Emerging Smallholder Rubber Farming Systems in India and Thailand: A Comparative Economic Analysis

P.K. Viswanathan
Gujarat Institute of Development Research, India
Email: pkviswam@gmail.com

ABSTRACT

This paper provides a comparative perspective on the performance of smallholder rubber farm livelihood systems based on case studies of two regions in India and Thailand. The analysis of the emerging farming systems in the two countries' rubber farms reveals that the rubber monocrop system is viable, provided prices remain remunerative and primary markets efficient. Findings further indicate the dominant contribution of rubber production to the gross household income of the rubber growers in the integrated farming systems. Nevertheless, from a sustainable livelihoods perspective, the socioeconomic significance of the rubber integrated farming systems assumes greater prominence, given the fact that small producers are highly vulnerable to market uncertainties. It has been found that rubber integrated livelihood systems provide the smallholders with ample capability for resilience during crises and ensure a sustained flow of income. The two case studies demonstrate the need to promote and scale up rubber integrated farm livelihood systems in the smallholder-dominated rubber producing countries in the Asian region. The paper also recommends enhancing the capabilities of the smallholders by strengthening their access to the five forms of capital that sustain their livelihood.

INTRODUCTION

Rubber plantation agriculture has evolved as an estate-based system in the tropical Asian countries since the early 1900s, mostly under the patronage of Western colonialism. The total area planted to rubber all over the world has grown by 1.71 percent per annum, showing an almost three-fold increase during the last four decades, that is, from 3.88 million hectares (ha) in 1961 to 11 million ha in 2006. Though rubber is grown in more than 20 countries now, four countries (*viz.*, Indonesia, Malaysia, Thailand and India) who were also the pioneers in commercial rubber plantation development, continue to dominate in area (77%) and production of rubber (79%) in the world. These countries have also experienced rapid structural transformation in terms of growth of the smallholding sector under various socio-economic, political, and institutional contexts (Osman and Tan 1988; George et al. 1988; Barlow et al. 1994; Burger et al. 1995; Hayami 2002). Today, the smallholdings account for almost 90 percent of rubber production in Thailand; 89 percent in India and Malaysia; and

83 percent in Indonesia (Rubber Board 2004).

However, despite the common feature of smallholder domination, these countries differ in production systems and institutional arrangements, as evident from the predominance of a monoculture setup in Malaysia (Barlow 1996) and Southern India (Viswanathan and Shivakoti 2005) as against the co-existence of rubber agroforestry systems and the *Jungle rubber* system in Indonesia (Joshi et al. 2002; Belcher et al. 2004). In contrast, the cases of Thailand and North East (NE) India seem to be unique in terms of the emergence of rubber integrated farm livelihood systems (Somboonsuke 2002; Viswanathan and Shivakoti 2006). Of course, various factors, including institutional support and extension services provided by the respective governments, have stimulated the process of such transformation in these countries. More recent evidences from Indonesia and Thailand suggest that the emergence of rubber agro-forestry/ integrated farming systems illustrates the coping strategies adopted by the smallholders, primarily to overcome the 1997 financial crisis and the growing market uncertainties in the era of globalization (Budiman 1999; Somboonsuke 2001; Joshi et al. 2002).

OBJECTIVES AND DATA

The focus of this paper is to make an empirical analysis about the performance of emerging rubber integrated farming systems and their livelihood impacts on smallholders in NE India and Thailand. It assumes relevance in the absence of empirical analysis which compares rubber farming systems using the conceptual framework of sustainable livelihoods analysis (SLA) developed by the Department for International Development (DFID). Moreover, India and Thailand are the dominant rubber producers in the world with unique features of synergies and sharp contrasts in the organization of production, and institutional processes to develop and facilitate market interventions. In particular, the paper compares and contrasts the two regions in terms of: a) the socioeconomic and demographic characteristics of rubber smallholders; b) the institutional and organizational aspects of rubber farming; c) the performance of the rubber monoculture *versus* the integrated livelihood systems; and d) the impact on livelihood of the rubber integrated farming systems in both countries.

The empirical analysis uses farm household data gathered from 309 rubber growers located in the three Indian states of Assam, Meghalaya and Tripura, which are the dominant rubber-growing regions in the NE region. For Thailand, data are gathered from 106 rubber growers in the Hat Yai district of Songkhla province in Southern Thailand, which has the highest concentration of rubber smallholders. The farm-level data pertain to the period 2005–06. A structured schedule is used to gather data from the key informants in both countries. Besides, interactive and focus group discussions are also held with the other stakeholders, including the research, development, and extension personnel. The sampled farmers are drawn at random in consultation with the local rubber grower societies (RGSs) in NE India and the local rubber markets/ 'latex groups' in Songkhla.

The rest of the paper is organized as follows: The next section provides a brief discussion on the theoretical framework used for the analysis. This is followed by the presentation of the socioeconomic and demographic profile of the rubber smallholders in NE India and Southern Thailand. It also discusses the institutional processes underlying the development and expansion of rubber cultivation in the two countries and the organizational aspects of rubber farming. The main findings of the paper are contained in the comparative assessment of the rubber farming systems, and the impact of the integrated farming system on the livelihoods of rubber smallholders. The last section concludes the paper by reflecting upon the implications of the emerging rubber integrated farming systems in the two countries from the perspective of future policy and institutional interventions aimed at the sustainable livelihoods of the smallholders.

INTEGRATED RUBBER FARM LIVELIHOOD SYSTEMS: A CONCEPTUAL FRAMEWORK

The interface between rural household diversification and sustainable livelihood systems has received greater attention among academics and policymakers in recent times especially since the study by Chambers and Conway (1992). We start with Chambers and Conway's (1992) definition of livelihood as that which "comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base". The empirical literature mostly deals with the causal relationship between household diversification and sustainable livelihoods across countries and regions in an interdisciplinary analytical framework. Particularly, the studies by Carney (1998, 1999), Scoones (1998), and Ashley and Carney (1999) have been instrumental in developing the framework, which is widely known as the DFID framework for sustainable livelihoods analysis (SLA). Using this framework, Bebbington (1999) defines livelihood sustainability of households in terms of their access to five types of capital assets, *viz.:* a) natural capital; b) human capital; c) physical capital; d) economic or financial capital; and e) social capital.

Though scholars have used the DFID framework to explain the positive impact of household diversification on sustaining livelihoods in heterogeneous contexts, they do not provide a holistic perspective of farm livelihood systems in terms of measurement of the important livelihood assets. Such perceptible gap in theoretical and empirical research on the influence of household assets and their impact on sustainable livelihoods has been an important concern. However, more recently, there have been some scattered but important studies, which include: Zhen and Routray (2003), Shrestha and Shivakoti (2003), Perz (2005), Shivakoti and Shrestha (2005a & b), VanLoon et al. (2005), and Chowdhury et al. (2005). These studies have used the DFID conceptual framework to develop various indicators/ scales to measure the degree(s) of sustainability of the livelihood assets as discussed above.

Particularly, the studies by Shivakoti and Shrestha (2005a & b) and Chowdhury et al., (2005) are relevant here, as they provide more comprehensive and coherent analytical framework for assessing the livelihood assets. They derive index values for the five livelihood assets and represent them in terms of a livelihood asset pentagon, so as to indicate the relative strength and sustainability of livelihoods at different asset levels. Accordingly, the higher the values of the assets (points scored in a scale of values ranging from 0 to 1), the greater may be the sustainability of such assets of the households. Sustainability of the livelihoods has been assessed using a hypothetical ranking of the values into four on a scale of 0 to 1, namely: a) sustainable (0.8–1.0); b) moderately sustainable (0.6–0.79); c) less sustainable (0.40–0.59); and d) unsustainable (<0.40).

The above conceptual framework underlies the significance of the linkages between household diversification and asset levels and their cumulative effect on sustainable livelihoods in diverse socioeconomic and agro-ecological contexts. Hence, we use this conceptual framework with slight modifications to suit the specific context of rubber farming systems in India and Thailand. The modified conceptual framework as used in the present study is presented in Figure 1.

Figure 1 shows the interrelationship between the five forms of livelihood assets and their subcomponents, as possessed by the rubber growers in the two study regions. The human capital includes active labor stock (male and female) available for wage work with reasonable levels of literacy, good health, etc. Natural capital means the growers' access to land for cultivating rubber and other subsistence/food crops, and land for shifting cultivation (*jhumming*). It also relates to access to drinking water, and the availability of fish ponds for growing fishery, so as to enhance livelihoods. Physical capital includes access to infrastructure facilities, like roads; access to rubber and other agricultural commodity markets; and access to rubber processing facilities, and post-harvest technology in case of other crops, etc. Financial capital includes income from: rubber cultivation, off-farm activities (like fishery, livestock and poultry raising), wage work, salary, sales of minor forest produce, etc. Social capital signifies the smallholders' access to institutional support provided by the governmental agencies for growing rubber; access to technology, R&D facilities, and training in tapping and rubber processing; access to extension services, self-help groups (SHGs), rubber growers' societies (RGSs); access to social networking, gender equality in participation, information, and collective processes, among others.

PROFILE OF STUDY REGIONS AND RUBBER SMALLHOLDERS

In India, rubber was first introduced in the South Indian states of Kerala, Tamilnadu and Karnataka as early as 1902 by the British colonial powers. Since these regions had reached their saturation point in rubber cultivation with very limited scope for further expansion, the Government of India (under the aegis of the Rubber Board) launched rubber development programs in the North Eastern region (NER)

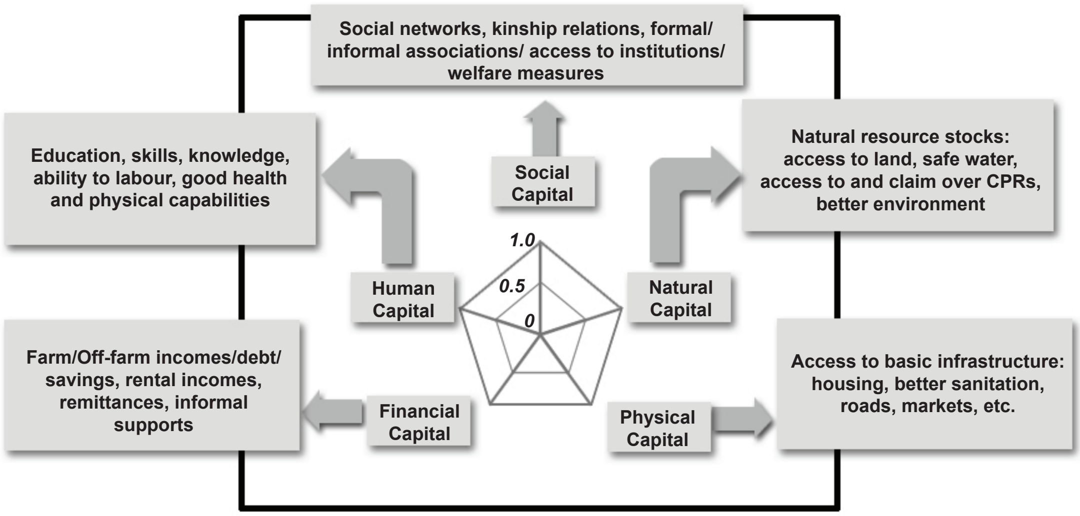

Figure 1. Linkages between livelihood assets of rubber smallholders

starting the late 1980s. The rationale for rubber expansion in the NER was to serve as an instrument for the effective rehabilitation of tribal communities in the region while meeting the ever-growing domestic demand for natural rubber.

Currently, the seven North Eastern states together make up the second largest area planted to rubber in the country at 71,840 ha (11.3%), and produce about four percent of the total output. Of the total rubber area in the NE region, Tripura accounts for 57 percent, followed by Assam (25%), Meghalaya (9.5%) and four other states (8%). Since Tripura, Assam and Meghalaya collectively account for 92 percent of total rubber area and 96 percent of rubber production in the NE region, these three states were chosen as the focus of the study. There are about 25,000 rubber smallholders spread over the three states, with Tripura accounting for 61 percent, followed by Assam (24%) and Meghalaya (15%). The average rubber holding size shows a relatively larger size of farm holdings in Tripura (1.18 ha) compared to Assam (0.85 ha) and Meghalaya (0.56 ha).

In Thailand, rubber was first introduced in the Trang province in Southern Thailand as an exotic plant brought in from Malaysia in 1911. Rubber smallholdings expanded rapidly in the 1930s, mainly controlled by the Chinese, Thai, and Thai Malays. The total rubber area in Thailand has increased from 0.4 million ha in 1961 to more than 2.05 million ha in 2004 with a concentration of area (86%) and production (88%) in the Songkhla province (Buncha 2002; Kosaisaevee 2003). Hence, the study was confined to the Songkhla region. There are about 0.14 million rubber smallholders in the Songkhla province operating 0.26 million ha of rubber farms with an average holding size of 1.94 ha. The total tapped area is about 60 percent of the total rubber-planted area in the country; its production in 2006 totalled 3.16 million tonnes.

The study uses cross-sectional data collected from 309 rubber smallholders from India's North Eastern states of Tripura (127), Assam (94), and Meghalaya (88); and 106 rubber growers from the Songkhla province in Thailand. The sample growers in India mostly belong to tribal communities, ranging from 74 percent in Meghalaya, to 62 percent in Assam, and 54 percent in Tripura. Majority of the tribal growers in Assam belong to clans such as the Rabha and Boro, and in Meghalaya, they belong to the Marak, Sangma, and Momin clans. On the other hand, majority of the farmers in Songkhla belong to the Phijit, Khlong Rang, and Namom communities. A comparison of the demographic and socioeconomic profile of the rubber smallholders in the two countries is provided in Table 1.

Table 1 shows that majority of the sample households are male-headed and the average age of farmers range from 50 years in Songkhla to between 40–46 years in NE India. Compared to Songkhla, farmers in NER do not have longer years of experience in rubber farming, probably due to the relatively recent introduction of rubber cultivation in the NER.

The share of economically active population is found to be higher in Tripura (63%) compared to Meghalaya (59%), Assam (57%), and the Songkhla (56%) regions. The average family size in the Indian states range from 6.3 members in Assam to 6 in Meghalaya and 5.92 in Tripura. Notably, Songkhla reports the lowest family size at 4.33. In the NER, farm-related activities other than rubber cultivation mainly include rice cultivation either in plains or hills, the growing of food and cash crops and vegetables, and the practice of shifting cultivation (*jhumming*) with different degrees of intensity. Majority of the rubber growers cultivate rice across the three NE states (71–77%). However, the proportion of farmers engaged in shifting cultivation is highest in Meghalaya (44%), followed by Assam (28%) and Tripura (23%). On the other

Table 1. Profile of rubber smallholders in NE India and Southern Thailand.

Farm household Characteristics	*Tripura (n=127)*	*Assam (n = 94)*	*Meghalaya (n=88)*	*Songhkla (n=106)*
1. Male-headed households (%)	93	91	92	87
2. Average age of the smallholder (years)	46.08	40.37	41.15	49.81
3. Experience in rubber farming (years)	12.95	10.68	10.20	24.71
4. Male family members (%)	53	47	54	52
5. Economically active population (%)	63	57	59	56
6. Average family size (no.)	5.92	6.28	6.09	4.33
7. Farmers growing rice (%)	71	77	77	25
8. Farmers practicing jhum cultivation (%)	23	28	44	---
9. Farmers growing other crops (%)	82	89	86	64
10. Average holding size (ha)	2.67	2.29	2.35	2.24
11. Average rubber area (ha)	1.81	1.52	1.49	1.97
12. Average rice area (ha)	0.34	0.46	0.37	0.14
13. Households with fishery (%)	48	46	57	5
14. Households with piggery (%)	26	54	64	6
15. Households with poultry (%)	59	69	66	37
16. Households with livestock (%)	65	64	70	31

Source: Farm Household survey (2005).

hand, in Songkhla, only 25 percent of the rubber growers cultivate rice, while majority (64%) report growing other crops, such as indigenous vegetables, fruit crops/ trees, etc. Majority of the households hold more than one rubber plot, the proportion of which varies from 64 percent in Meghalaya, followed by Tripura (56%), Assam (45%) and Songkhla (39%).

The extent of household diversification into farm and non-farm activities strengthens the livelihoods of small growers. Table 1 shows that majority of the growers in NE India have a diversified farm livelihood system which includes fishery, and raising of livestock such as swine, and poultry-raising. In Songkhla, the major household activities are confined to poultry (37%) and livestock (31%) alone. It may be noted that even before taking to rubber, the growers in the NER had been following such a diversified livelihood system from historic times. In contrast, urbanization has taken away much of the prime rubber lands in Songkhla region and the rubber farmers have been forced to grow fruit crops, vegetables, pineapple, medicinal/ herbal crops and others as intercrops, to meet their own and the market's demands.

Institutional and Organizational Aspects of Rubber Farming Systems in India and Thailand

The expansion of rubber cultivation in India's NE states has been promoted by the Government of India under the institutional aegis of the Rubber Board. The development programs comprise an array of R&D and institutional support activities, viz.: a) new planting and replanting grant of Rs. 20,000 per ha (US$ 444) for areas up to 5 ha, and Rs. 16,000 per ha (US$ 355) for areas above 5 to 20 ha; b) integrated rubber development programs at the village level; c) supply of farm inputs such as fertilizers, high-yielding planting materials, rubber rollers for processing rubber, smoke house, etc.; d) demonstration of agro-management practices; e) human resources development through the training of farmers in tapping and processing, and the formation of rubber growers' societies and women self-help groups, among others; f) quality-upgrading activities including the scientific post-harvest processing of latex into marketable forms of rubber, etc. (Rubber Board 2005). The planned setup is for the tribal communities to take up rubber cultivation work initially as wage workers in the plantations and earn their livelihood till the plantations start yielding (say 5–7 years). Once the plantations start yielding output on the 8th year of planting, the farms are transferred to the growers for permanent upkeep and management (Krishnakumar and Meenattoor 1999; Mohanan, et al. 2003). The economic life of a rubber plantation is expected to last for 20–25 years, which sustains the livelihood of smallholders.

Marketing of rubber is institutionalized through the licensing system regulated by the Rubber Board. Being the sole promotional agency for development of rubber in the region, the Rubber Board by itself has also been very active in the market through a network of rubber producers'/ growers' societies[1] (RPS/ RGS) and rubber marketing societies. Under such institutional arrangements, rubber growers sell their rubber (mostly in sheet form) to any of the above three sources depending on the price situation or proximity to such sources.

In Thailand, there are various institutions engaged in rubber development under the overall regulation of the Ministry of Agriculture and Co-operatives of the Royal Thai Government. The agencies are: a) the Rubber Research Institute, Thailand (RRIT); b) the Office of the Rubber Replanting Aid Fund (ORRAF); c) the Rubber Estate Organization (RES); and d) the Department of Agricultural Extension (Promdej 1986: 31).

The Department of Agriculture (DoA) through RRIT conducts research on all aspects of rubber development, including agro-ecological zoning, land suitability classification, technology transfer, rubber controlling act, etc. Another agency, ORRAF, is entrusted with providing planting grants for the establishment of rubber plantations on areas not greater than 14 rais (2.5 ha) at the rate of 4,621.5 Baht/rai, for a total period of 7.5 years corresponding to the immature stage of rubber cultivation. This financial assistance comes up to about 28,885 Baht per ha or roughly US$722 per ha). Another form of support is given by the Agricultural Land Reform Office (ALRO) which offers a 12-year long-term credit according to the needs of the farmers with not more than 7 rais at the rate of 6,250 Baht/rai (39,600 Baht/ha = US$ 990/ha), interest rate of 6 percent, and six-year grace period (Kosaisaevee 2003). Since 2003, the replanting assistance has been further scaled up to 73,00 Baht per rai (45,625 Baht/ ha = US$ 1,140/ha) paid over five and half years (ORRAF 2005, *personal communication*). Besides, raw rubber exporters are obligated to pay export duty or cess at the rate of 0.90 Baht/kg of the rubber exported. The cess will be credited to the account of the Rubber Replanting Aid Fund and in return it will be used as revolving fund for rubber research and farmers' replanting or new plantation establishment through the ORRAF.

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[1] The Rubber Producers Societies (RPS) are voluntary associations of small growers registered in 1986 under the Charitable Societies Act called the Rubber Producers' Societies (RPS). There are over 2200 RPS in the country working under the guidance of the Rubber Board. RPS function as self-help groups at the village level, each RPS having a coverage of 2-5 kms. RPS provides extension services, technology transfer, raising nurseries for the supply of high-yielding planting materials, processing and marketing of rubber, input and cash subsidies for new planting and replanting, availing of bank finance, welfare measures extended by the Rubber Board, etc. (Rubber Board 2005).

On the other hand, rubber marketing in the Songkhla province is facilitated through the operation of the Central Rubber Market (CRM), located in Hat Yai, the district headquarters. The market intervention by CRM aims at introducing an open and free rubber trading under systematic rules and regulations (Buncha 2002). The local rubber markets operate through various channels, involving the mobile trader, sub-village trader, village or district trader, provincial trader, and the smoking factory. The total rubber output is categorized into three grades, *viz.*, RSS (54%), Standard Thai Rubber (STR) accounting for 29 percent, and Latex Concentrate (LC) occupying 14 percent (RRIT 1999). However, after the 1997 economic crisis, there has been a significant shift in marketing from RSS to STR to meet the growing export demand, causing rubber smallholders to adjust their production (Tirasarnvong 1999). As a result, by 2004, the relative share of RSS had declined to 43 percent, while the share of STR increased to 36 percent and that of latex concentrate increased to 17 percent (Patanasirirak 2005).

RUBBER FARMING SYSTEMS: A COMPARATIVE ANALYSIS

A comparative assessment of the rubber farm livelihood systems in the two study regions is attempted here within the framework as discussed in the first section. First, an overview is presented of the synergies and contrasts of the production conditions prevailing in the two study regions. A life-cycle approach based on the discounted cash flow analysis is used to determine the financial performance of rubber as a monocrop system. This is followed by a discussion on the comparative economics of rubber monoculture *vis-a-vis* other farm livelihood systems. Finally, the sustainable livelihood outcomes of the rubber farm households are also analyzed for the two study regions.

Rubber Farming Environments in NE India and Thailand

In NE India, the rubber-growing areas differ in terms of topography, with a large percentage (30-36%) planted on combined hills and plains, followed by 16–32 percent on undulating lands, and 15–22 percent on gentle slopes. In Songkhla, on the other hand, 54 percent of the growers cultivate rubber mainly on the plains. The two regions also differ in terms of the property rights of the farmers; permanent land ownership is reported in Songkhla while a system of legal pluralism prevails in the NE states. The property rights in the NER are characterized by the communal ownership of the village commons especially in Meghalaya and Assam. Typically, the village commons are owned by the *Nokma* (*Gaon Bura*), the village head, who distributes the land for rubber cultivation to individuals based on the number of available workers in each tribal household (Viswanathan 2006).

The land use pattern in the study regions indicates that rubber occupies as high as 88 percent of the smallholder area in Songkhla, as against 67 percent in Tripura, 66 percent in Assam, and 63 percent in Meghalaya. Rice has the second largest area as a single crop, ranging from 20–13 percent in NE states compared to Songkhla (6%). The labor use pattern reveals that majority of farmers use family labor for rubber and other farming operations. It is highest in Meghalaya (76%) and Assam (74%), compared to Tripura (67%) and Songkhla (62%). Female work participation is highest in Songkhla (65%), compared to Tripura (25%), Assam (29%) and Meghalaya (38%). Women are mostly engaged in collecting the rubber latex and assisting the male family members in completing the daily tapping task.

However, a significant number of the farmers hire laborers for rubber tapping, a task that requires skill. The use of hired labor ranges from 38 percent in Songkhla to 26–18 per cent in the NE states. Tapping wages in the NE regions range between Rs. 1200 and Rs. 1800 per month (US$40–44). In Songkhla, tapping wages are based on a crop sharing contract system in which the rubber growers get 55 percent, with the remaining 45 percent going to the contracted tappers. However, the ratio shifts in favor of tappers (50:50/ 45:55/ 40:60) under situations of severe tapper shortage, owner absenteeism, inaccessible plots, or extremely harsh land conditions.

Rubber Monoculture vs Rubber Integrated Farming Systems

Three factors, namely, the share of tapped area, the number of trees tapped per hectare, and the average number of tapping days per annum, are important in determining the rubber yield in a rubber plantation. Table 2 provides a summary of the performance of the rubber farming systems in the two regions. The share of tapped rubber holdings is highest in Songkhla (94%), followed by Tripura (84%), Assam (77%), and Meghalaya (73%). Indirectly, this points to the age structure of the existing rubber holdings, which indicates that the proportion of younger rubber holdings is considerably lower in Songkhla (6%), compared to Tripura (23%), Meghalaya (27%) and Assam (16%). The average number of rubber trees available for tapping is more or less similar across regions, with the highest number in Meghalaya (394/ha) and the lowest in Tripura (367 /ha). The number of tapping days reported is relatively higher for Tripura and Assam (145-147 days/ annum), compared to Meghalaya (138 days/annum) and Songkhla (128 days/annum).

The comparison of costs of rubber farming reveals that Songkhla has the highest cost of rubber production at Thai Baht 23061 (THB) per ha compared to those in NE Indian states, owing to the crop share contract system that exists in Thailand. Since the imputed value of family labor is also included in the calculus, the cost of rubber tapping and other labor costs inflate the expenses in the Thai farms. The regular application of fertilizers, as well as the high material input costs, also explains the steeper cost of rubber production in Songkhla compared to the NE Indian regions.

Trends in rubber productivity reveal that Tripura has the highest yield of 1,238 kg/ha, followed by Assam (1,153 kg/ha), Meghalaya (1,043 kg/ha), and Songkhla (945 kg/ha). The rubber marketed in the NE regions is mostly in the form of graded sheet rubber. In Songkhla, however, rubber production and marketing underwent significant changes following the financial crisis and the launching of trade reforms. As a result of a change in the mode of processing, majority of their growers had shifted their output from conventional RSS graded sheet rubbers to latex which fetches a lower price. This, along with the system of crop sharing in rubber tapping, has affected the net profitability of rubber farming in Songkhla compared to the NE states. As the records show, the reported net profit is much lower at Baht 29,027 per ha[2] (US$726/ ha) in Songkhla compared to Tripura (Rs. 54,292 = US$1,206/ ha), Meghalaya (Rs. 45,519 = US$1,012/ha) and Assam (Rs. 44,427 = US$987/ ha).

The recent changes in Thailand that led to the marketing of rubber in the form of latex have had serious implications on the efficiency and performance of the smallholder farming

[2] The earlier studies by Buncha (2002) and Kosaisaevee (2003) in the rubber smallholder sector in Thailand had reported an annual income of 17,315 and 24,547 Baht per ha respectively from the rubber smallholdings, based on a plantation life cycle analysis.

Table 2. Comparative economic assessment of monoculture rubber farming system.

Descriptives	Tripura	Assam	Meghalaya	Songkhla
1. Rubber tapped area (ha)	177.10	119.36	95.72	195.40
2. Tapped area (% of total rubber area)	77	84	73	94
3. Rubber trees tapped per ha	367	388	394	378
4. No. of tapping days per plot	145	147	138	128
5. Fertiliser use per ha (kg.)	178	146	135	339
Cost components (Rs./Baht)[a]				
1. Cost of fertilizer per ha	926 (8)	672 (4)	685 (6)	2,215 (10)
2. Organic manure cost per ha	795 (7)	1020 (6)	854 (8)	---
3. Cost of plant protection per ha	463 (4)	712 (4)	286 (3)	1239 (5)
4. Tapping cost per ha	6,305 (57)	10,794 (67)	6,912 (63)	14,036 (61)
5. Other labour costs per ha	1,405 (13)	1,548 (10)	1,027 (9)	845 (4)
6. Material costs per ha	1,131 (10)	1,336 (8)	1,248 (11)	4,726 (20)
Total costs per ha	11,025	16,082	11,012	23,061
Output, prices and profit (Rs./Baht)				
1. Latex yield (wet weight)/ ha (kg)	---	---	---	2,496
2. Latex yield (dry weight)/ ha (kg)	---	---	---	835
3. Dry Rubber Content (DRC - %)	---	---	---	33.45
4. Avg. latex price (per kg/ DRC)	---	---	---	52.06
5. Dry rubber (per ha)[b]	1238	1153	1043	945
6. Average rubber price (per kg)	52.76	52.48	54.2	55.12
7. Value of output per ha	65,317	60,509	56,531	52,088
Net profit per ha	54,292	44,427	45,519	29,027
Net profit per ha (US $)	1,206	987	1,012	726

Note: 1 USD = Rs. 45; 1 USD = 40 THB; [a] Imputed value of family labor is considered for tapping and other labor costs; [b] Represents the weighted average yield; Figures in parentheses are respective shares in total cost of production.
Source: Farm Household survey (2005).

systems and the marketing interventions by the state. The local latex markets operated by private individuals are spread across the region and operate as agents of processing factories. Though the measurement of the dry rubber content (DRC) in rubber latex is done at the point of latex sales, the local latex market operators ensures a margin out of the rubber transaction by undercutting the DRC levels— a matter which has largely been taken for granted by the smallholders since they receive the cash for their produce on the spot. The price received by the smallholders is thus highly distorted through the manipulations in the DRC measurements, thus leading to a lower net profitability. The average DRC level reported at 33.45 percent implies that although the rubber growers sold an average wet weight of 2496 kg/ha, they got paid only for the dry weight equivalent of 835 kg/ ha (Table 2). Since majority of the smallholders in the Songkhla region now sell rubber mainly as latex to the local markets, they stand to lose significantly.

Monoculture rubber farming: a cash flow analysis. While static analysis for a given year/ period is more appropriate for seasonal and annual crops, perennial crops like rubber require inter-temporal analysis (Rae 1977). Hence, to account for the value of time and include the concept of time preference, a cash flow analysis of monoculture rubber farming system is attempted here following the discounted cash flow approach (DCFA) as suggested in Predo (2003) and Brian et al. (2004). Since the collection of time-series data pertaining to single farm holdings is difficult, the analysis uses the life cycle data generated based on the cross-sectional information from rubber holdings of different ages to approximate the entire plantation life cycle. All cost items are considered, including the initial plantation development costs, as well as the routine agro-management costs for weeding, fertilizer application, tapping, etc. for each region. The NPV of cash flows has been computed as:

$$\text{NPV} = \sum_{t=0}^{T} \frac{\left(B_t - C_t\right)}{\left(1+r\right)^t} \qquad \text{(Eq.1)}$$

where: B_t = Income from rubber farming in monetary terms at time *t*, C_t = cost for rubber farming at time *t*, *r* = discount rate, *t* = time (years) where observation is noted, and T = the entire life of the plantation across the regions (18-29 years), comprising a seven-year period of immaturity, followed by 22 years of rubber production.

The analysis considers two discount rates: 7.5 % which is the market rate of interest, and 12 %, which is the standard commercial rate, as also observed in the analysis of agro-forestry projects (see also Nadkarni 2001) in India. The internal rate of return (IRR) is used here to evaluate the overall feasibility of the monoculture rubber farming system across the study regions. Derivation of the IRR is analogous to solving for '*r*' in equation 1, as shown below:

$$0 = \sum_{t=0}^{T} \frac{\left(B_t - C_t\right)}{\left(1+r\right)^t} \qquad \text{(Eq. 2)}$$

The results of the cash flow analysis are summarized in Table 3.

The Table reveals that the survival period of the rubber holdings differs from 29 years in Songkhla to 18 years in Meghalaya, which is inclusive of the unproductive period of 7–9 years. As the tapped rubber holdings in Assam and Meghalaya fall in the initial years of the productive phase, the important parameters of economic performance, i.e., BCR, NPV and IRR, are reportedly low for these regions compared to the Tripura and Songkhla regions. The highest performance indicators have been

Table 3. Cash flow analysis of monoculture rubber farming system.

Descriptives	Tripura	Assam	Meghalaya	Songkhla
1. Life of the holding (years)	26	19	18	29
2. Cumulative costs (undiscounted) per ha (US$)	4,801	5,156	4,325	17,033
3. Cumulative benefits (undisc.) per ha (US$)	25,019	10,167	8,027	52,170
4. NPV (undiscounted) per ha (US$)	20,219	5,011	3,703	35,137
5. Benefit cost ratio (BCR)	4.17	1.59	1.25	2.45
6. Discounted costs (US$/ha –@ DF -7.5%)	2,304	2,848	2,308	7,917
7. Discounted benefits (US$/ ha -@ DF -7.5%)	11,162	5,233	4,081	23,243
8. NPV (US$/ha - @ 7.5%)	8,858	2,385	1,773	15,326
9. IRR	9.63	24.90	22.54	37.57
10. Discounted costs (US$/ha –@ DF 12%)	1,786	2,231	1,828	6,116
11. Discounted benefits (US$/ ha -@ DF -12%)	8,449	3,982	3,162	17,638
12. NPV (US$/ha - @ 12%)	6,663	1,751	1,334	11,522

Source: Farm Household survey (2005).

reported for smallholdings in Tripura, followed by Songkhla, Assam, and Meghalaya.

Overall, the analysis indicates that the rubber monoculture system by itself is a viable system, provided rubber prices are remunerative throughout the entire life cycle and the marketing practices remain efficient. The analysis also reveals that though the rubber farming system in Songkhla shows higher NPV at both discount rates, its IRR is lower than that achieved in Tripura. The lower returns accruing to the farmers in Songkhla have been due to the disadvantageous in terms of the crop-sharing arrangements, as well as the irregular methods of determining the dry rubber content at the local markets. The lower profitability of rubber farming in Songkhla can also be explained in terms of the higher opportunity costs of labor, which has led to the emergence of a wage payment system based on crop sharing.

Rubber integrated farm livelihood systems: comparative assessment. The above scenario warrants a comprehensive analysis of the diversification strategies adopted by the rubber smallholders across regions in view of the uncertainties that persist especially in the case of commercial crops like rubber, which is highly vulnerable to price fluctuations in the era of market integration. Hence, this section makes a comparative assessment of the prevailing rubber integrated farming practices of the growers. Table 4 gives a summary of the relative profitability of the integrated farm livelihood systems in the selected rubber-growing regions.

While rubber and livestock combinations fetch the maximum household income in Tripura and Assam, in Meghalaya, rubber and fishery provides the highest income. In Songkhla, the integration of rubber with fruit crops and indigenous vegetables cultivation offers the highest household income. However, it is important to note that income from rubber cultivation occupies the dominant share in all the combinations in view of the relative profitability and stability in cash flow of rubber production *vis-à-vis* other cropping and livelihood activities.

In addition, it would be significant to point out that more than offering as potential sources of income, these farm livelihood combinations amply contribute to the households' resilience during crises and ensure the subsistence of the smallholders. Moreover, their impact on livelihoods is mostly in terms of making the households less dependent on the market for

Table 4. Rubber monoculture vs rubber integrated farm livelihood systems.

Type of farming system	Tripura		Assam		Meghalaya		Songkhla	
	Income	Rank	Income	Rank	Income	Rank	Income	Rank
1. Rubber monocrop	54,292	7	44,427	7	45,519	7	29,027	7
2. Rubber + fruit + agriculture	57,057	5	47,672	5	49,837	4	44,811	1
3. Rubber and poultry	55,715	6	45,807	6	46,764	6	31,314	6
4. Rubber and livestock	60,325	1	50,288	1	51,316	2	42,948	2
5. Rubber and rice	58,080	4	49,412	3	49,595	5	32,775	5
6. Rubber and fishery	58,466	3	47,733	4	51,502	1	40,476	3
7. Rubber and piggery	59,398	2	50,193	2	51,030	3	37,187	4

Note: Income is expressed in Rs. per ha per annum for NE India and Thai Baht for Songkhla
Source: Farm Household survey (2005).

the purchase of these items. One of the most explicit positive impacts of such integration process, as reported in the NE regions, is that using the income from rubber, the tribals could avoid the `distress sale of paddy' which they usually resort to in the course of producing traditional crops. Whereas they used to sell rice previously during times of distress, they are now able to keep rice as a buffer to meet their own future consumption requirements. Similarly, since rubber offers a regular income, these farmers engage in other activities such as piggery, poultry-raising and fishery mainly to meet their own consumption requirements, after which they sell the surplus.

Rubber Farming Systems and Sustainable Livelihood Outcomes

The findings presented in the foregoing analysis on the relative performance of combining various livelihood options with rubber cultivation in the selected regions provide a case in point favouring the promotion and wider scaling up of rubber integrated farming systems. There are also evidences from other rubber-producing countries, like Indonesia and Malaysia, attesting to the growing prominence of rubber integrated farm livelihood and agroforestry systems. Empirical evidences suggest the economic dynamism imparted by rubber-based agroforestry systems in Indonesia where the traditional shifting agriculture is dominant[3].

The following section compares the sustainable livelihood outcomes of the rubber smallholder systems in the study regions. The analysis attempts to measure the various components of the five types of capital assets of the rubber smallholders.

The various constituents of the five forms of capital assets, as considered here, are represented as indices. The indices have been derived based on different methods, such as dividing the individual scores by simple averages, or obtaining the standard deviation of the entire series or the highest values observed for a particular series. In cases where farmer responses are binary (0, 1), the indices have been taken as the simple average of the series. In deriving the values of indices, we have followed the measurement procedures as discussed in Shrestha and Shivakoti (2005a and b), VanLoon et al. (2005), and Chowdhury et al. (2005).

First off, the indices representing human capital assets include the following variables, namely: a) experience in rubber farming; b) educational status of the head of the household; c) family labor availability; d) gender participation in rubber farming; e) children's education; and f) annual household expenditure on healthcare. To derive natural capital assets, the indices considered are: a) the rubber-grown area owned by the smallholder; b) the quality

[3] Dove (1993) reported that rubber was well integrated into the Bornean systems of swidden agriculture in Indonesia. While rubber occupied a distinct niche in the farm economy and catered to the need for market goods, the shifting cultivation fulfilled the subsistence requirements. The `jungle rubber' as widely prevalent in Indonesia (Gouyon et al., 1993; Angelsen 1995; Penot and Wibawa 1997; Joshi et al. 2002) is another example of the rubber agroforestry integration. Rubber agroforestry systems in Malaysia are integrated with fruit trees, bamboo, poultry, vegetables and other short-term crops as well as animal rearing (Arshad 2000). Studies also indicate that tree crops like rubber enable the tribal communities to secure property rights over land (Barlow and Muharminto 1982; Cramb 1988; Shepherd 1991; Suyanto et al. 2001) and thereby overcome the economic consequences arising from harvest failure/ harvest shortfalls in shifting cultivation (Ward and Ward 1974; Chin 1982; Best 1988; King 1988). Studies from Bangladesh also report that the adoption of diversified cropping systems along with innovative elements of modern rubber farming systems have been beneficial and rewarding as the previously shifting cultivator farmers have tended to be less dependent on forests and other CPRs for eking their livelihood (Dendi et al. 2005; Nath et al. 2005).

of land; and c) access to safe drinking water. Physical capital assets are measured using the index of market access and the access to a rubber processing facility. Financial capital assets are measured as indices of: a) income other than rubber farming (wages, salaries, farm–off farm income); b) savings; and c) value of household assets (both essential and semi-luxury items). Social capital assets are measured using these indices: a) access to R&D and institutional support (planting grant for new planting or replanting, subsidy for inputs, plant protection, etc); b) access to training in rubber tapping and processing; c) access to extension activities; and d) access to local development institutions, cooperatives/ SHGs, etc.

The indices so derived range from 0 to 1 with the higher values indicating the greater strength of the livelihood assets of the rubber growers. In order to determine the sustainability of the different livelihood assets, we use a hypothetical ranking of the values derived for the indices. Accordingly, we classify the values of capital assets into three classes on a 0–1 scale. Thus, we categorize the capital asset as highly sustainable if its overall score ranges from 0.67 to 1; moderately sustainable, if the value ranges from 0.34 to 0.66; and unsustainable if the value falls between 0 and 0.33. The values of the indices representing the five livelihood capital assets are shown in Table 5.

Table 5 shows that the access to, and control over natural capital assets enable the livelihoods of the rubber smallholder households to be highly sustainable as compared to the rest of the capital assets. Financial capital assets status appears to be rather weak and unsustainable for all the regions, which suggests that the income realized from rubber farming and other integrated activities is inadequate or not effectively utilized by the growers for building up or strengthening the economic or financial asset status. Human capital values are moderately sustainable for all regions, except Assam. Physical capital values also appear to be moderately sustainable for all the regions.

Though the values for social capital assets show moderately sustainable levels for all the regions, it is found to be lowest for Songkhla (0.48). This denotes the relatively weaker performance of institutions and institutional support mechanisms available to smallholders in the region. The values of the capital assets are plotted in terms of a radar diagram, representing the livelihood assets pentagon (Figure 2). Thus, it emerges from the analysis that though the rubber growers are relatively better off in terms of access to natural capital assets like ownership of rubber area and quality lands, the sustainability of the same is rather constrained in all the regions. For instance, in NER, the access to rubber landholdings is

Table 5. Values of the livelihood capital assets of the rubber smallholders.

Capital assets	Tripura	Assam	Meghalaya	Songkhla
1. Human capital	0.38 *(2)*	0.27 *(3)*	0.35 *(2)*	0.41 *(2)*
2. Natural capital	0.73 *(1)*	0.78 *(1)*	0.83 *(1)*	0.70 *(1)*
3. Physical capital	0.57 *(2)*	0.*46* (2)	0.48 *(2)*	0.52 *(2)*
4. Financial capital	0.33 *(3)*	0.28 *(3)*	0.26 *(3)*	0.38 *(2)*
5. Social capital	0.56 *(2)*	0.54 *(3)*	0.63 *(2)*	0.48 *(2)*

Note: Figures in parentheses indicate the hypothetical scores of sustainability of the assets. Accordingly, 1= (0.67-1) highly sustainable; 2 = (0.34 – 0.66) moderately sustainable; 3 = (0-0.33) unsustainable.
Source: Farm Household survey (2005).

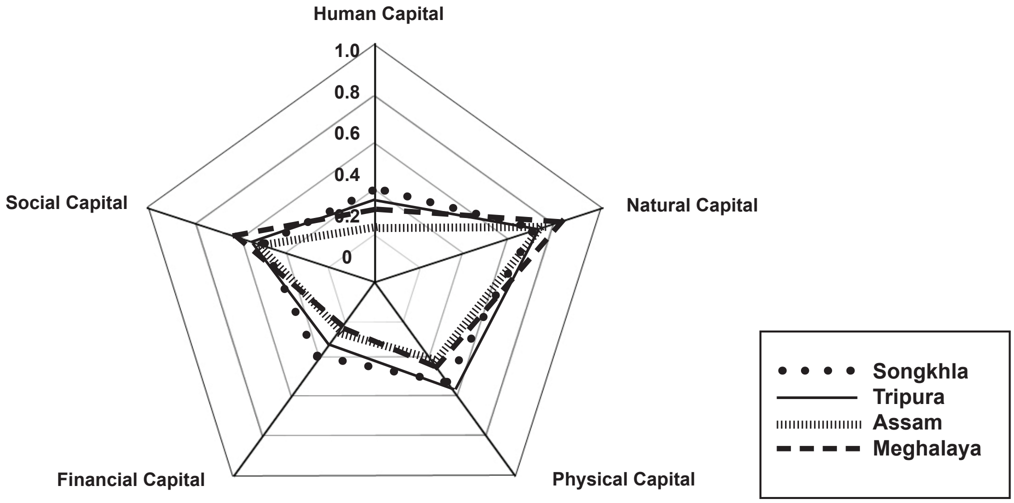

Figure: 2. Livelihood asset pentagon of rubber smallholders

contingent upon agro-climatic suitability factors as well as the prevailing property rights regime, which does not provide tenurial security for most of the growers. Given this, an increase in population, coupled with the increasing demand for land for rubber area expansion stimulated by its profitability, may adversely affect the sustainability of the natural capital assets. In Songkhla, a major proportion of the rubber holdings is very old and would need significant institutional support to launch replanting programs. However, in view of the weaker institutional arrangements, the sustainability of replanting programs is in doubt. Moreover, since rubber landholdings are also facing stiff competition from high opportunity values arising from the urbanization process, the pace of replanting program may be rather slow, adversely affecting the sustainability of the livelihoods of the smallholders in the region.

CONCLUSIONS AND POLICY IMPLICATIONS

The paper offered a comparative assessment of the emerging rubber farm livelihood systems in Northeastern India and Southern Thailand. The findings indicated that the emerging integrated farm livelihood systems could be considered as manifestations of the coping strategies adopted by the small and marginal rubber farmers to face the challenges brought about by market uncertainties and changing policy regimes. The economic analysis of the rubber farming systems also revealed that producing rubber as a single crop was a viable option as long as the prices remained remunerative and marketing arrangements were efficient. However, the new marketing practices that have developed in the local latex markets and the resultant manipulations in the DRC measurements in the Songkhla region have been observed to have deleterious effects on the returns from rubber farming. These, along with the prevailing contractual arrangements in rubber tapping, and the greater dependence on rubber for livelihoods among the households, appeared to make rubber farming system less viable, especially in the case of Thailand. These imperfections in the primary rubber markets need to be corrected, in this case by devising appropriate technological solutions to determine DRC at the farm level.

Although the economic analysis of rubber smallholders pointed to the dominant contribution of rubber cultivation in the gross household income, the increasing importance of the emerging rubber integrated farming systems assumed greater significance. Evidence showed that various combinations of rubber and other crops or activities amply contributed to the households' capacity for resilience and ensured the sustainability of their livelihoods, in both rubber-growing regions. Viewed from this perspective, there is a strong case for further promoting and scaling up the rubber integrated farm livelihood systems in the smallholder-dominated rubber-producing countries in Asia, in general, and NE India and the Southern Thailand, in particular, to make significant and sustainable impacts on smallholder livelihoods.

The analysis also highlights the need to strengthen the smallholders' access to different forms of capital assets. Especially in the case of India's NE region, the sustainability of the rubber growers' natural capital assets depends on their access to secure property rights over rubber-grown areas, which presently are allotted for rubber cultivation under certain conditions. This necessarily calls for policy and institutional interventions to secure the appropriate property rights of the smallholders. Similarly, in the Songkhla province, the sustainability of smallholder systems call for revamping and strengthening of the prevailing institutions along with provision of financial incentives for replanting and achieving transparency and efficiency in rubber marketing. The study also offers a conceptual framework for better understanding, analyzing, and comparing the rubber integrated farm livelihood systems taking shape in the newly emerging rubber-producing regions of Laos, Vietnam, Cambodia, and Myanmar. Considering the strategic role of rubber as a raw material as well as the socioeconomic significance of the emergent rubber integrated farming systems in the global scenario, the paper also makes a case for evolving country- and region-specific institutional regimes and R&D interventions aimed at the sustainability of rubber smallholder systems in the era of globalization and market uncertainties.

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