Rubber-based farming diversification in Thailand:

Barriers, facilitators and support needs

Deliverable 2

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Executive summary

This study aims to develop an in-depth understanding of barriers and enabling factors for small-scale rubber farms in Thailand to implement sustainable on-farm diversifications as well as support needed to practice sustainable rubber-based farming diversification. Drawing on a comprehensive quick scoping review of extant literature on agroforestry, face-to-face interviews with rubber farmers in Southern Thailand and multi-stakeholder group discussions, the study found that the main barriers for rubber-based farming diversification are lack of skills and knowledge, lack of investment capacity, lack of land, and shortage of labour. Farmers' personal preference for an easy lifestyle may also contribute to the reluctance to diversify into other crops. To enable more rubber farmers to practice farming diversification, there is a need for better financing schemes to counter the investment, enhanced market access and extension services, more widely disseminated best practices and government policy to advice and incentivise farming diversification.

Contents

1. Introduction

Thailand is the world's largest natural rubber producer and exporter with an annual output of 4.5 million tons (36.3% of the world total), exporting 3.6 million tons in 2016, equivalent of £3,250 million worth (140,580 million THB). Very nearly 3.5 million hectares are planted with natural rubber in Thailand. Of the 1.1 million Thai rubber growers, 79% are small-scale farmers with landholdings below 2.4 hectare. The monthly income of Thai rubber growers averaged 9,236 THB (£215) per month in 2015, but some 40,000 rubber growers face poverty with a monthly income of only 2,341THB (£54, poverty line defined as 2,667 THB or £62, NESDB 2015).

The major threat to livelihood derives from price volatility on world markets. Where smallholders rely primarily on income from monoculture rubber they are particularly vulnerable to these fluctuations in price (Romyen et al., 2018). On-farm diversification strategies, such as growing other cash crops with rubber, provide a potential strategy for these farmers to mitigate this risk (McNamara and Weiss, 2005; Stroesser et al., 2018). Farming diversification, defined as farming activities aiming to add any new agricultural products to the current farming system to increase economic sustainability, has attracted a broad range of attention amongst academic researchers and policy makers. Although research has demonstrated both economic and environmental benefits of tree-crop diversification (intercropping), nearly 90% of Thai rubber plantations is still monocropped.

This study aims to develop an in-depth understanding of barriers and enabling factors for small-scale rubber farms in Thailand to implement sustainable on-farm diversifications as well as support needed to practice sustainable rubber-based farming diversification.

2. Methods

A multi-method approach was taken. This involved a comprehensive quick scoping review of extant literature on agroforestry to identify inhibiting and enabling factors for small-scale farmer to practice farming diversification. The scoping review was based on 45 studies which reported farming diversification of rubber agroforestry systems and 77 studies reported diversification in agroforestry systems other than rubber. The details of the literature search, screening and review process are presented in report D1a (Huang *et al.* 2020) and D1b (James et al., 2020).

The outcome of the scoping review informed the design of primary data collection in Thailand which involved: 1) focus group discussion with key stakeholders such as rubber

cooperative, government organisation (Rubber Authority of Thailand, RAOT and agricultural extension officers; 2) face-to-face structured questionnaire survey of Thai rubber farmers in two southern provinces (Chumphon and Surat Thani) in Thailand to understand the current economic status of rubber farming and farming diversification, and 3) face-to-face in-depth follow-up interviews with five farmers who were previously surveyed.

3. Results

3.1 Findings from scoping review

Three key themes emerged from the extant literature: ecological synergies achieved through intercropping with rubber, key barriers and enabling factors to farming diversification.

3.1.1 Ecological synergies rubber-based intercropping

Synergies achieved through intercropping included yield acquisition advantages found in some intercropping systems (e.g. banana), improved fertilisation, cost saving in watering and fertilisation, and labour saving for weeding (e.g. by integrating sheep with rubber).

Yield improvement was found to be due to both earlier tapping (by up to 6 months) and higher quality of latex. Rodrigo et al. 2005 and Ogwuche et al. (2012), through studies of rubber-based intercropping system in Sri-lanka and Nigeria respectively, found that tapping stage were reached earlier than mono rubber crop when rubber farm intercropped with arable crops. This may be due to increase in organic matter content as a result of residues from the intercropped plants after harvest which promote soil aeration and possible increase in soil nutrients required for the rubber growth and development (Ogwuche et al., 2012; Jungrungrot, 2014), less soil erosion (Giroh et al., 2012; Jungrungrot, 2014) and complementary of species interaction (Esekhade, 2003; Jungrungrot, 2014). Rodrigo et al. (2005), Jongrungrot (2014) and Choengthong and Choengthong 2014 suggested that more balanced ecosystem through biodiversity and shading areas may also have contributed to the increase of latex as the hevea bark may be softer and less damaged by storms.

Improved fertilisation was often achieved through the use of chicken or sheep manure (Tajuddin, 1986). This also leads to cost saving in fertilisation. Sheep or goat grazing also reduced labour and input costs in weed control. Tajuddin (1986) reported up to 21% of cost reduction when practiced in Malaysia.

3.1.2 Barriers or constraints to rubber-based diversification

A wide range of constraints to diversification, in particular intercropping, have been reported in the literature. Traditional planting densities of rubber, to maximise yields and reduce damage from wind, can in some cases make intercropping difficult or impossible, due for example to shading from rubber trees (e.g. Snoeck et al., 2013). The loss in rubber yield through the reduction in number of trees with reduced planting density needs to be weighed up against the benefits to farmers of diversifying their income (e.g. quicker return on investment compare to monoculture rubber and increase resilience to fluctuation in rubber price). Much of the evidence gathered in this review indicated that intercropping of non-tree food crops is limited to the immature period of rubber, often only the first few years before canopy closure. Few crop species grow under mature rubber and even fewer benefit from rubber tree shade, for example in some parts of Asia tea quality is improved by being grown in partial shade of rubber trees (e.g. Parham, 2000). Consequently, where diversification has occurred it is in separate fields.

Other constraints to adoption of diversified rubber systems include the additional labour requirements and local labour shortage (e.g. Guo et al., 2006; Snoeck et al., 2013; Stroesser et al., 2018), skills and knowledge to implement diversification (e.g. Jongrungrot et al., 2014b; Rodrigo et al., 2001a), investment capacity (e.g. Somboonsuke 2001), government policies (e.g. Romyen et al., 2018) and concerns about rubber tree productivity resulting from competition for resources, and pest and diseases associated with the intercrop (Somboonsuke 2001; Langenberger et al., 2016).

Key barriers to uptake of rubber-based farming diversification including constraints of existing rubber planting density, lack of skills and knowledge, labour shortage, insufficient capital for investment, and instability of market price for other crops are presented in table 1 below.

Table 1 Barriers to diversification in rubber

Barrier	No studies	Exemplar quote
Skills & Knowledge	14	'This is partly because the farmers lack the knowledge and skills required for this system' Jongrungrot et al., 2014, Thailand 'The major constraint to uptake being access to effective extension information and advice' Stirling et al., 1998, Sri Lanka 'Lack of knowledge or experience in intercrop- ping of rubber was one of the main reasons offered by farmers for not adopting this practice on immature rubber land' Rodrigo et al., 2001, Sri Lanka
Labour requirement	8	'They [small-scale rubber farmers] do not have enough time and labour to take on the additional workload' Jongrungrot et al., 2014, Thailand
Unsuitable land	6	'most of the rubber small holdings were on sloping lands. The difficulties in cultivating sloping lands, and the risks this would pose to soil erosion', suggest that high density intercropping may be less suitable to hilly regions' This might explain the lower incidence of intercropping on sloping compared to flat lands' Rodrigo et al., 2001, Sri Lanka
Investment capacity	5	*'insufficient capital for farm investment….* are also important constraints' Somboonsuke 2001, Thailand
Commodity price	4	'Recently, rubber-tea intercropping has gradually been given up and replaced by rubber monoculture – largely because of the increasing labour costs and decreasing tea prices. This is consistent with the sensitivity analysis' Guo et al., 2006, China
Social vs economic role of diversification	1	'Farmers who chose agroforestry didn't do it for economic reasons in the first place. They first refer about growing fruits trees and vegetables crops to feed themselves, their families, their guests, and even visitors. In rural societies of Southern Thailand, the gift of fruits has a huge social value. This reason is consistent with the context in which current agroforestry practices with rubber clones were introduced. The market-oriented purpose comes in the second place, behind the availability of fruits and their social role' Penot et al., 2016, Thailand

Lack of research dissemination	2	'research and the dissemination of research results on hevea-based inter-cropping is still limited' Jongrungrot et al., 2014, Thailand
Disease and pests	1	'disease and pests.. are also important constraints' Somboonsuke 2001, Thailand
Age of rubber plantation	1	'before letting the animals (sheep) in, the rubber trees must be not less than 1½year old and the plants at least 2m tall, because the animals tend to feed on the lower whorls of the rubber plants' Tajuddin 1986, Malaysia
Livestock security	1	'Security of animals is one of the major problems in rearing sheep under rubber. Casualties due to attack by wild dogs as well as thefts have been experienced in the past. Regular shooting of wild dogs is necessary, and animal sheds should not be too isolated. Security problem has been a major reason for not initiating large scale free ranch system of sheep rearing under rubber. In this context, the use of solar-powered electric fencing with alarm system seems advantageous and it needs to be looked into' Tajuddin 1986, Malaysia
Minimum wage policy	1	'Threats - The 300-Baht minimum wage policy which came into effect in January 2013 increased the cost of hiring labourers on farms without sufficient household labour. The impact will be even greater when the sales prices for farm products are low, as the farmers will have even fewer resources to hire additional labour' Jongrungrot et al., 2014, Thailand

Other barriers to farming diversification in other agroforestry systems included land tenure (Viswanath et al., 2000; Rahman et al., 2007; Kamin and Harrison 2016), land availability (Liyanage et al., 1993, Rahman, 2017), risk averse farmers not wanting to change from traditional way of farming (Rahman, 2017) and perception of risk of diversification (Nchanji et al., 2016), off-farm work opportunities leading to in come from agriculture not seen as important (Rahman, 2017), and difficulties in storing and preserving food harvests, particularly fresh fruits and vegetables (Aiyelaagbe et al., 1998; Eckert, 2000). Many of those constraints may also apply to rubber-based farming systems.

3.1.3 Key facilitators and support needs for adoption of rubber-based farming diversification

In a recent publication Romyen et al (2018), suggested that rubber farmers have a positive attitude towards intercropping in Southern Thailand and rubber intercropping tutorials are a

driving force behind the adoption of intercropping. However, they noted that promotion of the expansion of this practice will be quite difficult to achieve in practice if left to happen naturally and there should be positive measures adopted to promote this expansion. Potential facilitators to adoption of diversification identified from studies of rubber-based and non-rubber-based agroforestry systems included:

- better financing arrangements (Rahman et al., 2007; Bernard et al., 2016; Charernjiratragul et al., 2015; Pande et al., 2018; Pereira et al., 2018);
- changes in government policy to incentivise farming diversification (Abdul-Sattar and Shameem, 2009; Rahman, 2017);
- enhanced access to markets (e.g. Rahman et al., 2007; Choengthong & Choengthong 2014);
- enhanced diversification extension services (e.g. Charernjiratragul et al., 2015);
- farmer groups and other sectors to share knowledge and promote intercropping (e.g. Jongrungrot et al., 2014b; Thamban et al., 2016);
- better dissemination of academic research on economic and environmental benefits of agroforestry (Rahman et al., 2007; Jongrungrot et al., 2014b);
- more research to support sustainable diversified rubber systems, which looks beyond a few years of intercropping at the immature period of rubber, or just planting other plants on separate plots (e.g. Thongyou 2014).

3.2 Findings from primary sources

3.2.1 Profile of respondents

Primary data collection was conducted in three stages as explained in the methods section. Three key informants group discussions were held in May 2019 with three rubber farmers, three extension officers, two managers of Rubber Fund Cooperatives in Rayong Province, and finally four senior and middle managers of Rubber Authority of Thailand (RAOT) in Rayong.

Stage two face-to-face structured but detailed questionnaire survey was conducted with 20 rubber farmers in two southern provinces (10 from each of the Chumphon and Surat Thani provinces) in Thailand. Five of those participated in stage-3 face-to-face in-depth follow-up interviews. All farmers reported farming diversification activities based on multi-cropping rather than intercropping systems. This means the crops were farmed in different

plots. The profiles of the farmer participants in the two provinces are presented in Table 2. Of the 20 participants, 17 were heads of households, two were spouses and one was son. Five were females. Majority had education level between primary to senior high school (n=16). One had higher diploma and three had bachelors or higher level of education. Average years in farming was 20. Farm size ranges from 13 rai (2ha) to 65 rai (10.4ha) with an average size being 30 rai (4.8ha). Land size for rubber plantation ranges from 8 rai (1.28ha) to 40 rai (6.4 ha) with an average size of 22 rai (3.5ha). Land size for other crops ranges from 2 rai (0.32ha) to 25 rai (4ha) and the average size was 8 rai (1.28ha).

Of the five farms who participated in both stages of interviews, two were from Chumphon province and three were from Surat Thani province. However, different family members were interviewed for farms ID 9 (wife) and 20 (son).

Table 2. Profile of rubber farmer participants

Farm ID	Province	Age	Household status	Gender	Education	Farming Years	Total Land Size	Rubber farm land size (rai)	Other crops	Land size for other crops (rai)
1	Chumphon	64	HoH	Male	PG or above	36	25	20	Durian	5
2[a]	Chumphon	57	HoH	Male	Primary	40	40	35	Mangosteen + hens	5
3	Chumphon	64	HoH	Male	Primary	50	20	15	Durian	5
4	Chumphon	61	HoH	Female	Primary	40	20	15	Durian	5
5	Chumphon	48	HoH	Female	Bachelor's	20	15	10	Durian	5
6	Chumphon	62	HoH	Male	Senior High	45	35	20	Oil palm	15
7	Chumphon	76	HoH	Male	Secondary	10	13	8	Coconut	5
8	Chumphon	70	HoH	Female	Primary	50	24	20	Durian	4
9[b]	Chumphon	63	HoH	Male	Primary	10	14	12	Baegu	2
10	Chumphon	67	Spouse	Female	Primary	47	33	24	Vegetables	2
11[d]	Surat Thani	56	HoH	Male	Senior High	20	26	18	Oil palm + cattle	8
12	Surat Thani	51	HoH	Male	Secondary	28	33	20	Oil palm	13
13	Surat Thani	50	HoH	Male	Higher diploma	30	29	17	Mangosteen	12
14	Surat Thani	58	HoH	Male	Primary	34	30	20	Oil palm	10
15	Surat Thani	48	Spouse	Female	Senior High	25	65	40	Oil palm	25
16	Surat Thani	48	HoH	Male	Senior High	20	30	20	Durian & Mangosteen	10
17	Surat Thani	27	Son	Male	Bachelor's	4	43	33	Durian	10
18	Surat Thani	42	HoH	Male	Secondary	20	35	31	Baegu	4
19[d]	Surat Thani	56	HoH	Male	Senior High	35	38	32	Durian + Veg	6
20[c, d]	Surat Thani	59	HoH	Male	Senior High	40	45	35	Coconut + Durian + Corn and vegetables	10

Note:

a. participated in interviews at both stage 2 and stage 3;

b. His wife was interviewed in stage 3;

c. his son was interviewed in stage 3;

d. stage 3 interviews were conducted off-farm in Chumphon rather than in Surat Thani.

3.2.2 Reasons for rubber farming

Farmers were first asked about what motivated them to practice rubber farming. Nearly all farmers interviewed suggested two main reasons: price of rubber was high and/ or family (parents) were already growing rubber trees and the land was passed over thereafter. Below are some quotes from the respondents:

> *"At that time, the price of rubber was good and my parents had a rubber farm. So I just took over my parents' land and continued with rubber farming" – Respondent 2*

> *"My husband's family had rubber farm" – Respondent 9*

> *"I start to plant a rubber since I was 30 years old. I got a land from my parents. I did not know what I should plant but the land that I got from my parents was a rubber farm. So, I decided to continue to do rubber farming" – Respondent 11*

> *"I have been helping my parents since I was born. I remember since I was a kid, everywhere I went, I was surrounded by rubber trees. Every single house in our village owned a rubber farm because the rubber price was really high. Because my family already started growing them, so I just continued. But right now, price of rubber is really low, I almost break even. We earn very little, but I have no other choices." – Respondent 20*

3.2.3 Crops for farming diversification and reasons for diversifying

Overall, fruit trees, particularly durian (n= 9) and oil palm (n=5) were the most common crops and three farmers planted vegetables and two planted baegu (a kind of leave vegetable); three grew mangosteen and two grew coconut. One farmer reared cattle and one reared laying hens. Farmers were asked what motivated them to diversify farming.

Responses from the farmers indicate that economic reasons were the main motivators. They are a combination of the rubber price drop (hence drop of household income), the need to have more stable and regular income and extra source of income. Below are some typical quotes from respondents:

> *"Mono-cropping is not enough for us. Farmers who plant only rubber have suffered when the rubber price is down. If you plant many plants you will have other crops rather than rubber that you can sell. " – Respondent 11*

> *"Even when the price of rubber drops, we still have other plants. I have three plants (rubber, coconut and durian). It is harder for the prices of these three will drop at the same time." – Respondent 20*

"To grow 2 crops means that I have income all year long" – respondent 19

"The income from selling rubber latex is not as good as it was. The price of rubber dropped drastically. The government said they will help increase rubber price. We have been waiting but it does not change, the price is still low. As farmers, we can't do anything. If I did not plant other crops, I would have been in debt." – Respondent 19

Other reasons for farming diversification included:

- Seeing market demand for other crops
- Family used to plant other crops
- Other crops (e.g. baegu) are less labour intensive
- Hobby
- Influence from friends and family members

3.2.4 Challenges of and Barriers to farming diversification

Difficulties experience by farmers who have diversified include: 1) lack of experience and knowledge, 2) price fluctuation of other crops and 3) irrigation system. Some exemplar quotes are below:

"The hardest period was the first phase of planting. I had never done it before, and I did not know what to do." – Respondent 2

"It was difficult when I first started. I planted durian like other cultivations which was watering them regularly and using fertilizers. Some of the durian tree died as I did not have lots of experience growing durian." – Respondent 19

"It was really difficult at first, because we had never grown durian before, and we were the first in our area. We did not start with lots of durian trees as we wanted to test it out first to see if it would work." – Respondent 20

Participants reported two major barriers to farming diversification: establishment costs and limited land as demonstrated in the exemplar quotes below:

"Actually, I wanted to plant durian but the cost of investment is very high. You need to pay for irrigation system, fertilizer, labour and harvesting."" – Respondent 9

"The most difficult moment was when I started to raise cattle because capital investment was expensive. The first flock of cattle (5-6 cows) costed 10,000 baht per cow. I had to borrow money to invest in this business because I did not have enough saving. I was really stressed to be in debt." – Respondent 11

"The investment required was really high, especially irrigation system. The first few years, I did not have irrigation system, so I used the same water sources as for rubber trees, but it did not work. Most of my durian trees died because it didn't have enough water." – Respondent 20

"The other farmers are not growing other crops because the land around this area has become more limited." – Respondent 19

Discussions with the RAOT and Rubber cooperatives suggest farmers' decision to diversify may also be hindered by some farmers' personal preference for more work-life balance as one of the participants commented:

"Rubber is sometimes called the lazy man's crop. Most rubber farmers in the South of Thailand hire tappers to tap and maintain rubber plantations. Some rubber farmers don't want to grow different crops because they want to rest."

3.2.5 Facilitators to farming diversification

Discussions with the RAOT and Rubber cooperatives suggest that more support from government, better market information and funding would enable rubber farmers to diversify more as commented by some of the workshop participants:

"The government has encouraged rubber farmers to grow other agricultural products, but never establishes a policy to help farmers explore markets these."

"The government has to support farmers for training, marketing, funding and processing."

The need for training and advice for farming diversification has been suggested by farmer respondents too.

"…. 's suggestion gave us confidence to plant durian"

"If anyone intends to start growing other crops, firstly it needs to have someone to advise them. Actually, it can be done by anyone without any advice, but it may be costly. It is better to have the opportunity to learn from experienced people. We will know what we should do and should not do. It would be better than learning by trial and error." – Respondent 2

"Before I started to plant oil palm, I learned to plant an oil palm from someone so when I started to plant oil palm as a business, I thought it is a good decision." – Respondent 11

4. Conclusion

In summary, the interviews and workshop discussions in Thailand seemed to corroborate findings from extant literature. Overall, the main barriers for rubber-based farming diversification are lack of skills and knowledge, lack of investment capacity, lack of land, and shortage of labour. Farmers' personal preference for an easy lifestyle may also contribute to the reluctance to diversify into other crops. To enable more rubber farmers to practice farming diversification, there is a need for better financing schemes to counter the investment, enhanced market access and extension services, more widely disseminated best practices and government policy to advice and incentivise farming diversification.

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