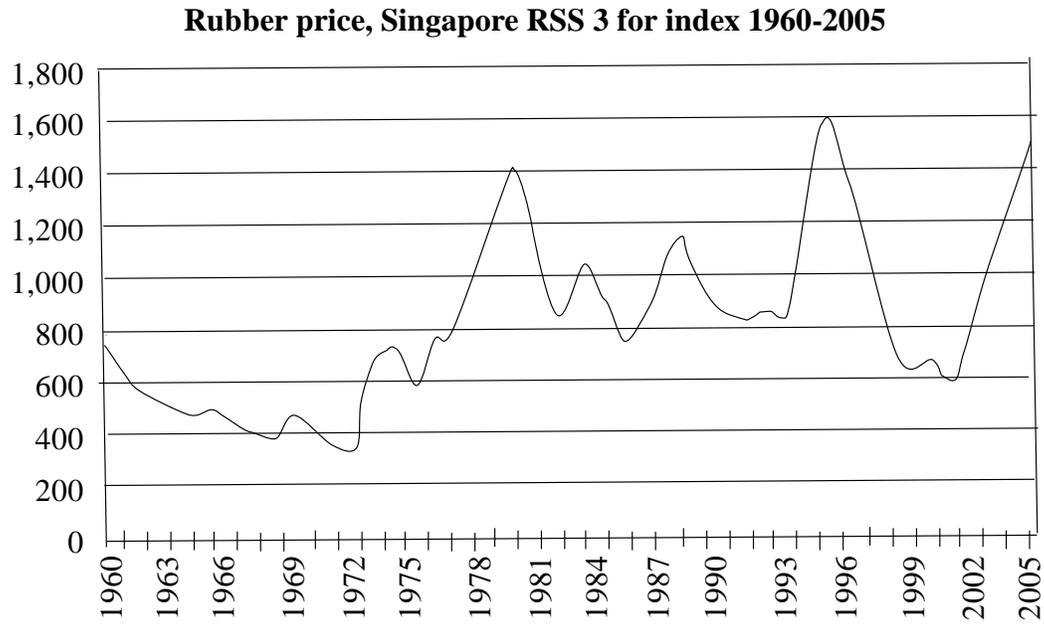


Figure 5 Market Instability

Source : UNCTAD Community Prices Bulletin

Figure 6. Major End Users of Natural Rubber

<http://unctad.org/infocomm/anglais/rubber/uses.htm>

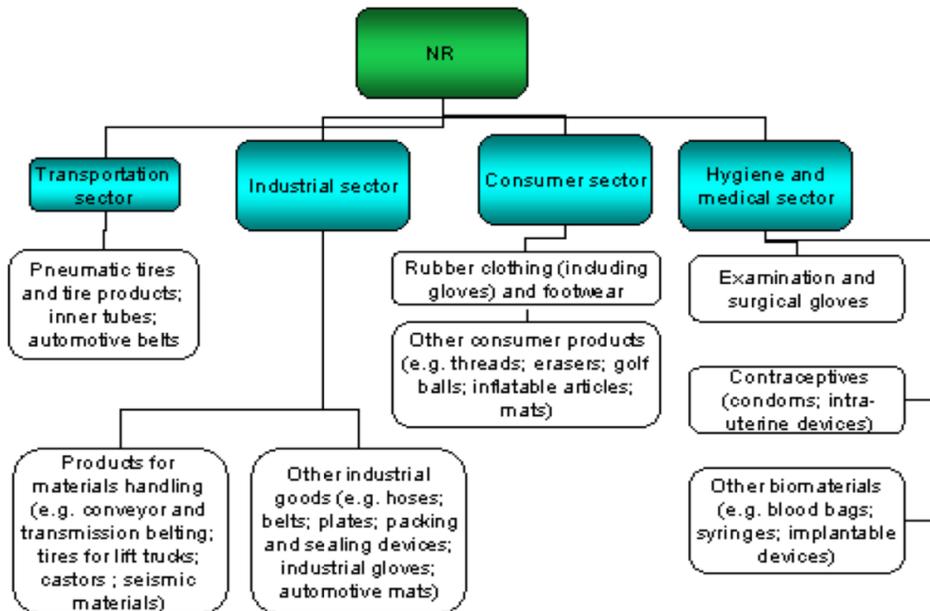
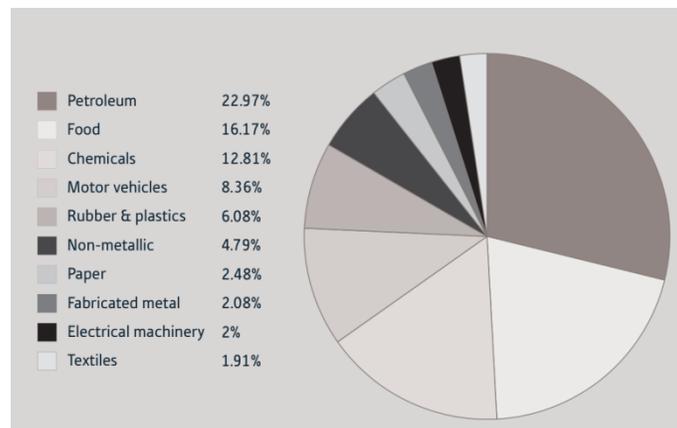


Figure A1 Sectoral Distribution of Firm Research and Development in Thailand, 2009



Source: Oxford Business Group (2011, p. 189).