THE PHILIPPINES

IN THE NATURAL RUBBER GLOBAL VALUE CHAIN

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The Philippines in the Natural Rubber Global Value Chain

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The Philippines in the Natural Rubber Global Value Chain

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Acronyms

5MHRP	5 Million Hectare Reforestation Program (Vietnam)
BPS	Bureau of Philippine Standards
CV	Constant Viscoscity
DA	Department of Agriculture, Philippines
DTI	Department of Trade and Industry, Philippines
EPZ	Export Processing Zone
EU	European Union
FDI	Foreign Direct Investment
FSC	Forest Stewardship Council
ISO	International Standards Organization
M&A	Mergers and Acquisitions
NGO	Non-Governmental Organization
OEM	Original Equipment Manufacturer
PEFC	Programme for Endorsement of Forest Certification
PRIA	Philippine Rubber Industry Association
PRRI	Philippine Rubber Research Institute
RSPO	Roundtable on Sustainable Palm Oil
RSS	Ribbed Smoked Sheet
SICOM	Singapore Commodities Exchange
SNR-I	Sustainable Natural Rubber Initiative
TICOM	Tokyo Commodities Exchange
TSR	Technically Specified Rubber
UNCTAD	United Nations Commission on Trade and Development
USAID	United States Agency for International Development
US	United States
VRC	Vietnam Rubber Company
VRG	Vietnam Rubber Group

Executive Summary

This report uses the Duke CGGC Global Value Chain (GVC) framework to examine the Philippines' position in the global rubber industry and identify opportunities for upgrading for the sector. While the nation is situated in the belt of rubber-producing countries close to the Equator and often ranks among the top 10 exporters of raw or semi-processed rubber, the domestic sector consistently generates the lowest unit value for its exports of any country in the top 15. Furthermore, the industry appears to have undergone economic downgrading in recent years, with businesses that used to process raw rubber into crumb rubber instead sending unprocessed natural rubber—cup lumps—to plants in Malaysia. In 2010, 65% of the Philippines' US$115 million total exports were for Technically Specified Rubber; by 2014, the value of the Philippines' exports of unprocessed or semi-processed rubber was US$77 million, roughly 78% of which was cup lumps.

Producers increasingly ship raw natural rubber abroad because of an uncompetitive domestic processing environment that features high logistics and energy costs as well as an uncertain security situation. Downstream, the Philippines' largest final product categories are motorcycle and automobile tires (US$382 million in exports in 2014) and articles of vulcanized rubber parts such as rubber mats, gaskets and seals (US$76 million). As the Philippines investigates ways to increase its output of higher-value rubber goods, especially in growth sectors such as health products, the challenges associated with production and initial processing will need to be first addressed to enhance the country's competitive position.

The Rubber Global Value Chain

The global rubber industry can be divided into two sub-sectors: natural and synthetic rubber. This report focuses on natural rubber. The GVC can be segmented into five value-adding stages: cultivation, tapping, processing, trading, marketing and distribution. Owing to favorable growing conditions, Southeast Asian nations account for over 90% of the world's output of natural rubber, with Thailand, Indonesia and Vietnam serving as the leading producers and exporters. Tire manufactures are the largest consumers, purchasing as much as 70% of rubber production. While tire demand is tied to automotive growth cycles, rubber demand has increased by approximately 30% since 2000, largely due to its use in medical (latex gloves, condoms) and athletic and apparel equipment (shoes and sporting equipment). These and other trends have led to some industry evolution in recent years, including the following:

- **Production patterns are changing as new players enter the industry**. Over the past 15 years, production has expanded in Southeast Asia and Africa. This was largely in response to the unprecedented high rubber prices in the 2000s—between 2004 and 2013, the total global area under production increased by 35% to 13 million hectares. As these trees have matured, the increased supply has combined with a general collapse of commodity prices to significantly decrease prices. Major production countries such as have responded by trying to control supply on global market and slowing their expansion rates. On the other hand, emerging producers with cheap land and labor resources have continued to ramp up production. Vietnam, for instances, surpassed Malaysia in 2012 to become the world's third largest natural rubber supplier.

- **Fluctuating rubber prices have increasingly led established producers to examine opportunity costs and consider more profitable alternatives.** Palm oil has offered higher margins per hectare, and oil palms only require three years to reach maturity, as opposed to the 5-7 years for rubber. This has motivated Malaysia to shift away from rubber—the leading producer of natural rubber until 1991, Malaysia is now a net importer. Thailand appears to be following a similar path.

- **After long being dominated by smallholders, rubber production is becoming more concentrated and characterized by plantation models**. Rubber in established countries is produced by smallholders, with farmers accounting for 91%, 85% and 93% of the share in Thailand, Indonesia and Malaysia, respectively. Among newcomers such as Vietnam, Cambodia and Laos, smallholders account for less than 35% of production. The plantations in these countries are owned by large-scale public and private investors, which are vertically integrating into processing. Since 2010, three large rubber firms have emerged: von Bundit, Sri Trang Agro-Industry and Halycon Agri.

- **Tire production, the key end market for natural rubber, has shifted from its traditional bases in the developed world to Asia.** Tire manufacturing accounts for the largest share of natural rubber demand. With the strong growth of the automotive sector in developing countries, both in terms of demand and localized production, tire production shifted towards Asia in general, and China in particular.

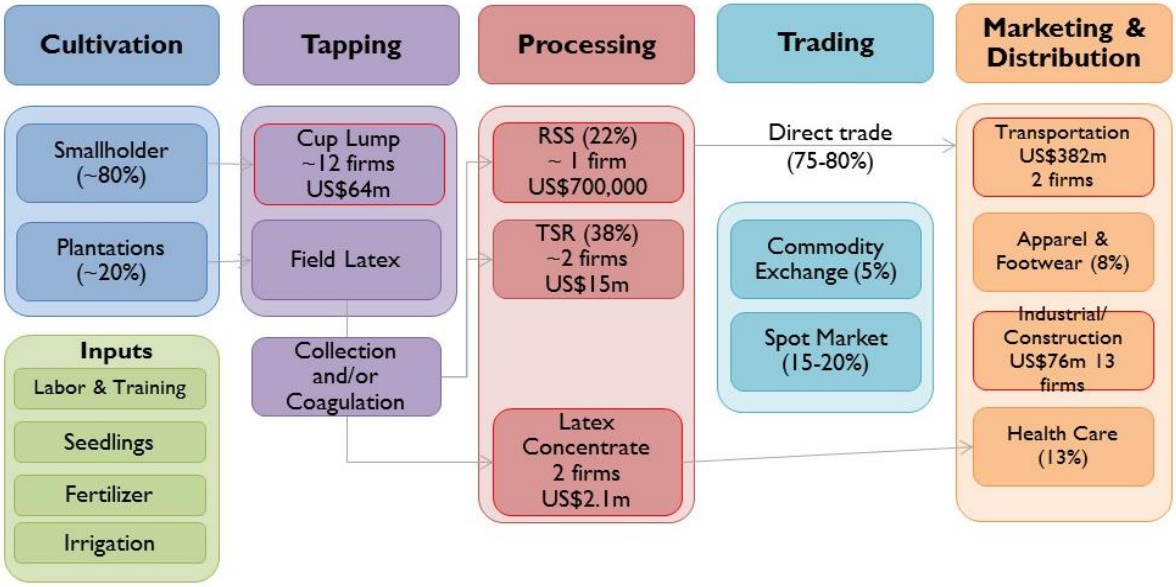
The Philippines in the Rubber GVC

The Philippines' rubber industry is concentrated around a small cluster of firms, most of which are based in Mindanao. While there is a broader network of companies, most of these are oriented toward the domestic market or concentrate primarily on synthetic rubber. No more than 10 or 15 firms across the value chain export natural rubber products in significant volume.

There are three categories of actors that govern the rubber chain in the Philippines: (1) Malaysian traders or processors who are increasingly buying raw natural rubber to maximize use of their installed capacity; (2) Foreign tire companies or traders who purchase processed rubber—usually crumb rubber—that is ultimately sold to tire companies in China, Korea, and other Asian locations; (3) Tire producers or other rubber parts manufacturers with operations in the Philippines. Of the three groups, the Malaysian businesses are the largest buyers, with roughly 60% of the Philippines' total rubber production being exported there.

Inside the Philippines, the major actors have historically been processors. These companies all have well-established connections with companies in the first two categories of lead firms, although that only affords them a modest amount of leverage as their export volumes are small. Domestically, many processors are either integrated backward or have long-standing linkages with land owners, tappers and traders. Although the larger Filipino companies have capabilities across multiple stages of the chain, many are de-emphasizing processing and focusing on larger-scale aggregation and trading of raw or semi-processed rubber. As of 2015, there were 21 processing companies in the country, although only five are ISO certified and export regularly.

Figure E-1. The Philippines in the Rubber GVC



Source: Authors based on PSA and UN Comtrade data.

These characteristics lead to strengths for the Philippines as it pursues upgrading trajectories in the rubber GVC. The advantages include:

1. **Favorable environmental conditions:** The Philippines is in the rubber belt, which describes the zone 10 degrees either north or south of the Equator where countries have temperate, damp climates that are well suited for producing rubber.

2. **Close proximity to major processors and consumers of natural rubber:** ASEAN is the world's preeminent producer and exporter of natural rubber. Four countries—Thailand, Indonesia, Malaysia, and Vietnam—exported roughly 85% of the globe's unprocessed and semi-processed natural rubber in 2014.

3. **Commitment of Yokohama to increase local sourcing:** The Japanese tire manufacturer has pledged to increase its domestic procurement of crumb rubber from 15% in 2012 to 50% in 2017. The company has also engaged local suppliers with extension efforts to improve rubber quality while also providing incentive for domestic businesses to pursue ISO certification.

4. **Engagement of government agencies in the sector:** DTI helped facilitate Yokohama's outreach to the local sector. DTI has also worked to connect buyers and sellers in Zamboanga and has collaborated with the DA to form the Philippine Rubber Technical Working Group. That agency serves an important role by serving as a lead agency in efforts to coordinate initiatives across the sector through its six action teams. Additionally, the DA has initiated capacity building while also launching the Philippine Rubber Research Institute (PRRI) to improve capabilities across the value chain.

At the same time, the Philippines has location-specific impediments that undermine export competitiveness. The most prominent of these include the following:

1. **Inadequate training in production and tapping techniques compromise rubber quality and yields:** While the PRRI and technical working group are significant initial steps to building capacity among farmers, there are misgivings about both the scope and institutional knowledge housed within the organizations. Despite some improvements in quality, Filipino processors still receive reduced prices for semi-processed rubber because of concerns about contaminated outputs.

2. **Access to higher-quality seedlings and appropriate fertilizers is constrained:** The Department of Environment and Natural Resources (DENR) has helped establish 27 nurseries in the country that are accredited by the Bureau of Plant Industries. However, stakeholders reported that the nursery seedlings are often of low quality with longer maturation periods, which confirms previous observations offered by agricultural experts.

3. **Cost prohibitive processing environment:** The shift in the Philippines' trading profile from the export to Malaysia of crumb rubber to cup lumps reinforces the challenges faced by domestic processors. The Philippines' energy costs are among the highest in the region, and domestic infrastructure and security considerations in Mindanao add costs.

4. **Low levels of ISO certification:** There are only five processors in the Philippines that have ISO certification. The international standard is an important prerequisite for crumb rubber and other intermediate rubber processors to integrate into supply chains of large-scale final product manufacturers. The Philippines' rubber industry has made progress in adhering to international standards in recent years, with the Land Bank of the Philippines and the Department of Science and Technology (DOST) supporting renovations at processing facilities for two more companies. However, overall enthusiasm for pursuing ISO accreditation remains low.

5. **Political and security instability in Mindanao:** The rubber industry has been a target of the attacks that impairs Mindanao's broader economic development. In 2013, the New People's Army burned Standeco's rubber processing plant in North Cotabato, killing one worker. The security risks make it difficult for private actors to secure loans.

6. **Communication gaps among industry stakeholders:** Communication between industry stakeholders could be enhanced in at least three respects: 1) Between government offices; 2) Between individual government offices and private sector actors: 3) Between private sector actors at different segments of the value chain. Between government offices, there does not appear to be a coordinated response to many of the industry's challenges. DTI is performing extension and matchmaking services for producers, traders and processors that might appear to fall under the purview of the DA. Between individual government offices and the private sector, there is sometimes a mismatch in priorities, with business officials indicating that many of the government's

outreach efforts being ill-suited to the rubber industry. Between different segments of the value chain, there appears to be trust deficits as well as failure to communicate market signals, most notably between traders and intermediate processors or between final product manufacturers and intermediate processors.

7. **Distance between EPZs in Mindanao and rubber production hubs.** The incentives offered by BOI and PEZA can serve as a significant tool for recruiting FDI. While there are EPZs on the island, most are concentrated close to Davao or Cagayan de Oro. The Zamboanga peninsula, which produces roughly 43% of the country's rubber, is particularly underrepresented.

These constraints restrict the country's possible upgrading trajectories. Most immediately, the Philippines' relatively low of levels of rubber production, its uncompetitive processing environment and its quality control issues should be addresses. The upgrading trajectories presented in Table E-1 offer the most immediate opportunities.

Table E-1. The Philippines and the Rubber GVC: Upgrading Trajectories

Time Frame	Upgrading Trajectory	Key Benefits	Philippines Challenges
Short Term	**Product and Process Upgrading in Production, Harvest and Post-Harvest Activities**	• Improves quality of Filipino rubber, and increase in unit price • Provides inputs for downstream processors and final goods manufacturers • Increase local value add in production	• Lowest-unit value for its output compared to regional peers • Insufficient use of high-yielding and fast maturing rubber varieties • Low levels of human capital (poor tapping practices, ineffective use of fertilizer, contamination of rubber)
Short to Medium Term	**Process Upgrading in Processing Activities**	• Improve quality of outputs that can be exported or used as inputs for domestic processors • Expand higher-value operations in the Philippines • Offer employment opportunities in less-developed regions of the Philippines	• Low levels of ISO certification • High costs of energy • Challenging logistics and infrastructure environment • Security in Mindanao • Entrenched structural advantages in regional competitors (Malaysia in particular)
Short to Medium Term	**Product Diversification in Final Product Manufacturing**	• Possibly increase backward linkages to rubber producers • Diversify export portfolio • Reinforce other government's public health initiatives (condoms, rubber gloves)	• Difficult competitive environment for processors (logistics, infrastructure, etc.) • Limited domestic supply of high-quality rubber • Competition from regional peers with strong domestic bases of production and initial processing

Source: Authors.

1. Introduction

Although in close geographic proximity to many of the most significant actors in the natural rubber value chain, the Philippines' stands apart from its neighbors in the industry. Hampered by security challenges in its main production region, high energy and transport costs, and industry skepticism about the quality of its outputs, the country's exports in upstream segments of the chain are concentrated in low-value activities. The value of its semi-processed rubber exports has plunged in recent years, with the Philippines increasingly exporting raw rubber to Malaysia. Downstream, the Philippines' largest product category is motorcycle and automobile tires—the country exported US$382 million worth of new tires in 2014. Yet challenges associated with upstream production and initial processing prevents the country from integrating its agribusiness chain for the production of final rubber products and downstream manufacturers rely heavily on imported inputs.

While these shortcomings have constrained the industry development, there are reasons to explore the potential of the sector. With its epicenter in the ASEAN region, the global natural rubber industry has experienced significant growth in the past 15 years. Much of this has been driven by favorable dynamics surrounding two of the industries that are rubber's largest consumers: automotive and healthcare.[1] In light of this environment, policymakers have in turn been attracted by the job opportunities in the labor-intensive sector, where year-round production has been seen an important rural employment generator that can provide income-smoothing alternatives for families in agriculture (Fox & Castella, 2013). At the same time, a dependable supply of quality natural rubber can provide downstream opportunities for manufacturing industries that serve the automotive, healthcare, apparel or industrial sectors.

The objective of this report is to identify potential upgrading paths into the Philippines' industry as policymakers attempt to reinvigorate the industry. But while there are opportunities, there are both global and local headwinds that must be navigated for the Philippines to successfully enter and upgrade within the chain.

The most immediate challenges are associated with some of the features that make the industry enticing to countries such as the Philippines—Southeast Asia's position as the worldwide hub for natural rubber. Together, Thailand, Indonesia, Vietnam and Malaysia account for 76% of global production. These four countries have extensive experience in the sector and high degrees of installed capacity in processing all natural rubber varieties. Moreover, they have also established strong positions in several downstream segments of the chain, including healthcare & apparel (Malaysia and Thailand) and tires (Vietnam, Thailand). With newcomer countries such as Cambodia, Laos and Myanmar mimicking their more established regional peers and establishing rubber operations, the size of plantations has swelled by approximately 40% since the turn of the century (Jumpasut, 2014). Although demand for rubber products remains strong—raising per global per capita consumption of rubber from 3kg to 4kg since 2000 (Jumpasut, 2014)—the ensuing flood of supply has caused prices to plummet. With a lag time as long as seven or eight years between planting and maturation, this situation is unlikely to recede

[1] Rising incomes have boosted worldwide demand for cars, while increased awareness of the benefits of protection in health have increased demand for condoms and latex gloves.

in the near future as plantations spurred by the global bull market in the late 2000s and early 2010s come online.

This paper uses the Global Value Chain (GVC) framework to assist the Philippines' government in its efforts to support rubber stakeholders. It provides analysis of important trends in the global industry, assesses the Philippines' current position in the chain and identifies opportunities to strengthen this position through upgrading to pursue economic development, especially in rural areas.[2] The report is structured as follows: First, an overview of the rubber GVC is presented to provide a clear understanding of the scope of the industry, how markets are structured and how changing distribution of demand and supply can alter the dynamics of the industry. These factors provide useful context for the next section of the report, which focuses on the Philippines' position in the chain. After a discussion of trading patterns, the domestic industry organization, and advantages and constraints associated with the local sector, the paper then offers two comparative cases—Vietnam and Sri Lanka—to derive lessons for the Philippines. It then closes by outlining upgrading trajectories for the country.

2. The Natural Rubber Global Value Chain

The global rubber industry spans agricultural, extractive and manufacturing sectors. The industry can be divided into two sub-sectors: natural and synthetic rubber. Natural rubber is harvested by scraping or cutting the Hevea brasiliensis trees that are typically found in developing countries in temperate regions close to the Equator. Synthetic rubber, on the other hand, is a derivative of the petrochemical industry and comes primarily from developed countries (The Rubber Economist, 2016; UNCTAD, 2015).

Although often treated synonymously, synthetic and natural rubber are close but not perfect substitutes (Marketline, 2015). Owing to different properties and performance characteristics, manufacturers of final products will often develop preferences based on cost, performance requirements and factory capabilities (Jumpasut, 2015a).[3] There are, however, some products that will mix both varieties, with automotive tires being a notable example. Overall, 60-70% of all rubber consumed globally is synthetic (Accenture, 2014).

This report focuses specifically on the natural rubber industry, with a focus on the agricultural and processing stages of the chain as well as a discussion of major outputs. Given its favorable environmental conditions, Southeast Asian nations are particularly suited toward rubber production; in 2015, the region accounted for over 90% of world output of natural rubber, with Thailand, Indonesia and Vietnam serving as the leading global producers.

[2] GVC analysis examines the full range of activities that firms and workers around the world perform to bring a product from conception through production and end use. As part of this analysis, multiple factors are considered; trade patterns, end markets, product characteristics, technology-intensity, labor, standards and regulations, among others. This information is analyzed from a global perspective and from the view point of the Philippines and peers in order to provide a holistic picture of the situation when identifying trajectories for entry, growth and upgrading along that chain.

[3] For example, products that require very high heat resistance, such as tires for industrial, agricultural and commercial vehicles, are more likely to use higher content of natural rubber than synthetic rubber (Freedonia, 2015).

Tire manufactures are the most important consumer of natural rubber, absorbing 70% of production (Accenture, 2014). This makes demand highly sensitive to economic cycles, as both new cars and replacement tires are large ticket items and often postponed during down periods (Sturgeon et al., 2016). Beyond tires, rubber is used for a variety of medical, athletic and apparel equipment, including gloves, condoms, shoes, sporting equipment and other items. Buoyed by the broad basket of final goods, consumption of global rubber has increased by approximately 30% since 2000, approximately half of which is natural rubber (Jumpasut, 2014).

2.1 Current Trends in the Global Rubber Industry

While some of the major characteristics of the industry such as Southeast Asia's preeminence and the strong relationship with tire producers have been entrenched for some time, several trends have shaped the industry in recent years in both the agricultural and manufacturing stages of the chain. The most significant of these are outlined below.

Production patterns are changing as new players enter the industry, and older more established locations draw back. Over the past 15 years, production has expanded in a number of countries in major production regions in Southeast Asia and Africa. This was largely in response to the unprecedented high rubber prices in the 2000s. Between 2004-2013, the total area under production increased by 35% to 13 million hectares (Jumpasut, 2014). Growth was driven by traditional producers as well as new producers; global leader Thailand expanded plantations by 1 million ha,[4] Indonesia undertook a major drive to improve productivity, India launched a major replanting program and China increased its production by 50% through supportive policies (Accenture, 2014).

As these trees have matured, the increased rubber supply has combined with a softening of global demand and a general collapse of commodity prices to significantly push down prices (see Figure 1, Box 1). Responses to this have varied; major traditional producers Indonesia (3.1million hectares), Thailand (4.1m) and Malaysia (0.8m have tried to control supply on the global market and have slowed their expansion rates (Accenture, 2014). However, emerging producers with cheap land and labour resources as well as optimal growing conditions that keep them profitable even at low prices have continued to ramp up production. Examples include Vietnam, which almost doubled its plantations during the 2004-2013 period (94% increase), Cambodia, which increased production five-fold, and Laos, which entered the sector with 250,000 ha of rubber trees (Jumpasut, 2014). This is contributing to a slow, but overall shift in the production patterns. Although a relative newcomer to the industry, Vietnam surpassed Malaysia in 2012 to become the world's third largest natural rubber supplier.

Fluctuating rubber prices since 2011 (see Box 1) have increasingly led individual producers to examine opportunity costs of rubber production and consider other more profitable alternatives. The uncertainty of the commodity market, combined with the boom of palm oil in recent years has pushed producers to consider removing rubber trees in favour of palm. Palm oil has recently been offering higher margins per hectare, and oil palms only

[4] Between 2000 and 2007, the Thai government actively encouraged smallholders in the south of the country to plant rubber trees. This resulted in a 30% increase in output between 2008 and 2013 as those trees matured and began to produce latex (Accenture, 2014).

require three years, as opposed to 5-7 years to reach maturity for rubber (Accenture, 2014).[5] This tendency has been seen in Malaysia, in particular (Fox & Castella, 2013). In addition, the country has seen a more general shift away from agriculture in favour of re-zoning land for urban and recreational use has resulted in a decline in the land dedicated to production (Weerathamrongsak & Wongsurawat, 2013). The leading producer of natural rubber until 1991, Malaysia is now a net-importer (Accenture, 2014; Jumpasut, 2014; UN Comtrade, 2016). Thailand appears to be following a similar path; as a result of poor returns on rubber in 2012-2014, the government encouraged famers to convert a portion of rubber production to oil palms, in order to eliminate some 350,000 rubber trees (Tan, 2014).[6]

Rubber production has long been highly fragmented and dominated by smallholders and small factories; however, the expansion into new growing countries has been mostly on plantations owned by large processors. In traditional growing countries, rubber is produced by smallholders, with the share accounting for 90.5%, 85% and 93% in Thailand, Indonesia and Malaysia respectively. Amongst newcomers, Vietnam, Cambodia and Laos, smallholders account for less than 35% of production (Fox & Castella, 2013). Plantations are owned by large-scale public and private investors, which are vertically integrating downstream into processing operations, as they benefit from economies of scale. Processors are also consolidating and integrating upstream into production plantations to increase competitiveness. Since 2010, three very large rubber firms have emerged, von Bundit, Sri Trang Agro-Industry and Halycon Agri.[7] Together, in 2015, these three firms had an annual capacity of close to 5 million tons of semi-processed rubber (Halcyon Agri, 2015a; Sri Trang, 2016), the equivalent to approximately half of globally traded natural rubber (Accenture, 2014).[8]

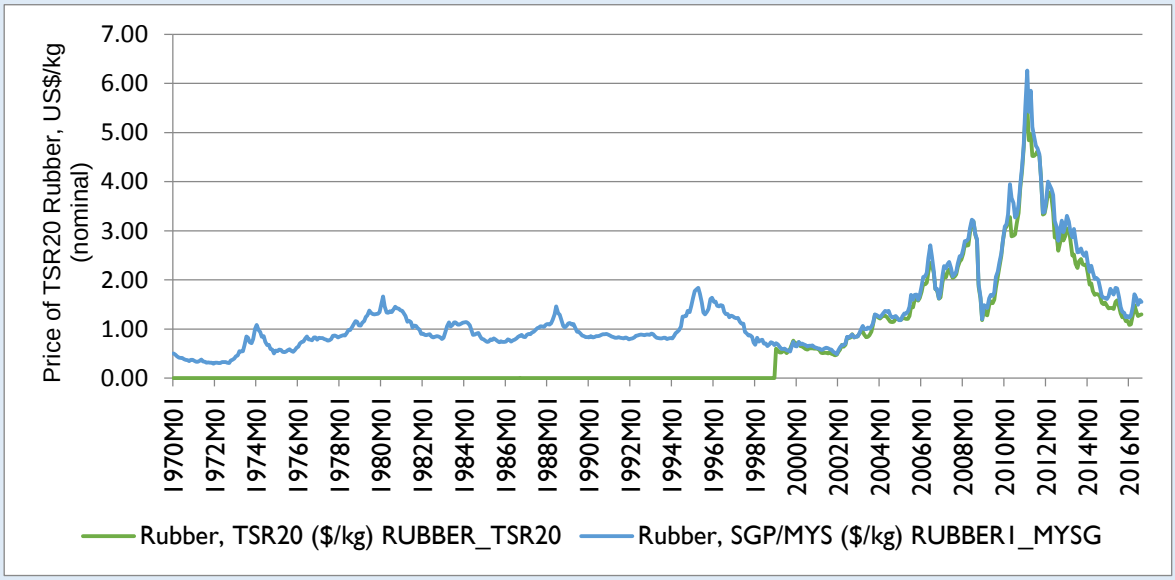
Tire production, the key end market for natural rubber, has shifted from its traditional bases in the developed world to Asia. Tire manufacturing accounts for the largest share of natural rubber demand, absorbing approximately 70% of the global supply (Accenture, 2014). With the strong growth of the automotive sector in developing countries, both in terms of demand and localized production (Sturgeon et al., 2016), tire production shifted towards Asia in general, and China in particular. As a result, since 2000, growth in the rubber industry, in general, has been dictated by China (Jumpasut, 2014). Chinese investors are also increasingly playing an important role in the industry; ChemChina, for example, purchased Italian tire manufacturer Pirelli, a leading global firm, in 2015 (Pirelli, 2016).

[5] New rubber varieties can shorten the maturation time to 3-6 years, in some cases (Field Research, 2016).
[6] In order to encourage producers to shift out of rubber production, in 2011, the government began offering producers grants for cutting down rubber trees; by 2014, they had increased this 30% to US$655 for every 1,600 square meters of cleared rubber plantation.
[7] These three firms have developed their bases largely through mergers and acquisitions (M&A). For example, Halycon Agri recently merged with Sinochem gaining access to the company's already large rubber production operations (CID, 2016).
[8] Mitsui & Co have also moved into the plantation business (Mitsui & Co, 2015).

Box 1. Fluctuations in the Global Natural Rubber Price

The global price of rubber has varied substantially over the past decade and a half, from a low of US$0.50/kg at the turn of the century to a peak of close to US$6/kg in 2011 (see Figure 1). While price fluctuations have been common over the past half-century, those of the past decade have been significantly more extreme, with unprecedented high prices—as much as double previous high prices when adjusted for inflation. This has made it increasingly difficult both for governments to set effective policy mechanisms in place for the sustainable growth of the industry as well as individual firms and farmers engaged in the sector. The recent high prices have made the sector attractive, but this volatility is highly concerning for those developing countries reliant on export earnings and employment in the rubber sector, particularly those where smallholders, with little in terms of support or savings, contribute the majority of production.

Figure 1. Price of TSR 20 Rubber, 1970-2016



Source: (World Bank, 2016)

Fluctuations have been attributed to a number of different factors; these include commodities speculation driven by the rising demand from China and other emerging economies; concerns about demand and supply fundamentals in response to demand in the global automobile industry (EIU, 2016); aggressive responses from developing country governments eager to tap into the potential high returns from the industry; as well as price manipulation by major buyers and suppliers on illiquid commodity exchanges, amongst others (Accenture, 2014; Jumpasut, 2014). Countries seeking to expand their production in the natural rubber market should be mindful of these factors as they set policy.

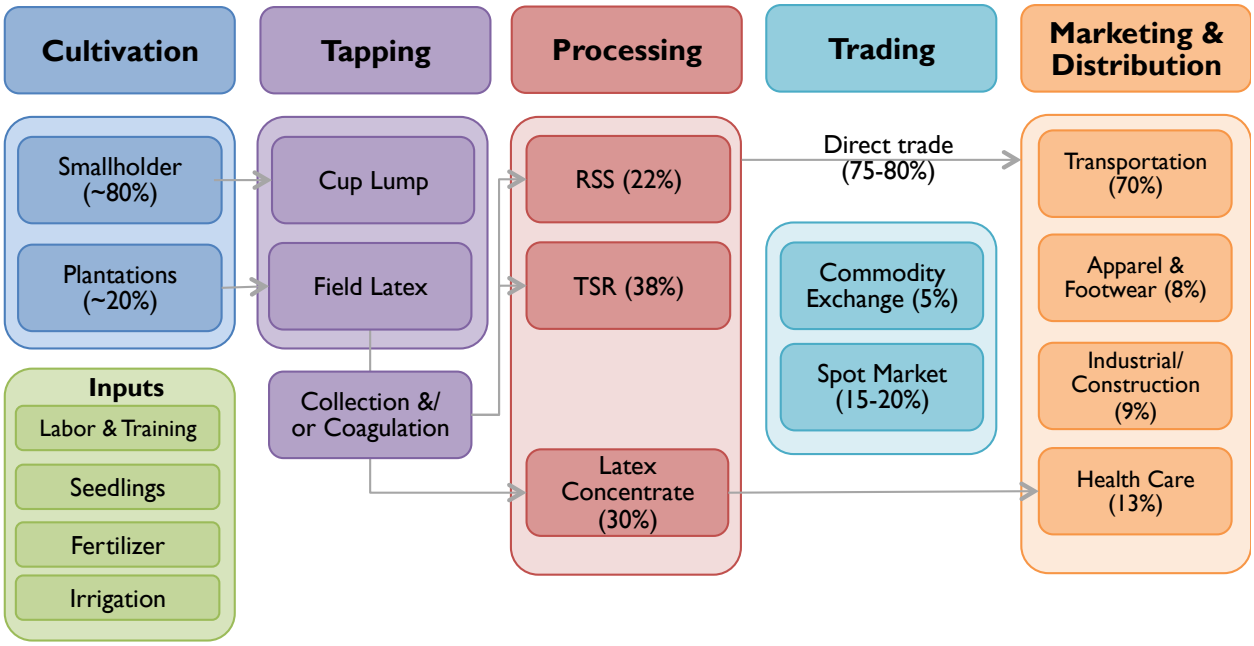
Tire producers, the leading consumers of rubber in the world, are increasingly looking for more sustainable alternatives. High prices, volatility in supply and growing awareness of the role of rubber plantations in deforestation has highlighted sustainability concerns in the industry. This has manifested itself with several firms looking for alternative sources of rubber, such as Continental and Pirelli's research on the use of guayule rubber (Continental, 2016; Pirelli, 2016). It has also led to the establishment of a new voluntary standard, the Sustainable

Natural Rubber Initiative, led by the International Rubber Study Group in Singapore (SNR-I, 2016). This initiative is very similar to the Roundtable on Sustainable Palm Oil (RSPO), comprised of both producers and consumers committed to reducing the environmental impact of rubber and tire production.

2.2 Mapping the Natural Rubber Global Value Chain

The natural rubber GVC is relatively short, with only a few major processing activities adding value in the post-production phase before the natural rubber is sold on to its final market. The GVC can be segmented into five value-adding stages: cultivation, tapping, processing, trading, marketing and distribution. Figure 2 illustrates these main stages of the chain, followed by a discussion of what each stage in the chain entails.

Figure 2. Natural Rubber Global Value Chain



Source: Authors; statistics based on (Accenture, 2014) and (Fox & Castella, 2013).

Cultivation: Latex is produced from the *Hevea brasiliensis* rubber tree, native to the Amazon region but now widely found in tropical regions in Asia and Western Africa. After planting, trees take a period of 5-7 years to mature (Halcyon Agri, 2015a; Rodrigo et al., 2005) and remain productive for up to 30 years (Marimin et al., 2014). In the long immature period, intercropping can be used with other crops such as banana and pineapple, helping to provide producers with income (Rodrigo et al., 2005).[9] Weeding and clearing is the most labor-intensive process required during this period. Historically grown on large plantations, rubber cultivation shifted towards primarily smallholders operations in the 1970s and 1980s (Fox & Castella,

[9] In order to maximize yields, a maximum threshold of some 600 trees/ha is recommended (Snoeck et al., 2013).

2013). In recent years, however, this trend has begun to reverse, with large plantation owners expanding much more rapidly than smallholders (Craymer, 2016).

Tapping: This stage involves 'tapping' the tree, or slicing the outer layer of bark to allow the latex to run freely. The latex collected is then transferred to collecting centers where it is filtered for dirt and clotted latex and temporarily preserved for further processing. Unprocessed latex left in the tapper's cup coagulates and is known as **'cup lump'**.[10] Tapping is a particularly labor intensive stage of the chain. It is carried out year-round and must be performed early in the morning (5am-8am) to maximize yields.[11] Land or tree owners may or may not engage in tapping activities; alternatives models include leasing trees to tappers, hiring external labor, or leaving the trees without production. Tappers either work as intermediaries, selling on their product to production facilities, or they work on behalf of the factories.

Processing: Latex is typically processed into one of the three major semi-processed product groups: 1) latex concentrate and pale crepe; 2) Technically Specified Rubber (TSR), and 3) Ribbed Smoked Sheet (RSS) (see Box 2).[12] The output depends on the process employed. The production of latex concentrate involves addition of ammonia and/or other preservatives and centrifugal spinning. The production of TSR involves coagulation and granulation, followed by cleaning, blending, washing and drying of the rubber before it is pressed into bales. RSS involves a similar process, although latex is diluted with water and coagulated using chemicals prior to being rolled, dried and smoked (Accenture, 2014). Processing facilities are generally located close to the latex production to reduce transportation costs and secure access to raw materials (Weerathamrongsak & Wongsurawat, 2013); however, they can be geographically separated. For example, cup lump can be exported without further processing, although high water content reduces the economic efficiency of doing so (Field Research, 2016). This node of the value chain has traditionally been relatively fragmented, with smaller domestically owned factories operating in rural areas in each of the producing countries.

Once processed, natural rubber in block or sheet form (TSR/RSS) can be stored for between three and seven years, provided certain temperature and humidity conditions are maintained. Variations in either can result in mouldy or crystalized rubber. Latex concentrate, on the other hand, has a much shorter shelf life and can be stored between six and 12 months. Nonetheless, storage and related-insurance costs are expensive, amounting to as high as 1% of the market price per month. Furthermore, rubber under 12 months old is considered to be premium rubber and earns a higher price. Thus, while rubber is physically well suited to stockpiling, which allows for a certain degree of price smoothing for both buyers and suppliers, high costs mean that inventories play only a short term role in affecting prices (Accenture, 2014).

[10] Latex may also be coagulated using acids or fruit juice, which is not uncommon amongst smallholders who cannot deliver the latex to a processing operation before it coagulates. The quality of this latex coagulae (sometimes referred to as 'smallholders latex' differs somewhat from 'cup lump', that is, latex which has been left to coagulate by itself in the tapper's cup and thus has fewer contaminants (Field Research, 2016).
[11] There is a short 'wintering' period of 6-8 weeks.
[12] Other alternatives also exist in each rubber processing country. However, these are the most commonly used categorizations in international trade of natural rubber.

Box 2. Types of Semi-Processed Natural Rubber

While often referred to as an undifferentiated commodity, the natural rubber market is comprised of a number of distinct product types, which vary in processing methods and have different end uses. There are three primary product groups: **Latex concentrate and pale crepe, Technically Specified Rubber (TSR) and Ribbed Smoked Sheets (RSS),** accounting for approximately 40%, 38% and 22% of the market respectively (Accenture, 2014). Latex concentrate is primarily used in the production of medical and consumer products, such as condoms, surgical gloves, bottle teats, etc. TSR and RSS products are typically used in the transportation, manufacturing, and apparel products segments. TSR is often called crumb rubber (Field Research, 2016). Specific use of these products depends on the grade of rubber, which is determined by rubber viscosity, contaminants and nitrogen content, amongst others. Table 1 details the different characteristics of these rubber grades and their main end uses.

Table 1. Natural Rubber Grades and Applications

Product Group	Type/Grade	Processing	Traded Formats	Primary Applications
Latex Concentrates & Pale Crepe	Preserved Latex Concentrates: High ammonia (HA); Low ammonia (LATZ)	Fresh liquid latex is centrifuged, and preserved with ammonia. A second staging of centrifuging improves quality.	Tanks; 205kg drums, flexibags	Contraceptives, surgical dipped goods, rubber threads, balloons
	Pale Crepe	Fresh liquid latex, deliberately coagulated, bleached, and milled	25 kg bales	Medical sundries, footwear, cements, adhesives
Technically Specified Rubber	TSR CV: Constant viscosity from latex			Tyres, engineering components, extruded and calendared products.
	TSR L: Light coloured from latex high quality, light coloured rubber.			Light colored products, feeding bottle teats, large industrial rollers, paper and printing industry; injection bottle caps, syringe heads, transparent items.
	TSR 5: Equivalent to 1 RSS from sheets	Coagulated latex, granulated, cleaned, blended and dried	33.3kg bales (35kg+/-5%), Shrink wrapped.	Conveyor belts, cycle tubes, engine mountings, footwear etc. Molded and extruded items like auto components, bridge bearings, rubber linings etc.
	TSR 10: Field grade material			Inner tubes, conveyor belts, footwear, water proofing materials, hoses and tubes.
	TSR 20: Base field grade material			All types of automobile tyres, re-treading materials, mats and other general rubber product
	TSR 50			Less costlier non-critical

				applications like hand made hose, footwear, mats and molded goods.
Ribbed Smoked Sheets	RSS 1 RSS 2 RSS 3 RSS 4 RSS 5	Coagulated rubber sheets, completely dried using smoke.		Industrial sector when extra tough rubber is needed ; RSS are used when extra tough (due to extensive cross linking) rubber is needed. Some applications are tires, tank liners, industrial products, etc.

Source: (Indian Rubber Board, 2016; PRDP, 2014)

The TSR scheme was developed over the last twenty years to allow natural rubber to be traded more easily alongside synthetic rubber. Previously, each country categorized their rubber output according to domestic standards. Specifications for this scheme were established by the International Standards Organization (ISO), with detailed requirements regarding dirt, water and nitrogen content amongst others and are regularly revised. However, each rubber producing country is responsible for establishing its own rubber standard and aligning this with the ISO standard. Indonesia, Malaysia, Thai and Indian Standard Rubber are relatively well-known standards on the global markets. Other smaller producing countries, such as the Philippines, have standards that are less well recognized abroad.

Trading: Natural rubber is primarily sold through bilateral contracts between processors and buyers in the final end-markets;[13] however, a small portion is sold through either the spot market or through two main commodity exchanges in Singapore (SICOM) and Tokyo (TOCOM).[14] These respective trade channels account for 75-80% (bilateral), 15-20% (spot) and 5% (commodity exchange) of global trade in natural rubber. Bilateral contracts are structured with specific price, delivery and quality requirements; price is increasingly indexed to the trading price on the SICOM in US dollars (Accenture, 2014). While buyers use all three channels to manage risk, long-term bilateral contracts are typically preferred for the original equipment manufacturer (OEM) tire business—that is, for car factories, where lead times are longer and buyers must guarantee access to inputs; while those serving the aftermarket (replacement tires) with short lead times tend more towards the spot market reducing inventory costs (Marketline, 2015). There are only a small number of traders (<50) operating in the commodity exchanges; these include tire manufacturers trading on their own behalf, larger processors, specialized rubber traders[15] and commodity traders (Accenture, 2014).

Marketing and Distribution: There are four primary end markets for natural rubber: transportation, healthcare, industrial/construction and apparel & footwear products. The transportation segment is the most significant of these, accounting for an estimated 70% of market demand. This, in turn, is dominated by tire production for the automotive sector, although the aerospace and agriculture industries also demand tires. This segment draws primarily on TSR10, TSR20 and RSS3 product grades (Accenture, 2014; Marketline, 2015). The market is further subdivided by vehicle type and the OEM and aftermarket (Freedonia, 2015;

[13] This reflects the historical relationship between buyers and producers.
[14] TOCOM mainly trades RSS3 while SICOM trades principally TSR20.
[15] Small processors tend to trade through specialty or commodity traders (Weerathamrongsak & Wongsurawat, 2013).

Marketline, 2015). Of these, the automobile aftermarket is the largest globally, accounting for 50% of tire sales by volume (Marketline, 2015).[16]

The healthcare market, on the other hand, draws primarily on latex concentrate, pale crepe and TSR L and TSR CV grades. This accounts for an estimated 13% of the natural rubber market share (Accenture, 2014). Demand for contraceptives and examination, surgical and cleanroom gloves has increased significantly over the past three decades with growing awareness of HIV/AIDS and improved safety protocols to prevent the spread of disease (Jumpasut, 2015b). This market segment is much less vulnerable to economic shocks than the automotive sector, making it an attractive alternative.[17] Other major end markets include apparel products (8%), such as footwear and rubberized protective clothing, and industrial/construction (9%) including conveyer belts, mouldings and linings.

Manufacturing firms typically do not operate in multiple final product categories, although there may be some overlap between tires companies and those producing outputs for the industrial sector. Rubber producers that have upgraded into final products manufacturing are the most likely to produce across more than one end market, but these actors typically do not engage in the transportation market segment as it is capital intensive and has high barriers to entry.[18] Buyers typically take ownership of rubber prior to shipping; shipping is done on a just-in-time basis for manufacturing in containers or bulk. Although rubber is increasingly being shipped via container, allowing for increased efficiencies, it also continues to be shipped in bulk, in specialized cargo ships still (Bonney, 2016).

2.3 Global Trade in the Natural Rubber Global Value Chain

Trade in natural rubber mostly takes place in three stages of the chain, unprocessed (cup lump), semi-processed (TSR, RSS and Latex concentrate) and final products. Natural rubber is a highly concentrated industry with most production and consumption occurring in a small number of countries in Asia. With its high number of tire and automotive manufacturers, China then plays a central role driving demand.

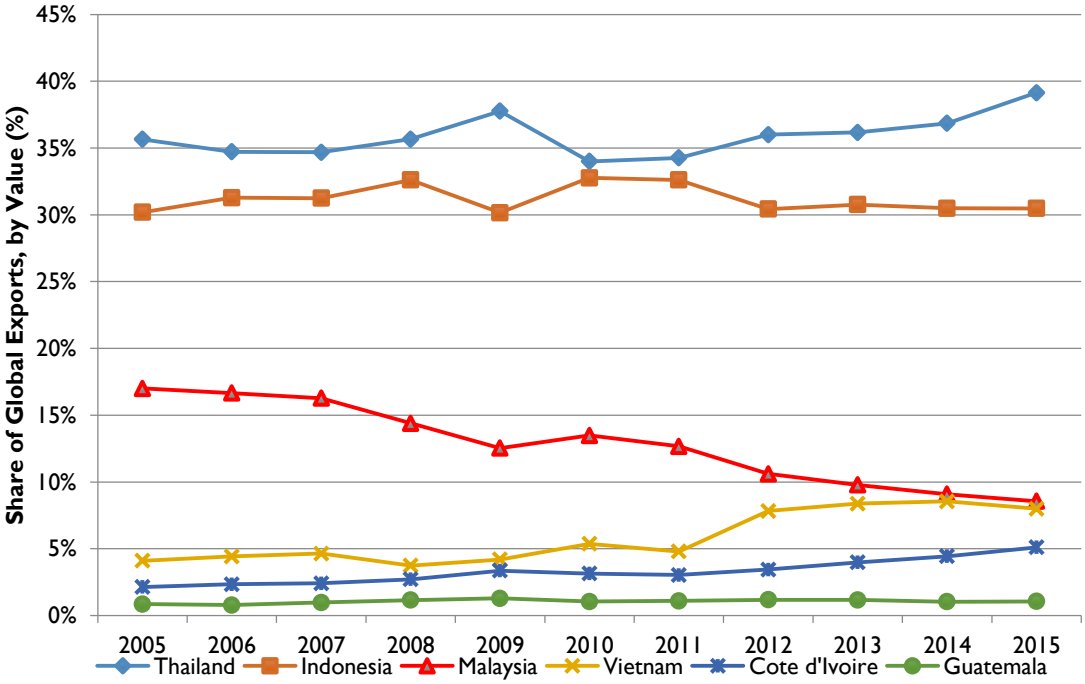
The concentration of production and consumption has accelerated over the past decade, with former developed country markets becoming less significant to the industry as they are replaced by emerging markets. Tire manufacturers have supported this trend by shifting production locations to sites that have lower human capital costs and provide access to new markets. While this trend is apparent in the trade data, the most pronounced shift in the production of final goods is concentrated in a small handful of countries and product categories where low barriers to entry facilitate upgrading (apparel goods and healthcare products are examples).

[16] Demand is driven by new car sales plus the number of cars on the road (Freedonia, 2015); mature markets thus are dominated by the aftermarket segment which can be as high as 80%, whereas in the newer markets, the OEM markets is typically stronger (UNCTAD, 2015).
[17] However, in recent years, there has been an increase in the substitution of nitrile gloves over latex gloves (Top Glove, 2016)
[18] Tire manufacturers may engage in upstream segments to ensure access to raw materials.

The following section outlines the most pronounced trends in global trade. Due to the volatility of prices in the market, much of the analysis of leading markets focuses on volume.

Natural rubber production is concentrated in a very small number of developing countries in Asia, most of which are net exporters of semi-processed rubber (e.g. latex, TSS etc). Roughly 87% of global rubber in 2015 was produced in the ASEAN region, with the remainder coming from a few select countries in West Africa (Cote D'Ivoire), Brazil and Central America (Guatemala) (Jumpasut, 2015b). The largest producers are Thailand and Indonesia, which together account for 62% of total output (see Table A-2). In most of the countries, the rubber industry is export oriented, although China, India and Brazil provide an exception. Five countries (Thailand, Indonesia, Malaysia, Vietnam and Cote D'Ivoire) have dominated exports over the past decade (2005-2015), accounting for 89% and 90% of the value and volume respectively (UN Comtrade, 2016) (see Figure 3). During the past decade, a number of new actors have increased their output, the most significant of which has been Vietnam, which has doubled its market share to 8% during.

Figure 3. Leading Exporters of Semi-Processed Rubber by Value, 2005-2015



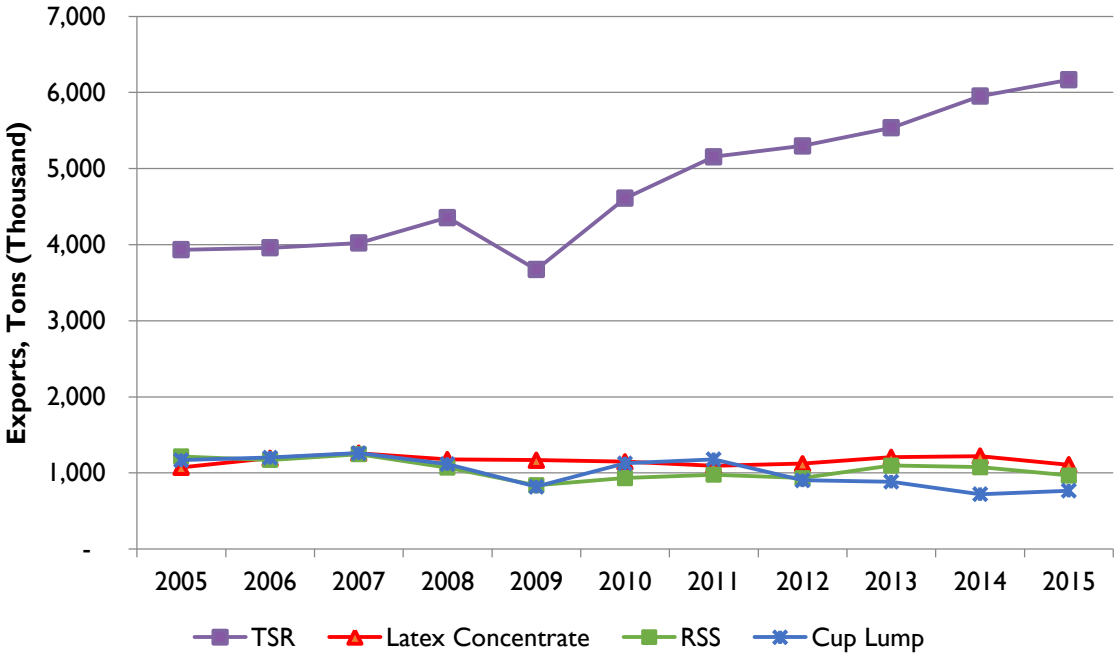
Source: UN Comtrade, Based on Import Data, HS 4001. Downloaded on Oct. 19 and Dec. 15, 2016.

Note: Includes data from HS400129, which is used by some countries to track trade in 'cup lump' rubber; however, this trade category is very small and has insignificant effect on broader trends.

Natural rubber exports from the leading producers—Thailand, Indonesia, Malaysia and Vietnam—are typically in a semi-processed state; that is, either as latex concentrate, TSR or RSS. These countries also lead in all three categories. Overall, producing countries have increased the export share of TSR over the past decade, reducing

their share of latex concentrate exports at the same time (UN Comtrade, 2016). In Thailand and Guatemala, latex nonetheless still accounts for 20% and 32% of export earnings (UN Comtrade, 2016). Thailand is by far the world's largest latex exporter, accounting for 60% of global supply (Jumpasut, 2015b).[19] Smaller actors, including the Philippines and Laos, export unprocessed "cup lump" to these larger processing actors, where it is converted into TSR and RSS and re-exported.

Figure 4. Global Exports of Unprocessed and Semi-Processed Rubber, 2005-2015



Source: UN Comtrade, Based on Import Data, HS 400110, 400121, 400122, 400129. Downloaded on Oct. 19 and Dec. 15, 2016.

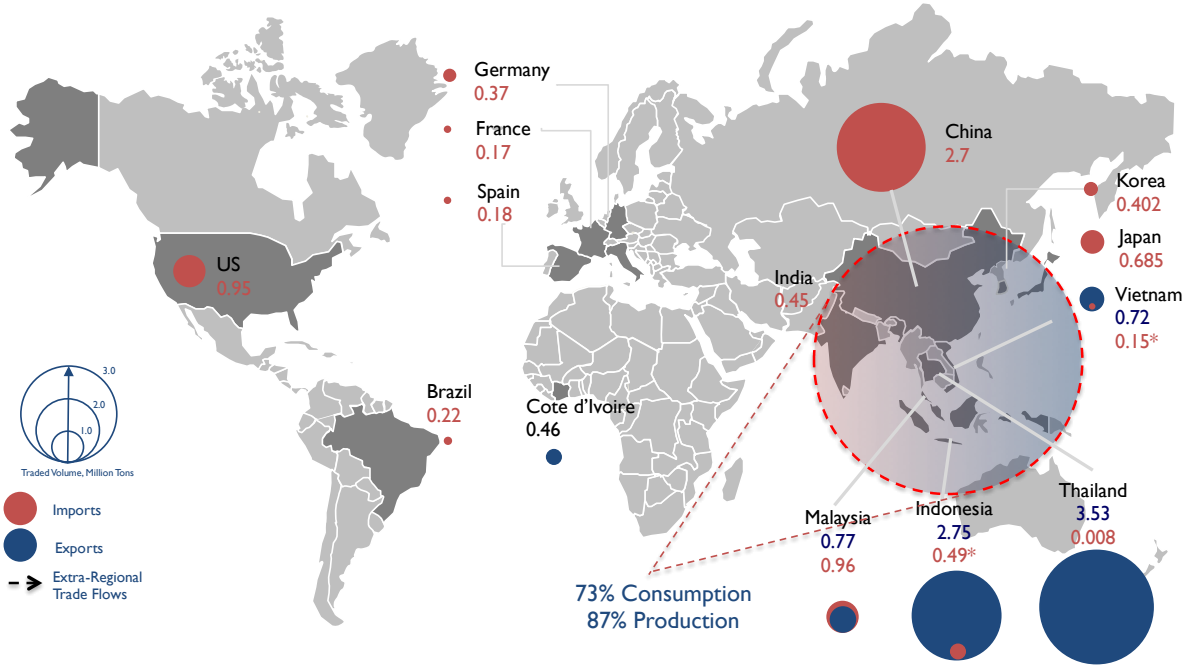
China and other countries in Asia dominate consumption of semi-processed natural rubber. Four of the top five consumers of natural rubber are based in Asia and the region consumed 73% of all natural rubber produced in 2015 (see Figure 5) (The Rubber Economist, 2016). Consumption in the region expanded 5.8% year on year in 2013, compared to a contraction of approximately 8% in the EU and US (Accenture, 2014). China is by far the largest market, accounting for close to 40% of the world demand by volume in 2015.[20] India, the second largest consumer, accounted for just 8% of global volumes, followed by the US and Japan with 7.6% and 5.8%, respectively. The market is highly concentrated with the top 10 countries consuming over 80% of production volumes (The Rubber Economist, 2016). China

[19] A significant share destined for Malaysia, the world's largest producer and exporter of surgical gloves (UN Comtrade, 2016).

[20] China's consumption of natural rubber has increased at 8.4% CAGR between 2004 and 2013 (Accenture, 2014), and it has exceeded 25% of world consumption of natural rubber since 2005 (UNCTAD, 2015). This is despite having imposed import tariffs on natural rubber imports to help incentivize local production. These tariffs were reduced in 2013 from 7.5% to 6% (UNCTAD, 2015).

and India also produce some natural rubber,[21] and both countries have made use of high import tariffs to incentivize the development of the local industry (ITC Market Access Map, 2016). [22] Nonetheless, along with a large number of developed countries, they are also net importers of semi-processed rubber (Accenture, 2014).

Figure 5. Global Trade in Semi-Processed Natural Rubber, 2015 (Million Tons)

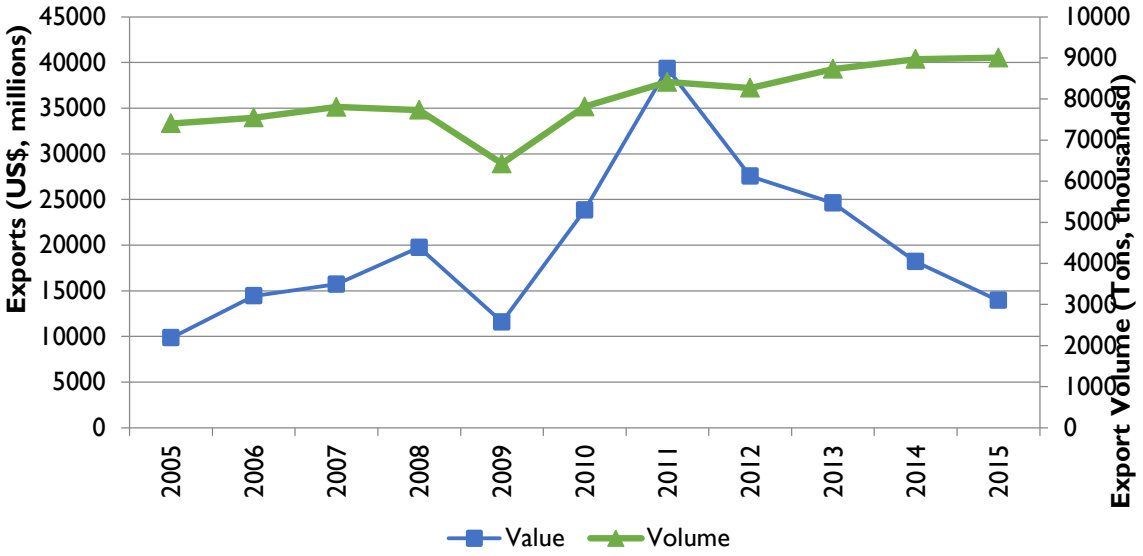


Source: Authors, Adapted from Accenture, (2014); (UNComtrade, 2016); Consumption/Production data from The Rubber Economist (2015a).

Trade in semi-processed rubber has increased by 41% in value and 22% in volume since 2005.[23] The global economic crisis had a notable, but short-lived, impact on trade volumes, which have subsequently recovered and continued on a steady upward trajectory. Trade value, however, has been affected by the volatility in global rubber prices, declining to below pre-crisis levels by 2015. Given their strong position in the production of semi-processed rubber, Thailand, Malaysia, Indonesia and Vietnam have sought to prop up the falling prices through the 'cartel' International Rubber Consortium to scale back supply; however, this has had only marginal effects (Crain News Service, 2015).

[21] The two countries account for 6.5% and 4.7% of global production, respectively.
[22] With 45% of its rubber trees already aged, India launched a major replanting effort in 2010. Many of these trees will be coming online between 2015 and 2017 (Accenture, 2014).
[23] Semi-processed rubber includes all varieties captured by HS code 4001.

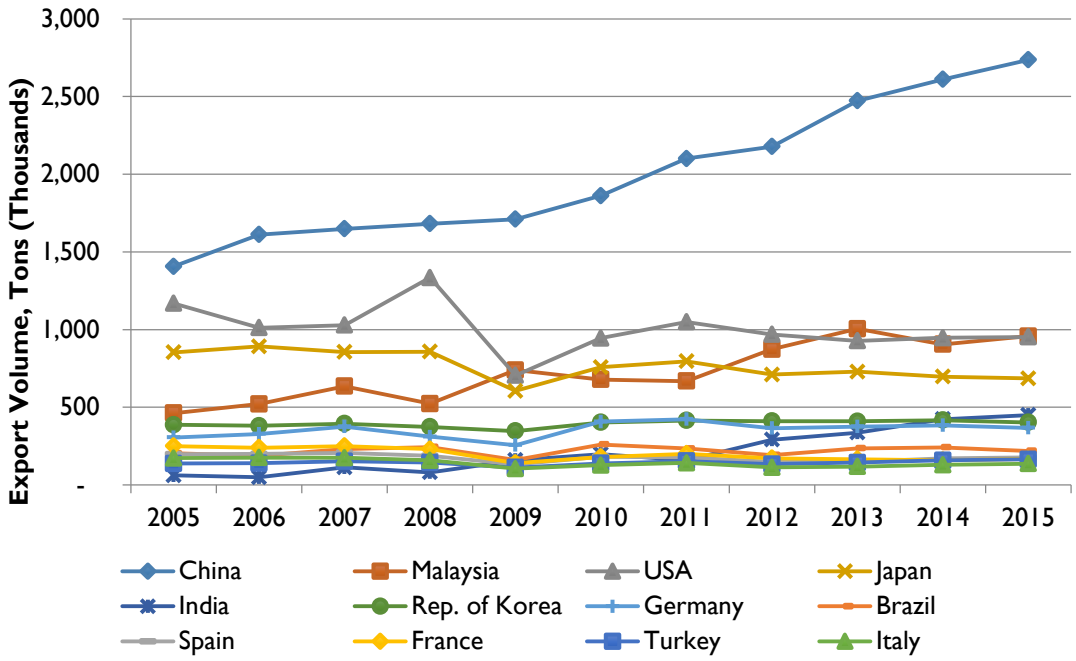
Figure 6. Trade in Semi-Processed Rubber, Value and Volume 2005-2015



Source: UN Comtrade, Importer Data, HS 4001. Downloaded on Oct. 18, 2016.

Global growth in volume, however, belies considerable structural changes in the industry. Growth has been led by a very small number of emerging markets, with developed country markets seeing significant reductions in imports in both relative and absolute terms. China, Malaysia and India account for the lion's share of import growth over the past decade; the compound annual growth rate (CAGR) for these countries was 7%, 8% and 22% respectively between 2005-2015, compared to a global growth rate of just 2%. Most developed country markets decreased their share of trade during this period. The US, Japan, France and Italy saw absolute import volumes fall by 19%, 20%, 10% and 33% respectively. Increased import volumes in the rapidly expanding markets have been supplied primarily by increased exports from Thailand and Vietnam, although Indonesia and India have established strong trade ties for natural rubber.

Figure 7. Importers of Semi-Processed Natural Rubber by Volume 2005-2015



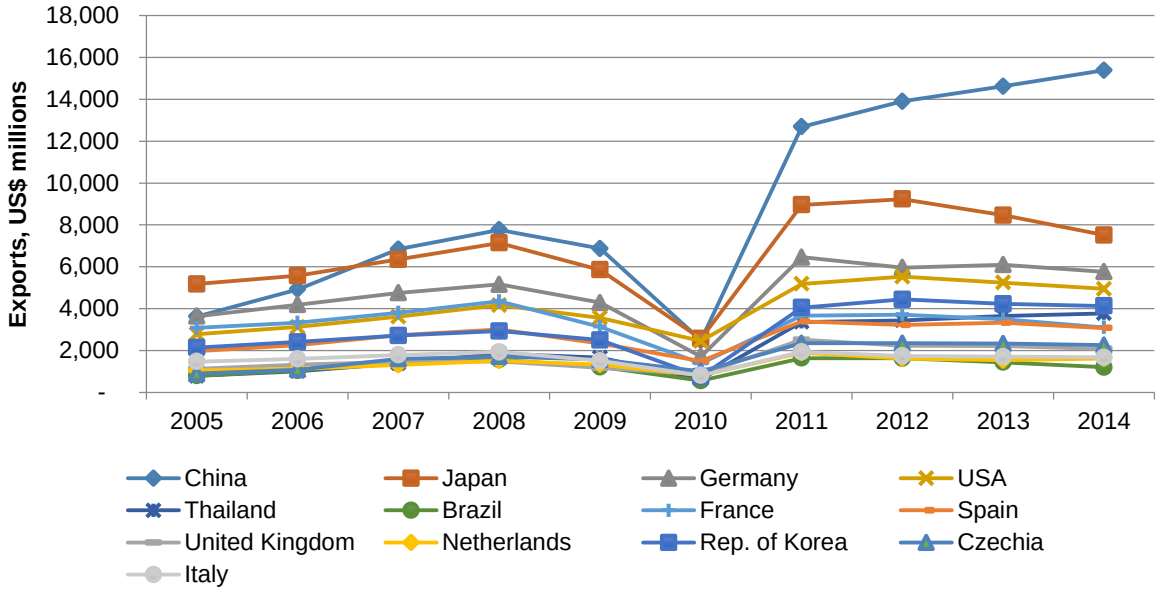
Source: UN Comtrade, 2015, based on importer data, HS 4001, downloaded on Oct. 18, 2016.

Accounting for most natural rubber consumption, tire production drives demand and import patterns of semi-processed rubber. Although in the past there was a tendency for tires to be manufactured near consumption because of low volume/value ratio, tire trade has doubled in the past decade. In 2005, total tire exports were valued at US$40 billion; by 2014, this had reached US$82 billion (see Table A.7 in the Appendix). Developed countries continue to account for a large share of tire exports but these patterns have also begun to change over the past decade.

Growth has been driven primarily by China, which has increased exports almost five-fold during this period to become the largest exporter of tires. China surpassed the previous leader, Japan, in 2007; by 2014, it had doubled its market share over Japan (20% vs. 10%).[24] The shift of the manufacture of tires to Asia is associated with growth of the automobile sector in the region, especially compared to mature markets in Europe and the US. In 2014, global tire demand reached 1.8 million tires/year (Marketline, 2015)—47% of which was generated in Asia compared to 22% in the EU and 16% in the US (Marketline, 2015). Regional production reduces overall shipping costs and allows firms to leverage lower overall production costs (e.g. labor, land, etc.) in these developing markets.

[24] Although not a perfect measure, the unit value of tires exported from China and other developing countries is generally lower than the unit value of exports from developed countries. This is reflective of a focus on higher quality production in established markets.

Figure 8. Leading Exporters of New Tires, by Value, 2005-2014



Source: UN Comtrade, Based on all Importers data. Data downloaded on Oct. 18, 2016.

At the same time, producing countries are increasing their local processing capacities to produce more final goods before exporting their rubber, albeit in less sophisticated product segments than tires. This is most notable with respect to upgrading into the manufacture of rubberized apparel products, as well as latex healthcare products. While these account for a considerably lower share of natural rubber consumption—healthcare (13%), industrial (9%) apparel products and others (8%) (Accenture, 2014)—these sectors have lower barriers to entry than the transportation segment. In rubberized apparel products, Malaysia, Thailand, Indonesia, China, Sri Lanka and Vietnam accounted for 88% of exports by 2015 (see Table A-9). In latex based healthcare products (i.e. condoms and latex gloves), Asian rubber producers Malaysia and Thailand together accounted for an average of 58% of global exports between 2005 and 2015. Malaysia in particular strengthened its capabilities in this segment, dominating supply with 42% of the market by 2015 (Figure A-1 & Table A-8).

2.4 Lead Firms and Governance

Consolidation at each stage is forcing some change in the relationship between actors that has permeated through the entire rubber value chain. Traditionally, tire manufactures have acted as lead firms, with a small handful of companies such as Michelin, Bridgestone, Continental and others dictating standards that rubber producers, traders and processors had to comply with. While the procurement strategies of the small number of major tire companies still influences the entire industry, the emergence of Chinese automotive firms as well as the ascension of rubber processors has altered the distribution of power. In the production segment of the chain, there has been less evolution, with smallholders continuing to be reliant either on local

processing plants or major processing centers such as those in Malaysia. There has, however, been some growth in plantation ownership, partially due to the desire of tire manufacturers to ensure access to ample supply of rubber. The following section outlines the most important of these trends in further detail.

While natural rubber is destined for several markets, it has long been governed by the procurement strategies of a few tire companies that absorb the largest share of TSR and RSS output. A small number of Western firms, including Continental, Bridgestone and Michelin, dominate the tire sector, and until recently absorbed almost three-quarters of rubber supplied globally.[25] Barriers to entry in the tire sector are generally high; it is a concentrated, low-margin, capital intensive sector that is very dependent on economies of scale (Freedonia, 2015; Marketline, 2015).[26] A shift towards the installation of progressively larger production facilities—as high as 11 million tires per year by 2021 (Freedonia, 2015)—suggests the issues of scale are likely to intensify, further constraining entry of new firms. This market power has given leading tire manufacturers significant control over the natural rubber GVC.

Yet growth of Chinese tire production in recent years has reduced lead firms' market share marginally. Following the turn of the century, a large number of Chinese firms entered the market—some estimates are as high as 500 new businesses (UNCTAD, 2015). Many of these firms were small and medium-sized, with a corresponding fragmented demand for natural rubber inputs. In recent years, the Chinese government has focused on driving consolidation of these firms by implementing minimum factory sizes,[27] stricter quality and labeling requirements, and tightening environmental standards for production. This will ultimately lead to the emergence of a smaller number of strong, globally competitive Chinese tire producers. Already, several of the leading firms are of Chinese origin, including Hangzhou Zhongce Rubber Co, Double Coin Holdings and Triangle Tire Company.[28] These firms—many of which grew out of Joint Ventures (JVs) with MNCs in China—have adopted the same procurement strategies as their Western peers.

The markets for latex concentrate—primarily the healthcare segment—varies in terms of concentration, with slightly less power being exerted by lead firms. Latex in this market segment is used primarily for the manufacturer of gloves and contraceptives. The latex glove market is relatively fragmented and has lower capital requirements than tires, allowing rubber processors to upgrade into this segment. The leading producer is Top Glove—the Malaysian company has an estimated 25% global market share (Top Glove, 2016). Other leading companies include Kossan, and Supermax. The global contraceptive market, on the other hand, is highly concentrated with three brands dominating the sector: Trojan, Durex and Lifestyle. Trojan condoms are manufactured in-house by brand owner Church and Dwight,

[25] The US market is controlled by a very small number of firms—Goodyear (22%), Cooper (14%), Bridgestone (14%) and Michelin (24%) controlled 74% in 2014 (Freedonia 2015).
[26] The tire business is a relatively low margin business, 2-6% depending on the natural rubber price, making this a scale operation (UNCTAD, 2015).
[27] In addition, the current 5-year plan (2012-2017) focused on only providing permits for large truck plants, closing small operations with annual capacity of under 500K (UNCTAD, 2015).
[28] There were five Chinese firms amongst Rubber and Plastics News Top 75 tire companies Top 20 (Rubber & Plastics News, 2015).

while Durex (owned by Reckitt Benckiser) and Lifestyle (owned by Ansell) use contract manufacturers, including Karex with operations in Asia. Karex is the world's largest condom manufacturer, with production facilities in Malaysia, Thailand, China and India. There is surprisingly little overlap between the glove producers and condom producers, despite both producing highly regulated products based on latex concentrate.

Procurement strategies of lead firms vary, although long-term bilateral contracts between end-market buyers and rubber processors account for approximately 80% of the market (Accenture, 2014; Weerathamrongsak & Wongsurawat, 2013). Alternative strategies include equity ownership in processing and production companies and spot market purchases on commodities exchanges such as the Singapore Commodities Exchange (SICOM). Operations with longer lead time, such as OEM operations, tend to rely on longer-term relationships to ensure adequate inputs, while those serving the aftermarket with short lead times tend more towards the spot market reducing inventory costs (Marketline, 2015). Tire firms also use centralized global sourcing in order to leverage their purchasing power to negotiate lower prices (Goodyear, 2015). The volatility of the rubber price globally over the past decade has favored direct engagement of tire companies in plantations. For example, Michelin has a 24% stake in *Société Internationale Plantations d'Hévéas,* which has 40,000 ha of mature plantations in Cote D'Ivoire, Nigeria, Liberia and Ghana.[29] Michelin is the company's largest buyer ("International,"", 2016), while Bridgestone has plantations in Liberia and Indonesia (Bridgestone, 2015; Marketline, 2015; Moore, 2016). Top Glove has also integrated into upstream latex concentrate production in Indonesia order to secure supply (Top Glove, 2016).

The rubber processing segment has undergone significant changes in the past five years, giving rise to several large players with an increasingly strong position vis-à-vis lead buyers. This segment of the chain had been relatively fragmented, with domestically owned factories operating in rural regions in producing countries. Since 2010, however, it has consolidated with the emergence of large firms, including Sri Trang Agro-Industry, Halcyon Agri and von Bundit—together, these companies account for approximately half of the global production of semi-processed rubber. These firms have grown through M&As as part of a broader trend of corporate agribusiness. In addition, well-known palm oil processors such as Malaysia's Sime Darby have identified rubber as a means of diversification away from overdependence on palm. Asset management firms have also entered into the sector, recognizing that rubber plantations can serve dual markets—latex and timber industries such as furniture and building materials (Craymer, 2016). With significant financial backing, these firms have established large scale processing operations and plantations throughout ASEAN as well as West Africa.

This change away from small-scale factory suppliers to large corporate operations has changed the contours of power relations between the processers and buyers. The procurement power of the downstream lead firms had often forced processors to accept price fluctuations based on market forces. Events in 2015 suggested that might be changing. Ten of the leading processors in Thailand and Indonesia jointly decided that they would no longer accept price indexing through the exchanges and that they would no longer deliver to the

[29] Michelin also own their own plantations in Vietnam and Brazil (UNCTAD, 2015).

exchanges. This was largely driven by two of the three leading firms—Sri Trang Agro-Industry and Halcyon Agri (Halcyon Agri, 2015b; Russell, 2015). These two firms each have a production capacity of over 1.5 million tons, or the equivalent of Indonesia's entire natural rubber production in 2015. While tire manufacturers are free to source their production from other suppliers, the increased market power of these processors indicates that further modifications will be likely in coming years. These may include an increased focus on product substitution, using either synthetic rubber products or other natural inputs to replace rubber, or further backward integration of tire firms into natural rubber production and processing.

While still overwhelmingly dominated by smallholders, production has also seen the entry of large-scale plantations. Some 85% of global production is still generated by smallholder farmers on plots below 5 ha (Fox & Castella, 2013; Moore, 2016; Pirelli, 2016, p. 157). These farmers receive a small fraction of the global price, and they enter and exit the market based on fluctuations in the market price. Opportunity costs of producing rubber are high since rubber takes longer than other perennial crops to reach maturity. Once established, the rubber canopy can also reduce potential for intercropping, increasing dependence on a single crop. Faced with the ongoing potential sustainability problem as well as low yields of small farmers, new production, particularly in newcomers such as Vietnam, Cambodia, Laos and Myanmar, is being driven by large plantation operators (Fox & Castella, 2013; Haberecht, 2010).[30]

2.4.1 Standards and Certification

While standards and certifications have become commonplace in food-based agricultural sectors such as coffee and cocoa, these initiatives have only recently emerged in the natural rubber industry. As performance is the key characteristic of natural rubber in its downstream manufacturing, the industry has been focused on quality standards. The primary standard adopted by the industry has been the introduction of Technically Specified Rubber (TSR) categorization as a result of work by ISO in the 1990s (see Box 2).

More recently, however, the expansion of rubber plantations in response to the high prices of the 2000s, led to growing deforestation concerns (Ahrends et al., 2015; Fox & Castella, 2013). Several existing certification organizations, including the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) International as well as international NGOs such as Global Witness, have helped to increase awareness of the negative impact of rubber expansion, including deforestation, coercion of local communities, and pollution.[31] However, uptake of these certifications has been sporadic, they are not yet widely required by industry buyers and the industry in general is considered to be lagging far behind other commodities.

[30] Of the US$26 million invested in Lao by Chinese firms, 77% of this was in rubber plantations (Haberecht, 2010). Chinese investments were facilitated by the Chinese Opium Replacement Program which provides financial incentives and regulatory support to Chinese agribusiness firms in Laos (Lu, 2015).

[31] For example, PEFC has hosted meetings to expand certifications to industrial forests (PEFC, 2013, 2015), and FSC certifies rubber plantations under the broader scope of the forestry industry (FSC, 2016). Global Witness's expose, "Rubber Barons" was key in FSC's decision to withdraw VRG's certification (FSC, 2016; Global Witness, 2013).

Nonetheless, there has been an industry-wide attempt to adopt a sustainability standard, via the Sustainable Natural Rubber Initiative (SNR-i). This has been driven by the International Rubber Study Group, an intergovernmental organization including both producers and consumers of natural rubber (International Rubber Study Group, 2016). Launched in 2016, it is a voluntary, self-certification that encourages producer members to adopt more sustainable and productive practices, and encourages major buyers (who can also become members) to source only from sustainable operations. Similar to the RSPO, FSC and PEFC certifications, criteria cover quality, productivity, conservation of natural forests, appropriate water management and respect for human and labor rights (International Rubber Study Group, 2016). Despite its recent launch, SNR-i already has six major tire manufacturers members (Bridgestone, Continental, Goodyear, Michelin, Pirelli, and Yokohama); one major processor member, Halycon Agri; and government membership from Cote d'Ivoire, Cameroon, Sri Lanka and India. Success of this initiative will ultimately depend on the buy-in from the major producing countries (Thailand, Malaysia, Indonesia and Vietnam) and commitments from buyers to only source certified natural rubber. To date, amongst the major tire producers, only Michelin has established a corporate zero deforestation policy for its rubber sourcing (Michelin, 2016).

3. The Philippines and the Rubber Global Value Chain

The Philippines is part of the emerging or second-tier group of countries in ASEAN that each contribute roughly 0.5% to the global natural rubber trade.[32] While the traditional producers, Thailand, Indonesia, Malaysia and Vietnam export semi-processed rubber in significant volume,[33] the Philippines instead provides Malaysia and other countries with unprocessed natural rubber—cup lumps—to serve as inputs for processing. Notably, among the largest 15 exporter countries, the Philippines consistently earned the lowest unit value from exports in the period from 2005-2015 (UN Comtrade, 2016). Table 2 lists the trading profiles of the largest exporters of natural rubber in Southeast Asia.

Table 2. Profile of ASEAN Exporters of Unprocessed or Semi-Processed Rubber

Global Rank	Country	2014 Export Value (US$, millions)	Leading Unprocessed or Semi-Processed Exports (% of total production)
1.	Thailand	6,701	Technically specified (47%), RSS (25%), Latex (24%)
2.	Indonesia	5,690	Technically specified (87%), other rubber (6%), Latex (4%)
3.	Malaysia	1,671	Technically specified (75%), Latex (11%), other rubber (11%)
4.	Vietnam	1,396	Technically specified (68%), other rubber (13%), RSS (12%)
16.	***Philippines***	***73***	***Other rubber (cup lump) (78%), RSS (20%)***

Source: UNComtrade. Based on 4001 HS codes. Retrieved on October 25, 2016.

The Philippines' export profile has evolved in recent years with the country essentially downgrading its position within the chain. While the value of the country's exports of TSR exceeded the value of its cup lump exports in the period from 2006 to 2012, cup lump exports

[32] Cambodia and Laos join the Philippines in this second tier. Cambodia's exports of unprocessed and semi-processed natural rubber were US$154 million in 2014, while Laos had $111 million.
[33] Together, these four countries account for roughly 76% of natural rubber production (The Rubber Economist, 2015).

have swelled in more recent years. In both 2014 and 2015, between 77.5-78% of the Philippines' exports were cup lumps. Producers increasingly ship raw natural rubber to processors in Malaysia for two reasons: 1) high logistical costs in the Philippines that add significant costs for energy and shipping; 2) producers can receive higher prices abroad for raw natural rubber than rubber that is processed in the Philippines because of concerns about the quality of semi-processed rubber.

While the country's footprint in the upstream segments of the natural rubber chain is light, there are more robust activities in downstream processing. In total, the county exported more than US$555 million worth of goods in the rubber value chain in 2014 (see Table 3). Close to 83% was concentrated in two product categories: automobile and motorcycle tires (68.8% of US$382 million) and other articles of vulcanized rubber parts such as rubber mats, gaskets, seals, etc. (13.8%). By comparison, led by the production of cup lumps, the upstream segments of the chain generated roughly US$77 million in exports in 2014, which was a 41% decline compared to 2012.[34]

Table 3. Philippines' Exports in the Natural Rubber Value Chain, 2005-2014

Product	Value (US$, millions)					Share of Total Rubber Exports				
	2005	2007	2010	2012	2014	2005	2007	2010	2012	2014
TOTAL	**199**	**386**	**560**	**639**	**555**					
Unprocessed and Semi-processed	**59**	**73**	**116**	**131**	**77**	**29.7%**	**19.1%**	**20.8%**	**20.6%**	**14.0%**
Latex concentrate	0.005	0.1	0.09	0.5	0.1	0.0%	0.0%	0.0%	0.1%	0.0%
RSS	0.09	0.6	0.9	0.9	0.7	0.0%	0.2%	0.2%	0.1%	0.1%
TSR	28	37	75	78	15	14.3%	9.8%	13.5%	12.3%	2.8%
Other (cup lump, etc.)	30	34	39	50	57	15.3%	8.9%	7.0%	8.0%	10.4%
TBA (4005 and 4006)	**1.6**	**7**	**33**	**36**	**8**	**0.8%**	**1.8%**	**6.1%**	**5.7%**	**1.5%**
Processed	**0.3**	**0.3**	**0.1**	**0.1**	**0.1**	**0.2%**	**0.1%**	**0.0%**	**0.0%**	**0.0%**
Final Products	**138**	**305**	**410**	**470**	**469**	**69.3%**	**79.0%**	**73.2%**	**73.7%**	**84.5%**
Transportation										
New tires	85	247	332	381	382	43.1%	64.0%	59.3%	59.7%	68.8%
Retreaded tires	0.6	0.09	0.2	0.01	0.04	0.3%	0.0%	0.1%	0.0%	0.0%
Inner tubes of rubber	0.1	0.1	0.01	0.5	1.1	0.1%	0.0%	0.0%	0.1%	0.2%
Healthcare										
Contraceptives	0.05	0.1	0.2	0.03	0.07	0.0%	0.0%	0.0%	0.0%	0.0%
Surgical gloves	—	0.001	—	0.005	0.01	0.0%	0.0%	0.0%	0.0%	0.0%
Apparel										
Rubber clothing	0.3	0.6	0.01	0.1	0.06	0.2%	0.2%	0.0%	0.0%	0.0%
Construction, Industry, and others										
Tubes, pipes and hoses	4	4	3	4	3	2.5%	1.3%	0.6%	0.6%	0.7%
Belts of rubber	4	3	4	5	4	2.2%	0.9%	0.8%	0.9%	0.9%
Vulcanized rubber parts	41	48	69	79	76	20.9%	12.5%	12.4%	12.4%	13.8%

Source: UNComtrade. Retrieved on October 25, 2016. The semi-processed HS codes includes HS 4001 and 4002. TBA and processed include HS codes 4005-4008. Final products include HS codes 4009-4015.

[34] While some of that decline can be tied from the move from exporting TSR or crumb rubber to cup lumps, the bearish global market, with significantly declining prices for natural rubber also played a significant role.

Optimistic that the industry can generate employment while also recognizing some of the weaknesses of the domestic industry, the government has attempted to nurture the sector through a variety of strategies aimed at both upstream and downstream segments and their integration. Some of these have had measures of success. Yokohama is the only automobile tire manufacturing with active operations in the Philippines. DTI has actively engaged the Japanese-based company about expanding its supply chain to include more Filipino producers of crumb rubber. While the company has increased its local sourcing from 15% in 2011 to more than 30% with pledges to further reduce imports to 50% by 2017 (PhlRubber Technical Working Group, 2015), there are questions about whether the effort can serve as a catalyst for broader industry development and boost overall value add from the agricultural production of rubber.

This section analyzes the rubber industry in the Philippines and assesses its potential for upgrading. It first examines the country's current participation in the value chain by using trade and firm-level data. It then outlines the industry organization and key firms active in the country. From there, it highlights examples of upgrading before concluding with advantages and constraints that will shape future participation in the rubber GVC.

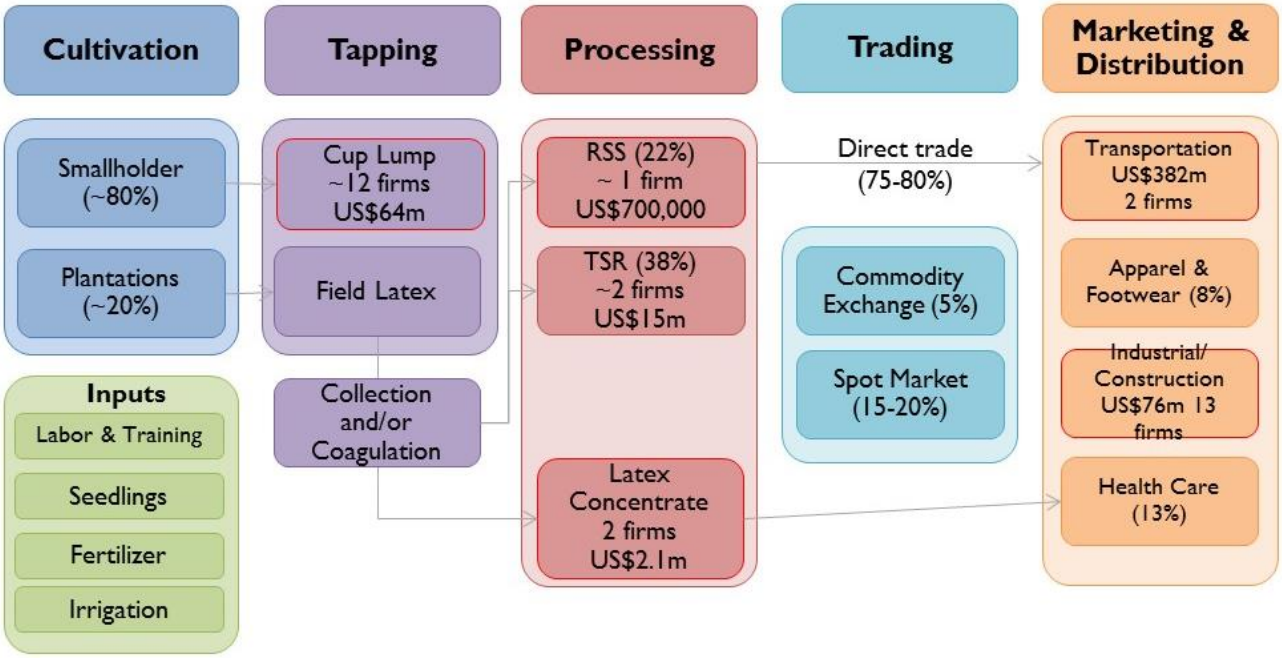
3.1 Current Participation in the Natural Rubber Global Value Chain

The Philippines is confined mostly to low-value activities in upstream segments of the natural rubber value chain. While the country has never been a major exporter, its primary output has shifted in recent years from the TSR or crumb rubber that is used as an input in tire manufacturing to unprocessed cup lumps. In 2014, 77% of the country's exports of unprocessed or semi-processed rubber were cup lumps (US$57 million); in the period between 2005-2013, 50-65% of the value of the country's exports in the same segment of the chain was for crumb rubber (Table 3 above charts the increase in value of the Philippines' cup lump exports).

Tires are the Philippines' largest rubber export, with the country exporting US$382 million worth of new tires in 2014. While the presence of Yokohama in the Clark Freeport Zone in Luzon provides the Philippines with a major tire manufacturer, the country has not demonstrated it can support widespread tire manufacturing on a significant scale. In 2009, Goodyear closed the Las Piñas plant because of high production costs (PRNewswire, 2009). Otherwise, the only product where the Philippines has significant rubber exports is for vulcanized parts such as gaskets and seals (US$76 million in 2014); however, this category includes both outputs that use both natural and synthetic rubber.

Across the entire chain, the number of businesses that regularly export more than US$1 million annually in natural rubber categories is around 10; it grows to 15 if one expands the category to include firms that exported more than $500,000 in 2014 (PSA, 2007-2014). Figure 10 illustrates current participation, including the number of exporters in each segment of the chain with over US$500,000 in exports in 2014.

Figure 9. The Philippines in the Rubber GVC



Source: Authors based on PSA and UN Comtrade data.

Production

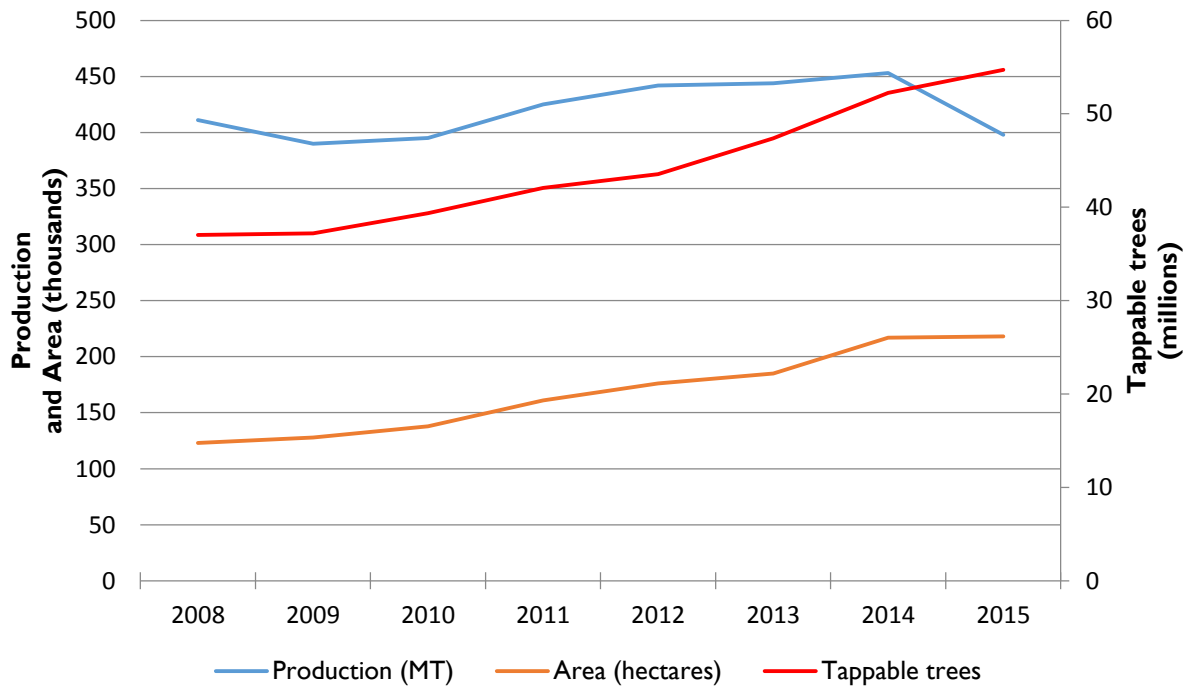
The Philippines generated roughly 1% of the globe's natural rubber supply in 2014, putting it in range of Myanmar and Sri Lanka toward the bottom of the world's top 10 producers (PhlRubber Technical Working Group, 2015). Within the country, production is exclusively concentrated in Mindanao, with Zamboanga in the west and Soccsksargen in the south serving as the two primary rubber growing regions.[35] The country has a smallholder model, with average farm size between 1.5-3 hectares; however, there are some larger plantations, especially in Bukidnon, that are owned by processors, traders, cooperatives, and wealthy families (PRDP, 2012).

Total output has remained between 390-450,000 MT in the period from 2008 to 2015, although more recent trend line is down.[36] As shown in Figure 11, the area devoted to rubber production as well as the number of tappable trees has steadily increased over that time span. The disconnect between the production and area/tree trends is a reflection of the lengthy maturation time associated with rubber in the Philippines as well as the increased plantings during the global bull market from 2009 to 2012 (Field Research, 2016).

[35] The Philippines' production data cited in this section is based on Major Non-Food and Industrial Crops Quarterly Bulletins provided by the Philippines Statistics Authority: https://psa.gov.ph/non-food.

[36] While this section uses PSA data, there is a wide discrepancy between the production data cited by the PSA and Philippines' production data used by organizations such as the International Rubber Study Group and other industry organizations. DTI used the International Rubber Study Group data in its roadmap for the natural rubber industry.

Figure 10. Rubber Production Profile in the Philippines, 2008-2015



Source: Philippines Statistical Authority (PSA), (2008-2015).

Approximately 70% of the Philippines' total natural rubber production is exported, mostly as cup lumps (PRDP, 2012). The remainder is processed into TSR (or crumb) and crepe rubber, usually in locations in the Zamboanga Peninsula, Soccsksargen and other major production hubs (Field Research, 2016). Producers of final rubber goods—tire, automotive, footwear companies, etc.—are concentrated in Luzon, although some are in Cebu and other locations.

After Goodyear's departure from the Philippines in 2009, Yokohama is the primary tire manufacturer with a plant in the country. Yokohama, which uses 70% imported crumb rubber, exports 96% of its Philippines' output. It generates approximately 21,000 tires per day and has pledged to increase the annual production capacity of its Clark plan from 7 million tires in 2011 to 17 million by 2017 (DTI, 2014).

Exports

Malaysia is the most significant consumer of the Philippines' unprocessed and semi-processed rubber. The country solidified its hold as the leading destination for Filipino rubber when the Philippines shifted toward exporting cup lumps in higher volume in 2014 and 2015—84% of the Philippines' rubber exports went to Malaysia in 2014 compared with 35% in 2005.[37] China and South Korea are the other consistent consumers. Table 4 lists the top-five destinations for the Philippines' exports in the 4001 HS code for all natural rubber varieties.

[37] During this same period, Malaysia has reduced its reduced its overall agricultural production, yet it still has existing processing capacity in rubber.

Table 4. Export Destinations for Philippines' Natural Rubber, 2005-2014

Country	Value (US$, millions)					Share of Philippines' Unprocessed and Semi-Processed Natural Rubber Exports				
	2005	2007	2010	2012	2014	2005	2007	2010	2012	2014
TOTAL	**59**	**73**	**116**	**130**	**73**					
Malaysia	20	41	82	107	61	35%	57%	71%	82%	84%
Rep.Korea	7	9	17	9	5	12%	13%	15%	7%	8%
China	18	7	10	6	2	32%	10%	9%	5%	3%
India	—	—	—	—	2	—	—	—	—	3%
SAfrica	1	2	3	3	0.7	3%	6%	3%	3%	1%
Belarus	—	—	—	1	—	—	—	—	1%	—
Vietnam	—	4	1	—	—	—	3%	1%	—	—
Czechia	1	—	—	—	—	3%	—	—	—	—

Source: UN Comtrade based on HS code 4001. (—) Indicates country was not in the top 5 in the given year. Retrieved on October 25, 2016.

In downstream segments of the value chain, more than 50% of the Philippines' tire exports went to US and Canada in 2014. However, the distribution of end markets in this product category is fairly diverse, with a wide variety of countries serving as consumers, depending on the year.[38] Table A-10 in the Appendix lists the leading destinations for the Philippines' tire exports in the period from 2005 to 2014. Japan is the major market for the Philippines' second largest export category, receiving between 50-55% of the value of goods in the "other" category that describes vulcanized rubber parts such as rubber mats, gaskets and seals.

3.2 Key Firms and Industrial Organization in the Philippines' Rubber Industry

The Philippines' rubber industry is concentrated around a small cluster of firms, most of which are based in Mindanao. While there is a broader network of companies that operate at all stages of rubber production and processing, most of these are either oriented toward the domestic market or concentrate primarily on synthetic rubber. With no more than 10 or 15 firms across the value chain exporting their products in significant volume, one official of a rubber company active in the Philippines said that "the rubber community is so small that our competitors are our friends (Field Research, 2016)."

There are three categories of actors that govern the rubber chain in the Philippines and set the rules of engagement for domestic companies: (1) Malaysia traders or processors who are increasingly buying raw natural rubber from the Philippines to maximize use of their installed capacity; (2) Foreign tire companies or traders who purchase processed rubber—usually crumb rubber—that is ultimately sold to tire companies in China, Korea, and other Asian locations; (3) Tire producers or other rubber parts manufacturers with operations in the Philippines, the largest of which is Yokohama. Of the three groups, the Malaysian businesses wield the most power, with roughly 60% of the Philippines' total rubber production being exported there.[39]

[38] Russia and Japan both accounted for 6% of the country's exports in 2014, while Thailand, Australia and Finland have all received more than 10% of the Philippines' tire exports in recent years.

[39] The 60% figure was determined based on the fact that 70% of Filipino natural rubber is exported (Field Research, 2016; PRDP, 2014). Of that amount, trade data indicates that 85% is destined for Malaysia (UNComtrade, 2016).

In all cases, suppliers have minimal leverage and must adhere to the quality and price protocols demanded by foreign buyers, who retain a high degree of power over sellers through rubber's commodity status. The first two groups—Malaysian businesses and foreign tire companies and traders—rely primarily on arm's length relationships, paying market prices for rubber while controlling quality standards. However, Yokohama's status as the only large tire manufacturer in the Philippines allows it to wield significant power over small suppliers, who have few other outlets to sell their rubber and therefore are largely price takers.

Inside the Philippines, the major actors outside of Yokohoma have historically been processors, prominent examples of which include Farma, Standeco, CTK Asia Rubber Corporation, and Pioneer Amaresa. These companies all have well-established connections with companies in the first two categories of lead firms, although that only affords them a modest amount of leverage as their export volumes are insignificant next to those of their competitors in Vietnam, Thailand, Malaysia, and Indonesia. Domestically, most of the major rubber processors are integrated backward or have long-standing linkages with the three primary groups of upstream actors: 1) land owners; 2) tappers; and 3) traders. Although the larger Filipino companies have capabilities across multiple stages of the value chain, many are de-emphasizing processing and increasingly focusing on larger-scale aggregation and international trading of raw or semi-processed rubber (Field Research, 2016). As of 2015, there were 21 processing companies in the country, although only five of these are ISO certified and export regularly (PhlRubber Technical Working Group, 2015; PSA, 2007-2014). Table A-11 in the Appendix lists the rubber processing companies and ISO certified firms in the Philippines.

The upstream actors are relatively dispersed. Local traders play an important role coordinating this segment of the chain. Production in the Philippines is spread out across different regions in Mindanao, which increases transaction costs for processors and accentuates the value of aggregation. Both land owners and tappers also borrow money from traders, who provide a measure of security and an income smoothing mechanism during downturns.

Box 3. Yokohoma and Tire Manufacturing in the Philippines

After Goodyear's departure from the Philippines in 2009, Yokohama is the sole major tire producer with a manufacturing plant located in the country. The Japanese firm, which has its Filipino operations in the Clark Freeport Zone, has worked with the DTI to increase its local sourcing. The company committed to increasing domestic supply from 15% in 2012 to a projected 50% in 2017. It has also engaged in extension services and buying missions with local producers. While local stakeholders report challenges in pursuing the ISO certification required by the company as well as conforming to Yokohama's internal policies, the tire maker had increased its local procurement of natural rubber to 32% by 2015.

Source: Phl Rubber Technical Working Group, 2015.

3.3 Advantages and Constraints for Upgrading in the Rubber Global Value Chain

The Philippines' rubber industry is characterized by stagnant production, quality concerns, a shift toward the export of unprocessed raw materials, and an uncompetitive processing environment, especially vis-à-vis regional peers. Despite these and other challenges, the sector offers employment opportunities, particularly in Mindanao. Recognizing the job potential, the government has taken steps to strengthen the sector, most notably through DTI's efforts to boost demand for Filipino rubber by engaging with Yokohama to increase domestic procurement and the DA's steps to increase technical acumen through the Philippine Rubber Research Institute (PRRI). Table 5 summarizes both the strengths of the Philippines' rubber industry as well as the entrenched challenges.[40] The most prominent advantages and constraints are then outlined in the section that follows. The potential upgrading section (Section 5) expounds on the possible opportunities.

Table 5. Advantages and Constraints of the Philippines in the Rubber GVC

Advantages	**Challenges**
• Favorable environmental conditions to produce natural rubber • Close proximity to major processors of natural rubber • Commitment of Yokohama to increase local sourcing • Engagement of government agencies in the sector	• Inadequate training and production techniques compromise rubber quality and yields • Access to higher-quality seedlings and appropriate fertilizers is constrained • Cost prohibitive processing environment • Low levels of ISO certification • Political and security instability in Mindanao • Communication gaps among industry stakeholders • Distance between EPZs in Mindanao and rubber production hubs
Opportunities	**Threats**
• Strong human capital • Growing healthcare product category (condoms, surgical gloves, etc.)	• Oversupply and low prices for natural rubber in global markets • Possible emergence of guayule or other substitutes in tire production

Source: Authors.

3.3.1 Advantages

The Philippines' most pronounced strengths in the rubber industry center on its geographic location. This manifests itself primarily in two ways: 1) Favorable environmental and climatic conditions to grow rubber; and 2) Relatively close proximity to major consumers (Malaysia, Thailand, China, and others). The following sub-section expounds upon these features:

[40] The road map identified some of these and other challenges and opportunities. The challenges it listed included: inadequate supply of high yielding clones; continued use of battery solution as coagulants in some areas; improper handling and coagulation processes in some areas; lack of trained tappers; high cost of tapping services; limited access to modern rubber processing technology and facilities; non-accredited testing laboratories; and poor road infrastructure. The opportunities were: availability of investment incentives; presence of PRRI; establishment of nurseries; lending programs; operationalization of testing laboratory and certification facility; available area for plantation expansion; presence of modern milling facilities; product consolidation; adequate supply of crumb rubber; high market demand; and strong government support (PhlRubber Technical Working Group, 2015).

1. **Favorable environmental conditions:** The Philippines is located in the rubber belt, which describes the zone 10 degrees either north or south of the Equator where countries have temperate, damp climates that are well suited for producing rubber. Major natural rubber producing nations including Malaysia, Indonesia, Vietnam and Thailand are all inside or near the zone. Inside the Philippines, production is concentrated in Mindanao, which is particularly suited toward rubber.

2. **Close proximity to major processors and consumers of natural rubber:** ASEAN is the world's preeminent producer and exporter of natural rubber. The region accounted for 87% of global production in 2015, and four countries—Thailand, Indonesia, Malaysia, and Vietnam—exported roughly 85% of the globe's unprocessed and semi-processed natural rubber in 2014 (Jumpasut, 2015a; UNComtrade, 2016). In addition, Asia accounts for three quarters of all natural rubber consumption (Jumpasut, 2015a). The relatively easy access to Malaysia, in particular, provides Filipino producers with a market for cup lumps—84% of the value of the Philippines' exports and roughly 60% of total production went to Malaysia in 2014.

3. **Commitment of Yokohama to increase local sourcing:** The Japanese tire manufacturer has pledged to increase its domestic procurement of crumb rubber for its plant in the Clark Freeport Zone from 15% in 2012 to 50% in 2017. Table 6 provides a projection of the country's domestic sourcing. It was current as of 2014. The company has also engaged local suppliers with extension efforts to improve rubber quality while also providing reason for domestic businesses to pursue ISO certification since that quality control standard is a requirement for participating in its supply chain. At least two of the Philippines' largest natural rubber processors—Farma and CTK Asia Rubber Corporation—have integrated into Yokohama's supply chain due to the company's efforts.

Table 6. Projected Crumb Requirements for Yokohama Clark Plant (as of 2014)

Year	Annual Requirement (MT)	Domestic Sourcing (Share)	Import Sourcing (Share)
2011	11,880	1,752 (15%)	10,128 (85%)
2012	10,536	1,536 (15%)	9,000 (85%)
2013	9,876	1,778 (18%)	8,098 (82%)
2014	14,424	2,580 (18%)	11,844 (82%)
2015*	20,832	6,624 (32%)	14,166 (68%)
2016*	24,144	12,072 (50%)	12,072 (50%)
2017*	30,756	15,378 (50%)	15,378 (50%)

Source: PhlRubber Technical Working Group, 2015. * = Projection.

4. **Engagement of government agencies in the sector:** DTI helped facilitate Yokohama's outreach to the local sector. The tire company has its operations in the export processing zone (PEZA) near Clark, which affords it a number of benefits, including income tax holidays, tax and duty free imports, reduced bureaucracy such as simplified import and export procedures, and access to special non-immigrant visas for employees. DTI has also played a role in connecting buyers and sellers, working in Zamboanga to link farmers with firms such as CTK Asia, which buys unprocessed rubber in significant volume (Field Research, 2016). DTI has also worked to connect

buyers and sellers in Zamboanga and collaborated with the DA to create the Philippine Rubber Technical Working Group in 2012. That agency, which is a public-private collaboration that is co-chaired by both the DA and DTI and helped create the industry road map, serves an important role by serving as a lead agency in efforts to coordinate initiatives across the sector through its six action teams focused on topics such as production improvements, Research & Development, finance and investment and other areas. The DA has engaged in capacity building while also launching the PRRI to improve research capabilities across the value chain. Other public-sector actors that have devoted attention to the rubber sector include the DA's Bureau of Plant Industry (budwood gardens and nurseries), the Department of Environment and Natural Resources (national greening program), the Department of Labor and Employment (provision of starter kits to tappers), TESDA (general training) and local governments.

3.3.2 Challenges

There are entrenched barriers to upgrading and integrating the Philippines' rubber industry. Some of these impediments cut across all segments of the chain—security risks in Mindanao impair the sector's development across the board, and insufficient communication hurts producers, traders, processors and final consumers. Others, however, are more concentrated around specific segments of the chain. This sub-section analyzes the most significant constraints.

1. **Inadequate training in production and tapping techniques compromise rubber quality and yields:** The Philippines' rubber production is dominated by smallholders. Extension services are especially critical for building capacity in non-planation based systems. Two entities have recently been formed to stimulate the dispersion of best practices within the sector. The first is the Philippine Rubber Research Institute (PRRI). Formally launched in 2014 and overseen by the DA, the PRRI's mission includes administering rubber R&D across the value chain as well as implementing training and capacity building programs and advocating for best practices for farmers. The second is the Philippine Rubber Technical Working Group. Key outputs from that organization include the industry road map as well as the formation of six action committees that help coordinate extension services and other rubber improvement exercises (PhlRubber Technical Working Group, 2015).

   While these are significant initial steps, there are misgivings about both the scope and the institutional knowledge housed within the organizations (Field Research 2016; Dy 2015). Moreover, the Philippines' rubber is believed to be substandard by industry actors. Domestic stakeholders said rubber used to be mixed with battery solution, dirt and other contaminants during initial processing (Field Research, 2016). While officials believe that improvements have been made through extension outreach by PhlRubber Technical Working Group, the formation of the PRRI, and Bureau of Philippine Standards (BPS)' Technical Committee's adoption of rubber standards, the overall perception remains, thereby reducing the price Filipino processors can receive for semi-processed rubber.

2. **Access to higher-quality seedlings and appropriate fertilizers is constrained:** The Department of Environment and Natural Resources (DENR) has helped set up nursery operations in Zamboanga and North Cotabato to help provide seedlings to high-quality clones for farmers. In total, there are 27 nurseries and budwood gardens in the country that have been accredited by the Bureau of Plant Industries (PhlRubber Technical Working Group, 2015). While this ensures there is access for new plantings or replantings, stakeholders reported that the nursery seedlings are often of low quality with longer maturation periods (Field Research, 2016), which confirms previous observations offered by agricultural experts (Dy, 2013). Additionally, industry stakeholders report that access to fertilizer suitable for industrial levels of agriculture is limited (Field Research, 2016).

3. **Cost prohibitive processing environment:** The shift in the Philippines' trading profile from the export of crumb rubber to cup lumps to Malaysia provides quantitative evidence of a characteristic described repeatedly by private sector actors: there is little economic incentive to process rubber in the Philippines.[41] Whereas Filipino processors report that they receive market price for cup lumps from Malaysia buyers, they receive US$50-$100 less per ton if they process the rubber domestically and then sell the crumb or semi-processed rubber to domestic and international buyers because of concerns about the quality. Furthermore, high energy costs in the Philippines—amongst the highest in the region (Enerdata, 2014; IEA, 2013)—provide further incentive for exporting raw natural rubber to the Malaysia and processing it there.

   The economics also complicate Yokohama's efforts to boost domestic procurement of crumb rubber for the company's tires. Because of the logistical challenges associated with shipping rubber from Mindanao to Luzon, there are substantial costs for Filipino processors, who must conform to company guidelines regarding shipping containers and payment schedules. With relatively low margins in the industry, these costs can quickly exceed those associated with directly exporting cup lump. Without the sufficient economic incentive for Filipino producers to process in the country, there are barriers to the widespread adoption of new norms.

4. **Low levels of ISO certification:** As highlighted, there are only five processors in the Philippines that have ISO certification (Table A-11 in the Appendix lists the rubber processing companies and ISO certified firms in the Philippines). The international standard is an important prerequisite for crumb rubber and other intermediate rubber processors to integrate into supply chains of large-scale final product manufacturers. The Philippines' rubber industry has made progress in adhering to international standards in recent years, with the Land Bank of the Philippines and the Department of Science and Technology (DOST) supporting renovations at processing facilities for two more companies (PhlRubber Technical Working Group, 2015). However, overall enthusiasm for pursuing ISO accreditation remains low, with many stakeholders

[41] Standeco, to cite one representative example, has elected not to rebuild its North Cotabato plant that was attacked by New People's Army rebels partially because of security considerations (see Challenge No. 5) and partially because it is more economical to export raw rubber (Field Research, 2016).

reporting that the economic benefits falling below the cost (see previous Challenge) (Field Research, 2016).

5. **Political and security instability in Mindanao:** The rubber industry has been a target of the attacks that impairs Mindanao's broader economic development. In 2013, the New People's Army burned Standeco's rubber processing plant in North Cotabato, killing one worker in the process (The Philippines Star, 2013). The security risks make it difficult for private actors to secure loans, especially from foreign sources, who sometimes place the region on a no-loan list or charge higher interest rates (Field Research, 2016).

6. **Communication gaps among industry stakeholders:** The Philippine Rubber Industry Association (PRIA) has the most diverse representation across the value chain. Founded in 1979 and based in Manila, PRIA includes 67 members as of February 2017.[42] Its stated objectives include a variety of measures to increase the sector's performance through professional development, knowledge sharing and networking opportunities. Table 7 lists the various product segments for the PRIA membership as of 2015.

Table 7. Membership in PRIA in Various Categories, 2015

Category	Number of Members
Tire Manufacturers/Suppliers and Retreaders	3
Automotive, Industrial Parts & Sporting Goods Manufacturers	17
Natural Rubber Processors and Traders	16
Footwear Manufacturers	3
Latex-Based Product Manufacturers	3
Synthetic Rubber & Chemicals	17
Other suppliers	3

Source: PhlRubber Technical Working Group, 2015.

Despite the PRIA's broad representation, communication between industry stakeholders could be enhanced in at least three respects: 1) Between government offices; 2) Between individual government offices and private sector actors: 3) Between private sector actors at different segments of the value chain.[43] Between government offices, there does not appear to be a coordinated response to many of the industry's challenges. DTI is performing extension and matchmaking services for producers, traders and processors that might appear to fall under the purview of the DA. Between individual government offices and the private sector, there is sometimes a mismatch in priorities, with business officials indicating that many of the government's outreach efforts being ill-suited to the rubber industry.[44] Between different segments of the value chain, there appears to be trust deficits as well as failure to communicate market signals,

[42] PRIA's membership includes businesses that use both natural and synthetic rubber.
[43] The analysis in this paragraph is based on stakeholder interviews across multiple segments of the value chain conducted during the field research phase of the project.
[44] Examples include loan programs that are difficult to access or do not take into account the longer gestation periods for rubber trees, the government's failure to appreciate key pockets of the value chain such as the value of small-scale traders, and the emphasis on organic inputs that may be ill-suited to commercial-scale agriculture.

most notably between traders and intermediate processors or between final product manufacturers and intermediate processors (Field Research, 2016). Table 8 below lists key stakeholders active in the rubber GVC in the Philippines.

7. **Distance between EPZs in Mindanao and rubber production hubs.** The incentives offered by BOI and PEZA can serve as a significant tool for recruiting FDI. While there are EPZs on the island, most are concentrated close to Davao or Cagayan de Oro. The Zamboanga peninsula, which produces roughly 43% of the country's rubber, is particularly underrepresented, with only one PEZA—the Irasan-Roxas Zanorte Special Economic Zone (PSA, 2008-2015).

Table 8. Key Stakeholders with Interests in the Philippines' Rubber Sector

Actor	Description	Role
Department of Agriculture	Public sector unit responsible for developing and implementing agricultural policy in the industry	Provides technical assistance and other support to smallholders in the country. Focuses on upstream segments of the rubber value chain
Department of Agriculture, High Value Crops Development Program	Program is designed to work closely with private sector, particularly smallholders and farmers	Through the provision of extension services, goals include food security, expansion of private sector investment and income as well as improved production techniques. Rubber is a priority commodity.
Department of Agriculture, Bureau of Agricultural Research (BAR)	Supports research and development (R&D) initiatives that generated technologies and initiated interventions	Focal point for DA research into rubber industry and provides institutional home for PRRI.
Department of Agriculture, Bureau of Plant Industry (BPI)	Source of seed and plant material	BPI has accredited 27 rubber nurseries and budwood gardens throughout the country with high-yielding rubber clones
Department of Trade and Industry, Board of Investments	The Board of Investment reviews and approves applications for investment incentives for the industry.	Coordinating agency of technical working groups to overcome industry-binding constraints, it focuses primarily on processing activities. DTI has also engaged with tire manufacturer Yokohama to increase its local sourcing of rubber.
PhlRubber Technical Working Group	Formed in 2012 and originally co-chaired by both the DA and DTI, organization focuses on increasing competitiveness of rubber industry	Acts as lead agency to coordinate efforts across rubber value chain, including formation of road maps.
Philippine Rubber Industries Association (PRIA)	Founded in 1979, the industry association represents companies across value chain	Objectives include variety of measures to increase the sector's performance through professional development, knowledge sharing and networking opportunities.
Philippine Rubber Research Institute (PRRI)	Research institute under the direction of the Department of Agriculture	Mandated to initiate and administer research and development (R&D) programs to improve quality of rubber and benefit of smallholder rubber producers and processors. Working with local governments to distribute planting materials to rubber farmers.

Source: Authors.

4. Upgrading: Lessons for Philippine Upgrading from Global Experiences

Establishing a competitive position in the natural rubber GVC today, in the context of low global prices and expanding production, requires the Philippines to upgrade its current rubber operations. By adopting new technologies, producing a new product or engaging in an entirely new set of activities, upgrading can also allow actors in the GVC to capture greater value from their participation (Humphrey & Schmitz, 2002). In agribusiness chains such as rubber, this can be achieved in a number of different ways; for example, by applying good agricultural practices in terms of irrigation, fertilization and planting density, improving harvesting and collection techniques to avoid contamination; or undertaking further processing to convert it into a higher value intermediate or final output. Table 9 summarizes the key upgrading trajectories that have typcially been pursued by countries in the rubber GVC.

Table 9. Selected Upgrading Strategies in the Rubber Global Value Chain

	Description
ENTRY INTO THE VALUE CHAIN	• Establishment of rubber plantations for export.
	Example: Vietnam launched a rubber-planting program in 2001 in an effort to establish itself as a player in the sector. These campaigns have continued to date. In doing so, it has focused on developing and using the best agro and harvesting practices. It has the highest yield in the industry at 1.75t/ha in 2013 (Accenture, 2014).
PROCESS UPGRADING	• Introduction of new or more sophisticated technologies or reorganization of production systems to increase productivity • Improved yields through new cultivation and tapping techniques, tree replacement, etc.
	Example: The Rubber Association of Indonesia, GAPKINDO, in collaboration with the Estate Crops Division of Indonesian government's Department of Agriculture and the Centre for Policy and Implementation Studies initiated an education program focused on improving tapping techniques, and a tree replacement program with higher-yield planting materials. These initiatives led to yield increase by over 90% between 2000 and 2013 to c.1 t/Ha (Accenture, 2014).
PRODUCT UPGRADING: PROCESSING SEGMENT	• Product upgrading involves the production of a higher value product. • Requires knowledge of market preferences, costs and prices. • Introduction of better quality or higher valued semi-processed rubber.
	Example: Overall, producing countries have increased the export share of TSR over the past decade; reducing their share of lower value latex concentrate exports. In Thailand and Guatemala, nonetheless latex still accounts for 20% and 32% of export earnings (UN Comtrade, 2016); and Thailand is by far the world's largest latex exporter (60%) (Jumpasut, 2015b).
FUNCTIONAL UPGRADING INTO FINAL PRODUCTS (HEALTHCARE)	• Acquiring new functions (or abandoning existing functions) which require an increase the overall skill content of the activities. • Shift into the production of health and hygiene products. • Requires knowledge of new activities, market preferences, etc.
	Example: Once the largest producer of rubber, Malaysia began to manufacture latex gloves in the 1980s and gradually became the largest manufacturer and exporter in the world. Due to pressure on its land and labor resources, the country subsequently reduced its rubber production and is now a net importer (Accenture, 2014; UN Comtrade, 2016). Recently, Thailand has also begun to increase its production capacity for final goods, with Ansell and Allegiance Health Care setting up operations in the glove and condom sector (Weerathamrongsak & Wongsurawat, 2013).

FUNCTIONAL UPGRADING INTO FINAL PRODUCTS (TRANSPORTATION)	• Acquiring new functions (or abandoning existing functions) which require an increase the overall skill content of the activities. • Shift into the production of tires, and other automotive parts.
	Example. The rise of the automotive sector in SE Asia has resulted in the installation of tire manufacturing capacity in Thailand and Indonesia. These productions draw on Thailand's supply of natural rubber, in addition to imports. For example, Goodyear, Michelin and Bridgestone have all established production facilities in Thailand (Weerathamrongsak & Wongsurawat, 2013). Shanghai Huayi Group Co has established a JV for tire production with a subsidiary of Thai Hua Rubber Public Co. Ltd—Thailand's third largest rubber exporter—with plantation ownership to manufacturer bus and truck tires. The plant will be export oriented (Ho, 2016).
BACKWARD LINKAGES	• Increasing in-country integration between value chain segments • Provision of supporting equipment, inputs and/or services for a downstream segment.
	Example. Thailand has begun to domestically produce the tools required for tapping and cultivation that used to be imported from Malaysia (Weerathamrongsak & Wongsurawat, 2013).
ENVIRONMENTAL UPGRADING	• Reducing the environmental footprint of value chain operations. • Reducing water contamination during processing.
	Example. In the 1980s and 1990s, Malaysia introduced legislation and measures to treat rubber water effluent, which if left untreated can pollute rivers with high concentrations of nitrogen amongst other contaminants. The introduction of inexpensive aerobic, anaerobic and facultative ponds has helped reduce the net organic load of Malaysia's rubber industry by over 80% (Mohammadi et al., 2010).

Source: Authors.

The potential upgrading trajectories open to a country at any one time, however, depend on the country's specific position in the value chain, a wide range of institutional factors, including infrastructure, the business environment, and trade and investment policy and importantly, the governance structure of the chain (Bamber et al., 2013; Gereffi et al., 2005).

For example, functional upgrading, that is, incorporating additional functional activities of the chain (e.g. moving into final goods manufacturing activities), while a highly sought after trajectory by developing countries, is often difficult for them to pursue because there tend to be higher barriers to entry in the higher-value stages of GVCs due to higher capital, skill and raw material requirements on the supply side and concentrated markets on the buy side—this is particularly true for the manufacture of tires. In developing countries, product and process upgrading can be more attainable short to mid term goal, since they may require relatively minor investments in skills, equipment, or adjustments to the production process.

In analyzing different prospective paths to upgrading in the rubber industry that could be pursued by the Philippines, having analyzed its position in the chain and its strengths and weaknesses, it is therefore useful to look more in depth at specific country examples from countries at similar levels of development and facing similar questions of how to establish their positions in the rubber GVC. Two cases were selected here for further examination, based on the Philippines current situation:

- Vietnam provides an example of strong entry into agricultural production and early processing stages of rubber, building a strong supply of raw materials before attempting to upgrade into the production of final products.

- Sri Lanka offers an example of a country where the government has prioritized the sector, allowing for process and functional upgrades that have led to economic gains. However, in light of current declines in rubber productivity, a new development plan is prioritizing increased inter-agency collaboration. (Table 10 highlights key rubber indicators for Vietnam, Sri Lanka and the Philippines).

Table 10. Vietnam, Sri Lanka and the Philippines in the Rubber GVC

Indicator	Sri Lanka	Vietnam	Philippines
GDP/Capita (2015, Current US$)	US$3,926	US$2.111	US$2.899
Total Rubber Exports (2014, US$)	$903 million	$2,229 million	$555 million
Unprocessed and Semi-Processed Exports (2014, US$)	$55 million	$1,962 million	$77 million
Leading Upstream Category (2014 Export Value, US$)	Cup lump/other ($32 million)	TSR ($943 million)	Cup lumps ($57 million)
Key Markets	Malaysia, India	China, Malaysia	Malaysia
Major Final Rubber Products (2014 Export Value, US$)	Solid/industrial tires ($385 million)	Automotive tires ($705 million)	Automotive tires ($382 million)
Key Upgrading Trajectories	Process, functional	Process, functional	Limited process

Source: UN Comtrade; authors. **Note:** Export value data is based on import data.

4.1 Vietnam in the Rubber Global Value Chain

Vietnam is the most recent newcomer of the three largest natural rubber producers, surpassing Malaysia in 2012 (Accenture, 2014). Since its inception, the industry has been export-oriented with less than 20% of latex produced being consumed locally (Phuc & Huu Nghi, 2014). Export growth in the last decade has been particularly significant; overall natural rubber exports have increased from U$508 million in 2005 to US$2.2 billion in 2014 (see Table 11). This has made rubber the country's third largest agricultural export (Luan, 2013).

In addition to strong semi-processed materials exports, there have been indications of functional upgrading—Vietnam's exports of raw and semi-processed rubber products have increased from US$327 million in 2005 to nearly US$1.4 billion in 2014 while final products (new tires and vulcanized rubber) have jumped from US$83 million in 2005 to US$705 million in 2014. Reflecting the global shift of consumption to Asia, Vietnam trades primarily with regional partners; China is Vietnam's leading export partner for natural rubber, with 47% of exports destined for that market.[45]

[45] One report suggests that this underestimates the flow of rubber into China from Vietnam, much of which is smuggled over the border (Jumpasut, 2014).

Table 11. Vietnam Profile in the Natural Rubber GVC by Stage, 2005-2014

Category	2005	2007	2010	2012	2014
Export Value (US$, millions)					
Total (All Segments)	508	923	1,831	2,844	2,229
Unprocessed and semi-processed natural rubber (Share of total exports*)	***327***	***687***	***1,297***	***1,962***	***1,396***
Latex	54 (11%)	108 (12%)	143 (8%)	116 (4%)	100 (4%)
RSS	18 (4%)	55 (6%)	86 (5%)	172 (6%)	174 (8%)
TSR	166 (33%)	369 (40%)	837 (46%)	1,412 (50%)	943 (41%)
Cup Lump/Other	88 (17%)	154 (17%)	230 (13%)	260 (9%)	178 (8%)
Processed (share of total)					
Unvulcanised rubber	92 (22%)	88 (12%)	166 (10%)	284 (11%)	170 (8%)
Final Products (share of total)	***83 (20%)***	***141(19%)***	***351 (22%)***	***573 (22%)***	***705 (33%)***
New tires	23 (6%)	45 (6%)	197 (12%)	331 (13%)	399 (19%)
Articles of vulcanized rubber	36 (9%)	66 (9%)	91 (6%)	150 (6%)	194 (9%)
Global Ranking (Share)					
Unprocessed and Semi-Processed Natural Rubber					
Latex	4 (5%)	5 (6%)	4 (5%)	4 (4%)	4 (4%)
RSS	6 (1%)	4 (2%)	4 (3%)	3 (5%)	3 (7%)
TSR	4 (3%)	4 (7%)	4 (6%)	4 (8%)	4 (8%)
Cup Lump/Other	4 (6%)	4 (6%)	7 (1%)	4 (9%)	4 (14%)
Processed (share of total)					
Unvulcanised rubber	12 (2%)	15 (1%)	12 (2%)	10 (3%)	14 (2%)
Final Products (share of total)					
New tires	56 (0%)	53 (0%)	39 (0%)	35 (0%)	31 (0%)
Articles of vulcanized rubber	38 (0%)	33 (0%)	31 (0%)	29 (1%)	28 (1%)

Source: UN Comtrade. Based on all importers. * = Share of the country's natural rubber exports in all segments across the value chain. Retrieved on October 24, 2016.

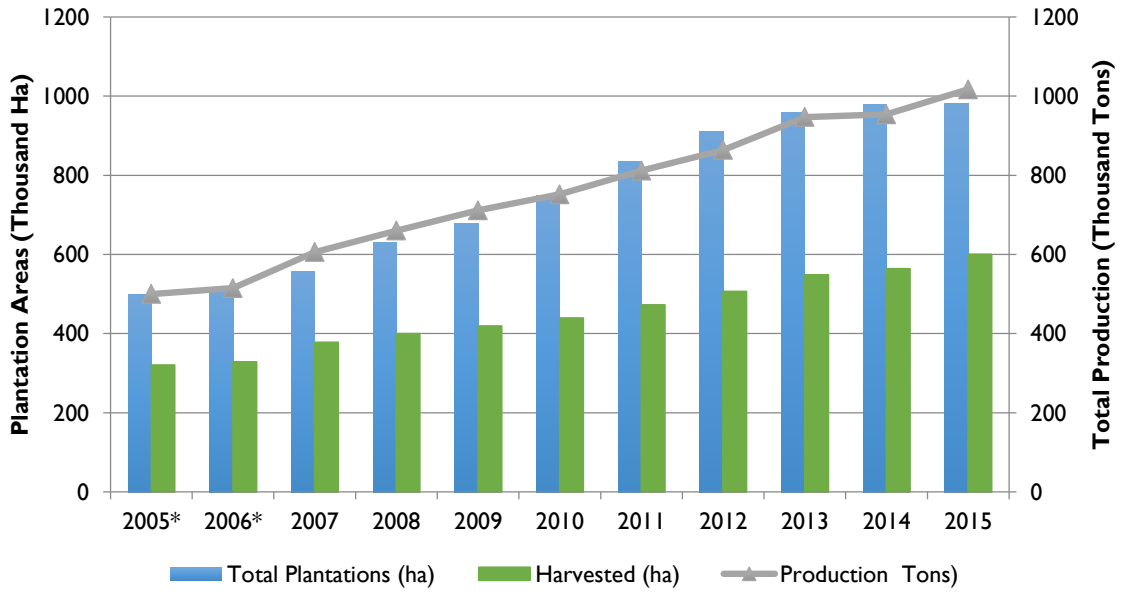
Vietnam's emergence as a global rubber player has its foundations in the country's strong focus on modernizing and strengthening its agricultural base due to its perceived contributions to rural development. Rubber production was prioritized thanks to geographical and climatic conditions suitable to its production, strong global demand with attractive export revenues, and its contributions to rural employment—many of the same reasons it has been supported in the Philippines. Rapid growth has been facilitated by the country's top-down approach to policy development and implementation. This section reviews Vietnam's participation in the rubber GVC over the past few decades, and examines the policy approaches pursued by government to increase economic gains from that participation.

(i) Expansion of Agricultural Production and Process Upgrading

Vietnam's natural rubber production developed primarily through a commercial approach to agriculture, involving large rubber production firms. In contrast to regional peers with dominant smallholder involvement, large plantations accounted for approximately 51% of national supply in 2014 (Luan, 2013). Production began in earnest in the mid-1980s with state-led efforts by the Vietnam Rubber Corporation (VRC), a state-owned enterprise (SOE). By 1993, the company had established 18 plantations and accounted for 87.5% of rubber production (Vo Hung Son et al., 1993).

Areas of production increased rapidly over the next two decades, mostly as a result of VRC expansion.[46] Although private sector expansion was encouraged during the late 1990s and early 2000s, with the government promoting expansion of approximately 20% (Vo Hung Son et al., 1993), there was low uptake as private investors viewed the sector as too risky. Private sector investment, nonetheless, slowly gained traction in the mid-late 2000s, with multiple private plantations being established after 2008 in the face of increasing global prices and changes in government policy (Phuc & Huu Nghi, 2014).[47] By 2012, production area had reached 900,000 ha (Phuc & Huu Nghi, 2014); it is estimated that within the next two to five years, the total area under production will surpass 1 million ha (Figure 12).

Figure 11. Vietnam Natural Rubber Production, Area and Output 2005-2015



Source: Authors; 2007-2012 data from Luan (2013) and Stoxplus (2014); 2012-2015 data from (Vietnam Rubber Association, 2016).

Note: * = estimates based on extrapolation and Luan (2013).

VRC, which continues to dominate the industry (44.3% (Luan, 2013), was tasked with driving the country's strategy to modernize agricultural production in the rubber sector. Its rubber plantations were guided by a centralized technical management systems which stipulated varieties, fertilizer and herbicide use and tapping techniques based on findings from the in-house rubber research institute and foreign technical assistance (Vo Hung Son et al., 1993). As the country gained production experience over the next decades and the number of young, but productive, trees increased, output increased. Joint ventures between VRC subsidiaries and private firms also facilitated knowledge and technology flows across firms (Phuc & Huu Nghi,

[46] In 2006, the government restructured the VRC, creating the Vietnam Rubber Group (VRG) holding company.
[47] Prior to nationalization, several private rubber plantations had operated in the country, one of the largest was Dong-Nai Rubber Company established by a French firm which left Vietnam in 2015.

2014). Between 2002 and 2014, productivity increased from 1.25MT/ha to between 1.8 and 2.4MT/ha (Luan, 2013; Phuc & Huu Nghi, 2014).

More modern agricultural techniques in rubber production were also extended to smallholder plots—which account for the remaining 49% of land allocations for rubber—through a relatively institutionalized approach to land consolidation operations.[48] Smallholders in areas earmarked for rubber production were encouraged to "contribute" a share of their land use rights to rubber companies in exchange for a share of the profits (albeit small around 8-9%), prioritized employment, guaranteed input supply and purchase. This model has been popular in the Northwest, in particular, where 18,000 households had contributed 23,000 ha by 2012. These value chain linkages were critical to support commercialization of these credit-constrained smallholder plantation holders, increasing capital investment in the sector, facilitating technology transfer to increase productivity and generate more competitive economies of scale. Some local governments even provide financial support to reduce the higher transaction costs for processing firms associated with this model.

(ii) Functional Upgrading into Semi-Processed and Final Products

Functional upgrading is relatively new to the country, and as recently as 2012, only about 75MT (<20%) was absorbed locally for further processing (Luan, 2013). Nonetheless, recent growth has been notable. Exports of final rubber products increased from US$141 million in 2008 to US$705 million in 2015 (see Table 11 above). The ample supply of quality raw materials combined with advantageous trade agreements,[49] effective EPZs, low cost energy and labor and proximity to China have all facilitated this upgrading. The rapid expansion of Vietnam into a wide range of manufacturing sectors has also provided a strong foundation for added-value in the sector.

In particular, key investments have been in final products primarily destined to the automotive, apparel and healthcare markets. Automotive growth has been the strongest; by 2008, there were nine foreign tire manufacturers in the country. Although some of these were oriented towards serving the domestic market, particularly for the booming motorcycle sector (Moore, 2012), these were soon to orient towards the export sector. For example, Bridgestone opened a aftermarket tire production facility in 2014, with a daily capacity of 24,700 tires destined to the US, European and Japanese markets (Bridgestone, 2014; USAID, 2011). As a result of these investments between 2005 and 2014, tire exports increased from US$23 million to US$399 million. Other upgrading includes investments in the production of protective clothing for the fishing and industrial sectors, and an expansion of VRG's latex glove factory (Luan, 2013).

[48] This industrial structure has been significantly influenced by the forest-land reallocation program which has reallocated state-owned and community forest land to SOEs, private actors and households. This policy has been carried out at a provincial level and thus distribution patterns differ by region; for example, in the Northwest, SOEs and households have received a significant portion of reallocation of land, while in the Central Highlands, private enterprises have been favored for investment.

[49] Certain recent investments have been made to take advantage of Vietnam's free trade agreement with the US in the face of the imposition of anti-dumping tariffs against Chinese manufacturers (Chia-erh, 2016).

(iii) Environmental and Social Downgrading

While Vietnam has seen significant economic gains in the industry from exports, the environmental and social impact of its rapid rubber expansion have a mixed record. Many of these new plantations were planted in areas cleared of natural forest as a result of loopholes in implementing rules, resulting in deforestation and a reduction of biodiversity. For example, in the rapidly expanding Central Highlands area, 79% of plantations were established on former natural forests (Phuc & Huu Nghi, 2014). In addition, despite efforts to shift towards sustainable forestry management, the largest company, VRC lost its FSC certifications in 2015 as a result of the company's alleged abusive practices as its new plantations in Laos and Cambodia.[50] The total economic cost of this loss is yet to be seen in terms of buyer response; at a minimum, the cost to the firm was US$200,000—the cost of certification for their 11,700 ha in 2012 (Forest Trends, 2012). Nonetheless, this was a blow to the country's efforts to improve its environmental and social record in the industry.

Policy Approach to Driving Growth and Upgrading

The natural rubber sector in Vietnam has been driven by a combination of sector specific, top-down and macro-economic policies fostering private investment in the forestry sector, incentivizing rubber production and supporting market access for rubber output. These policies, founded in land reallocation measures, have been pursued in efforts to drive rural development, curtail deforestation, create employment and boost exports.

At a sector-level, policies began at the forestry level driven by a need to address deforestation[51] before being narrowing in on the rubber sector specifically. Five key policies and programs have considerably contributed to the rubber industry's rapid growth. The first of these programs was Program 327, implemented between 1992 and 1998, a major effort to develop industrial plantations. The reforestation program sought to reforest some five million hectares. As part of this initiative, it allocated three million ha to "production forests", of which industrial forest crops such as rubber, tea and fruit trees were allocated one million hectares (Barney, 2005). More followed in 1998—327,000—by a much more ambitious program—the 5MHRP—that allowed for reforestation of the degraded forest land, natural regeneration of logged forest areas and effective forest protection (Putzel et al., 2012). Although these programs did not achieve their projected goals—with just 9% of land converted—efforts helped to establish forestry as a priority sector in the country.[52]

More direct initiatives for the rubber sector began in 2007, with the approval of the National Forestry Strategy for 2006-2020. This established explicit goals for the expansion of industrial

[50] "Rubber Barons," a 2013 Report by Global Witness first exposed the labor and social practices being implemented by two Vietnamese firms in Laos and Cambodia. This led the FSC to investigate further during 2014, and eventually rescinding its certifications from VRC in 2015 (FSC, 2016; Global Witness, 2013).
[51] Vietnam lost natural forest cover at a rate of 185,000 hectares per year from 176 until 1990 (Barney, 2005).
[52] Since 1992, the area of plantation forests has expanded by 6.5% per year, three times faster than the 2% world average, and it reached approximately 3.5 million hectares in 2010 from just one million hectares in 1990 (FAOSTAT, 2015; Sandewall et al., 2015). The natural forest protection mechanisms have also helped boost the total forest area available for logging, called the production forest, which was estimated 6.3 million hectares in 2010 (Quyen & Nghi, 2011; Sandewall et al., 2015).

plantations, including crops such as rubber, tea and fruit, to 8.3 million ha by 2020 (Forest Science Institute of Vietnam, 2009; Thang, 2015). Two years later (2009), the most significant program regarding the agricultural production of rubber was put in place; the rubber sector was specifically addressed with the Rubber Sector Development Strategy (Decision 750), with the goal to increase area under production to 800,000ha, production volumes to 1.2 million tons and exports to US$2 billion by 2020. A key element of this strategy was to permit the development of rubber plantations on previously degraded natural forest land, and unproductive agricultural land in areas deemed suitable for rubber production. This allowed provincial governments to actively begin to reallocate and/or lease land to private investors, households and SOEs specifically for rubber plantations. This was supported by guidelines (Circular 127/2008) detailing temperature ranges, rainfall and typhoon risk, altitude, slope, soil depth and composition amongst others (Phuc & Huu Nghi, 2014).

Numerous private companies set up plantation operations in the aftermath of this strategy and production area expanded rapidly by approximately 35% in the next three years (Figure 12). In addition, the strategy specifically highlighted that households within the projected production areas should contribute their land use rights to this initiative (Phuc & Huu Nghi, 2014). With land permitting and allocation issues mostly resolved, the sector continued to expand. Subsequent policies have generally been oriented towards supporting the sector in the face of depressed global prices and consideration to the invitation to join the International Rubber Consortium (Crain News Service, 2015; "ITRC Urges Vietnam to Join Association," 2015).[53] Part of the policy approach has been to drive upgrading into higher value segments of the chain, encouraging local processing rather than complete dependence on exports.

Specifically, in 2016, the government announced its long-term strategy for the rubber sector through 2025.[54] The plan, outlined in Decision 4665, is focused on first consolidating its presence in the automotive segment (motorbikes and automobiles) by expanding the range of tire and other products fabricated in Vietnam and increasing exports in addition to serving the domestic market. After this, between 2020-2025, efforts will shift towards conveyer belts. The implementation of the strategy is to be led by the Ministry of Industry and Trade, in collaboration with both other Ministries and rubber producers. The plan includes investment incentives, a focus on developing human capital and improving R&D facilities. It will also prioritize environmentally sustainable products (Vietnam Manufacturing, 2016).

At a macro-level, efforts to integrate Vietnam into the global economy were also essential for rubber expansion, improving the business environment for investors, facilitating knowledge and technology transfer and gaining access to new markets. The overall shift in economic policy from centralized operations to a more market driven operations begun in the context of "Doi Moi" (renovation) in 1986 provided the essential backdrop to these efforts. This was accompanied by a wave of market and land tenure reforms (UNCTAD, 2008), including the

[53] Efforts to convince Vietnam to join the ITC began at the end of the 2000s as the country's production soared disrupting global supplies.
[54] This follows the 2015 Industrial Development Plan 2025, Vision 2035, which set out an overall strategy for industrialization (http://www.vir.com.vn/industrial-development-strategy-through-2025-vision-to-2035.html).

Land Law in 1993 which granted farmers land use certificates to lease, exchange, inherit, transfer and use land as collateral.[55]

In addition, the country joined several bilateral and multilateral trade agreements, including with the EU (1995), US (2001) and ASEAN-China (2010), and accession to the World Trade Organization (WTO) in 2007 (UNCTAD, 2008). These trade efforts were supported by changes to investment policy aimed at leveling the playing field for domestic and foreign investors and attract foreign investment; for example, the 2005 Investment Law allowed 100% foreign ownership of firms (OECD, 2009). The 2003 Corporate Income Tax Law simplified the tax code by introducing a single corporate income tax rate of 28% for all business, regardless of structure and ownership—special concessions have also been made to rubber producing companies, in some cases reducing corporate tax to 15% (Luan, 2013). It also adopted a modern approach in determining taxable income, allowing companies to deduct the standard business-related expenses such as depreciation of fixed assets, research and development (R&D) costs, training, advertisement and marketing costs (UNCTAD, 2008). These developments helped to foster investment in downstream manufacturing facilities.

4.2 Sri Lanka in the Natural Rubber Global Value Chain

Rubber has a long history in Sri Lanka and has been one of the country's leading exports for some time along with tea and textiles (Kapugama et al., 2011). By the mid-1970s, the country was the world's fourth largest producer of natural rubber at 155,000 metric tons per year and the country had moved into the manufacture of final rubber products (USAID, 2002). The industry continues to make a significant contribution to the country's economy. Sri Lanka is still a top 10 global producer and exporter of natural rubber, and across the value chain, the sector accounted for 7.7% of the country's exports and employed roughly 300,000 workers in 2015 (Oxford Business Group, 2015a, 2015b). After the government and external development organizations focused attention on the potential of the sector in the early 2000s, the country has expanded its capacity in the production of final rubber products. As it has diversified its rubber portfolio, Sri Lanka has become the world's largest exporter of solid tires while also using as much as 88% of the country's raw natural rubber generated by domestic producers (Rubber Development Department of Sri Lanka; UN Comtrade, 2016).

Final products accounted for almost 89% of Sri Lanka's rubber exports in 2014, with the value of exports in that segment of the chain more than doubling in the last decade from US $372 million in 2005 to US$803 million in 2014 (see Table 12 below). Much of that can be attributed to the country's strong presence in solid tires. Sri Lanka accounted for 43% of global exports in 2014 in the niche product category, which describes tires used by industrial construction

[55] Initially, from 1993 to 1998, LUCs, also called Management or Protection Contracts, have issued five-year land use rights to households (Quyen & Nghi, 2011). Whereas LUCs still imposed numerous restrictions including its temporary nature, permanent LUCs or 'Red Books' replaced them as the most secure land document for the rural households in Vietnam (Sandewall et al., 2010). 'Red Book' certificates still did not permit full ownership, but they accorded the recipient 50-year use rights, which were transferable, exchangeable and available for use in leasing arrangements and as loan collateral. Further, the government's Decree 23 in 2006 provided the policy framework for renting and leasing of land to individuals and organizations (Quyen & Nghi, 2011).

equipment such as forklifts and cranes (Oxford Business Group, 2015a). The value of the country's exports in production segments of the chain have dropped during that same time span, which can only be partially attributed to declining global price as well as increased absorption by domestic industry.

Table 12. Sri Lanka Production and Trade in the NR GVC, by Stage, 2005-2014

Category	2005	2007	2010	2012	2014
Export Value (US$, millions)					
Total (all segments)	**431**	**633**	**705**	**964**	**903**
Unprocessed and semi-processed natural rubber (Share of total exports*)	***50 (12%)***	***108 (17%)***	***168 (24%)***	***133 (14%)***	***55 (6%)***
Latex	4 (1%)	12 (2%)	12 (2%)	12 (1%)	5 (1%)
RSS	15 (4%)	38 (6%)	66 (10%)	33 (3%)	4 (1%)
TSR	7 (2%)	15 (3%)	20 (3%)	27 (3%)	12 (1%)
Cup Lump/Other	22 (5%)	41 (7%)	68 (10%)	61 (6%)	32 (4%)
Leading final products (share of total)	***372 (86%)***	***512 (81%)***	***516 (86%)***	***772 (80%)***	***803 (89%)***
Retreaded or interchangeable tires	163 (38%)	209 (33%)	218 (31%)	357 (37%)	385 (43%)
New tires	126 (29%)	171 (27%)	172 (25%)	254 (26%)	258 (29%)
Articles of vulcanized rubber	46 (11%)	80 (13%)	70 (10%)	85 (9%)	95 (11%)
Global Ranking (Share of Global Total in Each Export Category)					
All Natural Rubber					
Latex	18 (0%)	13 (1%)	15 (0%)	13 (0%)	14 (0%)
RSS	7 (1%)	6 (1%)	5 (2%)	6 (1%)	16 (0%)
TSR	20 (0%)	18 (0%)	24 (0%)	27 (0%)	28 (0%)
Cup Lump/Other	9 (1%)	8 (2%)	6 (2%)	6 (2%)	7 (2%)
Final Products					
Retreaded or interchangeable tires	1 (24%)	1 (22%)	1 (21%)	1 (24%)	1 (25%)
New tires	37 (0%)	38 (0%)	40 (0%)	37 (0%)	37 (0%)
Articles of vulcanized rubber	33 (0%)	30 (0%)	32 (0%)	32 (0%)	33 (0%)

Source: UN Comtrade. Based on all importers. * = Share of the country's natural rubber exports in all segments across the value chain. Retrieved on October 24, 2016.

Sri Lanka's experiences in the rubber industry—both its successes and challenges—highlight the importance of broad levels of government support. While the institutional support that exists in the country is not necessarily unique, its depth and organization has helped rubber be targeted as a priority industry by agencies such as the Board of Investment and the Export Development Board. Moreover, in response to current challenges in the industry that have led to declining production and yield of raw rubber, the government has committed to an expansive master development plan that is focused on increasing inter-agency collaboration.

Previous interest by the government has helped facilitate two broad upgrading trajectories that can be observed in Sri Lanka's rubber industry: *1) Process upgrading and expansion of rubber production;* and *2) Functional upgrading into production of final outputs*. Sri Lanka's experience both cultivating its rubber industry as well as confronting recent challenges provides a model for countries such as the Philippines that are looking to reinvigorate their domestic sectors. The following section examines Sri Lanka's upgrading in the natural rubber GVC by first charting the industry's development before analyzing the policy approaches pursued by the government.

1. **Process upgrading and expansion of rubber production:** Production is dispersed in the southern regions of the country. Historically, there has been roughly a 60-70% split between smallholders and plantation companies, with smallholders being the more common.[56] During its most recent census, it estimated that smallholders account for 63% of rubber cultivation area and 77% of total production (Ministry of Plantation Industries, 2014).

   Since the time when Sri Lanka was one of the world's five largest natural rubber producers in the mid-1970s, there have been three distinct production periods within the country: 1) From the mid-1970s to 2000, production declined from 155,000 MT per year to less than 90,000 (UNESCAP, 2009; USAID, 2002); 2) A sharp increase from 2004 to 2011, in which time annual production jumped from roughly 93,000 to almost 159,000 MT (Rubber Development Department of Sri Lanka); 3) A dramatic decrease from 2012 to the present, from 159,000 MT to a little more than 88,000 MT.

   The original fall over the latter decades of the 20th century was the result of a variety of factors. In addition to a host of shortcomings that are common developing country constraints in agriculture value chains—limited use of fertilizer, inadequate technology and machinery, low human capital skills, and lack of investments and access to finance—there was upward pressure on land prices associated with urbanization in southern Sri Lanka, which encouraged some rubber producers to sell their farms (Nakandala & Turpin, 2011; UNESCAP, 2009). The low prices for global rubber during the Asian financial crisis in 1997-1998 also played a role (UNESCAP, 2009).

   The rapid rise in rubber production from 2004 to 2011 was partially the result of process upgrades that boosted yields from 1.2 kg/hectare to 1.6 kg/ha and expansion and replanting programs (see Table 13 below). The most common were outreach to smallholders in the form of extension services by many agencies as well as finance programs and broader investments in infrastructure (UNESCAP, 2009). The following section on policy approaches provides further detail on the government strategies. Because of the pervasiveness of the smallholder model described earlier, there was not a widespread move toward larger-scale plantations. While there are companies with significant rubber holdings in the country—Lalan Group and C.W. Mackie are two prominent examples of rubber producers—many of these firms have been active in Sri Lanka for decades owing to the long history of rubber production (C.W. Mackie; Lalan Group).

   Since 2012, Sri Lanka's average yield per hectare and its total production have both plunged, forcing the country to import US$55 million of unprocessed and semi-processed natural rubber in 2014 and US$32 million in 2015 to supply its final products operations (UN Comtrade, 2016). The drop in yield and overall production have both been attributed both to global industry headwinds such as the

[56] The government defines smallholders as having less than 50 hectares.

decline in global prices and producers not tapping as well as local constraints (Sri Lanka News, 2016). Inside Sri Lanka, the most immediate challenges include the shortage of skilled tappers as well as broader deficits in human capital, aging rubber trees, and insufficient application of inputs (Oxford Business Group, 2015a).

Table 13. Sri Lanka Production Profile of Unprocessed and Semi-Processed Rubber

Description	2008	2009	2010	2011	2012	2013	2014	2015
Total production (MT, 000s)	129	125	153	158	152	130	98	88
Total area (ha, 000s)	119	122	125	128	130	132	134	134
Under tapping	94	94	98	97	99	101	106	114
Immature	25	28	27	31	31	31	28	20
Replanted area (ha, 000s)	6	6	6	3	2	3	2	1
New planted area (ha, 000s)	2	0.7	3	3	2	3	1.4	0.7
Subsidies for planting (US$, 000s)	867	2,314	2,468	3,808	1,917	2,911	3,784	3,965
Average yield per hectare (Kg)	1,246	1,382	1,561	1,631	1,531	1,290	930	776

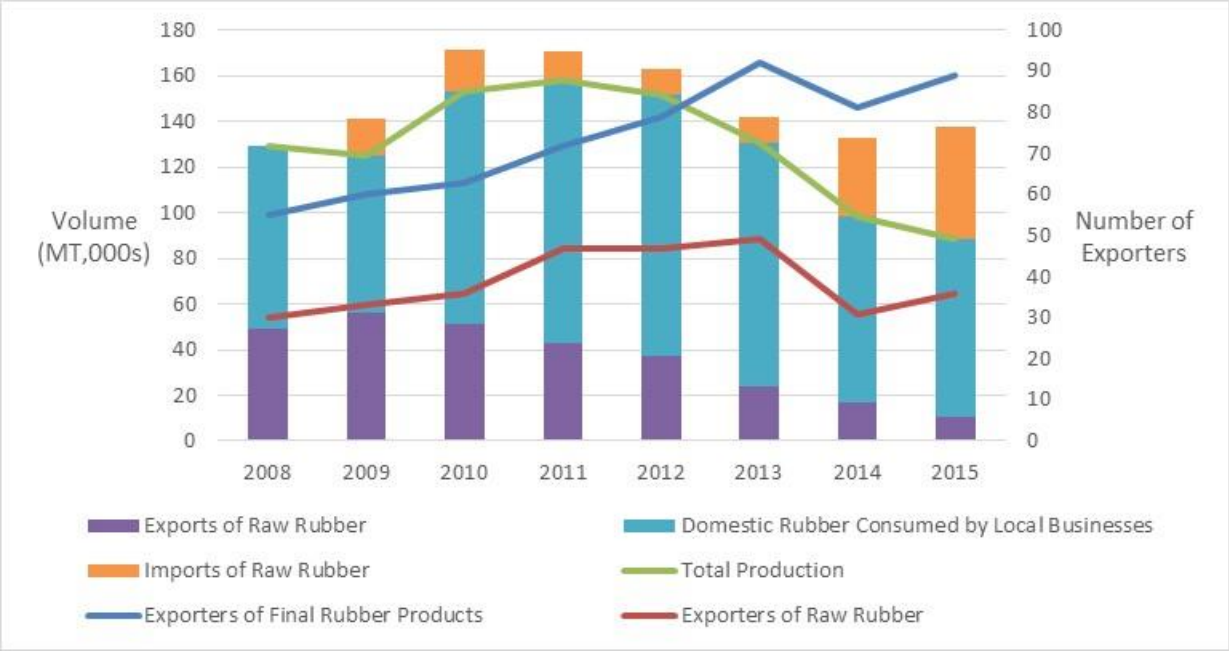
Source: Rubber Development Department of Sri Lanka.

2. **Functional Upgrading into the Production of final rubber outputs:** While the production of final rubber products has a longstanding history, the value Sri Lanka's exports of industrial tires, new tires, articles of vulcanized rubber (rubber mats, gaskets, seals, etc.,) and gloves have increased by at least 70% in the period from 2005 to 2014.[57] Sri Lanka also ranks as top 10 exporter of rubber clothing (fifth) and surgical gloves (seventh) (UN Comtrade, 2016). The country's global preeminence within the solid tire segment of the chain has been particularly pronounced since 2004—Sri Lanka's exports more than doubled from US$163 million to US$385 million from 2005 to 2014.

   The expansion of producers of final rubber producers based in Sri Lanka has increased the share of unprocessed or semi-processed rubber that is consumed inside the country. In 2015, locally based companies absorbed roughly 88% of the country's total raw rubber production, up from 62% in 2008. During the same period, the number of exporters of final rubber products has increased from 55 in 2008 to 89 in 2015. Figure 13 below charts these and other trends associated with the country's rubber industry. The industry's use of Sri Lankan rubber as an input is depicted in light blue in the bar graph while exports are purple and imports are in orange.

[57] Table 10 includes Sri Lanka's leading three product exports. The country also exported US$55 million in surgical gloves in 2014 (HS code 401511), up from US$31 million in 2005 (UN Comtrade).

Figure 12. Production and Export Profile of Sri Lanka Rubber Industry



Source: Rubber Development Department of Sri Lanka.

Note: Imports of raw rubber were calculated by using the data provided by the Rubber Development Department and first subtracting the export volume from the production volumes. That figure was then compared against the local consumption of rubber. The difference between the local consumption figure and the production minus exports was estimated to be the Sri Lanka's import volume.

Much of the country's functional upgrading in the sector has been driven by FDI from firms interested in securing raw materials, employing low-cost human capital or accessing public research capacity (Nakandala & Turpin, 2011). As the leading producer and exporter of solid and industrial tires for construction equipment, many of the leading companies have operations in Sri Lanka. Loadstar is perhaps the most prominent example. Loadstar is a Joint Venture between Solideal and the Jinasena Group of Sri Lanka; Solideal is the global market leader in solid tires, controlling between 20-25% of the market (USAID 2002; company profile). The company opened in 1984 to take advantage of Sri Lanka's natural rubber supply. Loadstar operates its own collection centers inside the country and also buys directly from smallholders (Kapugama et al., 2011).

FDI has provided the Sri Lankan rubber industry with different benefits depending on the product segment. Nakandala & Turpin (2011) noted that the tire companies such as Loadstar that have pursued JVs have been more likely to be attracted by the country's higher-skilled educational capacity; as a result, they have encouraged technology spillover and mobility of human capital among competing firms. On the other hand, the glove businesses have used Sri Lanka as a low-cost production center. These latex companies have placed a strong emphasis on quality of raw materials; as a result, they have stressed standards in their supply chain, demanding that local business possess minimum certifications.

The export markets for producers often depend on their outputs. Sri Lanka's primary destinations for unprocessed and semi-processed rubber are Malaysia, India and Pakistan. Tires, on the other hand, are exported in bulk to the US or Germany while gloves end up in the US, Germany and India (Sri Lanka Export Board; UN Comtrade, 2016).

Policies and Programs

Rubber's embedded position in the Sri Lankan economy has provided the industry with a level of institutional support from lawmakers, private sector actors and international aid organizations that have been critical in enabling both process and functional upgrading. Inside the government, the Ministry of Enterprise Development and Investment Promotion, the Ministry of Industrial Development, the Ministry of Trade and Commerce and the Ministry of Plantation Industries have all implemented programs specifically designed to assist and nurture the rubber sector. (UNESCAP, 2009). Industry associations such as the Sri Lanka Association of Manufacturers and Exporters of Rubber Products, the Sri Lanka Society of Rubber Industry, and the Colombo Rubber Traders' Association represent the interests of their respective segments of the value chain. Finally, organizations such as the Rubber Development Department, the Rubber Research Institute and the Plastic and Rubber Institute of Sri Lanka provide either training or research support.

These organizations have had both their successes and their shortcomings. Inter-institutional communication has been cited as an industry-wide constraint (Sri Lanka News, 2016; UNESCAP, 2009). In light of the recent productivity downturn, the government has committed LKR 100 million (roughly US$665,000) to formulating a new industry master plan that will target improved inter-agency collaboration as well as broader strategies for increasing yields and sector-wide efficiency (Paranawithana, 2016).

Although these bodies are being asked to communicate more effectively across the value chain, they have had successes in advocating for their respective constituents. This institutional commitment has been critical in identifying specific measures to assist the development of the sector. The most notable are outlined below.

1. Process upgrading: In order to facilitate the process upgrades to boost productivity, the government has implemented a variety of new initiatives targeting the smallholders that generate the majority of Sri Lanka's rubber. These efforts have generally encompassed two forms: 1) economic incentives; and 2) extension services.

The government's economic incentives focus on the provision of critical inputs such as seeds and fertilizers as well as subsidy programs for both replanting and new planting of rubber trees. In turn, the subsidy program works in tandem with extension services. Farmers receive LKR 150,000 (approximately US$1,000) for new plantings and LKR 175,000 (approximately US$1,150) for re-plantings (Rubber Development Department of Sri Lanka). Payment is made in eight installments and dependent on a variety of best practices such as proper holing techniques, planting of cover crops and the installation of rain guards. The Rubber

Development Department of Sri Lanka conducts an inspection to ensure guidelines are being followed. Table 14 below lists the subsidy payment schedule.

Table 14. Subsidies Available to Rubber Farmers in Sri Lanka

New Planting		Re-Planting	
Installment	**Per Hectare**	**Installment**	**Per Hectare**
First	LKR 6,000 (~US$88)	First	LKR 8,000 (~US$117)
Second	LKR 36,000 (~US$528)	Second	LKR 43,000 (~US$631)
Third	LKR 12,000 (~US$176)	Third	LKR 15,000 (~US$220)
Fourth	LKR 18,000 (~US$264)	Fourth	LKR 21,000 (~US$308)
Fifth	LKR 18,000 (~US$264)	Fifth	LKR 21,000 (~US$308)
Sixth	LKR 18,000 (~US$264)	Sixth	LKR 21,000 (~US$308)
Seventh	LKR 19,000 (~US$279)	Seventh	LKR 22,000 (~US$323)
Eighth	LKR 23,000 (~US$340)	Eighth	LKR 23,000 L (~US$340)

Source: Rubber Development Department of Sri Lanka. **Note:** Based on exchange rate of 1 USD = LKR 68.1 on Jan. 16, 2016.

The subsidy program is supported by a tax on the import of processed and synthetic rubber and the export of unprocessed and semi-processed rubber (Sri Lanka Export Board, 2014; UNESCAP, 2009). The levy—which is known as the Cess and calculates its charges based on import values and export weights—is designed to encourage the export of value-added products by targeting the upstream segments of the natural rubber value chain. Rubber is one of 29 agricultural products supported by the program.

2. Functional upgrading: Rubber is one of seven sectors identified by both the Board of Investment and the Export Development Board as priority industries. That emphasis has encouraged functional upgrading observed in the expansion of Sri Lanka's exports in final rubber products. At an industry level, Sri Lanka's Board of Investment and its Export Development Board both provide a range of services to investors, including coordination of permits, visas, sites, incentives and import-export clearance (Oxford Business Group, 2015b). Further upgrading has been supported by general improvements in the country's business environment. At a broad level, the government has recently prioritized broad infrastructure investments, including a US$1.4 billion port project (Economist, 2015), which has helped boost its overall infrastructure rankings to a top-20 global position (World Economic Forum, 2015).

4.3 Key Lessons for the Philippines

Vietnam and Sri Lanka have managed to carve out niches in the rubber GVC, using both process and functional upgrading to increase economic benefits. In both cases, there are valuable lessons for the Philippines to draw from these cases if it is going to enter the rubber GVC in significant fashion.

Both countries have made a concerted effort in boosting production through process upgrades. Vietnam and Sri Lanka's strategies have revolved around two primary pillars: 1) Increasing qualified human capital through extension and research services; and 2) Access to finance or subsidy programs. Both efforts have been assisted by economies of scale considerations. At the same time the global industry embraces a corporate agriculture model

with larger production sites, Vietnam has oriented its sector toward plantations, while the Sri Lankan government considers anything less than 50 hectares a smallholder. Vietnam's process upgrading was also part of a country wide effort to increase the productivity in the agricultural sector in general, allowing for spillovers across crops. The government has placed a high emphasis on fertilization and irrigation.

Both countries adopted industrial policies geared toward the sector to drive functional upgrading. Vietnam's has been layered into several stages, first achieving production scale before launching a policy to drive functional upgrading. Sri Lanka has been aggressive in efforts to support its rubber sector, with its Board of Investment and the Export Development Board naming rubber one of seven priority industries in the country. In turn, that has allowed the government to structure efforts that encourage upgrading—not only through import and export taxes to finance planting programs or incentives associated with export processing zones, but by specifically targeting firms.

Finally, Sri Lanka has recognized that its institutions need to engage in more comprehensive inter-agency communication. Owing to rubber's history as a major export, Sri Lanka has a high number of institutions and organizations that advocate for the rubber industry. While that has helped facilitate the functional upgrading described above, recent challenges in the production segment has led the government to initiate a new master plan for the industry that aims to improve collaboration between the institutions in the different segments of the chain.

Box 4. Malaysia in the Natural Rubber GVC

Malaysia's participation in the industry has shifted somewhat over the past two decades. The country was initially one of the strongest producers and exporters of natural rubber. Based on these strengths in the availability of raw material, the country upgraded into the production of downstream healthcare products, ultimately becoming the world's largest latex rubber glove producer and exporter, a top-three exporter of condoms and home to the world's largest condom manufacturer, Karex. However, rising incomes, combined with higher return opportunities in palm oil and urban planning subsequently led to a decline in local production to just 5.7% of global supply in 2015. To satisfy its internal demand for processing requirements, Malaysia has become a net importer, relying strongly on latex supply from Thailand.

Sources: The Rubber Economist, 2016; UNComtrade, 2016b

5. Upgrading Trajectory Recommendations

Opportunities for the Philippines to make strong headway into the rubber industry are limited in the short term by constraints in the upstream stages of the value chain that must be resolved before the country can integrate the agricultural sector with its mid-stream processing and downstream production of final products. The country does not have particularly strong competitive advantages with respect to processing or downstream production, as a result of high energy and logistics costs, and a relatively weak domestic demand for final product output.

In addition, important security concerns make processing investments in key rubber growing areas an unlikely proposition in the short term.

(1) **Short term: product and process upgrading in production, harvest and post-harvest activities.** Poor harvest and post-harvest operations contribute to the shortage of high-quality field latex and cup lump. The Philippines has consistently received the lowest-unit value for its output over the past 10 years compared to peers in the region. Relatively low yields can be improved upon through the introduction of more modern agricultural techniques at the farm level, including the appropriate use of higher-quality inputs (seedlings and fertilizer) as well as improved irrigation and pruning techniques. The poor quality of the field latex and cup lump can also be upgraded by better training for tappers and traders. Although the Philippine Rubber Technical Working Group and the PRRI are engaged in extension services to an extent, more expansive measures can help to increase the overall value of exports based on existing plantations, while also improving the reputation of the product quality of Philippine natural rubber, leading to higher unit prices. Improved quality may also help to support DTI's initiatives to increase backward linkages with Yokohoma. Increased production in the short-to-medium term could help to generate sufficient economies of scale for processors to reconsider their role in the country and undertake process improvements noted in (2).

(2) **Short to medium term: process upgrading in processing activities.** Linking into the global value chain to supply major end markets such as the transportation and the healthcare markets requires a reliable and large-scale supply. While (1) addresses the supply of raw materials, this upgrading trajectory addresses the operations of locally based processors. Since 2012, processors have shifted into a role of aggregators and traders of raw natural rubber rather than processing it to produce TSR, RSS or latex concentrate. This is because the final price they receive for their processed rubber on the international market does not justify the costs of local processing. Poor quality output is partly responsible for these low prices. Improvements need to be made in the processing operations to improve that quality. This is a key challenge even for the Yokohoma anchor firm deal pursued by DTI—processors require ISO certification to join their supply chain, but it is difficult for local businesses to achieve certification without major expense. Other process upgrading required includes increased training for tappers and traders as well the use of higher-quality inputs.

(3) **Short-to-medium term**: **product diversification in final product manufacturing** using imported natural and synthetic rubber supply. Although Goodyear closed its factory in 2009, the relatively strong exports in final rubber products in the transportation sector, and emerging producers in the healthcare field offer a potential short-term opportunity for the country. PEZA manufacturing EPZs, together with BOI incentives for the domestic market,[58] combined with availability of manufacturing personnel help contribute to the competitiveness of rubber

[58] The CARS program could potentially help to drive this if smaller items such as gaskets, etc. can be manufactured locally.

manufacturing operations in the country. By allowing for duty free imports of processed rubber, the PEZA zones can facilitate increased manufacturing using imported rubber. In the long term this could potentially help to drive demand for local production and processing of natural rubber if other major constraints can be overcome (e.g. security and transportation issues) and allow for the emergence of an integrated agribusiness sector.

7. Appendix

Table A.1. Industry Product Categories, Based on Trade Data Classifications

Value Chain Segment	Product Group	HS-2002 Code	Description
Semi-Processed	Raw Rubber	HS-4001	HS-4001: Natural rubber and gums, in primary form, plates, etc HS -400110 – Natural emulsion/Latex Concentrate HS-400121 – Ribbed Smoked Sheet (RSS) HS-400122 – Technically Specified Rubber (TSR)
	Synthetic Rubber	HS-4002	HS-4002: Synthetic rubber and factice derived from oils, in primary forms or in plates, sheets or strip; mixtures of any product of heading 40.01 with any product of this heading, in primary forms or in plates, sheets or strip.
	Unvulcanized Rubber	HS-4005	HS-4005: Compounded unvulcanised rubber, in primary forms
	Unvulcanized Rubber for other uses	HS-4006	HS-4006: Unvulcanised rubber as rods, tubes, discs, rings, etc
Processed	Vulcanized Rubber	HS-4007 HS-4008	HS-4007: Vulcanised rubber thread and cord HS-4008: Rubber plate, sheet, strip, rod etc, except hard
Final Products	Transportation/Tires and parts of	HS-4011 Hs-4012 (Excl. 401220 –used tires) HS-4013	HS-4011 New pneumatic tyres, of rubber (breakdown by type 6D) Hs-4012: Tyres nes, retreaded, used pneumatic, solid, cushioned HS-4013 Inner tubes of rubber
	Healthcare	HS-4014 HS- 401511	HS-4014: Hygienic or pharmaceutical articles of rubber (Contraceptives, etc) HS- 401511: Surgical Gloves
	Apparel	HS-4015 (excl.401511)	HS-4015: Rubber clothing and accessories, except hard rubber (excluding surgical gloves)
	Construction, Industry, and others	HS-4009 HS-4010 HS-4016	HS-4009: Rubber tube, pipe, hose, except hard rubber HS-4010: Conveyor and similar belts or belting of rubber HS-4016: Articles of vulcanised rubber except hard rubber, nes (many for construction sector)

Source: Authors; based on UNComtrade HS classifications; see Mapping the Natural Rubber Global Value Chain for context.

Table A.2. Leading Producers and Consumers of Natural Rubber, 2015

Production					Consumption				
Rank (2015)	Rank (2014)	Country	Production (000 tons)	%	Rank (2015)	Rank (2014)	Country	Consumption (000 tons)	%
1	1	Thailand	4,473.3	36%	1	1	China	4,820.0	39%
2	2	Indonesia	3,175.4	26%	2	2	India	991.6	8%
3	3	Vietnam	1,017	8%	3	3	US	936.5	8%
4	4	China	794	6%	4	4	Japan	721.6	6%
5	5	Malaysia	695.4	6%	5	5	Thailand	600.6	5%
6	6	India	575	5%	6	6	Indonesia	567.9	5%
7	7	Cote d'Ivoire	337.6	3%	7	7	Malaysia	474.6	4%
8	8	Myannmar	227.5	2%	8	8	Brazil	399.9	3%
9	9	Brazil	194.4	2%	9	9	Rep. of Korea	387.7	3%
10	12	Cambodia	126.8	1%	10	10	Germany	223.5	2%
11	10	Philippines	111.1	1%	11	12	Vietnam	180.0	1%
12	11	Sri Lanka	91.3	1%	12	11	Spain	173.6	1%
13	13	Guatemala	90.7	1%	13	13	Turkey	155.4	1%
14	14	Liberia	60	0%	14	15	France	130.4	1%
15	15	Nigeria	57	0%	15	14	Canada	128.7	1%
16	16	Cameroon	54	0%	16	18	Italy	120.5	1%

17	17	Laos	45.7	0%	17	17	Taiwan	102.8	1%
18	18	Gabon	19.7	0%	18	19	Mexico	98.1	1%
19	29	Bangladesh	18.4	0%	19	16	Poland	95.8	1%
20	20	Ghana	17.9	0%	20	21	Russia	89.4	1%
21	21	Guinea	17	0%	21	22	Czech Republic	71.6	1%
22	22	Mexico	15.1	0%	22	20	Sri Lanka	71.4	1%
23	23	DRC	13.1	0%	23	25	Philippines	70.7	1%
24	24	Colombia	11.4	0%	24	23	Slovakia	67.1	1%
25	26	Papau New Guinea	7.3	0%	25	26	Belgium	65.0	1%
		Other	20.9	0%			Other	603.6	5%
		Total	**12,267**				**Total**	**12,348.0**	**100%**

Source: (The Rubber Economist, 2016)

Table A.3. Top Ten Exporters of Semi-Processed Rubber, by Value, 2005-2015

	Export Value (US$ millions)											Share of World Exports (%)										
Exporters	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
World	**9,837**	**14,428**	**15,712**	**19,752**	**11,580**	**23,828**	**39,332**	**27,551**	**24,616**	**18,194**	**13,951**											
Thailand	3,450	4,783	5,156	6,915	4,339	7,997	12,612	9,515	8,401	6,702	5,267	35%	33%	33%	35%	37%	34%	32%	35%	34%	37%	38%
Indonesia	3,021	4,623	5,056	6,505	3,491	7,951	13,214	8,914	7,520	5,690	4,435	31%	32%	32%	33%	30%	33%	34%	32%	31%	31%	32%
Malaysia	1,731	2,512	2,669	3,009	1,487	3,290	5,019	3,005	2,365	1,671	1,223	18%	17%	17%	15%	13%	14%	13%	11%	10%	9%	9%
Vietnam	328	587	688	698	478	1,298	1,769	1,962	1,829	1,397	1,059	3%	4%	4%	4%	4%	5%	4%	7%	7%	8%	8%
Cote D'Ivoire	217	356	402	575	378	744	1,167	958	948	778	680	2%	2%	3%	3%	3%	3%	3%	3%	4%	4%	5%
Guatemala	81	107	145	212	140	229	382	305	258	173	143	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Myanmar	--	--	--	--	--	194	--	219	200	121	118	--	--	--	--	--	1%	--	1%	1%	1%	1%
Liberia	168	227	222	263	159	259	360	278	204	166	107	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Germany	--	--	151	--	--	--	424	--	235	--	87	--	--	1%	--	--	--	1%	--	1%	--	1%
Cameroon	79	128	120	141	95	--	--	--	--	--	79	1%	1%	1%	1%	1%	--	--	--	--	--	1%
Laos	--	--	--	--	--	--	--	--	--	111	--	--	--	--	--	--	--	--	--	--	1%	--
France	--	--	--	--	--	--	567	--	--	--	--	--	--	--	--	--	--	1%	--	--	--	--
Nigeria	--	--	--	136	--	--	--	230	--	--	--	--	--	--	1%	--	--	--	1%	--	--	--
Cambodia	73	94	--	--	92	199	324	260	220	154	--	1%	1%	--	--	1%	1%	1%	1%	1%	1%	--
Singapore	92	--	112	--	--	173	--	--	--	--	--	1%	--	1%	--	--	1%	--	--	--	--	--
Sri Lanka	--	104	--	127	97	--	--	--	--	--	--	--	1%	--	1%	1%	--	--	--	--	--	--

Source: UN Comtrade, Based on Import Data, HS 4001, Downloaded 10/19/2016, 12/15/2016

Table A.4. Top Ten Exporters of Semi-Processed Rubber, by Volume, 2005-2015

	Export Volume (Thousand Tons)											Share of World Exports (%)										
Exporters	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
World	**7,405**	**7,544**	**7,806**	**7,734**	**6,509**	**7,827**	**8,416**	**8,271**	**8,729**	**8,973**	**9,006**											
Thailand	2,640	2,619	2,707	2,758	2,457	2,662	2,884	2,978	3,157	3,306	3,525	36%	35%	35%	36%	38%	34%	34%	36%	36%	37%	39%
Indonesia	2,236	2,360	2,439	2,522	1,963	2,565	2,745	2,517	2,686	2,736	2,745	30%	31%	31%	33%	30%	33%	33%	30%	31%	30%	30%
Malaysia	1,259	1,256	1,270	1,113	816	1,055	1,066	877	853	816	771	17%	17%	16%	14%	13%	13%	13%	11%	10%	9%	9%
Vietnam	304	334	362	290	273	421	404	647	731	767	720	4%	4%	5%	4%	4%	5%	5%	8%	8%	9%	8%
Cote D'Ivoire	159	177	188	210	218	246	255	285	347	398	460	2%	2%	2%	3%	3%	3%	3%	3%	4%	4%	5%
Guatemala	63	59	77	89	83	82	92	98	102	93	95	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Myanmar	--	--	--	--	--	67	--	65	74	63	76	--	--	--	--	--	1%	--	1%	1%	1%	1%
Philippines	62	51	--	--	--	--	66	--	64	66	74	1%	1%	--	--	--	--	1%	--	1%	1%	1%
Liberia	127	90	116	105	92	95	87	87	76	80	59	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Cameroon	61	67	61	56	57	59	--	--	--	--	52	1%	1%	1%	1%	1%	1%	--	--	--	--	1%
Nigeria	--	--	--	53	--	--	69	69	--	--	--	--	--	--	1%	--	--	1%	1%	--	--	--
Cambodia	--	--	54	--	53	61	75	87	90	91	--	--	--	1%	--	1%	1%	1%	1%	1%	1%	--
Singapore	66	--	54	--	--	--	--	--	--	--	--	1%	--	1%	--	--	--	--	--	--	--	--
Sri Lanka	--	53	--	53	54	--	--	--	--	--	--	--	1%	--	1%	1%	--	--	--	--	--	--

Source: UN Comtrade, Based on Import Data, HS 4001, Downloaded 10/19/2016, 12/15/2016.

Table A.5. Top Ten Importers of Semi-Processed Rubber, by Value, 2005-2015

Importers	Trade Value, US$ millions											Share of World Imports (%)										
Row Labels	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
World	**9,837**	**14,428**	**15,712**	**19,752**	**11,580**	**23,828**	**39,332**	**27,551**	**24,616**	**18,194**	**13,951**											
China	1,855	3,030	3,259	4,302	2,814	5,667	9,378	6,813	6,393	4,951	3,917	19%	21%	21%	22%	24%	24%	24%	25%	26%	27%	28%
US	1,665	2,100	2,205	2,950	1,359	2,987	4,961	3,544	2,710	2,106	1,660	17%	15%	14%	15%	12%	13%	13%	13%	11%	12%	12%
Malaysia	423	560	831	1,048	1,268	1,798	2,296	2,493	2,482	1,783	1,307	4%	4%	5%	5%	11%	8%	6%	9%	10%	10%	9%
Japan	1,195	1,836	1,802	2,394	1,176	2,423	3,908	2,506	2,021	1,427	1,088	12%	13%	11%	12%	10%	10%	10%	9%	8%	8%	8%
India	--	--	--	--	270	637	--	967	902	841	722	--	--	--	--	2%	3%	--	4%	4%	5%	5%
Rep. of Korea	509	734	789	1,003	600	1,195	1,929	1,373	1,109	828	612	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	4%
Germany	412	678	793	854	473	1,261	2,044	1,271	1,061	798	589	4%	5%	5%	4%	4%	5%	5%	5%	4%	4%	4%
Brazil	269	386	484	666	283	790	1,102	662	645	494	341	3%	3%	3%	3%	2%	3%	3%	2%	3%	3%	2%
Spain	278	416	448	527	246	573	869	--	427	358	283	3%	3%	3%	3%	2%	2%	2%	--	2%	2%	2%
France	352	503	547	662	264	578	988	619	484	342	272	4%	3%	3%	3%	2%	2%	3%	2%	2%	2%	2%
Turkey	--	--	--	--	--	--	724	--	--	--	--	--	--	--	--	--	--	2%	--	--	--	--
Canada	--	--	--	--	--	--	--	528	--	--	--	--	--	--	--	--	--	--	2%	--	--	--
Italy	246	366	379	439	--	--	--	--	--	--	--	3%	3%	2%	2%	--	--	--	--	--	--	--
Top Ten	**7,204**	**10,609**	**11,537**	**14,845**	**8,753**	**17,911**	**28,199**	**20,776**	**18,232**	**13,929**	**10,792**	**73%**	**74%**	**73%**	**75%**	**76%**	**75%**	**72%**	**75%**	**74%**	**77%**	**77%**

Source: UN Comtrade, Importer Data, HS 4001, downloaded 10/18/2016

Table A.6. Top Ten Importers of Semi-Processed Rubber, by Volume, 2005-2015

	Trade Volume, (Thousand Tons)											Share of World Imports (%)											CAGR 2005-2015
Importers	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	
World	**7,405**	**7,544**	**7,806**	**7,734**	**6,430**	**7,816**	**8,416**	**8,271**	**8,729**	**8,973**	**9,006**												1.98%
China	1,407	1,612	1,648	1,681	1,711	1,861	2,101	2,177	2,473	2,610	2,736	19%	21%	21%	22%	27%	24%	25%	26%	28%	29%	30%	6.88%
Malaysia	462	521	635	522	739	679	668	873	1,005	905	957	6%	7%	8%	7%	11%	9%	8%	11%	12%	10%	11%	7.55%
US	1,169	1,012	1,029	1,334	705	945	1,049	969	928	947	952	16%	13%	13%	17%	11%	12%	12%	12%	11%	11%	11%	-2.03%
Japan	854	892	856	858	605	758	795	710	729	697	685	12%	12%	11%	11%	9%	10%	9%	9%	8%	8%	8%	-2.18%
India	--	--	--	--	160	199	160	291	336	423	450	--	--	--	--	2%	3%	2%	4%	4%	5%	5%	22.12%
Rep. of Korea	387	380	394	374	346	402	415	410	410	417	402	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	4%	0.38%
Germany	305	329	376	310	257	408	424	366	376	384	367	4%	4%	5%	4%	4%	5%	5%	4%	4%	4%	4%	1.87%
Brazil	204	187	230	244	161	261	235	193	236	241	219	3%	2%	3%	3%	3%	3%	3%	2%	3%	3%	2%	0.17%
Spain	197	200	207	188	132	182	177	148	149	171	177	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%	-1.06%
France	250	240	250	231	141	180	200	171	165	159	166	3%	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%	-4.01%
Italy	172	175	175	158	--	--	--	--	--	--	--	2%	2%	2%	2%	--	--	--	--	--	--	--	-2.32%
Top Ten	**5,407**	**5,546**	**5,799**	**5,901**	**4,958**	**5,876**	**6,224**	**6,309**	**6,806**	**6,954**	**7,113**	**73%**	**74%**	**74%**	**76%**	**77%**	**75%**	**74%**	**76%**	**78%**	**77%**	**79%**	

Source: UN Comtrade, Importer Data, HS 4001, downloaded 10/18/2016

Table A.7. Leading Exporters of Tires, by Value 2005-2015

	Export Value, US$ millions											Share of World Exports (%)										
Exporters	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
World	40,729	46,842	56,772	62,857	52,854	25,186	84,401	85,209	84,957	82,511	6,674											
China	3,623	4,919	6,836	7,766	6,870	2,487	12,690	13,907	14,622	15,389	1,357	9%	11%	12%	12%	13%	10%	15%	16%	17%	19%	20%
Japan	5,174	5,568	6,349	7,135	5,850	2,565	8,955	9,236	8,459	7,511	776	13%	12%	11%	11%	11%	10%	11%	11%	10%	9%	12%
Germany	3,638	4,190	4,755	5,158	4,285	1,712	6,461	5,958	6,096	5,764	498	9%	9%	8%	8%	8%	7%	8%	7%	7%	7%	7%
US	2,778	3,121	3,614	4,165	3,559	2,450	5,181	5,528	5,239	4,944	448	7%	7%	6%	7%	7%	10%	6%	6%	6%	6%	7%
Thailand	--	--	--	1,849	1,660	--	3,364	3,434	3,654	3,771	300	--	--	--	3%	3%	--	4%	4%	4%	5%	5%
Brazil	--	--	--	--	--	--	--	--	--	--	273	--	--	--	--	--	--	--	--	--	--	4%
France	3,077	3,332	3,806	4,354	3,134	1,379	3,667	3,712	3,497	3,103	216	8%	7%	7%	7%	6%	5%	4%	4%	4%	4%	3%
Spain	1,965	2,260	2,733	3,006	2,332	1,496	3,382	3,213	3,324	3,071	201	5%	5%	5%	5%	4%	6%	4%	4%	4%	4%	3%
UK	1,121	1,318	1,467	--	--	864	2,510	--	--	--	194	3%	3%	3%	--	--	3%	3%	--	--	--	3%
Netherlands	1,044	1,121	--	--	--	825	--	--	--	--	187	3%	2%	--	--	--	3%	--	--	--	--	3%
Rep. of Korea	2,137	2,409	2,712	2,923	2,496	752	4,046	4,439	4,222	4,122	--	5%	5%	5%	5%	5%	3%	5%	5%	5%	5%	--
Czechia	--	--	1,604	1,713	1,562	1,004	2,343	2,348	2,326	2,256	--	--	--	3%	3%	3%	4%	3%	3%	3%	3%	--
Italy	1,466	1,596	1,784	1,928	1,506	--	--	--	--	--	--	4%	3%	3%	3%	3%	--	--	--	--	--	--
Poland	--	--	--	--	--	947	2,429	2,296	2,531	2,427	--	--	--	--	--	--	4%	3%	3%	3%	3%	--
Top Ten	**26,023**	**29,834**	**35,661**	**39,998**	**33,255**	**16,482**	**55,026**	**54,071**	**53,970**	**52,359**	**4,450**	**64%**	**64%**	**63%**	**64%**	**63%**	**65%**	**65%**	**63%**	**64%**	**63%**	**67%**

Source: UN Comtrade, HS 4011, Downloaded 10/18/2016

Note: 2015 Data problem -- short by a factor of 10.

Table A.8. Leading Exporters of Rubber Healthcare Products, by Value, 2005-2015

	Exports, US$ millions											Share of World Exports (%)										
Exporters	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
World	**306**	**302**	**310**	**324**	**343**	**582**	**343**	**322**	**354**	**326**	**368**											
Malaysia	105	103	114	113	112	150	131	125	150	141	156	34%	34%	37%	35%	33%	26%	38%	39%	42%	43%	42%
Thailand	76	79	73	75	85	111	67	62	56	64	63	25%	26%	24%	23%	25%	19%	19%	19%	16%	19%	17%
China	23	26	28	31	31	37	36	37	40	35	44	7%	9%	9%	10%	9%	6%	10%	12%	11%	11%	12%
India	7	8	7	9	9	171	8	6	24	7	24	2%	3%	2%	3%	3%	29%	2%	2%	7%	2%	6%
Austria	7	7	7	8	11	15	9	8	9	10	10	2%	2%	2%	3%	3%	3%	3%	3%	3%	3%	3%
Germany	11	11	13	14	14	12	13	10	9	9	9	4%	4%	4%	4%	4%	2%	4%	3%	3%	3%	2%
France	--	--	--	6	9	--	5	9	--	7	9	--	--	--	2%	3%	--	2%	3%	--	2%	2%
Sri Lanka	8	9	10	10	9	8	9	8	8	7	7	3%	3%	3%	3%	3%	1%	3%	3%	2%	2%	2%
Indonesia	6	6	5	6	8	9	7	6	5	6	6	2%	2%	2%	2%	2%	1%	2%	2%	2%	2%	2%
Belgium	5	6	8	7	--	17	20	11	7	7	5	2%	2%	3%	2%	--	3%	6%	3%	2%	2%	1%
US	6	6	6	--	--	6	--	--	9	--	--	2%	2%	2%	--	--	1%	--	--	3%	--	--
UK	--	--	7	7	8	--	--	--	--	--	--	--	--	2%	2%	2%	--	--	--	--	--	--
Top Ten	**264**	**270**	**282**	**292**	**307**	**547**	**312**	**292**	**326**	**299**	**337**	**86%**	**90%**	**91%**	**90%**	**90%**	**94%**	**91%**	**91%**	**92%**	**92%**	**92%**

Source: UN Comtrade, HS4014, 401511

Table A.9. Leading Exporters of Rubber Apparel Products, by Value, 2005-2015

	Export Value, US$ millions											Share of World Exports (%)										
Exporters	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
World	**2,255**	**2,554**	**2,928**	**3,519**	**3,387**	**4,305**	**4,990**	**5,252**	**5,285**	**5,211**	**5,134**											
Malaysia	902	1,112	1,303	1,635	1,615	2,166	2,458	2,604	2,685	2,606	2,743	40%	44%	45%	46%	48%	50%	49%	50%	51%	50%	53%
Thailand	454	480	512	587	624	753	903	976	939	916	791	20%	19%	18%	17%	18%	17%	18%	19%	18%	18%	15%
China	255	291	364	471	395	477	544	569	554	592	551	11%	11%	12%	13%	12%	11%	11%	11%	10%	11%	11%
Indonesia	126	148	162	194	177	210	237	229	201	205	229	6%	6%	6%	6%	5%	5%	5%	4%	4%	4%	4%
Sri Lanka	69	78	81	88	82	102	138	144	134	139	136	3%	3%	3%	2%	2%	2%	3%	3%	3%	3%	3%
Germany	37	48	56	54	59	70	85	98	111	99	87	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Vietnam	--	--	--	--	--	--	--	57	65	77	79	--	--	--	--	--	--	--	1%	1%	1%	2%
Belgium	--	42	47	48	42	51	57	54	59	68	73	--	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%
US	45	46	53	56	53	62	70	64	66	54	59	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%
France	39	--	--	42	38	41	58	--	61	50	40	2%	--	--	1%	1%	1%	1%	--	1%	1%	1%
Other Asia	--	--	--	--	41	52	49	60	--	--	--	--	--	--	--	1%	1%	1%	1%	--	--	--
UK	33	35	43	--	--	--	--	--	--	--	--	1%	1%	1%	--	--	--	--	--	--	--	--
Netherlands	58	--	--	--	--	--	--	--	--	--	--	3%	--	--	--	--	--	--	--	--	--	--
Mexico	36	35	40	45	--	--	--	--	--	--	--	2%	1%	1%	1%	--	--	--	--	--	--	--
Top Ten	**2,052**	**2,314**	**2,661**	**3,220**	**3,127**	**3,983**	**4,599**	**4,854**	**4,875**	**4,806**	**4,788**	**91%**	**91%**	**91%**	**92%**	**92%**	**93%**	**92%**	**92%**	**92%**	**92%**	**93%**

Source: UN Comtrade, HS 4015, excluding 401511 (surgical gloves).

Table A.10. Export Destinations for Philippines' Tires, 2005-2014

Country	Value (US$, millions)					Share				
	2005	2007	2010	2012	2014	2005	2007	2010	2012	2014
TOTAL	**85**	**247**	**332**	**381**	**382**					
USA	5	55	59	57	132	7%	22%	18%	15%	35%
Canada	—	17	49	48	55	—	7%	15%	13%	14%
Russia	1	24	62	89	24	2%	10%	19%	23%	6%
Japan	—	—	—	—	21	—	—	—	—	6%
Finland	—	—	14	43	14	—	—	4%	11%	4%
Italy	8	16	17	13	13	9%	7%	5%	4%	4%
Australia	8	19	10	9	12	10%	8%	3%	2%	3%
Mexico	8	—	—	11	11	—	—	—	3%	3%
Malaysia	6	10	13	15	9	8%	4%	4%	4%	2%
India	—	—	—	—	8	—	—	—	—	2%
Germany	2	—	11	10	—	3%	—	—	3%	—
Portugal	—	—	6	6	—	—	—	—	2%	—
Sweden	—	—	6	—	—	—	—	—	—	—
UK	3	11	—	—	—	4%	5%	—	—	—
Thailand	9	10	—	—	—	11%	4%	—	—	—
Singapore	3	6	—	—	—	4%	3%	—	—	—
Brazil	3	5	—	—	—	4%	2%	—	—	—

Source: UN Comtrade based on HS code 4011. (—) Indicates country was not in the top 10 in the given year. Retrieved on October 25, 2016.

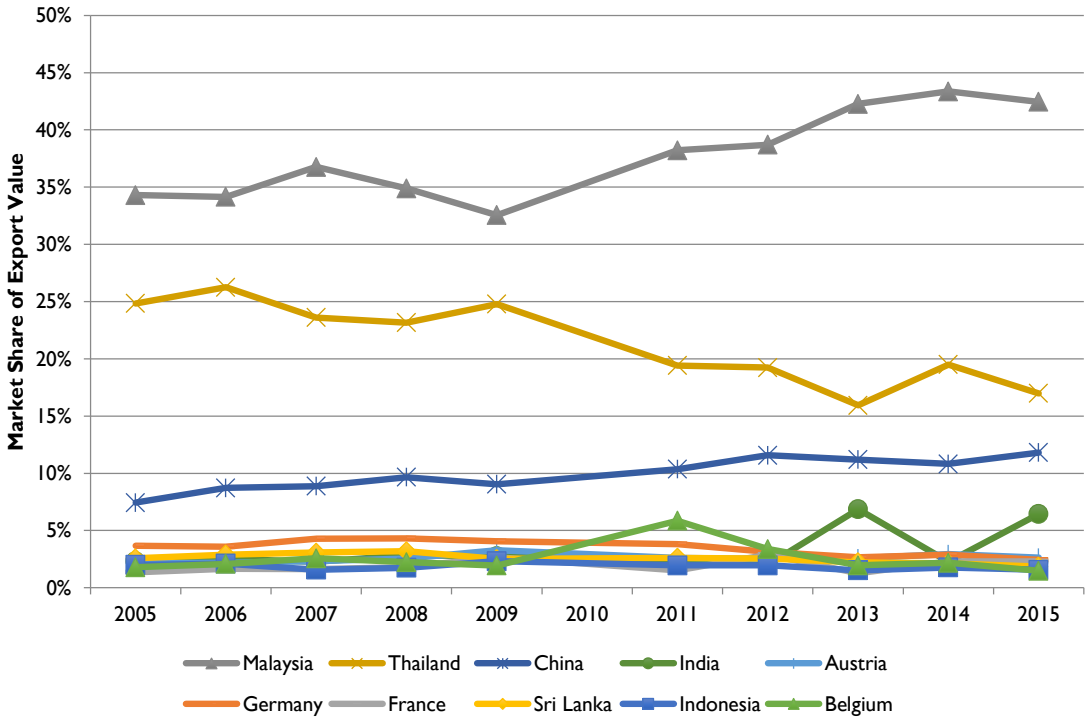
Table A-11. Rubber Processing and ISO Certified Companies in the Philippines

Company	Location	ISO certified
Pioneer Amaresa Rubber Company	Zamboanga	Yes
CTK Asia Rubber Corp.	Zamboanga	Yes
Dacon	Zamboanga	No
FJC Rubber Processing Plant	Zamboanga	No
HBM Rubber Company	Zamboanga	No
Kalamahoy	Zamboanga	No
Malangas Rubber Mill	Zamboanga	No
MJ Rubber Company	Zamboanga	No
Philippine Pioneer Rubber Products Corp.	Zamboanga	No
Philippine Rubber Company	Zamboanga	No
Tire King Rubber	Zamboanga	No
UWARBMPC	Zamboanga	No
Zanorte Rubber Oil Palm Plantation	Zamboanga	No
Pioneer Enterprises	Northern Mindanao	
MSU Rubber Processing	Northern Mindanao	
F.S. Sajulga Processing Plant	Northern Mindanao	
Standard Rubber Corp.	Northern Mindanao	
Pioneer Amaresa Rubber Company	Soccsksargen	Yes
Davco	Soccsksargen	Yes
Farma	Soccsksargen	Yes
MJ/San Nicolas	Soccsksargen	No
MRDI	Soccsksargen	No
Standeco	Soccsksargen	Yes
Sto. Nino Rubber Company	Soccsksargen	No
Agusan del Sur Rubber Producer	Caraga	No

Tarbidc	ARMM	No
Marbedco	ARMM	No
Scadibc	ARMM	No
Larbeco	ARMM	No

Source: PRDP, 2012; DTI, 2015.

Figure A-1. Exporters of Natural Rubber Healthcare Products by Value, 2005-2015



Source: UN Comtrade, HS4014, 401511, Based on All Importers, Downloaded Oct. 18, 2016.

Note: Export data reported for India in 2010 was 200 times the previous and subsequent export values. 2010 data is thus excluded from the table.

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