

**STUDY ON MYANMAR RUBBER INDUSTRY
TOWARDS EMPIRICAL BASED
DEVELOPMENT POLICY**

KYAW MYO THU

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**STUDY ON MYANMAR RUBBER INDUSTRY
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DEVELOPMENT POLICY**

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**A thesis submitted to the postgraduate committee of
the Yezin Agricultural University as a partial
fulfillment of the requirements for the degree of
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(Agricultural Economics)**

**Department of Agricultural Economics
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The thesis attached here to, entitled “**Study on Myanmar Rubber Industry towards Empirical Based Development Policy**” was prepared under the direction of the chairperson of the candidate supervisory committee and has been approved by all members of that committee as a requirement for the degree of Master of Agricultural Science.

Dr. Theingi Myint
Chairperson
Supervisory Committee
Professor
Department of Agricultural Economics
Yezin Agricultural University

Dr. Duncan Bougton
External Examiner
Professor
Department of Agricultural, Food
and Resource Economics
Michigan State University

U Aung Phyo
Member
Supervisory Committee
Assistant Lecturer
Department of Agricultural Economics
Yezin Agricultural University

Dr. Kyaw Kyaw Win
Member
Supervisory Committee
Pro-Rector (Admin.)
Yezin Agricultural University

Dr. Cho Cho San
Professor and Head
Department of Agricultural Economics
Yezin Agricultural University

Date

This thesis was submitted to the Rector of the **Yezin Agricultural University** and was accepted as a partial fulfillment of the requirements for the degree of **Master of Agricultural Science (Agricultural Economics)**.

Dr. Nang Hseng Hom

Rector

Yezin Agricultural University

Yezin, Nay Pyi Taw

Date

DECLARATION OF ORIGINALITY

This thesis represents the original works of the author, except where otherwise stated. It has not been submitted previously for a degree at any other university.

Kyaw Myo Thu

Date

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ABSTRACT

Myanmar rubber industry had about 0.65 million hectares plantation which employed about 400,000 workers and which had huge natural rubber market demand of neighboring countries. However, the national average yield per area was lower than that of other rubber producing countries and it produced poor quality rubber with the low market price. The study aimed to review the rubber policy context of rubber producing countries, estimate profitability of rubber farm, stakeholders' involvement to identify critical intervention areas towards empirical based alternative policies for rubber industry development. Five Townships were selected from Mon State, Tanintharyi and Bago Regions as major traditional rubber plantation areas for primary data collection. The total 75 rubber farmers were selected by proportionate stratified random sampling from October 2018 to February 2019. In order to investigate the stakeholders' involvement and situational investigation in the rubber industry, nine focus group discussions and SWOT analysis were conducted.

The operating ratio was about 55% that means the operational cost for rubber production was 55 MMK and current profit was about 45%. Moreover, the stakeholders' involvement in the rubber industry was actively working in their respective sectors with different limiting factors. In the production sector, critical intervention areas were land tenure system, quality control of rubber seedling, research for yield improvement, and capacity building. Critical intervention areas for the processing sector were encouraged the rubber factories, quality control and capacity building program while creating the international market demand and providing reliable market information was important in the marketing sector. Regarding the above critical intervention areas, alternative policies for sustainable development would be suggested as (1) rubber industry land tenure policy (2) quality control policy (3) research and development policy (4) human resource development policy and (5) database and market information service policy which would create for Myanmar rubber industry development.

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LIST OF ABBREVIATIONS

ANRPC	= Association of Natural Rubber Producing Countries
BCR	= Benefit-Cost Ratio
BOI	= Thailand Board of Investment
°C	= Celsius
DICD	= Department of Industrial Crops Development
DOA	= Department of Agriculture
EBD	= Export Development Board
FAO	= Food and Agriculture Organization
FGD	= Focus Group Discussion
ha	= Hectare
HYC	= High Yield Clones
ICAR	= Indian Council of Agricultural Research
ILCA	= International Livestock Centre of Africa
IRR	= Internal Rate Of Return
JEDB	= Janatha Estate Development Board
kg	= Kilogram
KII	= Key Informant Interview
LTC	= Latex timber clones
MADB	= Myanma Agriculture Development Bank
MICDE	= Myanmar Industrial Crops Development Enterprise
MMK	= Myanmar Kyat
MOAI	= Ministry of Agriculture and Irrigation
MOALI	= Ministry of Agriculture, Livestock and Irrigation
MOI	= Ministry of Industry
MPCE	= Myanma Perennial Crop Enterprise
MRB	= Malaysia Rubber Board
MRELB	= Malaysia Rubber Exchange and Licensing Board
MREPC	= Malaysia Rubber Export Promotion Council
MRPPA	= Myanmar Rubber Planters and Producers Association
MRRDB	= Malaysian Rubber Research Development Board
NPIP	= National Plantation Industry Policy

NPV	= Net Present Value
NR	= Natural Rubber
ORRAF	= Office of Rubber Replanting Aid Fund
PBP	= Pay Back Period
PCD	= Perennial Crop Division
RAOT	= Rubber Authority of Thailand
REO	= Rubber Estate Organization
RRII	= Rubber Research Institute of India
RRIM	= Rubber Research Institute of Malaysia
RRISL	= Rubber Research Institute of Sri Lanka
RRIT	= Rubber Research Institute of Thailand
RSS	= Ribbed Smoke Sheet
SLORC	= State Law and Order Restoration Council
SLSPC	= Sri Lanka State Plantations Cooperation
SR	= Synthetic Rubber
S ₂ D ₂	= Half Spiral Cutting and Tapping at Alternative Days
TSR	= Technical Specified Rubber
UNDP	= United Nation Development Programme
UNHCR	= United Nation High Commissioner for Refugees
USDA	= United State Department of Agriculture

LIST OF CONVERSION FACTORS

1 pound	= 0.453 kilograms
1 acre	= 0.405 hectare
1 metric ton	= 1000 kilograms

CHAPTER I

INTRODUCTION

1.1 History and Developments of the Natural Rubber Industry

The earliest references to natural rubber (NR) were mentioned in accounts of the over 500 years to the day (11th June, 1496) that Christopher Columbus returned from his second voyage, bringing back the first rubber balls from the West Indies to the Iberian Peninsula. However, NR did not attain any commercial value until nearly a century later. The first important chemical modification of NR was vulcanization in 1839, which was generally credited independently to Charles Goodyear, an American and Thomas Hancock, an Englishman.

The discovery of vulcanization of NR led to a blossoming of NR industries, it was fueled by Sir Henry Wickham, an Englishman, who transported 70,000 NR seeds from the Amazon Basin to the Royal Botanic Gardens at Kew in 1876. Among them, only 2,397 seeds and 1,900 germinated seedlings were shipped to Sri Lanka and Singapore (22 seedlings). Nine of the 22 seedlings from the Singapore Botanic Gardens were brought to Kuala Kanga, Perak, Malaysia. These seedlings formed the nucleus of the NR industries in South-East Asia, which account for around 75% of all cultivated NR plantation (Chan, Joy, Maria, & Thomas, 2013).

In 1888 to 1911, Sir Henry Nicholas Ridley, the director of the Singapore Botanic Gardens, developed the tapping techniques for the harvesting of latex from the rubber tree and it was well known as herringbone pattern techniques. It was an epoch-making innovation in the history of the rubber industry for commercial plantation (Baker, 1997).

Para rubber (*Hevea brasiliensis*) is native to rain forests of the tropical region of the Great Amazonian basin of South America. *Hevea* can be grown rapidly most at below 200 meters above sea level. It is usually found on well-drained sites but can grow in areas subject to short shallow flooding. Topsoil must be at least 100 cm with a pH value of 4-5. Rubber is a tropical plant grown best in places where there is fair distributed rainfall of more than 2,000 mm per annum and temperature range between 26° C and 38° C. Rainfall is the most important environmental factor affecting rubber cultivation (Verheye, 2010).

1.1.1 History of world natural and synthetic rubber production and consumption

In 1888 and later, the mass production of automobiles created the increased demand for pneumatic tyres, which were made exclusively NR and it was a golden age in terms of demand for NR. Before World War II, rubber products used 100% of NR. At that time, when the word rubber was mentioned, most people associate it with NR. Even latter-day, around 60% of NR was used in the production of tyres. Although this might had been appropriate before World War II, synthetic rubber (SR) had grown since then to assume an important position.

During World War II, Japan's occupation in most of the countries of South-East Asia blockaded the supply of NR to industrial requirement from the West. It was a cause for concern and these countries responded vigorously, by investigating SR for NR and searching for large-scale. Therefore, the development of SR, which was initiated politically and was strategically motivated and it had emerged as the most serious threat to NR. Although SR production technology was intensive and was less dependent on a skill-labour force and their high payment compared to the production of NR latex on estates (Chan et al., 2013).

The production of SR was prompted by cheap and relatively constant supplies of petrochemical feedstock. However, it could not compete upon NR's capacity because the NR has good tensile, strength, friction, abrasion resistance and renounces properties of NR which override to SR. According to its modified qualities, NR cannot be replaced with other substances (Ferreira, Moreno, Gonçalves, & Mattoso, 2002). Moreover, the increase in demand for NR over SR is related to widespread concerns about global warming, deteriorating ecosystems and depleting sources of fossil fuels. Moreover, Para rubber (*Hevea brasiliensis*) is one of the most effective trees for generating oxygen from carbon dioxide via photosynthesis.

Annual world NR latex consumption gradually increased from 170,000 tons to 300,000 tons between 1960 and 1980. In the mid-1980s, total demand for NR latex took off, subsequently growing exponentially. This was the critical juncture of the transition of NR latex industries from the West to the East countries. The NR demand take-off was also precipitated by the prevention of transmission of the human immunodeficiency virus (HIV) and hepatitis B with the increase in the use of NR latex gloves (Chan et al., 2013).

World production and consumption of NR and SR from 2001 to 2017 were summarized in Table 1.1. By comparing world production and consumption of NR and SR, there is slightly higher consumption than production in most of the years of last decade. However, it could be assumed that world rubber production was surplus NR in last 5 years and shortage SR in 5 years of current decades and these surpluses and shortage were balanced the current world rubber consumption.

1.1.2 Future world natural and synthetic rubber production and consumption

Although world NR production was slightly higher than NR consumption in several years as shown in Table 1.1, NR consumption will be projected to grow by 5% per year through 2025 (World Bank, 2016). As a result of China's economic slowdown, the sector had faced reduced demand in recent years (2012-2016), compared with the previous period (2008-2011). In the future, World NR demand will be accelerated again as a result of increasing demand in lower and middle-income countries and sustained demand of China, India, the United States, and Japan.

At the same time, with the movement away from rubber production in Malaysia and Singapore and limited scope for rubber expansion in Indonesia, Myanmar could become an important rubber exporter in the rubber producing countries (Van, Htoo, & Dorosh, 2017).

1.2 Natural Rubber Industry in Myanmar

The agriculture sector is pivotal in Myanmar as there are attempt to increase income, alleviate widespread poverty and upgrade the living standard of Myanmar people. Myanmar's agricultural sector dominates the country economy, contributing 38% of gross domestic product (GDP), and employing more than 60% of the workforce. Although the contribution of the rubber products sector in Myanmar in terms of GDP was rather limited as less than 1%, it was important for economic development because livelihoods of the rural people in rubber growing areas totally reply on downstream and upstream sector of the rubber industry (National Export Strategy, 2019). Moreover, rubber is also second-most agricultural export item following by bean and pluses.

Therefore, rubber industry has been chosen as one of the priority sectors of export strategies. Moreover, Myanmar's geographic position and climate make a potential driver for growth and development of rubber production.

Table 1.1 World production and consumption of natural rubber and synthetic rubber from 2001 to 2017

Year	Production ('000 MT)			Consumption ('000 MT)		
	Natural Rubber	Synthetic Rubber	Total Rubber	Natural Rubber	Synthetic Rubber	Total Rubber
2001	6,913	10,483	17,396	7,039	10,253	17,292
2002	7,317	10,906	18,223	7,515	10,679	18,194
2003	7,986	11,414	19,400	7,797	11,177	18,974
2004	8,726	11,979	20,705	8,562	11,693	20,255
2005	8,921	12,025	20,946	9,049	11,731	20,780
2006	9,850	12,700	22,550	9,513	12,434	21,947
2007	10,057	13,829	23,886	10,138	12,576	22,714
2008	10,098	12,285	22,383	10,187	12,173	22,360
2009	9,723	11,488	21,211	9,289	11,228	20,517
2010	10,403	13,277	23,680	10,759	13,225	23,984
2011	11,239	14,091	25,330	11,034	13,856	24,890
2012	11,658	14,042	25,700	11,046	13,964	25,010
2013	12,281	14,184	26,465	11,430	14,148	25,578
2014	12,142	14,071	26,213	12,181	14,158	26,339
2015	12,271	14,507	26,778	12,140	14,661	26,801
2016	12,451	14,831	27,282	12,587	14,946	27,533
2017	13,539	15,051	28,590	13,225	15,184	28,409

Source: Malaysia Rubber Board [MRB], 2018

In particular, Myanmar becomes a large exporter of natural rubber among the NR producing countries by following the gradual liberalization of the agriculture sector in the 1990s and a surge in rubber prices in international markets in the 2000s and increase in investment of smallholder rubber farmers.

It was reported that rubber (*Heavea brasiliensis*) was first introduced to Myanmar in 1876, immediately after it was transplanted from its native place in Latin America (Amazon) to London. The commercial planting of rubber in Myanmar started in 1905, with its gradually increased area to 4,000 hectares in 1909, 29,000 hectares in 1920, and 46,575 hectares in 1940. Then, it reached 56,000 hectares in 1960. At the same time, a support program for rubber smallholders of the Food and Agriculture Organization of (FAO) started in 1957, though it was short-lived (Myint, 2008).

In 1962, Revolutionary Council of the Union of Burma took power and the military regime was started and many rubber estates owned by both local citizens and foreigners were nationalized from 1964 to 1973. Also, the state procurement system was soon introduced for almost all the agricultural products including rubber, leaving virtually no profit margins in the hands of private estate owners and rubber smallholders.

After that, the government had made rubber as a priority crop in national development plans since 1979. The government sought assistance from international organizations to replant rubber plantations with high-yielding cultivars and to modernize the deteriorating rubber industry, which resulted in a two-phase Rubber Rehabilitation Project, implemented with credit from the International Development Association from 1979-1980 to 1984-1985 (Phase I) and from 1984-1985 to 1992-1993 (Phase II). The United Nations Development Programme (UNDP) and FAO supported the project with technical assistance. These projects contributed considerably to the institutional and technical development of the government rubber sector, by establishing the necessary supporting infrastructure and thus laid a foundation for future participation by the private sector (Odaka, 2015).

1.3 Government Policies on Natural Rubber Development in Myanmar

The major role of government in every country is proper planning or policymaking to develop their country. Planning serves as a guide to positive actions, which could has been, otherwise is the unregulated course of event. Therefore, the government and their policies become a crucial ingredient in any meaningful

development. Rubber sector development has relied on the government policy issues and the Myanmar government had a long support for rubber as a strategic export crop to earn foreign income.

According to country economic reform, State Law and Order Restoration Council (SLORC) government launched an Open Door policy in 1989 and the production of perennial crops was partially liberalized from the control in regulations, although it was still limited in routine.

However, the rise of domestic rubber price was accelerated as the country opened up its economy for the private sector and foreign investment. By the mid-1990s, smallholders reengaged in the rubber production sector.

In 1994, Myanmar Perennial Crop Enterprise (MPCE) was established and the government gave more attention to the rubber industry. Another major new driver of rubber plantation area expansion was the government's policies that had been emphasized on industrial crop development.

Additionally, a 30-year Master Plan of Ministry of Agriculture and Irrigation (MOAI) for the Agriculture Sector (2000 - 2001 to 2030 - 2031) aims to convert 10 million acres of 'wasteland' for private industrial agricultural production. The period between from 2000 to 2010 was an epoch-making period for the rubber industry policy by the government. Myanmar government increasingly supported the development of the rubber sector. In 2004, the government also liberalized the rubber export policy by allowing both growers and dealers to export without first fulfilling the quota to MPCE (Woods, 2012).

Since 2010, Myanmar economic policy is following market-oriented reforms and substantially has been increasing its integration into the world economy. The government conjectured that rubber industry could be a major source of capital for modern economic growth. Alternatively, it was estimated that the sector employed between only 350,000 and 400,000 workers, mainly in the plantation or upstream sector linked to planting and production of raw natural rubber. Therefore, the development of the sector, more particularly of its industry, could have high socio-economic impacts and become a driver of job creation. Additionally, the strategy of rubber products sector held significant promise in terms of contributing to the export performance of Myanmar, while also was driving improvements across the sector export value chain. The rubber products sector also had the potential to develop as a key industry to support the automobile industry in Myanmar in the future (Odaka, 2015).

Although rubber yields per unit area was remained low, Myanmar became one of the largest rubber producers around the world in 2017. Table 1.2 showed the ten important countries that exported the highest dollar value worth of natural rubber during 2017 (Workman, 2019).

1.4 Rationale of the Study

Myanmar rubber industry has a huge market as a high demand for NR around neighboring countries. The neighbor countries such as China utilized 37% of world NR for their industrialization and India for 9% and South East Asian countries for 17% respectively (Markit, 2017).

However, the national policy context of rubber production in Myanmar was highly influenced on rubber planting area, production and export value. Figure 1.1 showed remarkable policies for rubber industry and its impacts in rubber planting area, production and export value. The rubber plantation areas were instantaneously increased after 1994-1995 consequence of Open Door policy (1989) and establishment of MPCE, focal institute of rubber industry in 1994 as shown in Figure 1.1. There was also significantly increased in after 2006-2007 because the government was liberalized the rubber export policy by allowing both growers and dealers to export without any restrictions. Thereafter, rubber plantation areas, tapping areas and production were steadily increased until present time. Figure 1.2 presented growth rate of rubber planting areas, tapping areas and production. Therefore, national policy context for rubber industry was vital for further development.

Moreover, Odaka (2015) pointed out that the national average yield was much lower than other rubber producing countries. Additionally, the problems in Myanmar are not confined to the low yield level and numerous. Moreover, they appear as a very complicated issue. The author assumed that currently the major problems for the rubber industry in Myanmar would be;

- Land tenure problem
- Recommended clones are outdated
- Skilled labour scarcity
- Limited access to improved technology
- Impact of climate change
- Lack of quality product market and quality control
- Weak correlation with world rubber price and poor bargaining power of farmer
- Inefficient transportation facilities

Table 1.2 Top ten major rubber exporting countries and export value in 2018

Rank	Major exporting countries	Exported value (US\$ million)	Ratio of World exported value (%)
1.	Thailand	4,600.0	34.5
2.	Indonesia	4,000.0	29.9
3.	Vietnam	987.3	7.5
4.	Malaysia	936.5	7.1
5.	Ivory Coast	752.6	5.7
6.	Myanmar	260.0	2.0
7.	Belgium	202.0	1.5
8.	Laos	168.3	1.3
9.	Guatemala	152.7	1.2
10.	Liberia	127.2	1.0
11.	Other countries'	1,146.4	8.3
	Total	13,333.0	100.0

Source: Workman, 2019

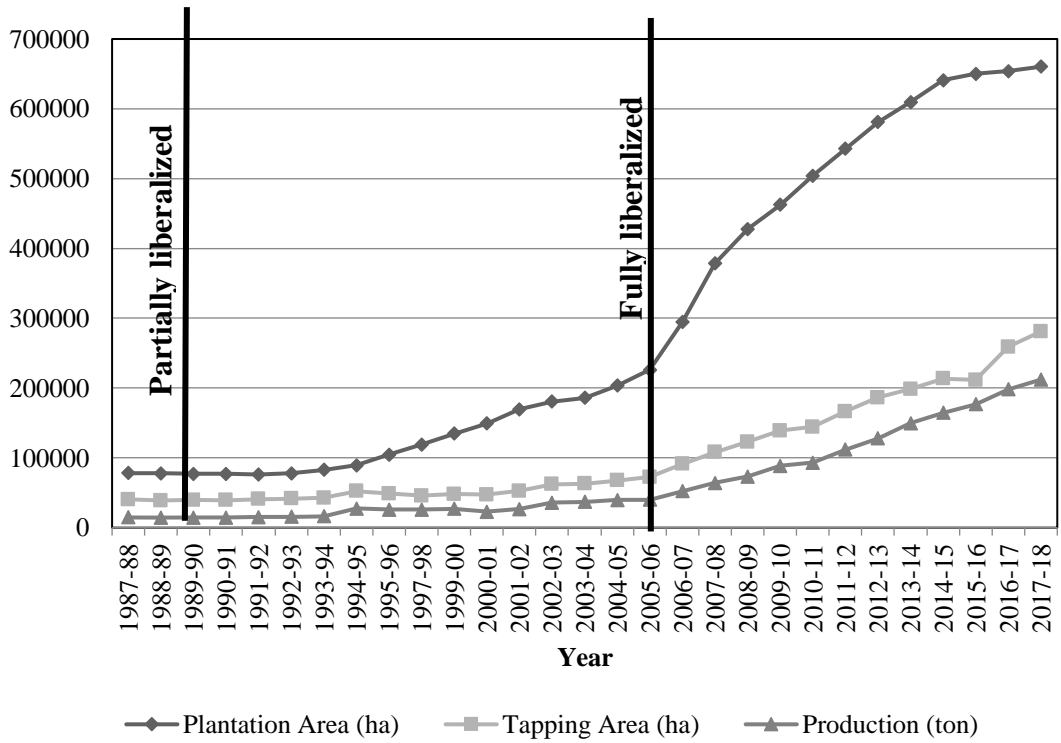


Figure 1.1 Rubber plantation and production in Myanmar from 1987 to 2017 and remarkable policies and their impact on rubber industry

Source: DOA, 2018

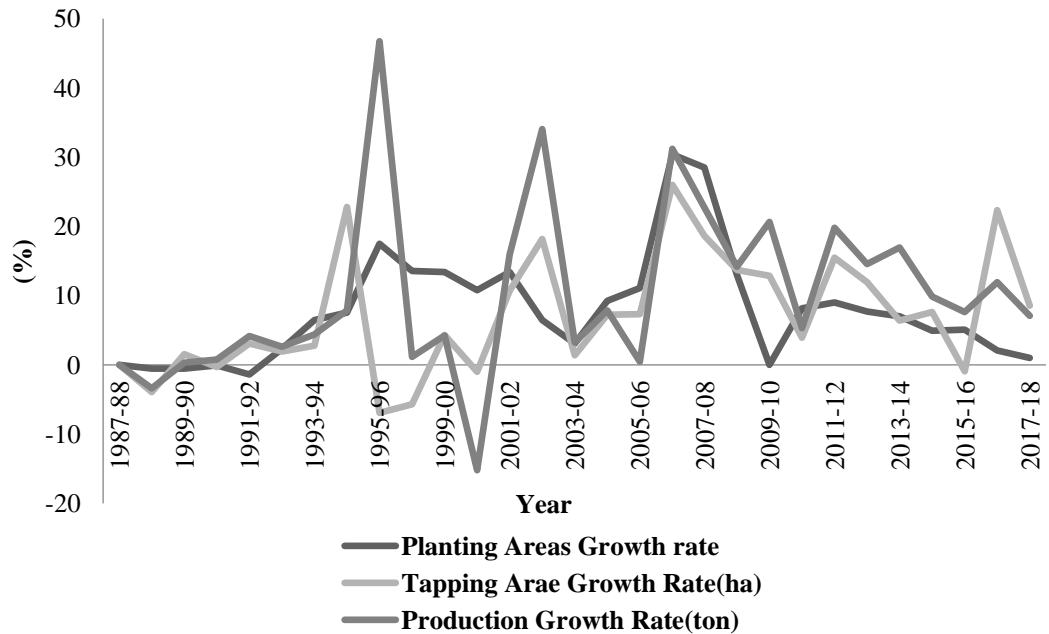


Figure 1.2 Growth rate of rubber planting areas, tapping areas and production of Myanmar from 1987 to 2017

Source: DOA, 2018

However, all the problems were listed without surveying and analyzing the related factors. To date, it has become necessary to survey key predicaments, analyze the structure of the problem and find out intervention areas to improve competitiveness for further developments of Myanmar rubber industry. The survey research can provide understanding to policymakers for the priority and policies that can protect the livelihood of stakeholders and to enhance competitiveness of the rubber industry.

1.5 Research Questions

Myanmar rubber industry was required alternatives rubber development polices and finds out critical intervention areas under empirical study for the following key research questions.

- (1) What kinds of rubber related policy and regulations had been developed and implemented in major rubber producing countries?
- (2) Is the rubber industry still profitable enterprise for rubber farmers and will it require alternative substitute crops or not?
- (3) What are the functions of key stakeholders in rubber industry?
- (4) What are the most important competitive factors in value chain of rubber industry?
- (5) What are the critical intervention areas in rubber industry for enhancing the competitiveness and sustainable development ?

1.6 Objectives of the Study

The main objective was to investigate critical intervention areas and alternative policies for the sustainable development of rubber industry. The specific objectives were as follows:

- to review the national policy context of the rubber industry of major rubber producing countries including Myanmar,
- to estimate rubber profitability for alternative crops substitution and different profitability for export destinations,
- to investigate stakeholders' involvement in Myanmar rubber industry,
- to identify critical intervention areas of rubber industry by SWOT analysis and
- to advise alternative policies based on empirical study for improve competitiveness of Myanmar rubber industry for future development.

CHAPTER II

LITERATURE REVIEW

2.1 Theoretical Background of Policy

2.1.1 Policy

The word "policy" is not a tightly defined concept but a highly flexible one, used in different ways in different occasions. The policy is the set of ideas or a plan for action followed by a business, a government, a political party, or a group of people (Cambridge dictionary online, 2019).

2.1.2 Policy objectives

When analyzing policies, it is often helpful to distinguish between two elements which are essential parts of any policy. These elements are policy objectives and policy instruments. Policy objectives are the "ends" of policy and reflect the overall purpose or long-term aim(s); they are what the policy is intended to achieve (International Livestock Centre for Africa [ILCA], 1993).

2.1.3 Policy instruments

The second element of policy instruments are the "means" of a policy, the actions used to carry it out and the methods by which its objectives are achieved. The distinction is useful because the same objective can often be served by several alternative instruments. It is only by distinguishing between objectives and instruments that one can begin to assess the relative efficiency of different instruments (Sandford, 1985).

2.1.4 Policy studies

The study of policy includes the analysis of both the process of policymaking and the analysis (Ascher, 1986). Policy analysis includes substantive area research program evaluation and impact studies, and policy design (Sabatier, 1991). It also involves systematically studying the nature, causes, and effects of alternative policies, with particular emphasis on determining the policies that will achieve given goals. Policy studies also examine the conflicts and conflict resolution that arise from the making of policies in civil society, the private sector, or more commonly, in the public sector.

Traditionally, the field of policy studies focused on domestic policy, with the notable exceptions of foreign and defense policies. Policy studies emerged in the United States from 1960 to 1970 as a sub-discipline of political science. However, the wave of economic globalization, which ensued in the late twenty century and early twenty-first centuries, created a need for a subset of policy studies that focuses on global governance, especially as it relates to issues that transcend national borders such as climate change, terrorism, nuclear proliferation, and economic development (Nagel, 1980).

2.1.5 Policy analysis

Policy analysis is the process of investigating issues and options, and of drawing up and comparing different proposals. To define the role of policy analysis, we need to distinguish between two major processes. These are:

- (1) Policy formulation - it is defined as the process of considering alternative policy options and deciding to implement one or several of them.
- (2) Policy implementation - it is defined as the process of carrying out the policy (or policies) decided on during the formulation stage. Within policy formulation, we can further distinguish between policy analysis and policymaking (Wyckoff & Ngutter, 1984).

2.2 Theoretical Background of Competitiveness

The term competitiveness has been intensively dissected in the academic literature ever since it became a focus of the policy debate in the late 1980s and early 1990s (Krugman, 1994). The different views on what competitiveness is and what value it has for policy that emerged at the time been never really reconciled (Sanfey & Zeh, 2012). Definitions of abstract concepts like competitiveness are never true or false.

Others build an understanding of competitiveness at the firm-level is synonymous with a firm's long-run profit performance and its ability to compensate its employees and provide superior returns to its owners. Feurer & Chaharbaghi, (1994) defined competitiveness as "depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes."

Scott and Lodge (1985), move the focus of competitiveness to the country level proposing that competitiveness is a "country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources. Paul Krugman's old differentiation of competitiveness was two main competing views of how to define competitiveness:

2.2.1 Cost-market share-view of competitiveness

The first definition looks at competitiveness as a location's unit cost level, driving companies' ability to compete successfully on global markets. This definition is motivated by a concern about a location's 'external balance', i.e. its ability to sell its products and services, defend international market share, and thus generate the inflows needed to pay for imports.

2.2.2 Productivity-based view of competitiveness

The second definition looks at competitiveness as a location's productivity level, driving the standard of living the individuals in that location can sustain (Delgado et al., 2012). This definition is motivated by a concern about a location's inherent ability to create value based on the production factors it has at its disposal.

2.3 Concept of Value Chain

Michael Porter was the first person who introduced the term "Value Chain" in his book *Competitive advantage: Creating and Sustaining Superior Performance* (Michail, 2011). Michael Porter defines "Value Chain" as a representation of a firm's value-adding activities, based on its pricing strategy and cost structure. The ability of any firm to understand its own capabilities and the needs of the customer is crucial for competitive strategy to be successful. The first steps in conducting the value chain analysis are to break down the key activities which involve in the frame work. The next steps are to assess the potential for adding value through the means of cost advantage or differentiation. Finally, it is very important for the analyst to determine the strategies that focus on those activities that would enable the company to attain sustainable competitive advantages.

The profitability of a firm depends on how effectively it manages the various activities in value chain. Value chains encompass the full range of activities and services required to bring a products or services from its conception to sale in its final market whether local, national, international or global.

Value chain includes producers, inputs suppliers, operation, processors, retailers and buyers. They are supported by a range of technical, business and financial services providers. The value chain mainly focuses on the market collaborating strategy, where it emphasized the linkages between production, marketing etc., activities of the products and services in an effective and efficient manner.

An agricultural value chain is defined as the people and activities that bring a basic agricultural product like maize or vegetables or cotton from obtaining inputs and production in the field to the consumer, through stages such as processing, packaging, and distribution. The United States Agency for International Development defines a value chain as the “full range of activities that are required to bring a product or service from its conception to its end use, including all the market channels available to all firms.” Even subsistence farmers are part of value chains.

In an effective value chain, people at different stages of the chain actively support each other. When everyone in the chain supports everyone else, everyone does their job more efficiently, and everyone’s livelihood is improved. Each person in the chain shares the common goal of satisfying consumer needs in order to increase their own profits (Cuddeford, 2014).

2.3.1 Structure of value chain

Value chain has both structural and dynamic components in which the structure of the value chain influences the dynamics of firm behavior and this dynamic persuade how well the value chain performs. Value chain structure includes the five elements like end market, business and enabling environment, vertical linkages, supporting market and horizontal linkages. End markets plays a significant role in determining the quality, quantities, prices and timing for the success of the product and it also helps to create a demand.

Different types of policies, trade agreement, rules & regulation and infrastructure scarcity which creates barriers and its availability helps in smoothening the progress of the value chain of the products at the local, national and international level. Some of the rule or regulation which was made at the local level has a great role for influencing the competitive level of the firms. The linkage between the firms also affects the value chain of the products or services. The vertical chain of the firms is most efficient transaction which increases the overall competitiveness of the firms. The support market has their own role for the making of the value chain more efficient (Kumar & Rajeev, 2016).

2.3.2 Value chain analysis

Value chain is a robust methodology for exploring various aspects of the economy-environment interface and a useful complement to material flow or life cycle analysis with a potentially very widespread applicability. The value chain analysis also provides a framework for coherent and integrated response by industry as well as policy makers, through its focus on linkage within the different stages and actors in a chain (Dahlström & Ekins, 2006).

2.3.3 Competitiveness in value chain

An analysis of the value chain rather than value added is the appropriate way to examine competitiveness because value added fails to highlight the linkages between a firm and its suppliers that can reduce cost or enhance differentiation.

To diagnose competitiveness, it is necessary to define firm's value chain for competing in a particular industry. Defining relevant value activities requires that activities with discrete technologies and economics be isolated. Broad functions such as manufacturing or marketing must be subdivided into activities. Subdividing activities can proceed to the level of increasingly narrow activities that are to some degree discrete. Thus, the number of potential activities is often quite large.

In using the value chain, successively finer disaggregation of some activities are made as the analysis exposes differences important to competitiveness. The appropriate degree of disaggregation depends on the economics of the activities and the purposes for which the value chain is being analyzed. Therefore, value activities should be assigned to categories that best represent their contribution to a firm's competitiveness.

If order processing is an important way in which a firm interacts with its buyers, for example, it should be classified under marketing. Similarly, if inbound material handling and outbound material handling use the same facilities and personnel, then both should probably be combined into one value activity and classified wherever the function has the greatest competitive impact. Firms have often gained competitiveness by redefining the roles of traditional activities (Porter, 2001).

2.4 Review of National Policy Context of Rubber Producing Countries

2.4.1 Thailand

In 1901, government program was introduced rubber to Thai Buddhist villages in small plantations by Phya Ratsadanupradit, governor of Trang Province. In 1920s,

Thai farmers increased the rubber planting areas and responded to the high prices as the result of Stevenson Plan. It was also known as Stevenson Restriction Scheme, it was an effort by British government to stabilize low rubber price with the restriction of rubber production in British colonial countries.

In 1935, high rubber prices resulted Thailand rubber production increased again and new plantings had occurred before the outbreak of World War II and during the Korean War. In 1951, the first rubber association in Thailand was established by Thailand traders under the name of "The Rubber Traders Association of Thailand". The objectives were to serve as the central organization of rubber producers and traders to cooperate between government agencies (Sakarindr, 1979).

The important Act developed in Thailand rubber industry was Thai Rubber Plantation Aid Fund Act, which had received cabinet approval in 1955. The Act was depended upon an export tax to create a special fund for replanting grants (Office of Rubber Replanting Aid Fund [ORRAF], 2015).

According to Thai Rubber Plantation Aid Fund Act, the ORRAF was established under the Ministry of Agriculture. The objectives were to manage the Rubber Replanting Aid Fund and the Economic Plant Replanting Aid Fund. The Act had been revised three times in 1962, 1975 and 1987 to meet the requirement for supported rubber farmers in organizing cooperatives and facilitate the improvement of rubber production and processing.

In 1999-2003, Thai government reduced rubber plantations areas according to National Economic and Social Development Plan No. 8. The plan aimed to solve long term of falling rubber price problems.

In 2003, Thai government developed the subsidize programme to rubber farmers for replanting. It was established the relief fund (CESS) and became the main financial source of ORAF. The programme was approved by the Cabinet and charged from the international rubber exporters (ORAF, 2015).

In 2015, Thai government reformed the institutional structure in rubber industry by combination of three national rubber-related organizations, the Rubber Estate Organization (REO), the ORRAF, and the Rubber Research Institution of Thailand (RRIT) into the "Rubber Authority of Thailand (RAOT). Therefore, RAOT was established as a state enterprise under the Ministry of Agriculture and Cooperatives. As a state enterprise, it could start new businesses to earn alternative revenue and

implementing government policy. RAOT also had responsible for strategic planning for rubber industry development (Yamamoto, 2016).

Meanwhile, the country has grown to become the world's number one producer and exporter of NR. Moreover. The domestic consumption of NR was also increased about 0.60 million tons and export volume was about 3.76 million tons in 2015 (Thailand Board of Investment [BOI], 2015).

2.4.2 Malaysia

The Malaysia rubber industry was established in 1878, meantime, rubber tree was planted in Kuala Kangsar, Perak State. In the early 20th century, the farmer switched to grow rubber and became the main agricultural commodity of the country. However, they did not have enough capital to establish large rubber estate and British trading companies played a vital role in bringing financial interests to Malaysia.

The 1909-1910 rubber boom led to further changes as the local estates owner largely disappeared by selling their estate to new corporate entities (Kaur, 2010). As like other British colonial territories, the currency of the Stevenson Rubber Restriction Scheme was operated in Malaysia from 1922 to 1930 due to lower rubber price. The new planting was not formally prohibited, but it was discouraged and little land was alienated for rubber planting partly by administrative to smallholders. Moreover, in 1934 the International Rubber Regulation Scheme was introduced by British government. Under this scheme, new planting was prohibited but did not substantially affect the Malaysian smallholder rubber farmers.

In 1926, rubber research institute was initiated by Malaysian Federal council. It became the origin of successful rubber research institute known as Rubber Research Institute of Malaysia (RRIM). In 1940, a memorandum was widely circulated by the secretariat of the International Rubber Regulation Committee. The memorandum pointed out that the restriction of replanting and new planting gravely would endanger the position of the smallholders. It was because the production of smallholder would decline with the ageing of their rubber plantation. However, the prohibition of new planting was not repealed in Malaysia until 1947 (Rudner, 1976).

In 1956, chairman of the Rubber Growers' Association had been publicly criticized the restriction on the alienation of land for rubber plantation in Malaysia. As a result, in 1958, the Malaysian government appointed a Rubber Industry Enquiry Mission, to examine the prospects of the industry and factors influencing its future

output and competitive strength. Consequently, in 1970 high yield rubber clones occupied the rubber area on Malaysian estates and the rubber production retained about 40% share of world total NR production.

In 1988, the institutional structural reformed was observed in Malaysia with the establishment of the Malaysian Rubber Board (MRB). It was founded by the merged of three well-established agencies; Rubber Research Institute of Malaysia (RRIM), Malaysian Rubber Research and Development Board (MRRDB) and Malaysian Rubber Exchange and Licensing Board (MRELB). These institutions had been contributed significantly to the development of the rubber industry for the last 78 years (Malaysian Rubber Board [MRB], 2005).

In 1996, the Malaysian rubber board act was an amended and launched under the authority of the revision of the laws act 1968. This act was to repeal the Rubber Shipping and packing control act 1949, the Malaysian rubber research and development fund act 1958, the RRIM act and the rubber export registration act 1966 and the Malaysian rubber exchange and licensing board act 1972 (Malaysian Rubber Board Incorporation Act 511-1996, 2011).

After 1972, due to the cause and effect of Malaysian rubber board (Incorporation) act, rubber planting areas of smallholdings had also expanded substantially and Malaysia had become the world leader in NR production. However, rubber plantation area had been showing a decreasing trend from 1990 to 2009 with the reason of competition of the land used with oil palm plantation in Malaysia (UK Essays, 2018).

Nevertheless, in 2016, Malaysia was the world's fifth-largest producer of NR after Thailand, Indonesia, Vietnam and China. Moreover, Malaysia received about US\$ 4.32 billion from the exports of rubber and rubber products (Malaysian Rubber Export Promotion Council [MREPC], 2018).

2.4.3 India

The beginning of commercial cultivation of NR in India was during the early 20th century in Travancore, Cochin and Malabar Regions in Southern India. Initially, the scientific department of the United Planters' Association of Southern India was largely responsible for the initiative in research activities of rubber (Viswanathan & Bhowmik, 2014).

In 1926, consequent of falling revenue of rubber estates, rubber experiment stations were closed down. Since then, for over two decades, the Indian rubber plantation industry had been without any organized research support (Tharian, Haridasan, & Sreekumar, 1988). However, in 1945, all India Rubber Industries Association were established as one of the premier industries' associations in the country.

In 1947, the Indian Rubber Board was established to look after the rubber plantation industry in the country. Its functions were defined under the India rubber act, and it included in the development of the NR industry (India Rubber Act, 1947).

In 1951, the Tariff Board, the institution entrusted by the Government of India, was reported the establishment of India Rubber Research Institute on a scale comparable to the existing research organizations. In 1952, the Indian Council of Agricultural Research (ICAR) also recommended the establishment of experiment station and seed garden for the production of high yielding seeds (Tharian George et al., 1988).

In 1954, the Rubber Board had approved a research scheme prepared by the Rubber Production Commissioner for the establishment of a Rubber Research Institute of India (RRII). The foundation stone of the RRII building was laid in 1956 in Kottayam city for implementing research activities to improve India rubber industry (Spices Board, 2010).

In 2009, Indian government amended Rubber Act (1947) for further development of India rubber industry called as Rubber (Amendment) Act, 2009. India government also amended Rubber (Amendment) Rules in 2010, 2016 and 2017 to accommodate the special need of India rubber industry.

In 2016, India Rubber Board also did amendment in import policy conditions of NR for promoting the brand of exported Indian NR in line with international standards. To date, India is the fourth important rubber producing country and annual rubber production stand at about 7.9% of the global rubber production (Rubber Board, 2019).

2.4.4 Sri Lanka

When rubber was first introduced into Sri Lanka in the latter part of the 19th century, it was grown only on large estates and there was considerable foreign investment in rubber at this time. With the increase in acreage, the country's exportable capacity continued to grow, and rubber became a significant export crop in Sri Lanka.

In 1909, Rubber Research Institute of Sri Lanka (RRISL) was established and become the oldest research institute on rubber in the world. It was the largest agency in Sri Lanka with the legally responsibility for the rubber industry of the country. Although Stevenson Restriction Plan was effected in 1919, both rubber plantation acreage and production were continued to expand until the 1930s.

However, the lowest production was recorded in 1932 due to the depressed market conditions. Therefore, some of the foreign estates shifted into the hands of the Ceylonese. In 1933-1934, rubber industry was boomed with world demand and the recovered in rubber business conditions. It was immediately followed the international rubber regulation agreement for world NR market (Herath, 1984).

The period after the 1940s, it was constituted a turning point in the history of the rubber industry in Sri Lanka. It was because some of the early plantings became old and damaged by the slaughter tapping and the response to these needs was marked by significant changes in Sri Lankan rubber policies. The new rubber policies caused a fundamental and wide-ranging transformation of rubber industry. The policy also introduced to scheme that intended to arrest a general deterioration of Sri Lanka rubber industry.

In 1951, the Korean War was boomed and during which rubber prices increased to unprecedented levels that helped some estates for replanting before replanting subsidy scheme started. The first policy in streamlining replanting activities was the establishment of a rubber replanting subsidy scheme in 1953.

After 1956, replanting by large estates had been uncertain by government threats to nationalize foreign assets. Therefore, the foreign assets were gradually transferred to the hands of the Ceylonese by foreign estate owners sold to local people. Thus, the policy of nationalization was constraint to the interests of the rubber industry and negated whatever benefits would had been generated by the subsidy programs (Herath, 1984).

In 1958, the Tea and Rubber Act (control of fragmentation) was developed to control the fragmentation of tea, rubber and coconut estates (Ali, Choudhry, & Lister, 1997). From 1970-1980, the plantation sector including rubber estates was nationalized again by government. Then, the two government institutions, Janatha Estate Development Board (JEDB) and Sri Lanka State Plantations Corporation (SLSPC) were managed the plantations for nearly two decades with huge losses and greater burden to government budget. In 2006, Sri Lanka government launched National

Plantation Industry Policy Framework for all plantation crops including rubber to achieve the national prosperity through development of the plantation industry (National Plantation Industry Policy [NPIP], 2006).

In 2014, Sri Lanka was in the sixth position among the global NR producers and exporters. Although a gradual growth of the rubber industry, the government has been implemented Sri Lanka's Rubber Industry Master Plan to ensure the growth of the rubber industry from 2017 through 2026. This plan combines programs, projects and initiatives for the development of the rubber industry that requires to be implemented the year 2027 (Export Development Board [EDB], 2015).

2.4.5 Myanmar

Heavea brasiliensis was first introduced to Myanmar in 1876, immediately after it was transplanted from its native place in Latin America (Amazon) to London (Chan et al., 2013). The commercial planting of rubber in Myanmar started in 1905 by European communities. In 1910 to 1920, it was a steep increased in rubber planted area. However, economic conditions in the 1930s, followed by the Japanese occupation in the early 1940s and local political conditions in the latter half of the decade, slowed further expansion (Keong, 1973).

In the 1950s, private rubber production resumed as a result of a support program for rubber smallholders of FAO started in 1957, though it was short-lived. In 1962, the Revolutionary Council took power and the military regime started. Many rubber estates owned by both local citizens and foreigners were nationalized from 1964 to 1973. Besides, the state procurement system was soon introduced for almost all the agricultural products including rubber, leaving virtually no profit margins in the hands of private estate owners and rubber smallholders (Keong, 1973).

After 1979, the government had made rubber as a priority crop in national development plans and sought assistance from international organizations to replant rubber plantations with high-yielding cultivars. Therefore, Myanmar government tried to modernize the deteriorating rubber industry, which resulted in a two-phase Rubber Rehabilitation Project from 1979-1980 to 1984-1985 (Phase I) and from 1984-1985 to 1992-1993 (Phase II) (Myint, 2008).

In 1988 when the socialist regime, the Burmese Way to Socialism finally collapsed and the State Law and Order Restoration Council (SLORC) government introduced an open-door economic policy. Consequently, the production and marketing of perennial crops were partially liberalized from state control.

In 1994, government promoted the industrial crops plantation by the establishment of a new organization Myanmar Perennial Crop Enterprise (MPCE) was formed under the Ministry of Agriculture and Irrigation (MOAI). Then, it became the government authority which had been responsible for the promotion and development of perennial crops in both the public and private sectors. In sense, rubber was the principal crop among the three major perennial crops, the other two being oil palm and cashew.

In 2006-2007, institutional reform was made under MOAI with the formation of a new enterprise Myanmar Industrial Crops Development Enterprise (MICDE) by merging of the former five enterprises, Myanmar Farms Enterprise, Myanmar Perennial Crop Enterprise (MPCE), Myanmar Cotton and Sericulture Enterprise, Myanmar Sugarcane Enterprise and Myanmar Jute Enterprise respectively. Later on, MICDE was renamed to the Department of Industrial Crops Development (DICD) with effect from 2012-2013. DICD again merged with the Department of Agriculture (DOA) with effect from 2015-2016 (Odaka, 2015). Therefore, since 2015, Perennial Crop Division (PCD) under DOA become the focal unit of government sector for the development of the rubber industry.

Additionally, the Wastelands instructions (1993) encourages the development of wasteland to arable land and granting the private to own were drivers for increased rubber planting areas. The additional major driver of rubber industry development was the 30-year Master Plan for the Agriculture Sector (2000-2001 to 2030-2031), it has being implemented by MOAI. The ministry aims to convert 10 million acres of 'wasteland' for private industrial agricultural production, specifically encourages rubber, oil palm, paddy, pulses, and sugarcane for export goal. The government had forced rubber plantation as crop campaigns that targeted both traditional rubber planting areas; Mon State, Tanintharyi Region and Bago Region and untraditional areas; Kachin and Shan States (Woods, 2012).

At the same time, the country adopted the open-market economic system but rubber could not be exported freely until 2003-2004. Rubber planters and exporters could export only after fulfilling the obligatory sale of 45% to the government then they were allowed to export the balance 55%. This system has been abolished in 2005 and the growers and traders can export rubber without restriction (Odaka, 2015).

According to the 30-year Master plan, it has about 1.5 million planted acres (0.6 million hectares) of rubber in the country, and the production capacity to attain

nearly 300,000 metric tons per annum. Based on government statistics, the government had already reached that figure in 2015 for rubber planting areas of 0.6 million hectares, fifteen years before the target implementing period.

Therefore, the massive change of national policy context has been made the blossom of Myanmar's rubber industry. To date, the total rubber plantation area in Myanmar is about 648,000 hectares and total production about 250,000 tons (DOA, 2018).

2.4.6 Most relevant and highly influent policy contexts of major rubber producing countries

By the review of the national policy context of rubber producing countries, following the most relevant and highly influent issues of rubber industry were observed.

- (1) Rubber producing countries were affected by the Stevenson Rubber Restriction Scheme regulated by the British government effort to stabilize the rubber price following World War I. The scheme restricts the new rubber plantation in British colonial rubber producing countries. It was remarkably negative impact on Malaysia rubber industry but not much on Sri Lanka. However, the restriction scheme was a benefit for Thailand because Thailand rubber farmers received higher price due to the shortage of rubber supply in response to the restriction rubber plantation induced by the British colonial authorities.
- (2) Korean War in 1950 was unexpected factor of shapely increased world rubber demand and price. Consequently, rubber producing countries emphasized on formulating the rubber related laws and acts and established government professional body for rubber industry to meet the requirement of further development.
- (3) Then, government professional body or institutions had managed the rubber replanting scheme, subsidize plans and other responsibilities in line with rubber related laws and acts. The most paradigm change was found in Thailand's rubber industry as becoming the world' number one rubber producing country with the effort of the ORRAF.
- (4) Last and most observable factor was most of rubber producing countries revised the rubber related laws and acts for several times to transform their rubber industries to meet world NR supply and demand.

2.5 Cost and Benefit Analysis

One of the objectives of the study was to examine the profitability of rubber farms in the selected study areas. Most of cost and benefit analysis model carried out with farming system perspective considered all the major components of the farm and their technical and functional relationships; hence the results of these studies are more relevant under the real-world situations.

The economic analysis of multiple enterprise systems was attempted by Singh (1961) and others were using simple budgeting techniques. However, these studies were based on annual crops-based farming system in which the returns for investments were realized within a year. These methodologies such as production function, cost function and programming techniques were suitable for annual crops.

In perennial crops, the absence of proper farm accounting procedures impedes the economic analysis. The distinct features of perennial crops are (i) long economic life span, (ii) multiphase of growth and bearing, (iii) continuous flow of costs and return over a number of years with varying magnitude, (iv) long maintain period between the investments in the initial years and pay-off in later years and (v) influence of present inputs on future output necessitate. These facts make/made different approaches of the economic analysis were/are performing in perennial crop plantation.

According to Bokil (1979), the initial investment on perennial crops having a pre-bearing period of about 4-7 years was an asset that cannot be recycled. This component of the cost of production was considerably higher than the annual maintenance cost and would be taken years to get realized by the growers. Hence, while performing the economic analysis in perennial crops, in addition to the maintenance cost and the return from a plantation should, therefore, cover the initial investment along with its interest. Das (1985) suggested that adding the annuity value of the initial investment was based on the economic life span of the crop to its annual maintenance cost to work out the cost of production.

The approach was subsequently followed by Babu, Chengappa, & Mallikarjunaiah (1992) for performing the economic analysis of other smallholder plantation crops. However, farmers cultivating smallholder plantation crops like coconut are seldom maintained records of inputs and outputs and hence compilation of data for economic analysis of these crops is a tedious task. Similarly, Latha & Abdurazak (1991) were also augured that it was restricted for their estimation of cost of cultivation in the bearing phase of the perennial crops.

Chand (1994) also criticized this approach stating that it was ignored the cross-farm differences in input use and suggested an alternative methodology through the construction of lifetime matrix of data for a given variable. Moreover, in general, the absence of farm records, neither the farmer nor the research personnel would be able to identify the precise age of the perennial crop. Hence, the methodology for constructing a lifetime matrix of data were lacked field level application.

Dey et al. (2014) reported that a multistage sampling procedure was adopted and tabular analysis was used to work out cost and returns in rubber cultivation study in Thailand. Project evaluation measures namely Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR) and Pay Back Period (PBP) were computed for evaluating the feasibility of investment in rubber plantation with the following assumptions:

- (1) The establishment cost included costs up to the sixth year until the crop started yielding. The expenditure incurred annually from seventh year onwards was considered as maintenance cost.
- (2) The stabilization of yield was assumed from the tenth year onwards and economic life of the plantation was assumed to be 30 years.
- (3) The returns from rubber plantations were considered in monetary terms and this constituted the cash inflows of the project (Dey et al., 2014).

However, to investigate the efficient and continuity of industry it was only required to consider the variable cost and return. Therefore, Min et al. (2017) analyzed the economics of smallholder rubber farming in mountainous region of southwest China using break-even analysis only considered the total variable cost due to the limitation of cross-sectional data.

2.5.1 Cost structure

Cost structure is a method to determine how much it will cost a company to manufacture a product and how much profit will be recognized from manufacturing the product (Cambridge dictionary online, 2019).

Spacey (2018) described a cost structure was a high-level model of the cost of industry, organization, business model or business unit. It typically includes high-level categorization of cost, the proportional size of each category and designation of fixed or variable cost. The author also proposed the cost structures were typically used to plan a business and communicate the cost of strategy or investment in business or industry.

2.5.2 Operating ratio

To analyze the current cost and benefit of the rubber production, the operating ratio is used as the parameter of representation profit and loss statement. It is presented as a ratio or a percentage value. Operating ratios totaling less than 100% denote an operating surplus. If operating ratio totaling more than 100% denote an operating deficit. In the case of deficits, the sector would either draw on reserves or carry the deficit as debt into succeeding production season.

In simple terms, the operating ratio is production operating cost to total revenue and usually given in percentage terms (Nalbandian-Sugden, 2016). To clarify, the operating ratio in rubber production is a ratio that shows the efficiency of industry or sector management by comparing operating expenses to net sales (revenue). It is mainly depended on the market price. Meaning, the smaller the operating ratio, the greater the margin the rubber industry has to make a profit. Conversely, the greater the operating ratio is, the lower the margin to generate profit for rubber farmer (Vaidya, 2019). The operating ratio presented one of the key factors to improve competitiveness of firm.

2.6 Break-even Analysis

In break-even analysis, the goal is to identify the point at which the net revenue was zero, that is, the total cost is equal to total revenue. A short-term break-even analysis is performed to explore the risks of smallholder farming by identifying the critical values of yield and price. Break-even analysis in an agricultural sector normally is used for decision-making and contributes to assessing the potential profitability and risk of agricultural practices (Dillon, 1993).

Min et al. (2017) also calculated to break-even yield and break-even point for smallholder rubber farming in the mountainous region of southwest China. The study was considered that rubber plantation had the relatively long production period and the limited availability of data; the annual fixed cost of rubber farming could not be accurately measured. Therefore, authors analyzed to calculating short-term break-even points for yield and price using the survey data.

2.6.1 Break-even price

The break-even price is when the money received from the sale of a product covers the expenses associated with producing that product (Financial dictionary online, 2019).

Carroll (2016) computed the break-even price of cotton-based on per pound of lint using cotton enterprise budget for conventional tillage cotton production without land rent. It was posted by North Carolina State University in 2013 and the study provided the price and yield effect on profit of cotton production.

Langemeier (2015) and Schnitkey (2017) also calculated the break-even price of corn, soybean for investigated the profitability as changes in soybean prices and the released of United State Department of Agriculture (USDA) reported for estimation trigger insurance payments of corn and soybean.

2.6.2 Break-even yield

The break-even yield is the yield necessary to cover and prevent a firm from operating at loss (Cambridge dictionary online, 2009). Carroll (2016), Langemeier (2015) and Schnitkey (2017) also computed the break-even yield of cotton, corn and soybean to point out potential profit or loss based on yield per unit area.

The break-even yield can indicate the risk of smallholder rubber farming under certain market conditions. Break-even price also can reflect the risk related to price fluctuations. Generally, a smaller break-even price and yield indicate lower risk and higher profitability (Min et al., 2017).

2.7 Focus Group Analysis

Focus group analysis was used as a qualitative approach to gain an in-depth understanding of social-economic issues and perceptions of stakeholder and their involvement in respective industry. The method was aimed to obtain data from a purposely selected group of stakeholders rather than from a statistically representative sample of a broader population (Nyumba, Wilson, Derrick, & Mukherjee, 2018).

2.7.1 Origin and application of focus group discussion (FGD)

Kreuger (1988) suggested that focus group interviews were born in the late 1930s by social scientists, had doubts about the accuracy of traditional information-gathering methods. According to Stewart & Shamdasani (2014), the focused group interview had its origins in the evaluation of audience response to radio programs by Robert Merton, prominent social scientists in 1941.

Focus group discussion (FGD) is a technique where a researcher assembles a group of individuals to discuss a specific topic, aiming to draw from the complex personal experiences, beliefs, perceptions and attitudes of the participants through a moderated interaction (Morgan, 1996).

The method's popularity is closely linked to the rise of participatory research, especially the "active experimentation with focus groups" in the academic social sciences during the 1980s (Morgan, 2002). The technique emerged as a qualitative data collection approach and a bridging strategy for scientific research and local knowledge (Cornwall & Jewkes, 1995). FGD is perceived to be a "cost-effective" and "promising alternative" in participatory research (Morgan, 1996) offering a platform for differing paradigms or worldviews (Orr, 1992, Guba & Lincoln, 1994). Given the rise of participatory research in conservation over the last few decades, Bennett et al. (2017) pointed out that it is crucial to reflect on the scope and remit of FGD as a methodological tool.

2.7.2 Types of focus group discussion

Five types of FGD have been identified in the literature, and a further two are emerging with the growth in access and varieties of online platforms.

2.7.2.1 Single focus group

The key feature of a single focus group is the interactive discussion of a topic by a collection of all participants and a team of facilitators as one group in one place. This is the most common and classical type of FGD (Morgan, 1996). It has been widely used by both researchers and practitioners across different disciplines.

2.7.2.2 Two-way focus group

This format involves using two groups where one group actively discusses a topic, whereas the other observes the first group (Morgan, 1996).

2.7.2.3 Dual moderator focus group

It involves two moderators working together, each performing a different role within the same focus group (Krueger & Casey, 2014).

2.7.2.4 Dueling moderator focus group

It involves two moderators who purposefully take opposing sides on an issue or topic under investigation (Krueger & Casey, 2014).

2.7.2.5 Respondent moderator focus group

In this type of focus group discussion, researchers recruit some of the participants to take up a temporary role of moderators (Kamberelis, Dimitriadis, Denzin, & Lincoln, 2005).

2.7.2.6 Mini focus group

Under these circumstances, researchers can only convene a small group of between two and five participants (Kamberelis et al., 2005). Such groups are usually made up of individuals with a high level of expertise (Hague, Hague, & Morgan, 2004).

2.7.2.7 Online focus group

Online focus groups are not a different type of FGD and the introduction of the internet as an adaptation of traditional methods. It is applied within the online environment, using conference calling, chat rooms or other online means (Kamberelis et al., 2005).

2.7.3 Type of focus group analysis

Multiple types of data can be collected during a focus group, including audiotapes of the participants from the focus groups, notes taken by the moderator and assistant moderator, and items recalled by the moderator and assistant moderator (Krueger & Casey, 2014). All of these data can be analyzed, yet they differ in the amount of time and rigor it will take to complete the analysis. Most common types of analysis are:

2.7.3.1 Transcript-based analysis

It represents the most rigorous and time-intensive mode of analyzing data. This model includes the transcription of videotapes and/or audiotapes, which, according to (Krueger & Casey, 2014), commonly will result in 50 to 70 pages of text per focus group meeting. These transcribed data can then be analyzed alongside field notes constructed by the moderator and assistant moderator and any notes extracted from the debriefing of one or more members of the debriefing team.

2.7.3.2 Tape-based analysis

It is another mode for analyzing data from a focus group, wherein the researcher listens to the tape of the focus group and then creates an abridged transcript. This transcript is usually much shorter than is the full transcript in a transcript-based analysis. Notwithstanding, this type of analysis is helpful because the researcher can focus on the research question and only transcribe the portions that assist in a better understanding of the phenomenon of interest.

2.7.3.3 Note-based analysis

It includes analysis of notes from the focus group, the debriefing session, and any summary comments from the moderator or assistant moderator.

2.7.3.4 Memory-based analysis

It is least rigorous because it involves the moderator recalling the events of the focus group and presenting these to the stakeholders. Unless the focus group researcher/moderator is experienced, it was recommended that transcript-based analysis can be used.

Finally, the researcher needs to consolidate the results into a coherent report for dissemination. Key decisions regarding the audience must be made to tailor the report to meet the needs of the target audience. The report can be presented in a narrative or point wise format. The report should capture participant information and key quotes from participants to emphasize points (Nyumba et al., 2018).

2.8 SWOT Analysis

2.8.1 Origin and application of SWOT analysis

In crediting SWOT analysis to Stanford University's Albert Humphrey, SWOT is credited to two Harvard Business School Policy Unit professors - George Albert Smith Jr and C Roland Christensen during the early 1950s. Later in the 1950s another Policy Unit professor Kenneth Andrews developed its usage and application. All professors were specialists in organizational strategy as opposed to marketing. SWOT went on to be developed by the Harvard Business School during the 1960s until SWOT became the tool that we use today.

There is a number of contrasting, if not contradictory views on the origin of SWOT. Despite most researchers' interest in the concept of SWOT analysis, none of these respected authors cite its origins. It may be that SWOT's origins have been forgotten and are confined to the corner of the library labelled 'folklore'. It may be that SWOT originated in a number of places, or became common place in the training rooms of corporate America in the 1950s and 1960s (Friesner, 2000).

The SWOT analysis is an assessment technic of an organization's internal strengths and weaknesses, its opportunities for growth and improvement, and the threats the external environment presents to its survival. Originally designed for use in other industries, it is gaining increased use in a number of the sectors developments.

Bass (2011) was analyzed Mali's Agro-Industry, a landlocked country in West Africa, with SWOT analysis. The major agro-industrial sub-sectors in Mali were the cotton processing industry; animal-based industries (dairy, meat, and leather) and fish processing; cereal processing; sugar refining; the processing of fruits, vegetables, and tobacco; and the processing of cashew nuts and shea (karité). SWOT analysis provided the supply-side factors and demand-side factors to revamp in Mali's Agro-Industry.

Nuga & Asimiea (2015) also analyzed the Nigerian agricultural sector with SWOT analysis as the tool for developing a strategic plan to make the agricultural sector remain competitive. By the analysis of SWOT, the author pointed out that Nigeria as a country was endowed with natural, human and capital resources will be stating the obvious. Unfortunately, harnessing these great potentials for agricultural development has been weakened by factors such as loss of focus, misplaced priority, and lack of encouragement to key players among others.

However, the study also revealed opportunities for Nigeria, it included income from crude oil exports, availability of large domestic and international market for most produce and their by-products like cocoa, palm oil, cashew, rubber, plantain/ banana, Shea butter oil, hides and skin, cotton, groundnut agricultural sector. Threatened factors such as climate change, high incidence of pests and diseases and the lack of proper management techniques, land degradation were also pointed out for economic and political considerations.

SWOT analysis for the rubber industry was recently done by Kadir, Wardhani, Novalia, & Maulana (2018). It was analyzed not only the rubber but also coffee and palm oil commodity in South Sumatra, Indonesia by using SWOT Analysis. The results from the SWOT analysis in the South Sumatra was in areas of aggressive strategies that mean short-term to make changes to these commodities. The factor that became the main force for strength was the land area with high soil fertility. While the weakness factor was the quality of commodity was relatively low, skilled labour was low then the factor of the opportunity of the many traders who supply the commodity. The threat factor of rubber commodity was inflated rubber price and inadequate infrastructure.

The author also has been developed the strategies from results from SWOT analysis. The strategies were in the short term or rapidly optimize the available land by replanting the plant back so that market opportunities increased. The scale of production needed to enhance to a greater extent by institutional strengthening. Then the amount of manpower available was required to much improve and apply appropriate technology by training the workforce.

2.8.2 Development of strategic options formulated by SWOT analysis

By modified SWOT analysis, cross-references the strengths, weaknesses, opportunities and threats facing a company or organization to generate actionable strategies and tactics (Tools, 2018).

By analyzing the external contents (threats and opportunities) and internal contents, and (weaknesses and strengths), it can use these techniques to think about the strategy for the organization, a department or a team.

In essence, it goes deeper than simply listing up strengths, weaknesses, opportunities and threats; it is a means of looking for relationships between each to “brainstorm” possible strategies and tactics.

2.8.3 Identifying strategic options

Alternatives strategic options were identified by rearranging SWOT factors and insert into decision matrix developed by Wehrich. (1982) with the arrangement and following considerations:

2.8.3.1 Strength-Opportunity strategies (S-O)

Strategies identified the ways to use strengths factors to maximize the opportunities of organization or company.

2.8.3.2 Strength-Threats strategies (S-T)

Strategies identified the way to use strengths factors to minimize the possible threats factors of organization or company.

2.8.3.3 Weakness-Opportunity strategies (W-O)

Strategies that identified the opportunities to develop strategies that would be minimized the weaknesses of organization or company.

2.8.3.4 Weakness-Threats strategies (W-T)

Strategies identified the opportunities to develop strategies that would be avoided or escaped from threats of organization or company.

Finally, it needed to evaluate a multiplicity of possible strategies by consideration both external realities and internal capabilities. It is also the situational analysis approach for an organization or company for further development.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Conceptual Framework towards Empirical Based Rubber Crop Development Policy

The study aimed to identify critical intervention areas and advise for alternative policies for the future development of Myanmar rubber industry. It was strategically very important for both the future development of rubber industry as well as the reduction of poverty of rural people link with upstream and downstream of rubber production, processing and marketing sectors. Figure 3.1 described the conceptual framework for Myanmar rubber industry towards empirical based development policy. There were four portions and the first portion was reviewed the national policy context of important rubber producing countries including Myanmar intended to point out impacts of policy on rubber industries in rubber producing countries. The second portion was studied in the current rubber industry by the estimated profitability of rubber farms in the study areas. Third portion was investigated the stakeholders' involvement by the collection of their perceptions on the rubber industry using FGD. The last portion was the exploration of the current situation of the rubber industry based on SWOT analysis and identified the critical intervention areas.

In the first portion, international rubber policy from important rubber-producing countries; Thailand, Malaysia, India and Sri Lanka and Myanmar were reviewed. The second portion was estimated profitability of rubber farms for alternative crops substitution and for comparing different export destinations in the study areas. In the third portion, stakeholders' involvements were investigated by collecting the perception of key stakeholders on rubber production, processing and marketing sectors using FGD. The selected key stakeholders were rubber farmers for the production sector, middlemen for the marketing sector and government official or representatives for institutions sector. In the last portion, the current situation of the rubber industry was explored based on internal and external factors of rubber industry by SWOT analysis. The results from SWOT analysis, it was formulated the specific strategies and identified the critical intervention areas for the rubber industry.

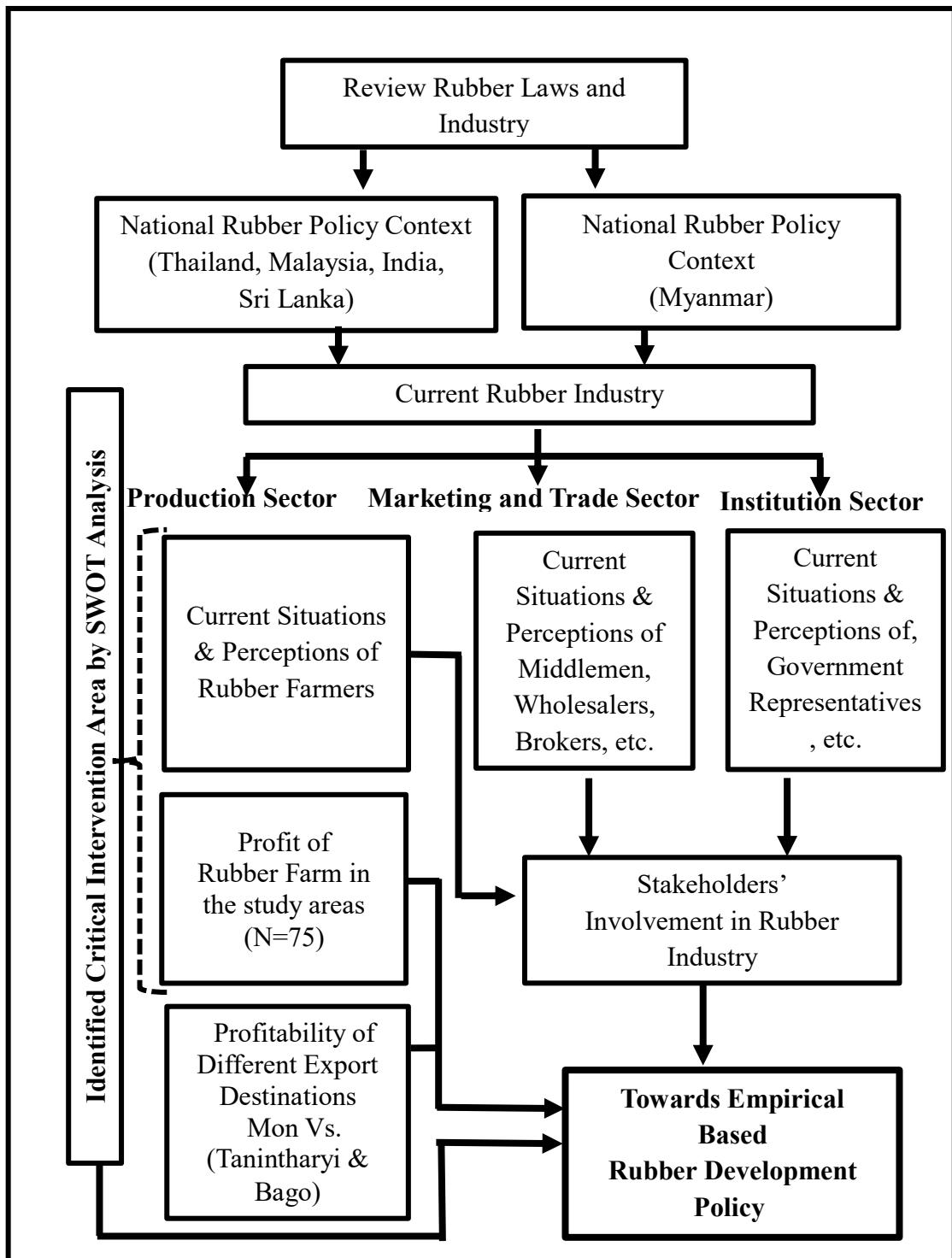


Figure 3.1 The conceptual framework for Myanmar rubber industry towards empirical based rubber development policy

3.1.1 Scope of the study

The study emphasized on ‘traditional’ rubber growing areas in Mon State, Tanintharyi Region and Bago Region. These three important areas contributed about 70% of the total rubber production in Myanmar rubber industry. Apart from the study areas, rubber sector study would be extended to the other rubber production areas located in the northern part of Myanmar including Kachin State, northern and eastern Shan State to cover the whole sector. The rubber plantation in northern part of Myanmar, ‘untraditional’ frontier area, would have had different aspects as comprise by following a private large-scale concessionary model mostly financed by Chinese investment through China’s national opium substitution program. In different circumstances, most of the perennial crops required different approaches for performing the economic analysis. The components of the production cost were considerably higher than the annual maintenance cost and it would take years to get realized by the growers. Hence, while performing the economic analysis in perennial crops, the return from a plantation should cover the initial investment along with its interest.

The economists suggested to add the annuity value of the initial investment based on the economic life span of the crop to its annual maintenance cost in order to work out the production cost. However, most of rubber smallholders seldom maintained farm records of inputs used and outputs and hence, data compilation for economic analysis of these crops was a tedious task.

Generally, in the absence of farm records, neither the farmer nor the research personnel would be able to identify the precise age of the rubber plant. Hence, the methodology for constructing lifetime matrix of data would be needed field level application. Considering the above lacuna, the present study was formulated with an aim to perform the economic analysis based on variable cost and return of rubber production.

3.1.2 Profitability of different export destinations in the study areas

The approaches for studying the impact of export destinations on rubber product quality were important to figure out intervention areas intend to provide proper policy advice to marketing and trade sector of rubber industry.

In the study areas, Mon State, Tanintharyi Region and Bago Region, the export destinations and types of rubber produced were much different. Most of the farmers

from Mon State produced low-grade rubber and their exportable demand mainly depends on the China market. Contrastively, farmers from Tanintharyi and Bago Regions were mostly produced higher quality rubber and their exporting destinations were Thailand and Malaysia. Figure 3.2 presented the value chains of rubber in different study areas based on export destinations and Figure 3.3 described stages and key stakeholders of value chain in Myanmar rubber industry. The figures were formulated by the author's assumption.

3.1.3 Stages and key stakeholders of value chain in Myanmar rubber industry

In Figure 3.3, the upper side of the Figure presented stages of value chain. The first stage was rubber production stages and then collecting stage. Another stages were processing stages. Last stage was marketing and trade of rubber. Key stakeholders in the chain that were involved at each stage. In some cases, the same actor would be involved in more than one stage.

In production stage, it includes land preparation, planting, maintain, production and harvesting of latex. In production stage, key stakeholder was rubber farmers with different farm sizes. In collecting stages, it included collecting of different types of rubber from rubber farmers. Key stakeholders were local collector and broker. However, some farmers directly sold their products to wholesalers, rubber processing factories and exporting companies. In processing stage, processing activities included such as coagulating, drying, smoking, etc. Key stakeholders were rubber processing factories, wholesaler and exporting companies. In some cases, rubber farmers with large farm size processed their rubber by their self. In marketing and trade stage, it includes purchasing, storing and selling rubber from rubber farmers and between middlemen, processing factories and exporting companies. Then exporting them to foreign and sell to domestic markets. Key stakeholders of marketing and trade were wholesalers and exporting companies.

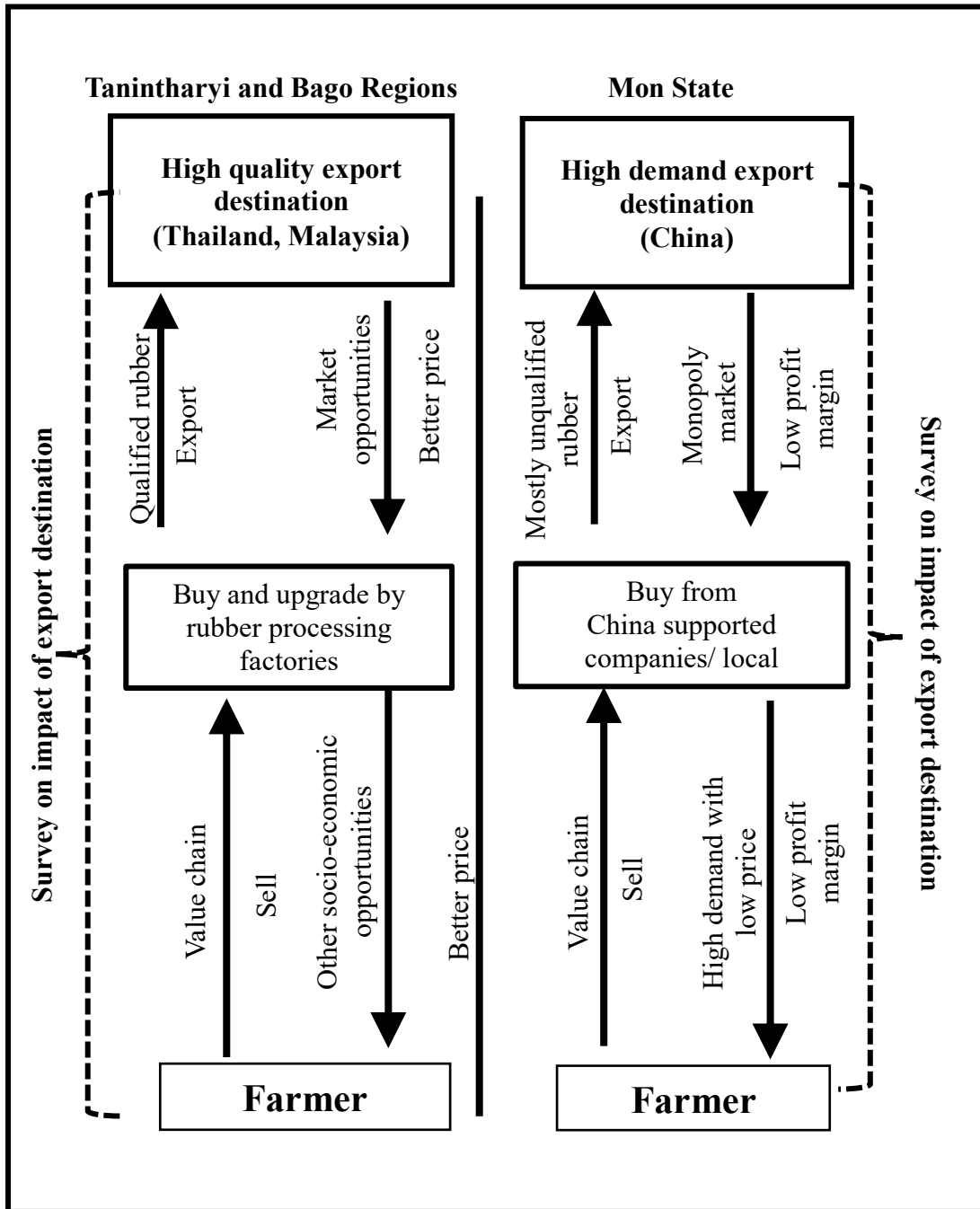


Figure 3.2 Comparison of the value chains of rubber in different study areas based on export destinations

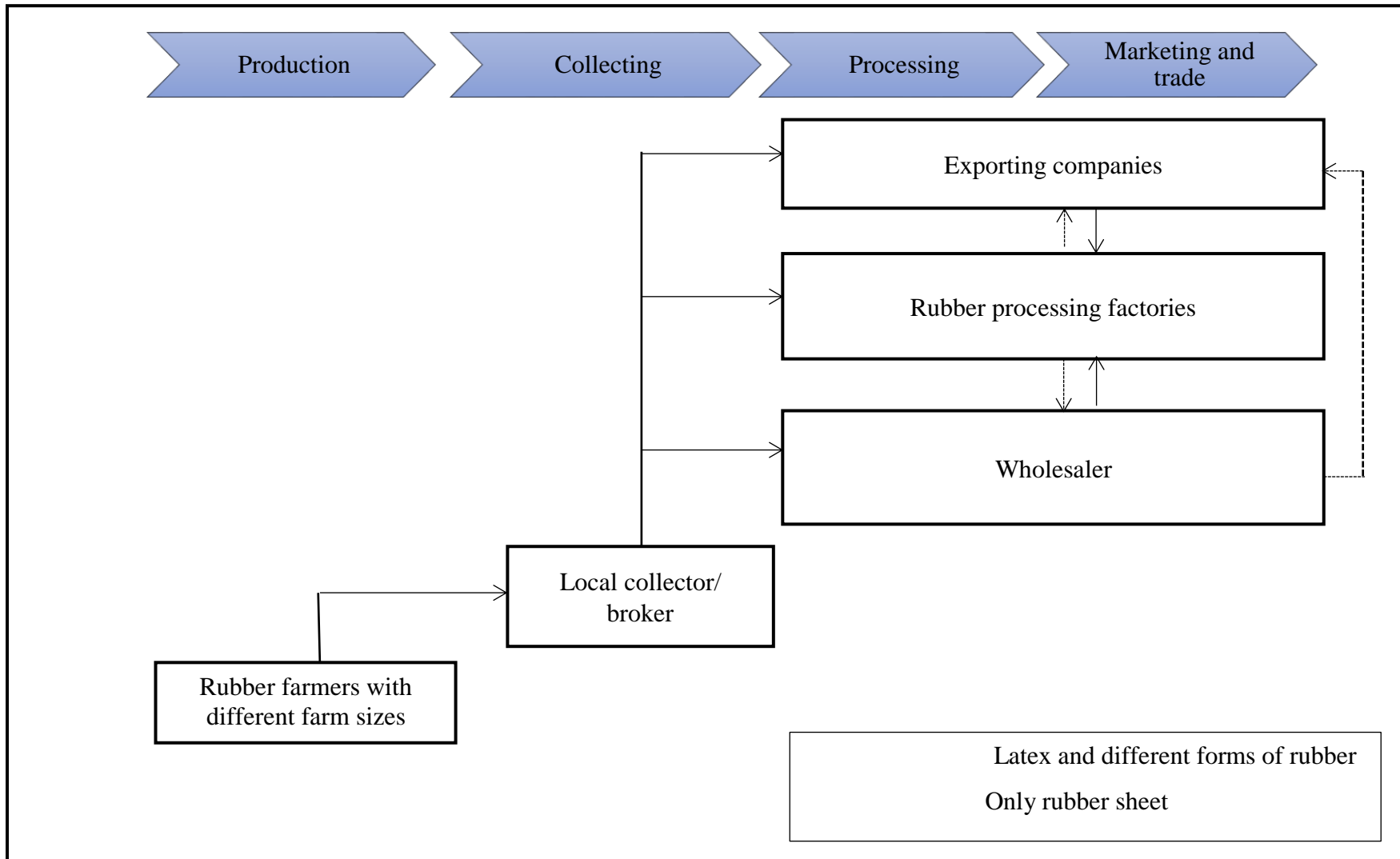


Figure 3.3 Stages and key stakeholders of value chain in Myanmar rubber industry

3.2 Primary Data Collection

3.2.1 Survey area selection criteria and selected study areas

The following key selection criteria were set up for effective engagement of survey in Mon State and Tanintharyi and Bago Regions.

- (1) A primary criterion was the areas should have large amount of total planting areas and also rubber tapping areas.
- (2) A second criterion for selection was the assessment on the high ratio of total tapping area in the total planting area. However, the area occupied only a small amount of total planting area and a relatively large tapping area should not be considered in selection.
- (3) Presence of main stakeholders should also be considered.
- (4) Reasons for security and mobility were also an important consideration in selection.

According to the above criteria, the following five townships were chosen as the survey areas in Mon State, Tanintharyi and Bago Regions. In Mon State, Kyaikto Township was chosen from Thaton District and Mudon Township from Mawlamyine District. In Tanintharyi Region, Dawei Township was chosen from Dawei District and Myeik Township was chosen from Myeik District. Accordingly, Shwegyin Township was also chosen for Bago Region because larger rubber plantation area exists (Appendix - 1). Moreover, most of the rubber farmers own the larger farm sizes than other traditionally rubber planting areas.

3.2.2 Description of the study areas

The study areas, Mon State, Tanintharyi Region and Bago Region, are traditional rubber plantation areas, largely contributing to country rubber planting area as well as rubber production and export value. The first two study areas are located at the southern part of Myanmar. Mon State is situated between latitudes 14°52'N and 17°32'N and longitude 96°51'E and 98°13'E. Tanintharyi Region also place in coordinates of latitude 14°5'2.98"N and longitude 98°12'E 5.67"E. The third study area, Bago Region is located in the country and approximately coordinates of between latitude 46°45'N and longitude 19°20'N and 94°35'E and 97°10'E.

3.2.2.1 Mon State

Rubber production in Myanmar is centered in Mon State. It is boundary with Bago Region to the north, Kayin to the east, and Tanintharyi to the south. It also shares a short southeastern border with Thailand. Mon State is one of the small States in Myanmar, but, with a population of two million inhabitants, so that it is relatively densely populated. The high population density makes it an economically important region. The central part of the state has the greatest concentration of the rubber industry. There are also the various type rubber markets and market participates, from broker to exporter. Moreover, different farm sizes of rubber farmers are found in Mon State. Additionally, different kinds of rubber processing industries like Technical Specified Rubber (TSR) factories and value-added processing like rubber ring and balloons factories can be found (Van et al., 2017).

In 2014-2015, Mon State contributed about 31% of the total rubber sown areas and about 49% of the rubber harvest of country. According to the Mon State Rural Household Survey conducted from May to June 2015, it was about 19% of households possessed rubber farms, making the sector as large as the state's rice sector.

The secondary data from DOA presented Thaton District contributed about 25.7% of rubber planting area and Mawlamyine District contributed about 74.28%. In Thaton District, the selected township was Kyaikto Township and it contributed about 29% of rubber planting areas of Thaton District and presented different stakeholders of rubber industry. Based on rubber farm size, different type of rubber farmers were observed in Kyaikto Township.

The selected township in Mawlamyine District was Mudon Township and it also contributed about 16% of rubber planting areas of district. Mudon Township was the market center of rubber industry in Myanmar and most of the rubber wholesalers and exporter were presented. There were different types of rubber farmer observed based on farm size and mostly who were smallholder rubber farmers. Table 3.1 described the rubber planting area and tapping area of Mon State in 2017.

3.2.2.2 Tanintharyi Region

Tanintharyi Region had about 20% of total rubber farmers in Myanmar in 2018 (DOA, 2018). The region is one of the longer coastal regions, bordered by Mon state and a long border with Thailand. The northern part of this region is more concentrated in the rubber industry than the southern part of the region as the oil palm plantation was

dominant. Like Mon State, there are also the various type rubber markets, from broker to exporter, and different farm sizes of rubber farmers can be found.

Additionally, there were different kinds of rubber processing industries like TSR factories and modern rubber smoking factories were found because the region possessed quality export destinations. The region had one of the largest remaining monsoon forests in Southeast Asia and richen with natural resources but the region had a largely rural population with high poverty levels (Vagneron, Chambon, Aung, & Aung, 2017).

There are three districts such as Dawei, Myeik and Kawthoung Districts in the Tanintharyi Region. According to secondary data from DOA, Dawei District contributed about 40% of rubber plantation areas of Tanintharyi Region and Myeik and Kawthoung Districts contributed 42% and 18% respectively.

The selected township from Dawei District was Dawei Township and it contributed about 13% of rubber planting areas in the district. Moreover, Dawei Township is the principle township of the Tanintharyi Region. Different types of rubber farmers were presented based on farm size and the rubber farmer group and cooperative were also prevailed in the regions. In Myeik District, the selected township was Myeik Township as the township process 25% of rubber planting of the district and different types of rubber farmers existed. Moreover, there were border trade station in Myeik Township for export and import commodities such as marine product, rubber, etc. Therefore, it provides a comprehensive study on empirical based rubber development policy of the rubber industry in Myanmar, including production, processing and marketing and regional trade and market mechanisms. Table 3.2 described rubber planting area and tapping area of Tanintharyi Region.

3.2.2.3 Bago Region

Bago Region is also one of considerable rubber planting and producing areas in Myanmar. It is located in the centre of Myanmar, bordered by Mon State, Kayin State, Kayah State, Rakhine State, Magway Region, Nay Pyi Taw Union Territory, Yangon Region, and Ayeyawady Region.

The selected survey area, Shwegyin Township, is the most rubber planting area in the region. The Township has historical background of rubber plantation since the beginning of British Colonial Rule in Myanmar.

On the other hand, the proportion of employed persons working in agriculture sector is the highest about 55% in Shwegyin Township. Moreover, the total rubber plantation areas were about 65,000 hectares (DOA, 2018). There are also different types of rubber farmers are presented based on their farm sizes. However, in contrast with other regions, there are large number of middle holder and large holder rubber farmers were existed. Table 3.3 described the number of farmers and planting area according to farm size in Tanintharyi Region.

3.2.2.4 Number of farmers and planting areas in the study areas

Table 3.4 presented the number of farmers and planting area according to farm size in Mon State, Tanintharyi and Bago Regions. In Mon State, 53,403 number of farmers were presented with rubber planting areas of 200,257 hectares. Accordingly, there were 21,983 rubber farmers and about 140,628 hectares of rubber planting areas in Tanintharyi Region. In Bago Region, there were few number of rubber farmers, 2,901 were existed. Accordingly, there were 47,793 hectares of rubber planting areas in Bago Region.

Table 3.1 Rubber planting area and tapping area of Mon State in 2017

Township	Maintaining area (ha)	Tapping area (ha)	Total planting area (ha)	Tapping %
Kyaikto	9,103	5,693	14,796	38.48
Bilin	2,611	7,354	9,964	73.8
Thaton	9,049	9,883	18,932	52.2
Paung	4,154	3,645	7,799	46.74
Thanton District	24,917	26,575	51,491	51.61
Mawlamyine	213	687	900	76.31
Chaungzon	379	2,019	2,398	84.21
Kyaikemaraw	14,097	19,306	33,403	57.8
Mudon	8,112	16,183	24,295	66.61
Thanbyuzayat	5,722	20,589	26,311	78.25
Ye	14,900	46,559	61,459	75.76
Mawlamyine District	43,423	105,343	148,766	70.81
Mon State	68,340	131,918	200,257	65.87

Source: DOA, 2018

Table 3.2 Rubber planting area and tapping area of Tanintharyi Region in 2017

Township	Maintaining area (ha)	Tapping area (ha)	Total planting area (ha)	Tapping %
Dawei	3,827	3,492	7,318	47.71
Myitta	3,377	1,467	4,844	30.29
Lounglone	2,581	3,413	5,994	56.94
Thayetchaung	6,958	4,852	11,810	41.09
Yebyu	12,998	2,937	15,935	18.43
Kaleinaung	7,772	1,841	9,614	19.15
Dawei District	37,513	18,002	55,515	32.43
Myeik	7,074	7,905	14,979	52.77
Kyunsu	3,037	13,068	16,105	81.14
Palaw	3,556	9,993	13,549	73.75
Palauk	1,684	2,966	4,650	63.79
Tanintharyi	7,407	2,858	10,265	27.84
Myeik District	22,758	36,790	59,548	61.78
Kawthoung	10,111	2,226	12,337	18.04
Khamaukkyi	2,750	850	3,600	23.61
Karathuri	1,678	83	1,761	4.71
Bokepyin	4,956	263	5,219	5.05
Pyigyimandaing	2,526	121	2,648	4.59
Kawthoung District	22,021	3,543	25,565	13.86
Tanintharyi Region	82,292	58,335	140,628	41.48

Source: DOA, 2018

Table 3.3 Rubber planting area and tapping area of Bago Region in 2017

Township	Maintaining area (ha)	Tapping area (ha)	Total planting area (ha)	Tapping %
Bago	16,291	40,296	56,587	71.21
Daik U	3,693	2,307	6,000	38.45
Shwegyin	34,807	8,130	42,937	18.94
Kyauktaga	517	0	517	0.00
Bago District	55,308	50,738	106,041	47.85
Taungoo	3,912	320	4,232	7.56
Oatwin	582	356	938	37.95
Pyu	164	25	189	18.26
Yaedashe	4,274	955	5,229	13.23
Htantapin	109	15	124	12.10
Kyaukkyi	113	0	113	0.00
Taungoo District	9,154	1,671	10,661	15.67
Pyay	4	0	4	0.00
Pyay District	4	0	4	0.00
Thayawady	655	150	805	18.63
Letpadan	311	70	380	18.42
Minla	25	0	25	0.00
Okpo	10	0	10	0.00
Thayawady District	1,001	220	1,220	18.02
Bago Region	65,467	52,624	117,926	44.62

Source: DOA, 2018

Table 3.4 Number of farmers and planting area according to farm size in Mon State, Tanintharyi and Bago Regions

Size of farm (ha)	Mon State			Tanintharyi Region			Bago Region		
	No. of farmer	% of farmer	Area (ha)	No. of farmer	% of farmer	Area (ha)	No. of farmer	% of farmer	Area (ha)
< 0.8 & 0.8	6,413	12.0	3,907	4,310	19.6	3,590	319	11.0	208
>0.8 to 2.02	15,957	29.9	22,650	5,582	25.4	9,756	597	20.6	849
>2.02 to 4.04	18,285	34.2	55,276	5,255	23.9	18,487	479	16.5	1,416
> 4.04 to 8.09	9,564	17.9	58,575	3,516	16.0	22,472	493	17.0	2,750
Smallholder	50,219	94.0	140,408	18,663	84.9	54,305	1,888	65.1	5,223
>8.09 to 12.14	2,135	4.0	22,095	1,364	6.2	15,274	223	7.7	2,032
>12.14 to 16.18	417	0.8	5,812	680	3.1	10,197	127	4.4	1,597
> 16.18 to 20.23	245	0.5	4,489	429	2.0	8,656	152	5.2	2,782
Middle holder	2,797	5.3	32,396	2,473	11.3	34,127	502	17.3	6,411
> 20.23 to 40.46	234	0.4	6,142	433	2.0	14,357	238	8.2	6,945
>40.46 to 202.34	131	0.2	10,599	377	1.7	23,056	242	8.3	18,340
>202.34 to 404.69	15	0.0	3,834	28	0.1	8,840	18	0.6	4,996
>404.69	7	0.0	6,878	9	0.0	5,943	13	0.5	5,878
Large holder	387	0.6	27,453	847	3.8	52,196	511	17.6	36,159
Total	53,403	100.0	200,257	21,983	100.0	140,628	2,901	100.0	47,793

Source: DOA, 2018

3.2.3 Climatic and weather condition of study areas

Most of the NR is grown between 15°N and 10°S where there are lowland tropical forest and the climate is permanently hot and humid. Rubber is a low altitude crop and sloping areas are less suited for rubber growth because of erosion risk and the difficulties for tappers and estate maintenance. The ideal climatic conditions for rubber growth is high and rather stable mean temperatures, a well-distributed high annual rainfall, and relative air humidity between 60% and 80%. Solar radiation should be between 1,500 and 1,800 hours per year. Optimal temperatures are between 24° C and 26° C. Air temperature has a direct effect on the flow of latex during tapping, especially at the start of a dry season (Verheye, 2010).

Mon State has a tropical climate and temperate weather as it is located in the low latitude zone and near the sea. The annual rainfall is about 4,800 mm. Similarly, the study areas in Tanintharyi Region has a tropical climate. It has significant rainfall and a short dry season in most of moths. The average rainfall is about 5,500 mm. The study area of Shwegyin Township, Bago Region has the normal average rainfall which is about 3,300 mm.

Hence, all of these study areas have the favorable climate condition of rubber plantation and become traditional and dominant areas for the rubber industry in Myanmar.

3.2.4 Sampling method and data collection

3.2.4.1 Proportionate stratified random sampling

The proportionate stratified random sampling was used to estimate rubber profitability for alternative crops substitution in traditionally rubber sowing areas. In which, the population of rubber farmer was divided based on the different farm size. Then, it applied random sampling techniques to each stratum.

In this approach, each stratum sample size was directly proportional to the population size of the entire population of strata. That meant each strata sample had the same sampling fraction.

The proportionate stratified random sampling formula as follow:

$$n_h = (N_h/N) \times n$$

Where, n_h = Sample size for h^{th} stratum

N_h = Population size for h^{th} stratum

N = Size of entire population

n = Size of the entire sample (Salkind, 2010)

In the rubber industry, the production sector is the most important key stakeholders are rubber farmers with different landholding levels. Therefore, data should be collected by proportionate stratified random sampling method for more accurate data of socio-economic characteristics and profitability of rubber production system.

The classification of rubber farmers is based on farm size different with rubber producing countries depending on their references. Most countries classified as rubber farmers for (2) types, smallholder and large holder or estate (Association of Natural Rubber Producing Countries [ANRPC], 2018). In Myanmar, the classification of rubber farmers based on farm sizes which have been recently approved by DOA. Table 3.5 described the types of rubber farmer classified by farm size in Myanmar by DOA.

According to classification of farm size, the proportionate stratified random sampling was used for determining the sample size of respondents based on proportion of each strata. Table 3.6 presented the number of farmers and planting areas according to the size of the farm in study areas. The total of 75 rubber farmers were selected from the five townships based on their farm size as presented in Table 3.7.

In data collection, socio-economic conduction, cost of production, processing, marketing in the rubber production system were collected as the primary data. Primary data set were collected by key informant interview (KII) with different rubber farmers according to their farm sizes using the semi-structural questionnaire from October 2018 to February 2019.

Table 3.5 Types of rubber farmer classified by farm size in Myanmar

Types	Specification
Smallholder	Less than 8.5 ha
Middle holder	8.5 ha - 20.25 ha
Large holder (Estate)	Above 20.25 ha

Source: DOA, 2019

Table 3.6 Total number of farmers and planting areas according to the farm size in study areas

Townships	Types of rubber farmer	No. of farmer (No.)	Percentage of farmer (%)	Area (ha)
Kyaikto	Smallholder	838	64.71	1,268
	Middle holder	290	22.39	1,383
	Large holder	167	12.89	3,335
	Total	1,295	99.99	5,986
Mudon	Smallholder	10,316	98.38	7,865
	Middle holder	155	1.48	627
	Large holder	15	0.14	1,339
	Total	10,486	100.00	9,831
Mon State	Total	11,781		15,817
Dawei	Smallholder	1,904	83.50	1,534
	Middle holder	353	15.48	687
	Large holder	23	1.01	736
	Total	2,280	99.99	2,957
Myeik	Smallholder	2,490	85.62	2,154
	Middle holder	329	11.31	500
	Large holder	89	3.06	2,407
	Total	2,908	99.99	5,061
Tanintharyi Region	Total	5,188		9,018
Shwegyin	Smallholder	568	59.10	875
	Middle holder	308	32.04	946
	Large holder	85	8.84	341
	Total	961	99.98	2,162
Bago Region	Total	961		2,162

Source: DOA, 2018

3.2.4.2 Purposive random sampling

According to research objectives (2), FGDs were conducted to analyze key stakeholders' perception of the rubber industry. In this study, FGD was used as a qualitative approach to gain an in-depth understanding of perceptions of stakeholder on the rubber industry for investigated their involvements. Therefore, qualitative data were collected from a purposely selected group of key stakeholders from the study areas.

As time and financial conditions were limited, the lists of stakeholders had to be prioritized by pilot survey to rubber farmers and it was helped in this process. The stakeholders were identified as key stakeholders for FGD in different study areas as shown in Table 3.8. Nine FGDs were conducted for covering larger study areas, wider interest groups. Although six and eight participants for FGD were generally accepted, it was organized the about 6 to 20 participants to cover the lack of guarantee to attend meeting. The participants were identified through DOA extension networks by using purposive sampling. It was because the FGD mainly relies on the ability and capacity of participants to provide relevant information about the rubber industry. The detail information of selected rubber farmers for FGDs was described in Table 3.9, that of middlemen in Table 3.10 and that of institutional representatives in Table 3.11.

In data collection, as FGD required a team consisting of a skilled facilitator and assistants, two facilitators and six note-takers were organized. Seven locations were chosen for focus group meetings in the study areas. It was set-up about 60 to 120 minutes for the duration of the meetings. The facilitators and assistants team was arranged the predictive discuss topics; these would be relevant discussions themes as shown in the Appendix 3.

The assistants' team arranged seating plan, note taking and also tested audio recording before the meeting. The assistants' team took detail participant's information in the registration counter and arranged seats in meetings. Table 3.12 presented example of the collection the information about FGD for stakeholder of middlemen in Mudon Township. Figure 3.4 also presented results of the level of middlemen's participation in FGD with the seating plan in Mudon Township.

Table 3.8 Key stakeholders of the rubber industry for FGD

Key Stakeholders	Types of stakeholder
Rubber farmers	<ul style="list-style-type: none"> - Rubber farmer with different farm sizes - Rubber tappers - Farmer cooperative members - Private estate owner/ manager
Middlemen	<ul style="list-style-type: none"> - Broker - Local collector - Wholesaler - Exporter - Rubber processing factories (Local & Thailand)
Institutional representatives	<ul style="list-style-type: none"> - Township officers and staff (DOA, MOALI) - Rubber estate managers (PCD, DOA, MOALI) & (No. 3, Heavy Industrial Enterprise, MOI) - Researcher (PCD, DOA, MOALI)

Note: DOA= Department of Agriculture, MOALI= Ministry of Agriculture, Livestock and Irrigation, PCD= Perennial Crops Division, MOI= Ministry of Industry.

Table 3.9 Detail information of rubber farmer's FGDs in the study areas

Stakeholder		Rubber farmer			
Particular	Unit	FGD (1)	FGD (5)	FGD (6)	FGD (9)
Region/ State	-	Mon	Bago	Tanintharyi	Tanintharyi
Township	-	Kyaikto	Shwegyin	Dawei	Myeik
Date	-	30 th Oct: 2018	1 st Nov: 2018	12 th Dec: 2018	15 th Dec: 2018
No. of stakeholders	No.	20	13	10	16

Table 3.10 Detail information of middlemen's FGDs in the study areas

Stakeholder		Middlemen	
Particular	Unit	FGD (3)	FGD (7)
Region/ State	-	Mon	Tanintharyi
Township	-	Mudon	Myeik
Date	-	31 st Oct: 2018	14 th Dec: 2018
No. of stakeholders	No.	11	6

Table 3.11 Detail information of institution's FGDs in the study areas

Stakeholder		Institutional Representatives		
Particular	Unit	FGD (2)	FGD (4)	FGD (8)
Region/State	-	Mon	Mon	Tanintharyi
Township	-	Kyaikto	Mawlamyine	Myeik
Date	-	30 th Oct: 2018	31 st Oct: 2018	14 th Dec: 2018
No. of stakeholders	No.	8	11	8

Table 3.12 Information of participants in FGD for stakeholder of rubber farmer in Kyaikto Township

FGD (1)

Type of FGD- Rubber farmer

Date - 30th Oct. 2018 (11:30 am)

Location - Golden Bless hotel, Kyaikto Township.

Respondents	Gender	Age	Rubber experience	Planting area (ha)	Respondent participation
1	Male	76	50	10.1	Active
2	Male	74	50	20.2	Active
3	Male	68	24	20.2	Active
4	Male	43	30	101.2	Active
5	Male	67	25	8.1	Neutral
6	Male	64	10	8.1	Active
7	Male	56	25	80.9	Active
8	Male	41	2	2.8	Active
9	Male	44	22	5.7	Neutral
10	Male	44	20	1.6	Neutral
11	Male	45	20	10.1	Silent
12	Female	42	15	4.9	Silent
13	Male	55	15	3.6	Neutral
14	Male	32	3	4.5	Silent
15	Male	55	14	8.1	Active
16	Male	30	25	2.0	Silent
17	Male	36	5	1.2	Silent
18	Male	59	4	6.9	Active
19	Male	77	30	14.2	Active
20	Male	45	17	(Staff Officer)	Silent
Mean		52.6	20.3	16.8	
Range		(30-77)	(2-50)	(1.2 -101.2)	

Most active persons =1, 3, 18

Active=10
Neutral=4
Silent=6

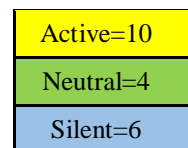
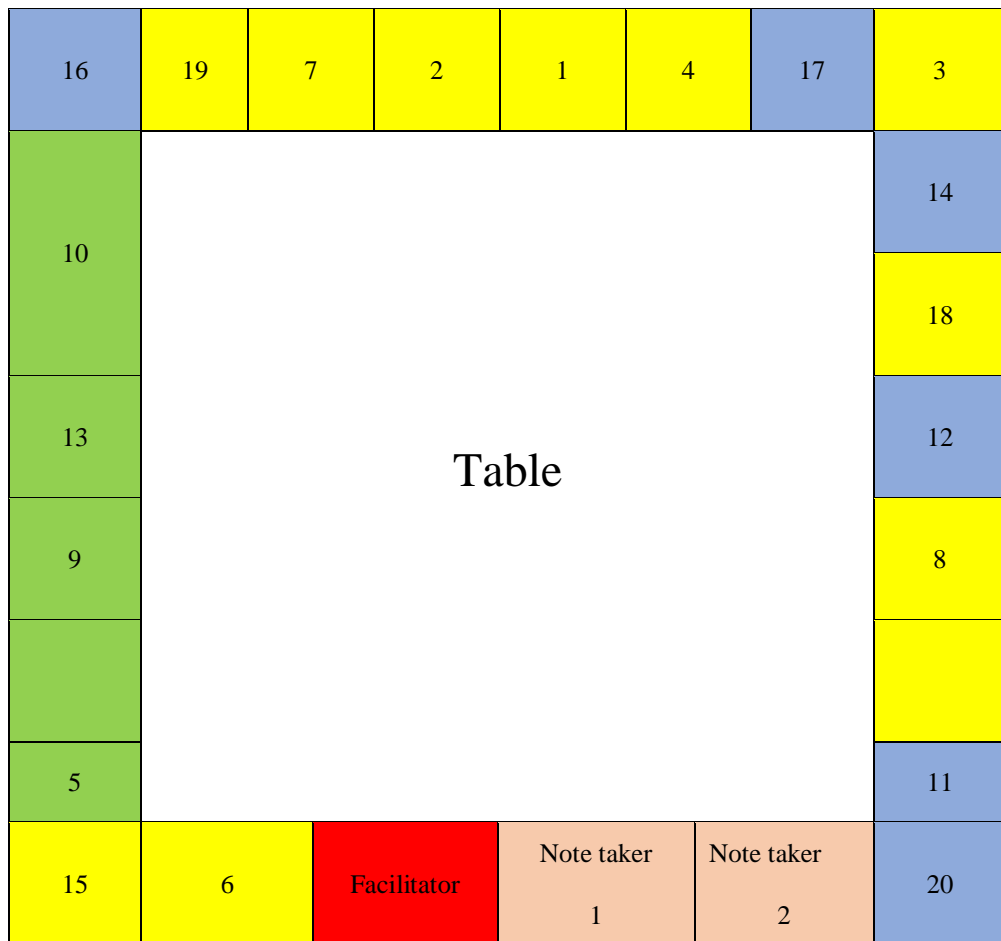


Figure 3.4 Level of rubber farmer’s participation in FGD with seating plan in Kyaikto Township

3.3 Secondary Data Collection

Most of the data used in this study were primary data, but secondary data was also used as supporting the validity of this study. The secondary data were time-series data of rubber production, planting area and average yield in Myanmar. The different levels of rubber planting area belong by farmers in the study areas of Mon State, Tanintharyi and Bago Regions were also collected. The data were mainly collected from DOA and some official website such as ANRPC, etc.

3.4 Method of Analysis

3.4.1 Cost and benefit analysis

3.4.1.1 Operational cost of the rubber production

The total operational cost of the rubber production is summed of the cost of production, processing and marketing per one unit of output. The cost of production per one unit of rubber included all variables cost incurred such as cost of fertilizer, equipment and labour for tapping and maintaining, etc. Opportunity costs for family labour were computed by using the most payment type and the most common wages in respective study areas.

The cost of processing per one unit of rubber comprised all variable costs of materials and labour for processing activities. If tapping labour cost included for processing activities, labour cost for processing would not be considered.

Marketing costs could be different based on distance from market, transportation facilities, number of alternative buyers and forms of rubber. Costs of marketing include the cost of transportation, loading-unloading, grading, re-baling, and painting etc.

In rubber industry, cost of production is mostly based on the unit area but the cost of processing and marketing are based on the unit of output. However, it was simple to transform based on unit of output to unit of area by multiply or divided by yield of the unit area.

$$\text{Operational cost per one unit output} = C_1 + C_2 + C_3$$

Where, C_1 = Cost of production per one unit of output

C_2 = Cost of processing per one unit of output

C_3 = Cost of marketing per one unit of output

3.4.1.2 Market price

The rubber market price was different from forms of rubber produced, market demand, type of acid use, presence of alternatives buyers, selling practice and other influenced factors. Hence, price received by respondents during the study period was used instead of reported average price collected by local wholesalers.

3.4.1.3 Yield estimation of the rubber production

The yield of rubber plantation was the most important factor for competitiveness and it was mostly expressed with gram/tree/tapping and transformed into area-based for the yield performance test in field conditions and expressed in kg/ha (Pathiratna, Seneviratne, Waidyanatha, & Samaranayake, 2006). Based on this estimation, the study collected yield estimation parameters for yield estimation as shown in Table 3.13. However, the production season of the study areas had about five months for raining season and drought for three months. Therefore, yield information was separated collected by peak and hard seasons. It was because the yield was fluctuated between the seasons and computed for both seasons' yield which would be provided more accurate estimation.

3.4.1.4 Operating ratio

The operating ratio was presented as a ratio or a percentage value and the ratio less than 100% denotes an operating surplus and the ratio more than 100% denote an operating deficit.

Meaning, the smaller the operating ratio, the greater the margin and the rubber production has to make a profit and indicated the higher level of competitiveness. Conversely, the greater the operating ratio is, the lower the margin to generate profit and presented lower level of competitiveness for rubber farmer. The formula for calculating operating ratio was therefore:

$$\text{Operating ratio} = \frac{\text{Total operational cost for one unit of output} \times 100}{\text{Current market price}}$$

Table 3.13 Parameters of yield estimation a for rubber production

Peak season yield	Hard season yield
Tapping days per month	Tapping days per month
Tapping months per season	Tapping months per season
Tapping days per season	Tapping days per season
Yield per day per area	Yield per day per area
Yield per area per season	Yield per area per season

Yield estimation ^a = Peak season yield + Hard season yield

3.4.2 Break-even analysis of the rubber production

3.4.2.1 Break-even price of the rubber production

Based on the total variable cost, it is equal to sum the cost of production, processing and marketing per one unit of output. Therefore, break-even point occurs where total operational cost of one unit of output is equal to current market price.

3.4.2.2 Break-even yield of the rubber production

The break-even was the yield necessary to cover and prevent a firm from operating at loss. The break-even yield is computed by dividing the total variable cost of the production system per unit area (ha) by current market price.

$$\text{Break-even yield} = \frac{\text{Total variable cost of production system of unit area}}{\text{Current rubber market price}}$$

3.4.3 Focus group discussion analysis

FGD in the study areas provided both qualitative and observational data, especially stakeholder perceptions on rubber industry. FGD consists of four major steps: sampling method, data collection, analysis and presentation of results as shown in Figure 3.5. The sampling method and data collection were already described in the previous section.

In analysis steps, stakeholder's perceptions from open-ended discussion topics were analyzed by FGD as followings:

- (1) The number of points responded by stakeholders to discussed topics were recorded.
- (2) The points most frequently mentioned were also noted.
- (3) The list of points were developed and the main points were also identified by using the coding system;
 - (a) The first step was the *initial coding* which provided category codes to discussed point by respondents (Charmaz, 2006). At this stage, listed emerging ideas and identified keywords used by respondents and frequently discussed points as indicators of important points or themes.
 - (b) The second stage involved *focused on coding* which eliminated, combined or subdivided the category codes identified in the first step. Eliminated some category codes that are not important for themes and combined or sub-divided category codes depended upon the degree of vital to discussed points.

- (4) The information was prioritized by the degree of critical to related discussed topics, summarized and then analyzed.
- (5) Assistants' team was also looked over responded of each respondent and record the level of their participation in meetings.
- (6) Rearranged and combined FGD by the same stakeholders and analyzed by note-based and tape-based analysis.

The analysis gave the perceptions of stakeholders and it was also provided their involvements in rubber industry by comparisons across FGDs in the study areas (Carey & Smith, 1994).

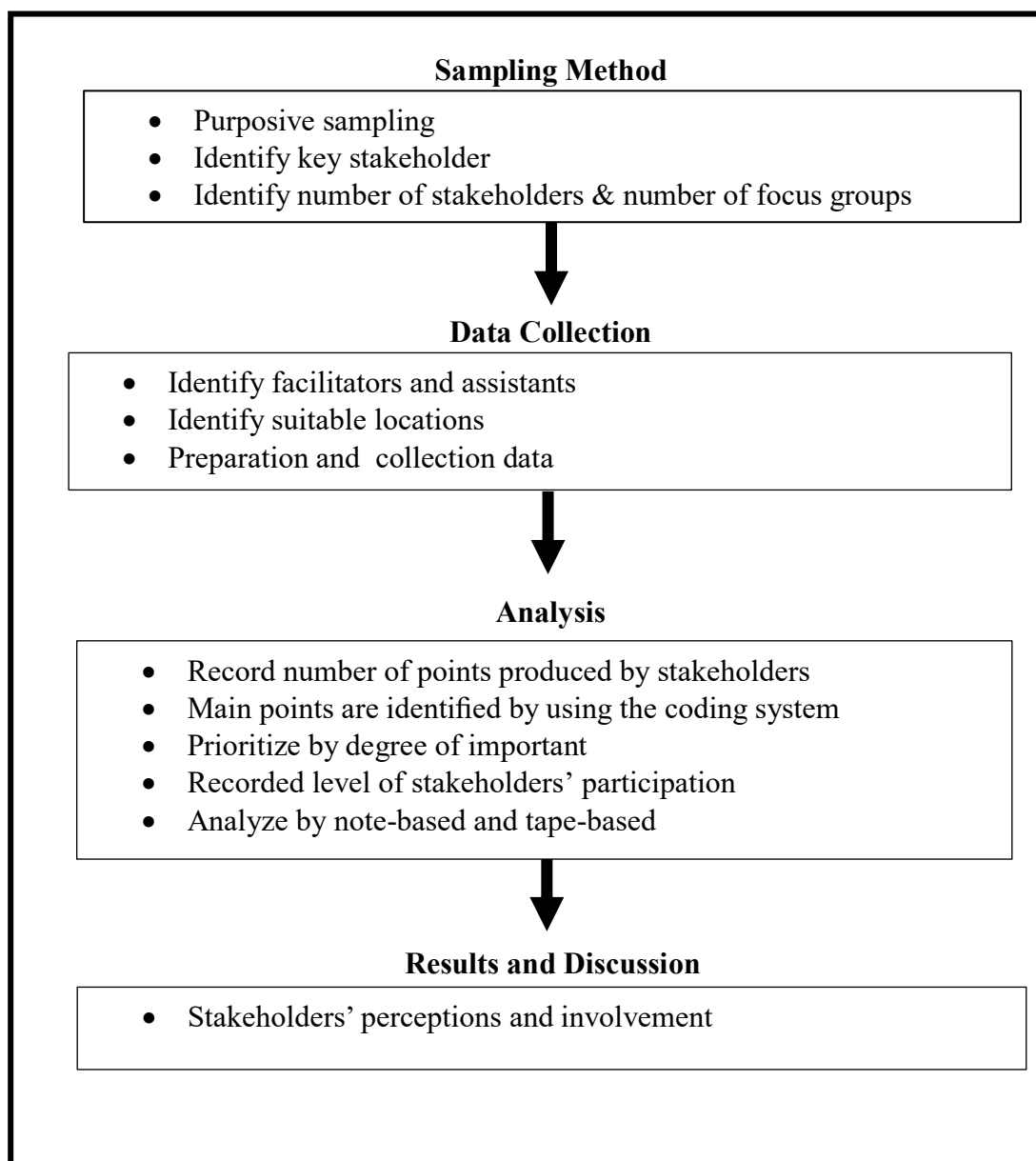


Figure 3.5 Steps of the FGD

3.4.4 SWOT analysis

The objective of study was analyzed the current situation of the rubber industry by SWOT analysis. Table 3.14 presented types of stakeholder and methods of data collection for SWOT analysis.

In the rubber industry, rubber production, processing, marketing and trade sectors were most important sectors. Therefore, all sectors would be required to identify internal contexts: strengths and weaknesses and also external contexts: opportunities and threats for investigated current situation and find out critical intervention areas. The steps of SWOT analysis for rubber industry were as follow:

- (1) Situational analyzed to rubber industry by SWOT analysis including the rubber production, processing and marketing and trade sectors.
- (2) Then, listed the internal contexts and external contexts of each production, processing and marketing and trade sectors.
- (3) Prioritized by combining the same factors and eliminated inapplicable and least important factors from each sector.
- (4) To deeper analysis, prioritized SWOT factors were inserted into strategies matrix. The strategies matrix formulated the possible strategies on the basis of internal contexts: strengths and weaknesses factors combination with external contexts: opportunities and threats.
- (5) The numbers of possible specific strategies were formulated for each sectors and combined into more common strategies.
- (6) These common strategies pointed out critical intervention areas for each sectors: production, processing, marketing and trade sectors.

Figure 3.6 presented the steps of SWOT analysis for rubber industry and Figure 3.7 described strategies matrix.

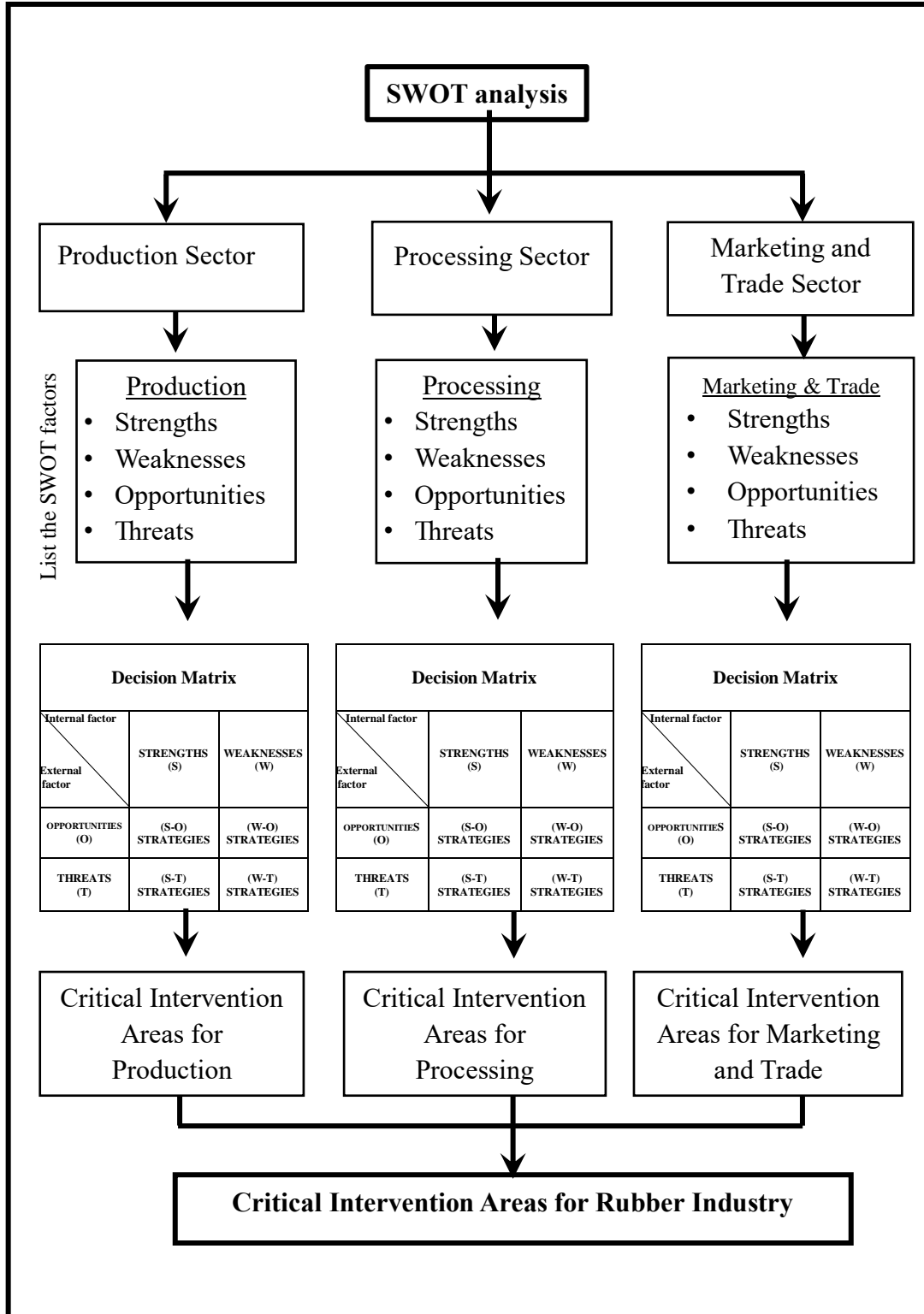


Figure 3.6 Steps of SWOT analysis for rubber industry

Table 3.14 Types of stakeholder and methods of data collection for SWOT analysis

Methods	KII	FGD
Types of stakeholder	Rubber farmers with different farm sizes	Rubber Farmers, Middlemen, Institutional Representatives
Number	75 respondents	9 FGDs

		Internal Contextt	
		STRENGTHS (S)	WEAKNESSES (W)
External	Internal	S1. Internal Strength S2. Internal Strength S3. Internal Strength	W1. Internal Weakness W2. Internal Weakness W3. Internal Weakness
	External	OPPORTUNITIES (O)	THREATS (T)
External Context.		S-O Strategies (Using internal strengths to take advantages of external opportunities)	W-O Strategies (Taking advantage of external opportunities to offset or mitigate internal weaknesses)
		<ul style="list-style-type: none"> • <u>S-O Idea</u> Description (S1, O2) • <u>S-O Idea</u> Description (S2, O1) • <u>S-O Idea</u> Description (S3, O3) 	<ul style="list-style-type: none"> • <u>W-O Idea</u> Description (O1, W2) • <u>W-O Idea</u> Description (O2, W3) • <u>W-O Idea</u> Description (O3, W1)
		S-T Strategies (Using internal strengths to mitigate or minimize external threats)	W-T Strategies (Strategies that minimizes both internal weakness and external threats)
		<ul style="list-style-type: none"> • <u>S-T Idea</u> Description (S3, T2) • <u>S-T Idea</u> Description (S1, T3) • <u>S-O Idea</u> Description (S2, T1) 	<ul style="list-style-type: none"> • <u>W-T Idea</u> Description (T3, W3) • <u>W-T Idea</u> Description (T2, W1) • <u>W-T Idea</u> Description (T1, W2)
		T1. External Threat T2. External Threat T3. External Threat	

Figure 3.7 SWOT strategies matrix for formulate possible specific strategies

CHAPTER IV

RESULTS AND DISCUSSION

This chapter explained national policy context of rubber industry of important rubber production countries and the current situation of the Myanmar rubber industry including profitability, stakeholders' involvement and critical intervention areas for sustained development with five sub-chapters. The first four sub-chapters explained the results and discussion of the research study and the last sub-chapter explained the alternative policies for the rubber industry.

The first sub-chapter reviewed the national policy context of the important rubber producing countries to know affected on the rubber industry.

Second sub-chapter provided the estimation of profitability for alternative crops substitution and competitiveness of rubber production by cost and benefit analysis and break-even analysis. Besides, estimation the profitability, the analysis also explained different profitability of rubber production depends on different export destinations.

In the third sub-chapter, FGD analysis pointed out and explained the key stakeholders' perception and their involvement in the rubber industry.

The fourth sub-chapter, explained about critical intervention areas of the rubber industry to improve competitiveness which consisted of the situational analysis of rubber industry especially production, processing, marketing and trade sectors by SWOT analysis. The last sub-chapter provided the alternative policies and recommendations which required to perform rubber industry for sustainable development.

4.1 Profitability of Rubber Production in Study Areas

4.1.1 Socio-economic characteristics of sample farmers

For estimation of the profitability of rubber production, the study was conducted 75 rubber farmers from different study areas, Kyaikto and Mudon Townships from Mon State, Dawei and Myeik Townships from Tanintharyi Region and Shwegyin Township from Bago Region. The socio-economic characteristics and productive characteristic of sample farmers for each State and Region were presented in Tables 4.1 and 4.2.

The results showed that the average age of household head in total respondent was about 53 years with the oldest 80 years and the youngest 32 years old (Table 4.1). For the specific areas, it was about 55 years for Mon State, about 53 years in Tanintharyi Region and 49 years in Bago Region. It was also noted that respondents in the study

areas had the average rubber experience of about 19 years. Specifically, the respondents from Mon State had rubber experience about 24 years, Tanintharyi Region's farmers had about 16 years and Bago Region's rubber farmers had 15 years respectively. The average educational level of the total respondents had about 10 schooling years and highest education was a bachelor's degree and lowest education level was grade two. However, there was not much different education level between sample respondents.

Family size was not much different among Mon State, Tanintharyi and Bago Regions and about 5 persons per family (Table 4.1). Although, the minimum family member of all study areas was the same about 3 persons but the maximum number was different; 7 persons in Tanintharyi Region, 8 persons in Mon State and 9 persons in Bago Region.

The average family labour used and hired labour used in study areas were about 21% and 78%, respectively. Highest family labour used and lowest hired labour was observed in Mon State as about 35% and 65%, respectively. The other study areas Tanintharyi and Bago Regions had low family labour used as about 12% and 13%. Accordingly, these areas were highly depended on hired labour for rubber production about 88% and 86%, respectively.

Table 4.1 Socio-economic characteristics of sample farmers in the study areas in 2018

Mean values	Unit	Mon (N=30)	Tanintharyi (N=30)	Bago (N=15)	Total (N=75)
Age of household head	Year	55.03 (36 - 80)	53.33 (32 - 70)	49.06 (34 - 67)	53.14 (32 - 80)
Rubber experience	Year	24.03 (4 - 50)	16.06 (4 - 46)	14.73 (7 - 29)	18.98 (4 - 50)
Schooling year	Year	9.70 (3 - 15)	9.66 (4 - 15)	10.86 (4 - 18)	9.92 (3 - 18)
Family size	No.	4.73 (3 - 8)	4.66 (3 - 7)	5.00 (3 - 9)	4.76 (3 - 9)
Family labour use	%	35.00 (0 - 100)	12.00 (0 - 100)	13.33 (0 - 100)	21.46 (0 - 100)
Hired labour use	%	65.00 (0 - 100)	88.00 (0 - 100)	86.66 (0 - 100)	78.33 (0 - 100)

Note: The parentheses in the table represent the range value.

4.1.2 Productive characteristics of sample farmers

The average percentage of tapping area per total areas and maintaining areas per total areas in study areas were about 82% and 18% (Table 4.2). There was not much different percentage for tapping and maintaining areas between study areas. One of the important parameters of rubber production was plant population per unit areas. It was observed that the highest in Bago Region about 506 plants per hectare. For the Mon State and Tanintharyi Region, there were about 481 and 445 plants per hectare respectively.

The distance of rubber farms far from town was considerable characteristic for rubber production. The results of the present study indicated the average distance to town from rubber farm for study areas was about 18 km (Table 4.2). Among the study areas, the location of sample farms in Tanintharyi Region had the longest distance from town about 30 km and about 10 km for farms in Mon State and 8 km for Shwegyin Township, Bago Region.

Table 4.2 also presented the average percentage of rubber tapping areas according to the age of rubber tree and classified as three categories - between 7-10 years, above 10-20 years and above 20 years. The average percentage of tapping areas in study areas according to the above categories were about 40%, 42% and 19%, respectively. The areas between 7-10 years were observed the highest in Tanintharyi Region and it was about 60%, the lowest in Mon State about 23% and 33% in Bago Region. However, in the most productive age, area between 10-20 years was found the highest in Bago Region about 63% and about 42% in Mon State and 33% in Tanintharyi Region. The average percentage of low productive age, above 20 years, was observed about 34% in Mon State, about 11% in Bago Region and 8% in Tanintharyi Region, respectively.

The average amount of fertilizer used for rubber production was 153 kg/ha in the study areas. The highest fertilizer application was observed in Mon State 198 kg/ha and followed by 150 kg/ha for Bago Region and 111 kg/ha for Tanintharyi Region.

Table 4.2 Productive characteristic of sample farmers in the study areas in 2018

Mean values	Unit	Mon (N=30)	Taninthary (N=30)	Bago (N=15)	Total (N=75)
Tapping area	ha	247.43 (0.6 - 80.9)	326.79 (0.8 - 81.0)	437.47 (2.0 - 121.4)	1,011.70 (0.6 - 121.4)
Tapping percentage	%	84.60 (33 - 100)	52.16 (20 - 100)	46.89 (25 - 100)	54.77 (20 - 100)
Maintaining area	ha	45.02 (0.0 - 14.3)	299.67 (0.0 - 202.3)	493.72 (0.0 - 303.5)	835.29 (0.0 - 303.5)
Maintaining percentage	%	15.39 (0 - 66)	47.83 (0 - 80)	53.02 (0 - 75)	45.23 (0 - 80)
Population of plant	Plant/ ha	481 (393 - 593)	445 (296 - 555)	506 (411 - 543)	472 (296 - 593)
Distance from town	km	10.61 (1 - 19)	30.03 (11 - 48)	7.66 (5 - 10)	17.79 (1 - 48)
Area between 7-10 years	%	23.26 (0 - 100)	59.99 (0 - 100)	33.33 (0 - 100)	39.96 (0 - 100)
Area between >10-20 years	%	42.71 (0 - 100)	32.38 (0 - 100)	56.00 (0 - 100)	41.24 (0 - 100)
Area above 20 years	%	34.01 (0 - 100)	7.61 (0 - 100)	10.66 (0 - 100)	18.79 (0 - 100)
Amount of fertilizer used	kg/ ha	198 (0 - 432)	111 (0 - 247)	150 (0 - 447)	153 (0 - 447)

Note: The parentheses in the table represent the range value.

The percentage of area classified by planting year was calculated based on tapping areas.

4.1.3 Cost and benefit analysis of the rubber production

4.1.3.1 Operational cost of the rubber production

Table 4.3 showed the operational cost of rubber production based on the weight of rubber produced. It was about 861 MMK/kg for the study areas. Among the study areas, the highest operational cost was observed in Tanintharyi Region (910 MMK/kg). In Mon State and Bago Region, it was about 846 MMK/kg and 789 MMK/kg respectively. The production, processing and marketing costs were included in the cost structure.

Among them, the cost of production was the largest amount (803 MMK/kg) and it took about 93% of the total operational cost in the study areas. Between the study areas, the production cost was observed the highest in Tanintharyi Region (863 MMK/kg) followed by Mon State (802 MMK/kg) and Bago Region (685 MMK/kg).

In the case of processing cost, Bago Region had the highest processing cost (81 MMK/kg) because most of the farmers were producing higher quality rubber smoke sheets than other two areas. The lowest processing cost was observed in Tanintharyi Region (23 MMK/kg) as most farmers sold filed latex directly to processing factories and these factories exported to Thailand and Malaysia. For Mon State, it was about 35 MMK/kg as the farmers produced different quality of sundry rubber.

The marketing cost was the lowest in Mon State (9 MMK/kg) because of efficient marketing channel and adequate transportation facilities. For Tanintharyi and Bago Regions, it was about 24 MMK/kg and 23 MMK/kg as these regions had inadequate transportation facilities and poor marketing channel. The operational cost indicated the competitiveness of rubber production, processing and marketing activities of rubber firms in study areas.

Table 4.3 Operational cost of the rubber production (MMK/kg)

Items	Mon (N=30)	Tanintharyi (N=30)	Bago (N=15)	Total (N=75)
Cost of production (C₁)	802	863	685	803
• <i>Cost of fertilizer</i>	96	107	65	95
• <i>Cost of production equipment</i>	44	55	29	45
• <i>Cost of tapping</i>	618	598	539	594
• <i>Cost of maintaining</i>	44	103	52	69
Cost of processing (C₂)	35	23	81	41
Cost of marketing (C₃)	9	24	23	17
Total operational cost	846	910	789	861

4.1.3.2 Market price

According to the results of the study, the average market price of the study areas was about 1,550 MMK/kg. As the rubber market price was fluctuated by a number of influenced factors, rubber farmers from different study areas received different market prices. In Bago Region, most farmers were producing qualified Ribbed Smoke Sheet 1 (RSS1). Even their processing cost were higher than other study areas, they received the highest market price (1,608 MMK/kg).

The second highest market price of about 1,546 MMK/kg was received by farmers from Tanintharyi Region even mostly produced field latex. It was because several rubber processing factories were producing quality rubber from field latex in the study area. The lowest market price (1,526 MMK/kg) was observed in Mon State as the most farmers produced low quality rubber products. Although rubber farmer required using some processing cost, their market price was lower than Tanintharyi Region.

4.1.3.3 Yield estimation of the rubber production

Based on seasonal yield estimation, Table 4.4 presented peak season yield, hard season yield and total yield of rubber production in the study areas. In peak season, the average yield was about 570 kg/ha/season. In the hard season, it was about 445 kg/ha/season. Therefore, the estimated yield of rubber production was about 1,013 kg/ha/year. Among the study areas, the peak season yield was the highest in Mon State and the lowest in Tanintharyi Region. On the other hand, the hard season yield was highest in Bago Region and the lowest in Mon State. It was because tapping month per season was highest in Mon State and lowest in Tanintharyi Region and tapping per months for hard season was observed the highest in Bago Region and the lowest in Mon State.

To compare the total estimated yield between the study areas, the highest estimated yield was observed in Mon State (1,109 kg/ha/year) followed by Bago Region (1,032 kg/ha/year) and the lowest estimated yield was observed in Tanintharyi Region (906 kg/ha/year). It was the same trend as in peak season yield (kg/ha/season) of the study areas. Yield estimation also indicated the competitiveness of rubber production among the study areas.

Table 4.4 Estimated yield of rubber production in study areas

Particular	Unit	Mon (N=30)	Tanintharyi (N=30)	Bago (N=15)	Total (N=75)
Peak season					
Tapping days per month	day	22.06	21.16	14.60	20.21
Tapping months per season	months	3.50	2.26	2.43	2.79
Tapping days per season	day	77.11	47.66	35.56	57.02
Yield per area per day	kg/ha/day	9.32	9.85	15.17	10.70
Yield per ha per season	kg/ha/season	689.74	466.38	529.32	568.31
Hard season					
Tapping days per month	day	22.06	21.60	14.33	20.33
Tapping months per season	months	3.53	3.66	3.90	3.66
Tapping days per season	day	78.23	78.61	55.66	73.87
Yield per area per day	kg/ha/day	5.54	5.78	9.11	6.35
Yield per ha per season	kg/ha/season	420.13	440.06	503.31	444.74
Estimated yield	kg/ha/year	1,109.87	906.44	1,032.63	1,013.05

Table 4.5 Operating ratio based on the total variable cost of the rubber production system in the study areas

Particular	Unit	Mon (N=30)	Tanintharyi (N=30)	Bago (N=15)	Total (N=75)
Total operational cost	MMK/kg	846	910	789	861
Current market price	MMK/kg	1,526	1,546	1,608	1,550
Operating ratio	%	55.44	58.86	49.06	55.55

4.1.3.4 Operating ratio of the rubber production in study areas

Table 4.5 presented the results of the operating ratio of the rubber production system and it was about 55% for all study areas. It meant that the operational cost for rubber production was about 55 MMK to obtain revenue of 100 MMK and the profit would be 45 MMK. Therefore, rubber plantation of the study areas was still profitable and efficient and still tolerated to world price crash.

Among the study areas, the lowest operating ratio was about 49% in Bago Region and it indicated that the area was the most profitable area for rubber production. The operating ratio for Mon State was about 55% and Tanintharyi Region was about 59%. Therefore, high competitiveness of rubber production was observed in Bago Region followed by Mon State and Tanintharyi Region.

4.1.4 Break-even analysis of the rubber production

4.1.4.1 Break-even price

Based on the variable cost, break-even price was equal to the operational cost per unit of rubber produced. Therefore, the break-even price of the study areas was 861 MMK/kg. It means if the prices received from the sale of rubber was 861 MMK/kg and it would cover the cost associated with producing of the 1 kg of rubber.

According to break-even analysis, break-even price was usually compared with the market price to investigate the profitability. It was observed that the average value break-even price of 861 MMK/kg was much lower than the average market price of 1,550 MMK/kg that the farmers received in the study areas. Therefore, the break-even price indicated competitiveness of rubber production that was the rubber farmers were not facing loss and received a considerable amount of profit. Moreover, the break-even price also served as an indicator of intervention if the market price would below the break-even price.

4.1.4.2 Break-even yield

The break-even yield of the study areas was observed about 535 kg/ha/year. Break-even yield of different the study areas was also calculated to compare within the study areas. According to observed data in Table 4.6, the highest break-even yield was found in Mon State about 597 kg/ha/year. The lowest break-even yield was observed in Bago Region which about 488 kg/ha/year and moderate yield at Tanintharyi Region about 500 kg/ha/year.

Therefore, the profitability analysis pointed out that although there are the same exported destinations, the profitability and competitiveness would be different according to the above factors. For this reason, it was required to investigate detail information about perceptions and involvement of key stakeholders in rubber production, processing, marketing and trade sectors to point out key factors of rubber industry competitiveness.

However, the estimated yield of study areas in Table 4.4 indicated about 1,013 kg/ha/year and it was nearly double of break-even yield presented in the above session. The lowest estimated yield was observed in Tanintharyi Region about 906 kg/ha/year. The other study areas, Mon State and Bago Region did not have much different estimated yield and it was about 1,109 and 1,032 kg/ha/year, respectively.

According to break-even analysis, the break-even price and the break-even yield were much lower than the market price and the estimated yield of sample farmers. However, if rubber farmers received better yield than estimated, it will be more profitable for rubber farmers and highly competitive for rubber production.

Table 4.6 Break-even yield of rubber production in study areas

Particular	Unit	Mon (N=30)	Tanintharyi (N=30)	Bago (N=15)	Total (N=75)
Total variable cost of production system	MMK/ha	911,719	771,403	784,100	830,069
Current market price	MMK/kg	1,526	1,546	1,608	1,550
Break-even yield	kg/ha	597.45	498.50	487.62	535.52

Table 4.7 Profitability of different export destinations in the study areas

Exported Destinations	China	Thailand & Malaysia	
	Mon	Tanintharyi	Bago
Current market price (MMK/kg)	1,526	1,546	1,608
Total operational cost (MMK/kg)	846	910	789
Profit (MMK/kg)	680	636	819
Operating ratio (%)	55.44	58.86	49.06

Table 4.8 Factors affecting the profitability of rubber farmer in the study areas

Factors	Unit	Mon	Greater > Less <	Tanintharyi	Greater > Less <	Bago
Production cost	MMK/kg	+ ¹	<	- ³	>	+ ²
Total operational cost	MMK/kg	+ ²	<	- ¹	>	+ ³
Yield	kg/ha	+ ¹	>	+ ³	<	+ ²
Current market price	MMK/ha	- ³	<	- ²	<	+ ¹
Profitability	Rank	2		3		1

4.1.5 Profitability of different export destinations

Comparing the profitability of rubber farmers in study areas, it was observed that the profitability was different from the export destinations. The rubber farmers from Mon State were producing low-grade rubber and prevailing China market with a considerable profit of 680 MMK/kg (Table 4.7). Contrastively, rubber farmers in Tanintharyi and Bago Regions sold their rubber to processing factories and these factories produced higher-quality rubber and their exporting destinations were Thailand and Malaysia. However, the highest profit was observed 819 MMK/kg in Bago Region and the lowest was found 636 MMK/kg in Tanintharyi Region. The reasons for the difference in profitability between the same export destinations were presented in Table 4.8.

The important factors affecting the profitability and competitiveness of rubber production were the cost of production and total operational cost (Table 4.8). It was the highest in Tanintharyi Region and followed by Mon State and Bago Region.

Yield per unit area was another important reason to increase the profitability and competitiveness of rubber production. The study observed the highest yield per unit area in Mon State followed by Bago and Tanintharyi Regions.

The current market price was one of the most powerful levers for driving profitable of rubber production. Among the different export destinations, the highest market price was received by rubber farmers from Bago Region because most of the farmers produced the highest quality rubber such as Ribbed Smoke Sheet (RSS) among the study areas. The second highest market price was received by rubber farmers from Tanintharyi Region and the lowest market price was received by Mon State's rubber farmers.

Therefore, the profitability analysis pointed out that although there are the same exported destinations, the profitability and competitiveness would be different according to the above factors. For this reason, it was required to investigate detail information about perceptions and involvement of key stakeholders in rubber production, processing, marketing and trade sectors to point out factors of rubber industry competitiveness.

4.2 Focus Group Discussion (FGD) Analysis with Key Stakeholders in Rubber Industry

4.2.1 Descriptive characteristics of key stakeholders

By using FGD analysis, perception of key stakeholders' on the rubber industry was investigated in production, processing, marketing and trade sectors. In this study, nine FGDs were conducted in Mon State, Bago and Tanintharyi Regions. The detail information of location, time and resource involvement in the FGDs was described in Appendix 2. There were iterative FGD for the same stakeholder in different study areas. There were 4 FGDs for rubber farmers and 3 FGDs for institutional representatives in Mon State, Bago and Tanintharyi Regions. However, there were only two FGDs for middlemen in Mon State and Tanintharyi Region as fewer middlemen in Bago Region.

The discussions sessions lasted for 55 and 145 minutes with an average of 106 minutes. The sample size of participants in the FGDs had about 6 to 20 participants and the average was about 11 respondents. The age of the stakeholders was different with ranged between 30 and 77 years and the average was about 49 years.

Rubber experiences of stakeholders were presented in Appendix 2 and it had a range between 2 and 50 years with an average of about 18 years. Rubber farm size was collected only for rubber farmer because the majority of middlemen and institutional representatives, mostly did not possess rubber farms. Respondent rubber farmers belonged to rubber farm size largely ranged between 1.2 and 526.1 hectares. Additionally, the information about the occupations of other stakeholders, middlemen and institutional representatives were also collected and presented in Appendices 4 to 11.

The stakeholders were classified as active, neutral and silent based on their participation. It was confirmed by recorded data of note-takers and also confirmed by audio-based and memorial-based analysis. Over half of the stakeholders (52%, N = 53) was active in the discussion. The others were neutral (26%, N = 27) and silent (22%, N = 23) respectively. The two facilitators had conducted 9 FGDs with assistants' team which comprised six note-takers.

4.2.2 Perception and involvement of key stakeholders in the rubber production sector

The perception of key stakeholders on rubber production was investigated by using FGDs with predictive discuss topics from rubber production theme presented in Appendix 3. The key stakeholders actively discussed on following topics by their perceptions and involvements.

4.2.2.1 Land tenure system

As shown in Table 4.9, all of the key stakeholders realized that land tenure was the most important for rubber production. It was also important for rubber processing factories. Therefore, farmers and processing factories owners required for receiving the official land certificated. It was also required peace between the government and other armed groups in rubber production areas for better land tenure system. The stakeholders also discussed conditions of land use and the secondary data of land utilization record. It had some difference in real conditions.

4.2.2.2 New planting and replanting

According to the results of the present study, rubber farmers from Mon State and Bago Region and institution representatives from Mon State and Tanintharyi Region thought that it was required to manage new and replanting of rubber (Table 4.10). It would also require the cooperation of public and private sectors to obtain accurate data of rubber production.

In Mon State and Tanintharyi Region, the illegal feeling of the rubber tree was observed and it could cause an excessive reduction in rubber planting areas. Therefore, the secondary data and real condition of land utilization record were different. Institutional representatives pointed out the farmer should follow the regional rubber feeling instructions.

In replanting, rubber farmers believed that latex timber clones (LTC) would be suitable for future replanting programs. Rubber farmers also predicted that rubber-based diversification model with animal husbandry would not be profitable because of labour scarcity in the study areas. Additionally, rubber farmers from Tanintharyi Region claimed about they wanted to grow any kinds of crops after feeling the old rubber trees. But the farmers from Mon State are willing to continue growing the rubber crop after feeling old trees.

4.2.2.3 Clones

Table 4.11 described the perception and involvement of key stakeholders for the importance of rubber clones in the rubber production sector. The rubber farmers and institutional representatives knew that the recommended high yield clones (HYC) were required to promote yield per unit area. It was also required to establish bud wood nurseries for producing quality rubber seedlings. Institutional representatives suggested that the nursery should have registration for producing HYC. The research activities of the clone trail for HYCs should be conducted to provide updated clones recommendation to rubber farmers. Institutional representatives and rubber farmers also suggested that to provide clone identification and inspecting training for nursery owners and government staff to control the quality of nursery and rubber seedlings.

4.2.2.4 Labour and wages

Table 4.12 provided the perception and involvement of key stakeholders for labour requirement and higher wages in rubber production sector. The key stakeholders believed that working in the rubber production business was decent and it could provide sustainable occupation with stable wages and incomes. Although it had opportunities to involve family labour in the rubber production sector, it had been facing labour scarcity problems because it required skilled labour, especially in tapping. There were some conflicts between rubber tapper (labour) and rubber farm owner for payment and wages. The farm owner had to depend on the internal migrants from other areas for rubber production. They had little knowledge and skill about rubber production and especially in tapping. Therefore, it had a negative impact on the economic life of rubber trees.

In the current payment system, there were two payment types: plant per payment type and products share type. The former had mostly prevailed in Mon State and Bago Region and the latter was common in Tanintharyi Region. Table 4.12 provided the perception and involvement of key stakeholders for labour requirement and higher wages in rubber production sector.

Table 4.9 Perception and involvement of key stakeholders for the land tenure system of the rubber production sector

Stakeholder	Land tenure system
Farmers ^{M, T, B} Institution ^{M, T}	<ul style="list-style-type: none"> - Most important for rubber production - Required land certificate for rubber farmers - Secondary data were different from reality
Middlemen ^{M, T}	<ul style="list-style-type: none"> - Also important for rubber processing factories
Farmers ^{T, B}	<ul style="list-style-type: none"> - Required peace between the government and other armed groups

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.10 Perception and involvement of key stakeholders for new planting and replanting in the rubber production sector

Stakeholder	New planting and replanting
Farmers ^{M, B} Institution ^{M, T}	<ul style="list-style-type: none"> - Required to manage new and replanting - Latex timber clones would be suitable - Rubber-based diversification would not be profitable
Institution ^{M, T}	<ul style="list-style-type: none"> - Required to follow regional rubber feeling instructions
Farmers ^T	<ul style="list-style-type: none"> - Required free choice of crops after feeling rubber

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.11 Perception and involvement of key stakeholders for clones in the rubber production sector

Stakeholder	Clones
Farmers ^{M, T, B} Institution ^{M, T}	<ul style="list-style-type: none"> - Limited recommendation of high yield clones - Clone identification and inspecting training are required - Required to establish bud wood nurseries
Institution ^{M, T}	<ul style="list-style-type: none"> - Required to control nursery by registration (Seed law) - Research for adaptable recommendation high yield clones are required

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.12 Perception and involvement of key stakeholders for labour and wages in the rubber production sector

Stakeholder	Labour and wages
Farmers ^{M, T, B}	- Stable wage, sustain occupation and decent work
Middlemen ^{M, T}	- Possibility of family labour use
Institution ^{M, T}	- Skilled labour scarcity
	- Depend on in-migrant labour
	- Conflicted between labour and owner
Farmers ^{M, B}	- Plant per payment type (Most common type)
Farmers ^T	- Product share type (Most common type)

Note: M = Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.13 Perception and involvement of key stakeholders for inputs of the rubber production sector

Stakeholder	Inputs
Farmers ^{M, T, B}	- Fertilizer is the most important and highest cost
	- Formic acid is important for rubber processing
Middlemen ^{M, T}	- Used inputs by credit system from middlemen
	- Less amount of input was used because of low profit
Farmers ^{M, T, B}	- Required for specific recommended fertilizer rate with
Institution ^{M, T}	specific regions
Institution ^T	- Required to check the quality of inputs

Note: M = Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.14 Perception of key stakeholders for capital investment or financial source in the rubber production sector

Stakeholder	Capital investment/ Financial source
Farmers ^{M, T, B}	- No financial source by government
Middlemen ^{M, T}	
Institution ^{M, T}	
Farmers ^{M, T, B}	- Afford to access the production loan with the support of regional authorities
Farmers ^T	- Soft loan or other forms of credit were required

Note: M = Mon State, T= Tanintharyi Region and B= Bago Region

4.2.2.5 Input

As presented in Table 4.13, most smallholder rubber farmers bought inputs from input dealer and rubber buyers with the credit system. Among the inputs, the fertilizer was most important for rubber production. Rubber farmer also required specific recommended fertilizer rate for cost effective. The Formic acid was also required and rubber farmers preferred small size with a small quantity to be affordable. Nowadays, as rubber farmers facing low-profit condition, they reduced input utilization than previous times.

4.2.2.6 Capital investment/financial source

The key stakeholders suggested that there was no financial source by the government for rubber production. The rubber farmers from study areas pointed out the regional authorities tried to access the production loan from government (e.g. Myanmar Agricultural Development Bank [MADB]). Moreover, rubber farmers from Tanintharyi Region hoped to get a soft loan and other forms of credit to fulfil the current price crash problem. Table 4.14 described the perception of key stakeholders for the requirement of capital investment or financial source in the rubber production sector.

4.2.2.7 Women participation

All key stakeholders agreed that women have the ability to work like as men in the rubber production sector and there was not discrimination to women in the wages. They also noticed that women had strong participation in rubber development activities, especially in educational programmes as presented in Table 4.15. In decision making process, men involvement was more than women in the production sector but women involved more than men in marketing sector.

4.2.2.8 Extension service

The rubber farmers from Mon State and Tanintharyi Region discussed there was less experience in extension service for the perennial crops. Consequently, the farmer's participation in extension programs was also limited. However, the information and knowledge of rubber production, processing and marketing were distributed by the farmer to farmer. They also requested to provide training programs for rubber farm management practices. Table 4.16 described the perception and involvement of key stakeholders for extension service in rubber production

Table 4.15 Perception and involvement of key stakeholders for women participation in the rubber production sector

Stakeholder	Women participation
Farmers ^{M, T, B} Middlemen ^{M, T} Institution ^{M, T}	<ul style="list-style-type: none"> - Ability to work as men in the production, processing and marketing - Not discriminated to women for labour wages - More than 50% in the rubber industry - Production decisions were done by men instead of women
Institution ^{M, T}	<ul style="list-style-type: none"> - More than 60% of the institutional sector of the rubber industry - Strongly participated in rubber development activities

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.16 Perception and involvement of key stakeholders for extension service in the rubber production sector

Stakeholder	Extension service
Farmers ^{M, T}	<ul style="list-style-type: none"> - Inexperience - Information and knowledge were distributed by the farmer to farmer
Farmers ^T	<ul style="list-style-type: none"> - Limited participation of farmers
Farmers ^T Institution ^T	<ul style="list-style-type: none"> - Rubber farm management training was required

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.17 Perception of key stakeholders for climate change in the rubber production sector

Stakeholder	Climate change
Farmers ^{M, T, B}	<ul style="list-style-type: none"> - Negative impact on the rubber production sector
Middlemen ^{M, T}	<ul style="list-style-type: none"> - No impact on the marketing price
Institution ^{M, T}	<ul style="list-style-type: none"> - Required to change production practices (Rain guard tapping)

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

4.2.2.9 Climate change

The results of the presented study indicated that rubber farmers had been suffering a negative impact of climate change on rubber production even the study areas had favourable climatic conditions (Table 4.17). Middlemen argued that although climate changes had a high impact on rubber production, there was no impact on market and market price. Institutional representatives thought that production practices should change to overcome climate change impact (e.g. rain guard tapping).

4.2.3 Perception and involvement of key stakeholders in the rubber processing sector

The perception of key stakeholders on rubber processing was investigated by using FGDs with predictive discussion topics from rubber processing theme presented in Appendix 3. The key stakeholders actively discussed on following topics by their perceptions and involvements.

4.2.3.1 Rubber product types

The rubber farmers from Mon State mostly produced low-grade rubber followed by unsmoked rubber sheet (USS 3 to 5) and thick slab. In the Tanintharyi Region, rubber farmers mostly produced field latex and cup lump and sold to processing factories. But in Mon State and Bago Region, rubber farmers argued to produce field latex and cup lump because of poor security from thieves and less bargaining power in selling.

The rubber farmers from Bago Region mostly produced good quality, RSS and unsmoked rubber sheets. They also pointed out most smallholders could produce only lower grade rubber as they did not have adequate processing facilities. The rubber farmers believed the market price was the most influential factor for the types of rubber produced. But middlemen argued that quality of rubber was more important for market opportunities and better price.

It was observed that the important constraint to improve the quality of rubber was changing from conventional processing methods. Table 4.18 presented perception and involvement of key stakeholders for the type of rubber produced in the rubber processing sector.

Table 4.18 Perception and involvement of key stakeholders for rubber product types in the rubber processing sector

Stakeholder	Type of rubber produced
Farmers ^M	- Low-grade, Unsmoked sheet 3-5, Thick slab
Farmers ^T	- Field latex, Cup lump
Farmers ^B	- Smoke sheet, Unsmoked sheet
Farmers ^{M, T, B}	- Price is important for the type of rubber processing - Required to receive a premium price for better quality
Middlemen ^{M, T}	- Quality of rubber produced was more important
Institution ^M	- Difficult to change conventional processing methods

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.19 Perception and involvement of key stakeholders for processing practices in the rubber processing sector

Stakeholder	Processing practices
Farmers ^{M, T, B}	- Able to produce higher quality
Middlemen ^T	- Need to use Formic acid for physical and chemical properties - Mostly used Sulphuric acid
Institution ^{M, T}	- Farmer's cooperative is important for mass quality processing - Required to support and initiate the rubber related factories

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

4.2.3.2 Processing practices

According to Table 4.19, the rubber farmers had adequate knowledge and ability to produce high-quality rubber. But, most farmers used Sulphuric acid because it was cheap, easy to buy and handling. These kind of acid reduced physical and chemical quality of rubber. For the export purpose, the farmer cooperative was important in mass quality processing and it had been developed in Tanintharyi Region. Key stakeholders recommended that it also needed to encourage and initiate the rubber processing factories to improve rubber processing sector.

4.2.4 Perception and involvement of key stakeholders in rubber marketing and trade sector

The perception of key stakeholders on rubber marketing and trade was investigated by using FGDs with predictive discussion topics from rubber marketing and trade theme presented in Appendix 3. The key stakeholders actively discussed on following topics by their perceptions and involvements.

4.2.4.1 Market mechanism

Table 4.20 described the perception and involvement of key stakeholders for market mechanism in marketing and trade sector. The market mechanisms in Mon State were (i) rubber farmers sold their rubber to local dealers and (ii) directly sold to wholesalers. The rubber farmers rarely sold directly to exporter or processing factories in Mon State. In Tanintharyi Region, farmers sold their rubber to local dealers or processing factories. There were limited alternative buyers and oligopoly market structure was observed, especially in Myeik District. In Bago Region, most farmers sold rubber to local collectors or exporters from Yangon city as there were a limited alternative buyers. It was noticed that the local collectors occupied the position of brokers as a key player of the market mechanism. It was because the market and price information became easier to access than the past. Most payment type in the study areas was cash down payment and followed by advance payment by middlemen. Rubber farmers from Bago and Tanintharyi Regions argued that there was limited transportation facilities but Mon State had the adequate transportation facilities for marketing. However, key stakeholders accepted that there were limited international markets and it mainly depended on the China market. Although most of the wholesalers were local people, exporters were backed up by China companies

Table 4.20 Perception and involvement of key stakeholders for market mechanism in marketing and trade sector

Stakeholder	Market mechanism
Farmers ^M	- Farmer to local collector/wholesaler/rarely sold to factories - Many alternative buyers
Farmers ^T	- Farmer to local collector/processing factories - Oligopoly structure
Farmers ^B	- Farmer to local collector/exporter (Yangon) - Limited alternative buyers
Farmers ^{M, T, B}	- Cash down payment
Farmers ^{T, B}	- Limited transportation
Farmers ^{M, T, B} Middlemen ^{M, T} Institution ^{M, T}	- Limited international market - Mainly depend on China market - Low-quality rubber markets have prevailed

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.21 Perception and involvement of key stakeholders for bargaining power in marketing and trade sector

Stakeholder	Bargaining power
Farmers ^{M, T, B} Institution ^{M, T}	- More bargaining power of middlemen - Low level of trust between buyers and sellers

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.22 Perception and involvement of key stakeholders for market price in marketing and trade sector

Stakeholder	Market price
Farmers ^{M, T, B} Middlemen ^{M, T} Institution ^{M, T}	- Low market price - Market information was mostly provided by the private sector - Weak correlation between the domestic price and world rubber price
Farmers ^M	- Price signals were reliable and transparency
Farmers ^T	- Price signals were not reliable and transparency
Farmers ^{M, T, B} Institution ^{M, T}	- Not incentive for the better grade

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

4.2.4.2 Bargaining power

The rubber farmers and institutional representatives claimed that there was more bargaining power in the middlemen in the market mechanism (Table 4.21). But there was a low level of the trust between rubber buyers and sellers.

4.2.4.3 Market price

The key stakeholders noticed that market price was gradually decreased in last two decades. The domestic price was also weakly correlated with world rubber price and it was mainly depended on regional events and celebrations.

It was also notified that market information was mostly provided by the private sector such as wholesalers, processing factories and export companies. The rubber farmers from Mon State believed that the price signals were reliable and transparent but farmers from Bago and Tanintharyi Regions believed that the price signals were not reliable and transparent. Rubber farmers and institutional representatives suggested that it required a price incentive to produce better rubber grades. Table 4.22 presented the perception and involvement of key stakeholders for market price in marketing and trade sector.

4.2.4.4 Women participation

The 60% and more of key players were women in the marketing sector (Table 4.23). The similar trend has been observed in the production sector (Section 4.3.2 vii). Moreover, key stakeholders pointed out the reason for the high participation of women in the marketing sector that was the rubber farmers sold their rubber sheets by women from their family member. Therefore, marketing decisions were mostly done by women and production decision was mostly done by men.

Table 4.23 Perception and involvement of key stakeholders for women participation in marketing and trade sector

Stakeholder	Women participation
Farmers ^M , Middlemen ^M	- About 70% of key players in the marketing sector
Farmers ^{M, T, B} Middlemen ^{B, T} Institution ^{M, T}	- About 60% of key players in the marketing sector

Note: M= Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.24 Perception and involvement of key stakeholders for the rubber industry policy

Stakeholder	Policy
Farmers ^{M, T, B} Middlemen ^{M, T} Institution ^{M, T}	<ul style="list-style-type: none"> - Strategically industrial crop in the last decades - Policies and law are required for the development of the rubber industry - The interest of regional authorities is important for the rubber industry - Required to include all stakeholders in developing rubber law
Farmers ^{T, B}	- Required to include all stakeholders in developing rubber law

Note: M=Mon State, T= Tanintharyi Region and B= Bago Region

Table 4.25 Perception and involvement of key stakeholders for the future development of the rubber industry

Stakeholder	Future development
Farmers ^{M, T, B} Middlemen ^{M, T} Institution ^{M, T}	<ul style="list-style-type: none"> - Potential for future development among the other countries - Required for cooperation and coordination between and within public and private institutes
Farmers ^{M, T, B}	- Not willing to extend the rubber planting areas
Farmers ^T	- Planned to change alternative crops
Farmers ^{M, B}	- Not to change crops
Middlemen ^{M, T} Institution ^{M, T}	<ul style="list-style-type: none"> - Required cooperatives type of rubber processing for mass quality production - Promote field latex and cup lump for production

Note: M=Mon State, T= Tanintharyi Region and B= Bago Region

4.2.5 Perception and involvement of key stakeholders in policy and future development of rubber industry

The perception of key stakeholders on policy and future development of the rubber industry was investigated by using FGDs with predictive discussion topics from policy and future development presented in Appendix 3. The key stakeholders actively discussed on the following topics by their perceptions and involvements.

4.2.5.1 Policy

As described in Table 4.24, key stakeholders noticed that rubber was one of the strategic industrial crops in last two decades. But it had been faded and neglected by the government. The most key stakeholders believed that policies and laws would be necessary for future rubber industry development. But some farmers from Mon State thought that rubber laws were not necessary and they hesitated on more restrictions by the laws. Accordingly, most of the stakeholders pointed out that the formulating the rubber law should involve all kinds and levels of stakeholders participating in the rubber industry.

4.2.5.2 Future development

The key stakeholders believed that Myanmar rubber industry would be potential for future development among the other rubber producing countries. They also revealed that cooperation and coordination between and within public and private institutes were important for future development. Moreover, key stakeholders pointed out the interest of regional authorities were also important for the development of the rubber industry.

Rubber farmers did not have the willingness to extend the rubber planting areas in current situations. The rubber farmers from Tanintharyi Region had planned to change alternative crops such as betel, coco crops, etc. However, rubber farmers from Mon State and Bago Region did not have a plan to change other crops because they thought that it was still economically sustainable conditions and there were no economically variable alternative crops. Middlemen and institutional representatives believed that cooperatives type of rubber processing for mass quality production required to occupy the potential international markets. They also suggested that field latex and cup lump production should be promoted to exclude the processing cost for rubber farmer and mass quality production. Table 4.25 presented the perception and involvement of key stakeholders for the future development of the rubber industry.

According to key stakeholders' perceptions from FGD analysis in the above session, the stakeholders from the rubber industry were actively involved in their respective sectors and their opinion was willing to sustain the development of rubber industry.

4.3 SWOT Analysis of Rubber Industry

According to the objectives of the study, the current situation of the rubber industry was analyzed by SWOT analysis to point out competitiveness by investigated internal strengths and weaknesses as well as external opportunities and threats. Then, using strategies matrix to develop the possible specific strategic options from an external-internal analysis and identify the critical intervention areas in the production, processing, marketing and trade sectors of the rubber industry to improve competitiveness.

4.3.1 SWOT analysis of the rubber production sector

According to results of SWOT analysis, the rubber production sector was basically important to become economically comparative of the rubber industry. It had a number of internal strengths and external potential opportunities that help to achieve the development and internal weaknesses and external possible threats that destructive for further development of rubber production (Table 4.26).

The strengths factors of rubber production sector were fertile soil types, favourable climate condition and the high market demand. Moreover, jobs opportunity in the rubber production sector created a stable income for the labour and it also had a chance to involve the family labour. The presence of strong public and private institutions, the presence of skilled labour and high women participation in rubber production were also the strengths factors of rubber production.

On the other hand, weaknesses factors of rubber production sector were land tenure problems, low quality of rubber seedling, limited and outdated recommended clones and low yield. Moreover, there were limited alternative crops for substitution to the rubber and labour scarcity with high wages for rubber tapping. Additionally, farmers were limited to access production technologies and financial sources.

However, there were opportunities for the rubber production sector such as cooperation and coordination between public and private, presence of internal migrated labour with low cost than the local labour. Additionally, remittance from migrants might be an opportunity to invest in rubber production. There was also an opportunity

to diversify rubber based integrated farming with livestock rearing. Moreover, public and private institutes were performed more research activities for rubber production than the previous time.

Conversely, the climate change impacts on rubber production, world rubber price crash and lower domestic price, increasing volume of rubber production and SR substitution were threatened to development of rubber production sector.

4.3.2 SWOT analysis of the rubber processing sector

By analysis to rubber processing sector using SWOT analysis, there were also the number of internal strengths and external potential opportunities that helpful and internal weaknesses and external possible threats that harmful for further development of rubber processing sector. The internal and external SWOT factors were described in Table 4.27.

The strengths factors of rubber processing sector were the possibility to involve family labour in small scale processing and it could be reduced the processing cost. There was also a number of buyers for any rubber product types in the study areas. In the Tanintharyi Region, there were many processing factories and it was also possible to sell field latex and cup lump. It could be excluded by processing cost and reduced total operation cost for rubber farmers. Like rubber production sector, there were strong public and private institutions for facilitated the further development of rubber processing sector.

On the other hand, there were weaknesses factors for rubber processing such as limited domestic utilization (about 5% of total production), limited alternative buyers in some areas, unbalance bargaining power, and low level of trust between buyer and seller for weight and grade of rubber products. Moreover, the cost of transporting was high as some rubber producing areas still needed transportation facilities.

Nevertheless, it was observed that the opportunities of rubber processing sector as increased in a number of processing factories and rubber farmers were more interest in the cooperative type of rubber processing. It could produce mass homogenous rubber demanded by world's tire companies.

However, rubber processing sector was also faced the threats factors such as a bad image on quality of rubber produced in the world market. The low market price was also a threat factor of rubber processing because some farmers used less and low quality processing inputs and they wanted to produce only low quality products.

4.3.3 SWOT analysis on rubber marketing and trade sector

Marketing and trade sector was also important in the consideration of the further expansion of the rubber plantation areas. There was a number of strengths and potential opportunities that helpful and weaknesses and threats that harmful for the development of rubber marketing and trade sector.

In marketing and trade sector, high market demand, good market mechanism and transparent price information were the strength factors. Moreover, most of the rubber products were possible to store and wait for the better prices.

However, the marketing and trade sector faced the weaknesses factors of more bargaining power by middlemen as limited alternative buyers in some areas. In some area, there was a weakness in price information and it was not transparent. Therefore, it caused a low level of trust between rubber buyer and seller.

The opportunity in the marketing and trade was that there was sustainable rubber demand by the world's tire companies and also demand from neighbouring countries. Moreover, world rubber demand was gradually increasing year by year and quality rubber exporting companies also increased in the country. Therefore, it was creating the potential to export the world market.

Conversely, increased world and domestic rubber production volume, limited high rubber quality markets and mainly relying on China market were threatening factors for marketing and trade sector. Additionally, domestic rubber price was weakly correlated with world rubber price and mainly depended on regional event or celebration. Table 4.28 described the internal and external contexts of marketing and trade sector.

Table 4.26 Internal and external contexts of the rubber production sector

Internal Contexts		External Contexts	
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> • The high domestic market demand • Fertile soil • Stable income • Usefulness of family labour • Strong public and private institutions • Favorable climate condition • Skilled labour • High women participation 	<ul style="list-style-type: none"> • Land tenure problems • Low yield • Low quality of rubber seedlings • Very limited alternative crops • Labour scarcity and high labour cost • Low access to technology • Very limited financial sources • Limited and outdated recommended clones 	<ul style="list-style-type: none"> • Cooperation and coordination between public and private • Internal immigrated labour force • Cheaper labour cost than other areas • Remittance for investment • Possibility of diversification • More research activities 	<ul style="list-style-type: none"> • World price crush and low domestic price • Climate change • Increasing volume of rubber production • Synthetic rubber substitution

Table 4.27 Internal and external contexts of the rubber processing sector

Internal Contexts		External Contexts	
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> • Low investment cost for processing • Availability of processing knowledge and techniques • Availability of buyers for any types of rubber • Strong public and private institutions • Usefulness of family labour • Possibility of selling latex and cup lump 	<ul style="list-style-type: none"> • Mostly produce low-grade rubber • Low domestic utilization • Requirement of a premium price • Land tenure problems • Limited rubber processing factories • Very limited financial sources 	<ul style="list-style-type: none"> • Increased number of rubber processing and products factories • More interest in cooperative' type of processing • Cooperation and coordination between the private and public sectors • Remittance for investment • Exclude the processing cost by selling latex 	<ul style="list-style-type: none"> • Low correlated with the world price • The world price crash and low domestic market price • Poor image on quality of rubber produced in world market • Mostly used Sulphuric acid • Increasing volume of rubber production

Table 4.28 Internal and external contexts of the marketing and trade sector

Internal Contexts		External Contexts	
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> • High demand of the domestic market • Possibility of storage • Possibility of family labour used • Good market mechanism • Price information is transparency and assured • High women participation • Strong public and private institutions 	<ul style="list-style-type: none"> • Limited domestic utilization • Limited alternative buyers • Cost of transportation • Trust between buyer and seller • More bargaining power by middlemen • Very few financial sources • Price information is not transparency and assured 	<ul style="list-style-type: none"> • World's tire companies interest in sustainable rubber • High demand from neighbouring countries • Increased world demand • Increased quality rubber exporting companies 	<ul style="list-style-type: none"> • High volume of world rubber production and price crush • Limited high rubber quality markets • Domestic production volume • Mainly relied on China market • Low correlated with world rubber price

4.3.4 Possible specific strategies of rubber industry by the combination of SWOT factors

4.3.4.1 Possible specific strategies of production sector by the combination of SWOT

According to the methodology, possible specific strategies of rubber production sector were formulated by a combination of SWOT factors using strategies matrix. Figure 4.1 presented possible strategies matrix for the rubber production sector.

4.3.4.2 Possible specific strategies of processing sector by the combination of SWOT

The same trend with the previous session, possible specific strategies of rubber processing sector were formulated by a combination of SWOT factors using strategies matrix. Figure 4.2 presented possible strategies matrix for the rubber processing sector.

4.3.4.3 Possible specific strategies of marketing and trade sector by the combination of SWOT

The same ways of production and processing sectors, possible specific strategies of marketing and trade were formulated by a combination of SWOT factors using strategies matrix. Figure 4.3 presented possible strategies matrix for rubber marketing and trade sector.

		Internal contexts	
		STRENGTHS (S)	WEAKNESSES (W)
		Internal factors	S1. Favourable climatic condition S2. Strong public and private institutions S3. Usefulness of family labour
External factors			
External contexts	OPPORTUNITIES (O)	S-O Strategies (Using internal strength to take advantage of external opportunities)	W-O Strategies (Taking advantages of opportunities to offset internal weaknesses)
	O1. Internal immigrated labour force O2. Cooperation and coordination between public and private O3. More research activities O4. Possibility of diversification	S2O1- Provide appropriate training to immigrate labours for better performance S2O4- Find an appropriate and profitable diversification model S2O3- Encourage research activities on increase rubber production S2O2- Initiated and encouraged farmer groups or cooperatives for efficient production	W1O2- Facilitated to the better land tenure system W2O3- Research programs on yield improvement and tapping technique for low cost W3O1- Training for immigrated labour to prevent labour shortage W3O3- Provide clones recommendation and control nursery for quality seedlings
	THREATS (T)	S-T Strategies (Using internal strength to mitigate or minimize external threats)	W-T Strategies (Strategies that minimize both internal weakness and external threats)
	T1. Increasing the volume of rubber production T2. World price crash and low domestic price T3. Climate change	S2T1- Adjust rubber area expansion to control production S2T2- Provide the training that reduced production cost and increase yield for comparative business S2T3- Provide the production practices that overcome climate change	W2T2- Promote yield per area and reduce cost for tolerance of price crash W2T3- Find climate-smart production practices for increased yield

Figure 4.1 Possible strategies matrix for the rubber production sector

Internal factors		Internal contexts	
		STRENGTHS (S)	WEAKNESSES (W)
External factors		S1. Strong public and private institutions S2. Possibility of selling latex and cup lump S3. Usefulness of family labour S4. Availability of processing knowledge and technologies	W1. Land tenure problems W2. Mostly produce low-grade rubber W3. Limited rubber processing factories W4. Low domestic utilization
		↓ ↓	
External contexts	OPPORTUNITIES (O)	S-O Strategies (Using internal strength to take advantage of external opportunities)	W-O Strategies (Taking advantages of opportunities to offset internal weaknesses)
	O1. Cooperation and coordination between public and private O2. Increased number of rubber processing and products factories O3. More interest in cooperative' type of processing O4. Exclude the processing cost by selling latex	S2O1- Initiated and supported rubber processing and products factories S1O3- Encouraged farmer groups or cooperatives S4O1- Provide training for better quality rubber processing	W1O2- Facilitated to become better land tenure system W2O3- Initiated cooperative mass quality production W3O4- Facilitated for selling latex directly to processing factories W4O2- Initiated and supported rubber processing and products factories
	THREATS (T)	S-T Strategies (Using internal strength to mitigate or minimize external threats)	W-T Strategies (Strategies that minimize both internal weakness and external threats)
	T1. Increasing the volume of rubber production T2. Limited high-quality rubber markets and mainly relied on T3. China market Poor images on quality of rubber products in the world market	S3T1- Reduce processing cost by family labour for comparative business S2T2- Find potential international markets for quality rubber S2T3- Control the exported rubber quality	W4T1- Promote domestic utilization W2T3- Encourage processing better qualities rubber and W2T3- find markets Training and education in processing technologies for better quality rubber

Figure 4.2 Possible strategies matrix for the rubber processing sector

<p>Internal factors</p> <p>External factors</p>		Internal contexts	
		STRENGTHS (S)	WEAKNESSES (W)
		<p>S1. Good market mechanism S2. Possibility of storage S3. Strong public and private institutions S4. High women participation</p>	<p>W1. Limited domestic utilization W2. Limited alternative buyer and more bargaining power by middlemen W3. Price information is not transparent</p>
External contexts	OPPORTUNITIES (O)	<p>S-O Strategies (Using internal strength to take advantage of external opportunities)</p>	<p>W-O Strategies (Taking advantages of opportunities to offset internal weaknesses)</p>
	<p>O1. High demand from neighbouring countries O2. World's tire companies interest sustainable rubber O3. Increase quality rubber exporting companies</p>	<p>S1O1- Promote the trade between rubber imported countries S3O2- Initiated the sustainable rubber production S3O3- Facilitated for export quality rubber and created favorable environment for investment</p>	<p>W2O3- Facilitated for export quality rubber and created favorable environment for investment W3O1- Provide reliable market information from neighbouring countries W1O2- Promote domestic utilization by inviting world's tire companies for tire manufacturing</p>
	THREATS (T)	<p>S-T Strategies (Using internal strength to mitigate or minimize external threats)</p>	<p>W-T Strategies (Strategies that minimize both internal weakness and external threats)</p>
	<p>T1. High volume of world rubber production and price crash T2. Limited high quality rubber markets T3. Mainly relied on China market and low correlated with world rubber price</p>	<p>S3T3- Provide capacity building to be a comparative business S3T2- Find potential international market for quality rubber S1T2- Provide world rubber market information and promote market efficiency</p>	<p>W1T1- Adjust rubber production with domestic consumption W2T2- Promote market efficiency and quality market W3T2- Provide reliable market information and find potential quality market</p>

Figure 4.3 Possible strategies matrix for rubber marketing and trade sector

4.3.5 Intervention areas by SWOT analysis

According to SWOT analysis, the critical intervention areas to improve competitiveness for the rubber industry were formulated by common strategies. The critical intervention areas to enhance competitiveness for the development of the rubber industry were described in the following section.

4.3.5.1 Critical intervention areas of the rubber production sector

(a) Land tenure system

The majority of rubber farmers were facing the land tenure problem in the study area. They wanted to receive an official certificate for land right for their rubber farm because it could be used for the loan collateral. They also wanted to validate their ownership. Some farmers required the legal permission of rubber production for existing rubber plantation in the forest land. Therefore, better land tenure system was required to achieve better competitiveness and the development of the rubber production sector.

(b) Quality of rubber seedling

The quality of rubber seeding was the second most important factor in rubber production. Rubber plantation was a long-run business and production decisions could not be adjusted in the short duration. The quality of rubber seedling was very important at the establishment of a rubber farm. Therefore, the rubber nursery and buds wood nursery were required better management to produce the quality rubber seedlings.

(c) Research and development

A number of research activities for rubber production were required in yield improvement, climate-smart agricultural practices and specific fertilizer rate. It would be both short-term and long-term programs for the development of rubber production sector. The research and development were critical needed to promote competitiveness in rubber production sector.

(d) Training and education

Training and education programme needed to be linked with the research and development activities. Training and education programme should be followed the results from the research activities to promote yield per unit area, capacity for better production decisions, comparative business and improve competitiveness of rubber industry.

4.3.5.2 Critical intervention areas of the rubber processing sector

(a) Land tenure system

Land tenure system was also important in the rubber processing sector like in the production sector. Most rubber processing factories owners were facing the restriction of land used policy and law in getting the required land for the establishment of the rubber factory. As the land tenure system was important for capital investment in processing factories, it was required to facilitate for better land tenure system for improve competitiveness in processing sector.

(b) Quality of rubber produced

The market price, demand and alternative buyers were key factors affecting the quality of the rubber produced. The quality of rubber products was vital to obtained better market prices and international market share. Therefore, it was required to control the quality of the rubber produced for the improve competitiveness and development of the rubber processing sector.

(c) Training and education

Training and education programme of rubber processing technologies were important to upgrade their technologies for small and medium processing factories. It would be provided by the public and private sectors to produce better rubber and rubber products.

(d) Domestic utilization

Rubber processing factories mainly depended on the international buyers. However, domestic utilization was also important for the rubber processing factories to get a sustainable situation. Therefore, it was needed to promote the domestic utilization of rubber for enhance competitiveness and further sustainable development for the rubber processing sector.

4.3.5.3 Critical intervention areas of rubber marketing and trade sector

(a) International market

Accessible of alternatives international markets was important for the rubber marketing and trade sector's competitiveness. Therefore, trade promotion should be prepared for the international market for rubber and rubber products by related public and private institutions.

(b) Domestic market

In some study areas, the price signals and market information for the rubber market were not reliable and transparent. Consequently, domestic market efficiency was lower in some rubber producing areas. Therefore, it was required to provide reliable market information to improve efficiency that is critical required for competitiveness of the rubber marketing and trade sector.

In the above session, the study revealed that critical intervention areas for rubber production, processing, and marketing and trade sectors of Myanmar rubber industry. These areas are required to intervene by related public and private institutes for improve competitiveness of rubber industry. As presented in the above section, the national policy context for the rubber industry had highly influenced on the development of rubber industry in rubber producing countries.

Therefore, alternatives policies for the intervention in critical areas of rubber industry should be formulated based on the results of the study to improve competitiveness. The last sub-chapter explained the possible alternative policy for improve competitiveness and sustainable rubber industry development.

4.4 Alternative Policies Based on Empirical Study of Rubber Industry**4.4.1 Rubber industry land tenure policy**

The first alternative policy for intervention was the rubber industry land tenure policy. It could solve the land tenure problems in rubber production and processing sectors to improve competitiveness. The policy should be formulated in line with the national land use policy. It provided the principles on how to implement, manage, and carry out land use and tenure rights in the country. It also included the recognition of customary land rights, the inclusion of women in land governance and the acknowledgement of the rights of ethnic minority groups.

Moreover, the rubber industry land tenure policy also should be harmonized with the land use and management policy launched by MOALI in 2017. In this policy, the first section stated that all farmers who produce the crop, livestock and fish were able to access, transfer, sell, mortgage, lend, exchange, give away, and inherit of their right of tilling and using. According to the above policies, rubber industry land tenure policy should be developed more specific for rubber stakeholders to access their land and to receive official land certificates for ownership rights in their property. Moreover, it was also required to facilitate rubber processing factories to receive an official certificate to improve competitiveness.

Additionally, the policy should also be emphasized on the legal permission for existing rubber plantation in the forest land. The policy should also be considered sustainable guidelines to balance the economic, environmental, and social aspects of rubber production to be green industries in the long-term.

4.4.2 Rubber industry quality control policy

Rubber industry quality control policy would be an essential alternative policy for improved competitiveness and the development of rubber industry. It should especially focused on rubber clones, seedling, nursery as well as rubber and rubber products. The policy should be fulfilled the requirement of rubber farmers for high yield recommended clones and qualified rubber seedlings by the registered nursery. Therefore, rubber industry quality control policy should be supported enforcement of seed law which had been launched by DOA since 2015.

Moreover, the policy should be promoted the producing of quality rubber and creating the international markets to enhance competitiveness in marketing and trade sector. It required the cooperation of public and private sectors for the preparation and standardization of rubber quality standard. It had also been designated in marketing, value-added processing and export policy of MOALI launched in 2017.

As the quality of inputs was also important for improve competitiveness in rubber production sector and cost-effectiveness, policy should also be emphasized not only for the product but also for the inputs used in rubber farm. However, to control agricultural inputs, it was required to follow by input strategic thrust policy launched by MOALI in 2017.

4.4.3 Rubber industry research and development policy

Regarding the results of the study, all kinds of stakeholders pointed out that there were few research and development activities of rubber production, processing, and marketing and trade sectors. It was created as the important constraints for the rubber industry development and the critical interventions were required in respective sectors to gain better competitiveness. Rubber industry research and development policy should be emphasized not only on production and processing but also market, supply and demand estimation of rubber and rubber products to enhance competitiveness of rubber industry.

Regarding to the interventions to improve competitiveness of rubber industry, the policy should be in line with research, development and extension policy of MOALI launched in 2017. It proposed to encourage the private sector involvement in the research and development activities and to establish cooperation and collaboration with the international organizations that were critically needed for rubber industry competitiveness and development.

4.4.4 Rubber industry human resource development policy

Human capital and resource development were basically needed to be competitive and comparative business both domestically and internationally. Rubber industry human resource development policy would be important for rubber industry development. The policy should be inclusive for improvement of unskilled and skilled labour participating in the rubber industry. In the consideration of policy content, it should be included not only the vocational training for skillfulness in production and processing but also generating the technical experts for respective sectors of the rubber industry to gain competitive advantages.

Therefore, the rubber industry human resource development policy should be harmonized with govern, institutional and human resource development policy of MOALI launched in 2017. The policy stated that academic education, vocational education and pre-service and in-service training would be enhancing for further development of human resources and producing sector-wise competent technicians and it would assign specifically and effectively to relevant services and work.

4.4.5 Rubber industry database and market information service policy

Myanmar rubber industry had potential in the domestic and international market. The market and price information were very important for an efficient market mechanism and improve competitiveness in rubber marketing and trade sector. To intervene in these areas, database and market information service policy would be required to intend for creating international demand and providing reliable and transparent market information.

Rubber industry database and market information service policy should be outlined for the ways of data addition, accessing, updating and removal of data concerning rubber markets information for better competitiveness. It should also be referred to as marketing, value-added processing and export strategic policy of MOALI

launched in 2017. The policy stated that it required to encourage mutual consensus between trading partners of government; internal and external market information dissemination: and issuance of relevant certificates by using advanced information technology.

Accordingly, to achieve the best outcomes and to gain competitiveness from the policy, it should also be followed strategic thrust of marketing, value-added processing and export proposed by MOALI launched in 2017. The strategic thrust supported in time access to sufficient local and international market information about local and external trade, the updated situation on supply and demand, prices fluctuation and market information.

CHAPTER V

SUMMARY OF MAIN FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The chapter consists of three main sections. The first section included a summary of the main findings from the research study. The second section concluded the research study regarding the summary of main findings. Then, the last section provided the recommendations to accomplish critical intervention areas for improved competitiveness and sustain the development of the rubber industry.

5.1 Summary of Main Findings

5.1.1 Review of national policy context of rubber producing countries

By the review of the national policy context of rubber producing countries, there were a number of policies and regulations to control the supply and demand of rubber according to the requirement of the respective nations. Moreover, the world political situation and crisis caused the changes in the world rubber consumption and production remarkably. Consequently, most of the rubber producing countries emphasized on national policy context to meet the world demand. It was observed that the national policy context for rubber industry had much effect on the rubber industry of respective nations. The rubber related institutes and professional government organizations had been developed as the result of the policy context and rubber laws in rubber producing countries. These institutes became powerful and the most responsible units for rubber industry development. The interesting finding was that each country had been revised laws and acts for several times to transform the rubber industry to meet world NR supply and demand.

In the case of Thailand, although the late introduction of commercial rubber plantation, the government developed effective rubber law and act like other rubber producing countries. The impressive act for a massive change in Thailand rubber industry was Thai Rubber Plantation Aid Fund Act. As a result from this act, Thailand's rubber industry as becoming the world' number one rubber producing country by the effort ORRAF through strategic replanting scheme.

By capturing the lessons learned from the achievement of Thailand rubber industry, Myanmar rubber industry should have the effective rubber law and act according to relevant development policies in time.

The important policy context for improvement of the rubber industry was observed in Malaysia rubber industry. It was the establishment of a rubber research institute and became the most successful rubber research institute of world known as RRIM. The institute has been provided valuable research results not only domestically but also to other rubber producing countries. Another remarkable rubber research institute, RRII was established by the India government to conduct rubber related research activities. Regarding the effort of RRII, the average national yield of India became the highest among in the rubber producing countries. Therefore, Myanmar needed to follow the relevant research and development policy to establish effective research institutes to conduct the research activities for the rubber industry.

The transforming of the institutional structure was also vital and extensively practices in most rubber producing countries. The notable transforming was examined in Malaysia by the establishment of the MRB by the merged RRIM, MRRDB and MRELB. The MRB contributed significantly to the development of rubber production by implementing human resources programs for stakeholders and revising the rubber related law and act. Another ideal institution transforming was also founded in Thailand in 2015 by combination REO, ORRAF, RRIT into the Rubber Authority of Thailand (RAOT). The RAOT successfully implemented rubber development policy including training programs for human resource development. The RAOT also managed the international and domestic market by standardization of rubber quality standard.

Although Myanmar adopted the institutional development and transformation policy, it needed to follow the experience and transformations model of Malaysia and Thailand to gain competitiveness of rubber industry form institutional transforming. Therefore, the transformation should be created the powerful institutions to implement the rubber development policy same as MRB in Malaysia and ROAT in Thailand.

As nationalization policy was adopted in Myanmar and Sri Lanka, the negative impact for the rubber industries was observed in both countries especially in foreign investment. Therefore, such kind of policy would not be appropriate for rubber industry competitiveness and future development. Moreover, both countries developed and implemented the Master Plans for rubber production and it had been achieved the goal of rubber plantation areas. However, it was not successful in improvement of national average yield. It pointed out that there were some challenges to solve in developing and implementing of these Master Plans in Myanmar to improve competitiveness and development of rubber industry as other rubber producing countries.

5.1.2 Profitability of rubber production

The analysis on the profitability and efficiency of the rubber industry in study areas brought out that rubber plantation system was tolerant to the current world price crash and still profitable. Alternatively, to be economically sustained and enhanced competitiveness of rubber production, it was required to reduce the cost of the production and to promote yield per unit area.

The major portion in the cost structure of production system was occupied by the cost of production and it contributed about 93% of total variable cost. In the production cost, the most considerable cost was the tapping labour cost, it was about 74%. The remaining costs were fertilizer, equipment and other labour costs. Therefore, the present study revealed that the tapping labour cost is the most appropriate cost to be reduced. It was possible to reduce tapping labour cost because it was different depending on tapping system. The different tapping systems were practiced in the study areas depending on availability of tapper, tapping days, weather condition, etc. Among them, half spiral cutting and tapping at alternative days (S_2D_2) tapping system resulted a lower tapping days per season and reduced tapping labour wages. However, the yield received by S_2D_2 system in Bago Region was not different from other tapping systems in Mon State and Tanintharyi Region. The tapping cost in S_2D_2 was much lower than that of other tapping systems. Therefore, S_2D_2 would be a proper tapping system for the study areas and it could reduce tapping labour wages and also help to overcome labour scarcity problem and to improve the competitiveness of rubber production.

In the case of processing, the study pointed out that there was a chance to exclude the total variable processing cost by selling field latex and cup lump directly to processing factories. It could reduce about 5% of the total variable cost and it was also one of the factors for better competitiveness in production. However, there were limited latex and cup lump markets and trust between buyer and seller. These were vital challenges in the study areas to gain competitiveness in rubber production. This scenario revealed that the establishment of new rubber processing factories and encouragement for existing factories were needed in the study areas.

For the marketing sector, there was not much the possible ways to reduce the cost in marketing activities. But bargaining power between buyers and sellers was very important to be efficient in marketing activities. Hence, the effort should be initiated to

improve marketing efficiency to reduce marketing cost and receive a better premium price for improved competitiveness in marketing sector.

The profitability could be different according to export destination in the study areas. Even in the same export destination, the profitability could also be different based on the production cost and market price. Therefore, the efficiency and competitiveness in the production and marketing activities was very important for the profitability of the rubber production.

The economic analysis summarized by evaluating operational ratio as an indicator of profitability and efficiency of the rubber production system. As the result, the operational ratio was about 50% and it indicated that the rubber crop was still economically viable in the study areas. It could also provide a recommendation for rubber farm to continue rubber production instead of changing alternative crops in the current situation. Moreover, current yield and market price created the profitable condition for the rubber farm according to the results from the break-even analysis. However, if the market price was lower than the break-even price, the intervention for the rubber sector would be critically needed.

5.1.3 Perception and involvement of key stakeholders

The results from the FGD analysis on key stakeholders of the rubber industry, following important involvement and perception were observed in the rubber industry.

In production, key stakeholders were facing land tenure problem, low-quality seedling, limited recommended high yield clone, no specific fertilizer rate, skilled labour scarcity and high wages and limited financial sources. Moreover, rubber farmers were experiencing climate change impact and poor extension service in rubber production. However, women had high participation in the rubber production and marketing sectors.

By investigating the perception of key stakeholders, although most rubber farmers were producing low-quality, they preferred to receive a premium price for better quality. In marketing and trade sector, there was a low market price as world rubber price crashed and limited international markets. The key stakeholders believed that mass quality processing was required to receive more international demand. Therefore, the study revealed that it was required to find the international markets and promote domestic utilization to sustain the market demand by the encouragement of rubber processing factories and product manufacturing factories.

During survey period, the rubber farmer did not have willingness to expand rubber plating area as lower profit and not willing to diversify with other crops and livestock rearing because there was no profitable diversified model in the study areas. The substitution with more profitable crops was limited economically and environmentally in the study areas except for Tanintharyi Region.

5.1.4 Critical intervention areas of the rubber industry

The critical interventions for improved the competitiveness and the development of rubber production sector were better the land tenure system for rubber farmers, control the quality of rubber seedling, research and development for improved, training and education for production practices.

In the processing sector, land tenure system for rubber processing factories, control for quality of rubber produced, training and education for quality rubber processing technologies and promote domestic utilization were needed for enhancing competitiveness and future development.

Critical intervention areas of rubber marketing and trade sector were finding potential international markets and accelerated to promote the domestic market efficiency to improve competitiveness of rubber industry value chain.

5.2 Conclusions

According to the results of cost and benefit analysis, rubber production was profitable and not urgently required to substitute with alternative crops. The study also revealed that the important factors affecting the profitability and the competitiveness were the cost of production, yield per unit area and current market price. Therefore, research activities should be emphasized to explore the more profitable rubber-based diversified models for improved competitiveness and find more economically viable alternative crops to substitute. In case of substitution other crops, it was required additional researches to make sure rubber crop which was not economically sustained in future. Therefore, additional researches should be emphasized economic analysis based on long-term investment, focusing of world rubber production, estimation of world rubber price and market demand. Moreover, additional researches should also be done on analysis of cost of production for competitiveness. Especially on profitability of difference payment types prevailed in rubber production that could provide competitiveness for production activities.

By doing FGD analysis, the perception of key stakeholders revealed that the stakeholders were actively working in rubber production, processing, and marketing

and trade sectors of the rubber industry. Additionally, the rubber industry possessed internal strengths and external opportunities for further development and improve competitiveness and it was also facing internal weaknesses and possible external threats as harmful for development. Moreover, step by step combination of SWOT and prioritized of possible strategies, critical intervention were also observed to enhance competitiveness in the rubber industry.

5.3 Recommendations

To achieve better profitability and competitiveness in rubber production, cost of production should be reduced by applied appropriate tapping system (S₂D₂). To obtain higher yield per unit area, farmers should use HYC and appropriate production practices including application of the specific fertilizer rate. To receive better market price, it was required to produce good quality rubber as rubber farmers from Bago Region or encourage the rubber processing factories like as in Tanintharyi Region.

Finally, to improve the competitiveness and sustainable development of the rubber industry, it was required to overcome weaknesses and threats as well as to intervene in critically needed areas. Therefore, the study pointed out and provided the recommendations to implement empirical-based alternative policies as intervention instrument as follows.

- Rubber industry land tenure policy which would be in line with national land tenure policy.
- Rubber industry quality control policy which would be specific for seedling, nursery and rubber products.
- Rubber industry research and development policy which would be emphasized not only on technical but also market, supply and demand estimation.
- Human resource development policy would be inclusive for skilled labour, processing technologies and generated rubber experts.
- Rubber industry database and market information service policy which would be creating for international demand.

However, as nature of perennial crops, it was not simply implied that the interventions for rubber industry would be considered for not only short-term planning but also long-term strategic planning which would protect the livelihood of stakeholders, especially for rubber farmers and ensuring sustained the development of rubber industry.

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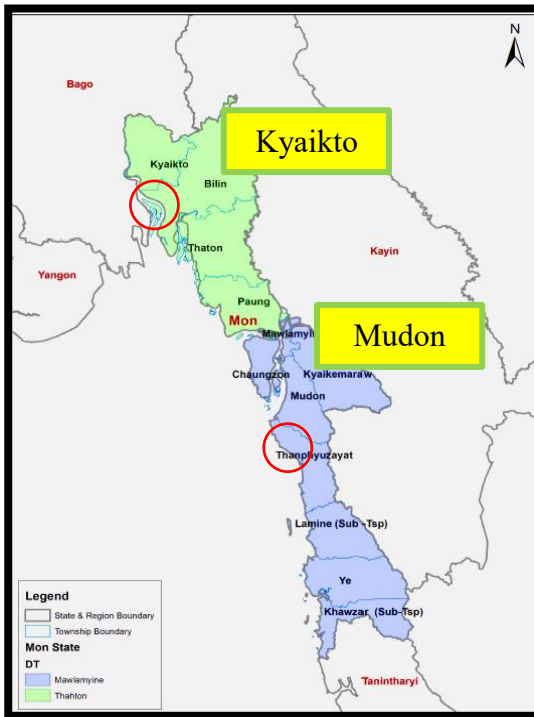
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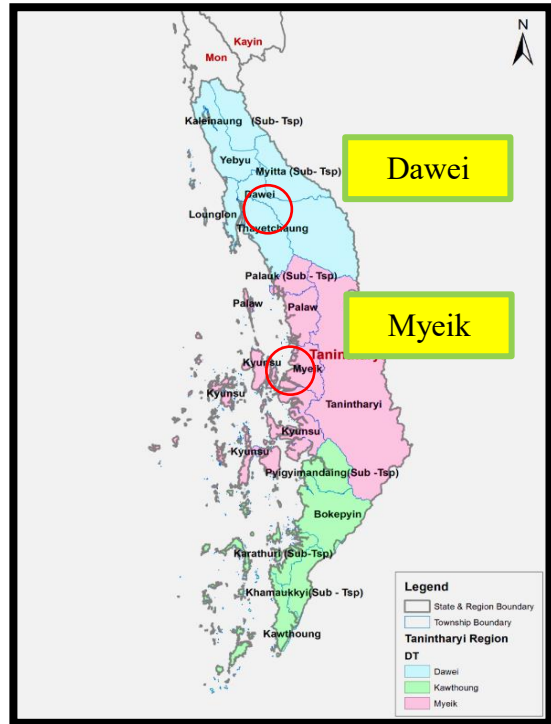
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APPENDICES

Appendix 1. Map of selected Townships in the study areas



Mon State



Tanintharyi Region



Bago Region

Appendix 2. Detail information of FGDs conducted in study areas

Stakeholder		Rubber farmer				Institutional representative			Middlemen		Total/ Average
Particular	Unit	FGD (1)	FGD (5)	FGD (6)	FGD (9)	FGD (2)	FGD (4)	FGD (8)	FGD (3)	FGD (7)	(9) Focus groups
Region\State	-	Mon	Bago	Tanintharyi	Tanintharyi	Mon	Mon	Tanintharyi	Mon	Tanintharyi	2 Regions + 1 State
Township	-	Kyaikto	Shwegyin	Dawei	Myeik	Kyaikto	Mawlamyine	Myeik	Mudon	Myeik	(5) Townships
Location	-	Golden Bless hotel	DOA office- (Shwegyin)	Bamboo house restaurant	Daw Cooperatives' office	Golden Bless hotel	PCRDC-DOA (Mawlamyine)	DOA office (Myeik District)	PCRDE-DOA (Mudon)	DOA office (Myeik District)	(7) locations
Date / time	-	30 th Oct. 2018 (11:30 am)	1 st Nov. 2018 (2:45 pm)	12 th Dec. 2018 (3:30 pm)	15 th Dec. 2018 (9:30 am)	30 th Oct. 2018 (5:30 pm)	31 st Oct. 2018 (3:30 pm)	14 th Dec. 2018 (4:00 pm)	31 st Oct. 2018 (1:30 pm)	14 th Dec. 2018 (1:30 pm)	30 th Oct.- 15 th Dec. 2018
Duration of session	minutes	145	123	140	134	98	63	101	96	55	106
No. of stakeholder	No.	20	13	10	16	8	11	8	11	6	11.44
Age	Year	52.6 (30 - 77)	50.3 (38 - 63)	52.1 (33 - 65)	51.1 (32 - 68)	48.7 (37 - 56)	47.5 (40 - 58)	46.7 (38 - 55)	48 (31 - 62)	43.3 (35 - 52)	48.8 (30 - 77)
Rubber experience	Year	20.3 (2-50)	20.0 (5-35)	19.7 (10-35)	11.3 (4-20)	18.8 (5-27)	21.0 (4-31)	17.5 (5-25)	13.7 (2-28)	17.3 (10-32)	17.7 (2-50)
Farm size (min-max)	ha	16.8 (1.2 - 101.2)	124.3 (4.0 - 404.7)	229.2 (12.1 - 526.1)	46.5 (3.2 - 323.8)	-	-	-	-	-	- (1.2 - 526.1)
Active respondents	No.	9	6	4	7	7	7	5	5	3	53 (51.4%)
Neutral respondents	No.	5	4	3	5	1	2	2	4	1	27 (26.2%)
Silent respondent	No.	6	3	3	4	0	2	1	2	2	23 (22.3%)
Facilitator	-	Dr. Theingi Myint	Dr. Theingi Myint	U Kyaw Myo Thu	U Kyaw Myo Thu	Dr. Theingi Myint	Dr. Theingi Myint	U Kyaw Myo Thu	Dr. Theingi Myint	U Kyaw Myo Thu	(2) Facilitators
Note-taker (1)	-	Daw Thanda Moe	U Kyaw Myo Thu	Daw Thu Thu Wai	Daw Thu Thu Wai	Daw Khaing Khaing Oo	U Kyaw Myo Thu	Daw Thu Thu Wai	Daw Thanda Moe	Daw Thu Thu Wai	(6) Note-takers
Note-taker (2)	-	Dr. Aye Thida Win	Daw Khaing Khaing Oo	Daw Aye Aye Thet	Daw Aye Aye Thet	Daw Thanda Moe	Daw Thanda Moe	Daw Aye Aye Thet	Daw Khaing Khaing Oo	Daw Aye Aye Thet	

Appendix 3. Predictive discuss topics for FGDs in rubber industry

Themes	Predictive Discuss Points
Production	<ul style="list-style-type: none"> • Land tenure system • New planting and replanting • Clones • Input • Labour and wages • Capital investment • Extension service • Women participation • Climate change
Processing	<ul style="list-style-type: none"> • Type of rubber • Processing practices
Marketing and trade	<ul style="list-style-type: none"> • Market mechanism • Middlemen • Market price
Policy and future development	<ul style="list-style-type: none"> • Policy • Future development

Appendix 4. Information of participants in FGD for stakeholder of institutional representative in Kyaikto Township

FGD (2)

Type of FGD- Institutional representative

Male- (5) Female- (4)

Date - 30th Oct: 2018 (5:30 pm)

Location - Golden Bless hotel, Kyaikto Township

Respondents	Gender	Age	Rubber experience	Occupation	Respondent participation
1	Male	54	25	Deputy Director (Ministry of industry)	Active
2	Male	56	27	Assistant Director (Ministry of industry)	Active
3	Female	52	23	Staff Officer (DOA)	Active
4	Female	47	20	Staff Officer (DOA)	Active
5	Male	45	5	Township staff Officer (DOA)	Neutral
6	Male	45	19	Township staff Officer (DOA)	Active
7	Male	54	20	Staff Officer (DOA)	Active
8	Female	37	12	Deputy staff officer (DOA)	Silent
Means		48.7	18.8		
Range		(37-56)	(5-27)		

Most active persons= 1, 2, 4

Active=6
Neutral=1
Silent=1

Seating plan

Assistant	1	2	5	6	7
	Table				
8	Note taker 2	Note taker 1	Facilitator	4	3

Appendix 5. Information of participants in FGD for stakeholder of middlemen in Mudon Township

FGD (3)

Name of the community (Rubber middlemen- Mudon Township)

Date – 31st Oct: 2018

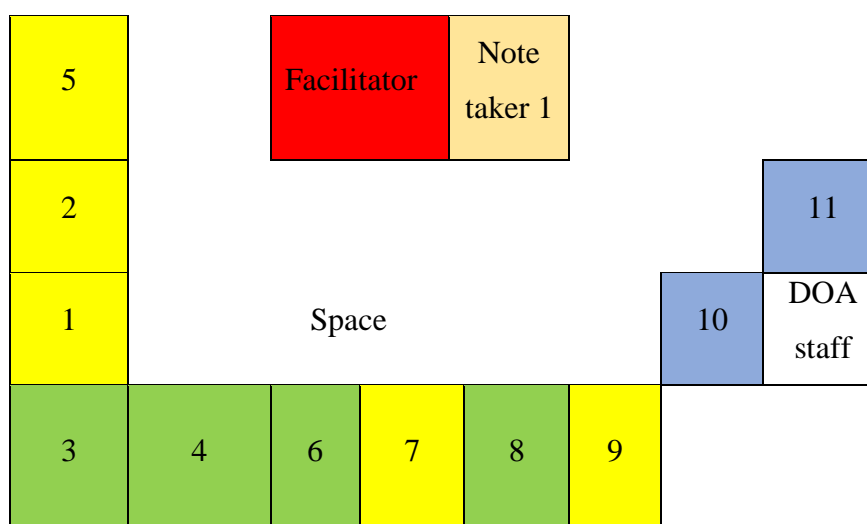
Location- Perennial Crops Research and Development Estate - PCRDE (Mudon)

Respondents	Gender	Age	Rubber experience	Occupation	Level of participation
1	Male	52	25	Exporting company	Active
2	Male	51	28	Wholesaler	Active
3	Male	49	14	Processing and exporting company	Neutral
4	Male	48	2	Processing and exporting company	Neutral
5	Male	54	15	Processor and buyer	Active
6	Male	62	28	Local dealer	Neutral
7	Male	48	5	Local dealer	Active
8	Female	45	4	Local dealer/ broker	Neutral
9	Male	45	15	Wholesaler	Active
10	Male	43	7	Processing and exporting company	Silent
11	Male	31	8	Processing and exporting company	Silent
Means		48	13.7		
Range		(31-62)	(2-28)		

Most active persons= 2, 1, 5

Active=5
Neutral=4
Silent=2

Seating plan



Appendix 6. Information of participants in FGD for stakeholder of institutional representative in Mawlamyine Township

FGD (4)

Type of FGD- Institutional representatives

Male- (4) Female- (7)

Date- 31st Oct: 2018 (3:30 pm)

Location- Perennial Crops Research and Development center- PCRDC (Mawlamyine)

Respondents	Gender	Age	Rubber experience	Occupation	Respondent participation
1	Male	50	24	Assistant Director	Active
2	Female	58	31	Assistant Director	Active
3	Female	57	26	Staff Officer	Active
4	Female	50	24	Staff Officer	Active
5	Male	46	22	Staff Officer	Active
6	Female	46	22	Staff Officer	Active
7	Female	47	22	Staff Officer	Active
8	Male	40	4	Township Staff officer	Silent
9	Female	44	21	Deputy Staff Officer	Neutral
10	Female	43	18	Deputy Staff Officer	Neutral
11	Male	42	18	Deputy Staff Officer	Silent
Means		47.5	21.0		
Range		(40-58)	(4-31)		

Most active persons= 1, 5, 2

Active=7
Neutral=2
Silent=2

Seating plan

DOA Staff

Note taker 1	1	5	11	9	4
	Table				10
					8
2	Note taker 2	Facilitator	6	7	3

Appendix 7. Information of participants in FGD for stakeholder of rubber farmer in Shwegyin Township

FGD (5)

Type of FGD- Rubber farmer

Male- (11) Female- (2)

Date- 1st Nov: 2018 (2:45 pm)

Location- DOA office- Shwegyin Township

Respondents	Gender	Age	Rubber experience	Planting are (ha)	Respondent participation
1	Male	57	20	4.0	Active
2	Male	62	21	12.1	Neutral
3	Male	44	15	60.7	Active
4	Male	63	30	344.0	Active
5	Male	45	15	32.4	Neutral
6	Male	38	10	6.1	Neutral
7	Male	43	25	60.7	Active
8	Male	46	25	80.9	Active
9	Male	50	25	161.9	Active
10	Female	57	20	20.2	Neutral
11	Male	45	20	404.7	Silent
12	Male	55	30	303.5	Silent
13	Female	50	5	-	Silent
Means		50.3	20.0	124.3	
Range		(38-63)	(5-30)	(4.0-404.7)	

Most active person =7, 3, 4

Active=6
Neutral=4
Silent=3

Seating plan

9	1	7	6	Note taker 1	10	11	5
Table						DOA Staff	
2	3	4	Facilitator	Note taker 2	8	12	13

Appendix 8. Information of participants in FGD for stakeholder of rubber farmer in Dawei Township

FGD (6)

Type of FGD- Rubber farmer

Male- (8) Female- (1)

Date- 12th Dec: 2018 (3:30 pm)

Location- Bamboo house restaurant, Dawei Township

Respondents	Gender	Age	Rubber experience	Planting area (ha)	Respondent participation
1	Male	62	20	404.7	Active
2	Male	60	10	121.4	Neutral
3	Male	48	24	526.1	Active
4	Male	54	10	20.2	Neutral
5	Male	33	10	161.9	Silent
6	Male	59	25	283.3	Active
7	Male	40	15	303.5	Silent
8	Male	65	35	12.1	Neutral
9	Male	50	25	Deputy-Director	Active
10	Female	50	23	Assistant – Director	Silent
Means	52.1	19.7	229.2		
Range	(33-65)	(10-35)	(12.1- 526.1)		

Most active person=6, 3, 5

Active=4
Neutral=3
Silent=3

Seating plan

10	Note taker 3	1	2	4	3	7	8
Table							
	Note taker 2	Note taker 1	Facilitator	6	5	9	

Appendix 9. Information of participants in FGD for stakeholder of institutional representative in Myeik Township

FGD (7)

Type of FGD- Institutional representatives

Male- (7) Female- (1)

Date- 4th December 2018 (4:00 pm)

Location- DOA office (Myeik District)

No.	Name	Age	Rubber experience	Occupation	Respondent participation
1	Male	51	25	Deputy Director	Active
2	Male	44	25	Staff Officer	Active
3	Female	46	5	Staff Officer	Neutral
4	Male	55	5	Staff Officer	Neutral
5	Male	38	15	Staff Officer	Silent
6	Male	38	20	Staff Officer	Active
7	Male	47	20	Staff Officer	Active
8	Male	55	25	Staff Officer	Active
Means		46.7	17.5		
Range		(38-55)	(5-25)		

Most active persons= 1, 2, 8

Active=5
Neutral=2
Silent=1

Seating plans

	6	Facilitator	Note taker 2	Note taker 1	7
	Table				2
	1	8	3	4	5

**Appendix 10. Information of participants in FGD for stakeholder of middlemen
in Myeik Township**

FGD (8)

Type of FGD- Middlemen

Male- (5) Female- (1)

Date- 14th December 2018 (1:30 pm)

Location- DOA office (Myeik District)

Respondents	Gender	Age	Rubber experience	Occupation	Respondent participation
1	Male	35	10	Local collector	Silent
2	Male	46	12	Local collector	Active
3	Male	52	15	Wholesaler	Neutral
4	Female	37	15	Local collector	Silent
5	Male	43	20	Wholesaler	Active
6	Male	47	32	Exporter	Active
Means		43.3	17.3		
Range		(35-52)	(10-32)		

Most active persons = 6, 5

Active=3
Neutral=1
Silent=2

Seating plans

		Facilitator	Note taker 2	Note taker 1	
Table					4
	6	5	2	3	1

Appendix 11. Information of participants in FGD for stakeholder of rubber farmer in Myeik Township

FGD (9)

Type of FGD- Rubber farmer

Male- (15), Female- (1)

Date- 15th December 2018 (9:30 am)

Location- Daw Cooperatives' office

Respondents	Gender	Age	Rubber experience	Planting area (ha)	Respondent participation
1	Male	62	10	8.9	Active
2	Male	48	10	72.8	Active
3	Male	44	14	40.5	Active
4	Male	68	10	5.3	Neutral
5	Male	53	10	80.9	Neutral
6	Male	44	15	323.8	Silent
7	Male	32	4	17.4	Neutral
8	Male	68	9	3.2	Silent
9	Male	50	15	18.2	Active
10	Male	58	12	5.3	Neutral
11	Male	32	12	24.3	Silent
12	Male	64	15	40.5	Active
13	Male	47	10	40.5	Silent
14	Male	43	20	18.2	Active
15	Female	53	10	15.8	Active
16	Male	63	5	29.9	Neutral
		51.1	11.3	46.5	
		(32-68)	(5-20)	(3.2-323.8)	

Most active persons = 5, 9, 12

Active=7
Neutral=5
Silent=4

Appendix 11.Continued - Seating plan

DOA Staff	Note taker 2	Note taker 1	1	12	2	8	11	15	6
	Table							7	13
	3	10	Facilitator	DOA staff	4	14	5	9	16