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RUBBER-BASED FARMING SYSTEMS IN THAILAND : PROBLEMS, POTENTIAL, SOLUTIONS AND CONSTRAINTS

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ABSTRACT

In dealing with the economic crisis of 1997, rubber-based small holders, along with many other farmers in Thailand, looked for ways to ease their problems. A variety of approaches were found, but a number of constraints in implementing these solutions were also encountered, which reduced farm productivity and decreased the farmers' ability to implement these solutions. Constraints included low production quality, low selling price (the most serious problem), deficient capital for investment, disease and pest problems, deficiency of input factors, and also high cost, inefficient local marketing systems, a generally low level of knowledge of agricultural production in general, shortage of water resources in many areas, low soil fertility, shortage of family labour.

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and poor local government extension services. Proposed solutions to these constraints include price insurance, a local capital investment fund, better technology transfer, an improved farmers' credit system; and improved infrastructure and financial incentives.

* * *

Introduction

The economic crisis of 1997 resulted in many changes to the rubber industry in South-east Asia. The small holding sector has become increasingly prominent in both hectares and production. More than 70 per cent of the world's Natural Rubber (NR) production comes from small holding sector (Kok, 1996), and in Thailand, Malaysia and Indonesia, 72 per cent, 74 per cent and 76 per cent, respectively, of total rubber production comes from the small holding sector using various cultivation patterns (Burger and Smith, 1999). In Thailand, there are some 800,000 rubber growing farms, of which some 744,000 are small holdings (RRIT, 1999). The major effect of the economic crisis was to change the main production from Ribbed Smoked Sheet (RSS) to Rubber Block to meet market and industrial requirements (Tirasrunvong, 1999). And also, under economic crisis, small holding farms in Thailand, as in Malaysia and Indonesia, have faced many constraints due to price fluctuation, capital inefficiency, shortage of labour, lack of access to credit, inefficient market systems and inefficient local-level small holders' groups (Penot, 1999). This indicates that small holders in Southeast Asia's rubber producing countries, especially Thailand, act on their own and are apparently unable to help themselves or to improve farm efficiency and productivity. Thus, this research has attempted to (1) determine the main constraints to small holders attempts to improve their farms, and their causes; (2) examine possible solutions for the small holder's adoption of better growing methods, and (3) suggest possible solutions to increase the productivity and income of rubber small holdings.

Current system of small holding rubber-based farms

In the southern region, Thailand, there are six main types of small holding rubber-based farming systems as classified by Somboonsuke and Shivakoti in 2000, based on their study of three communities: Khao Phra, Phijit and Klong Phea in Songkhla Province, Thailand. Their classification was based on the criteria of the individual farm's agricultural production activity, the socio-economic structure of local rubber small holders and agro-ecozone of rubber cultivation as suggested by Trebuil et.al in 1993 and Conway in 1985. They described the characteristics of the main small holding rubber-based farming systems as follows (summarised also in Table 1).

Type R₁: Small holding rubber-monoculture farming system

Rubber production is the major occupation of the farmers. In the study area these farms comprised 21.3 per cent of the total of 807 farm households studied. Rubber replanting is supported by the government, and high technology is usually used for breeding, plantation technique, and management. High yield varieties of rubber are grown, i.e. RRIM600, BPM24 and Songkhla 36 (Nissapa *et.al.*, 1994). There is low efficiency due to the diversity in management, lack of labour especially during tapping period, high cost of production and off-farm employment opportunities. However, most of the small holders of this type still maintain their rubber holding because growing rubber has been a part of their lifestyle for many years in southern Thailand (Ivanoff and Roux, 1989).

Type R₂: Small holding rubber-intercrop farming system

The majority of farmers in this farm type are those who have participated in the Office of Rubber Replanting Aid Fund's (ORRAF) replanting programme. They receive support during the initial unproductive period (0-36 months). Approximately 26.36 per cent (1,007 farms) of the surveyed farms fall into this category. Normally, crops as intercrops are

pineapple, rice, corn, and vegetables (Laosuwan, 1987; Bulanathum, 1999). The decision to intercrop depends on a number of factors such as soil and terrain conditions, marketing and labour availability. When the rubber plants reach more than 36 months old, small holders change the farm's cultivation pattern to other types of rubber-based farming for a sustainable family income (Thungwa, 1995).

Type R₃ : Small holding rubber-rice farming system

These comprise 33.69 per cent (1,287 farms) of the total small holding farms. Normally, there are two patterns: (1) rice is grown between immature rubber rows, as intercropping; and (2) rice is grown in a different sector within the rubber plantation. Normally, the small holder's experience in rice farming is derived from their ancestors and they use both high-yield and indigenous rice strains but the rice is only for family consumption. In the future, this type may decline due to many constraints such as a shortage of family labour, the high cost of inputs and uncertain prices (DOAE, 1998).

Type R₄ : Small holding rubber-fruit tree farming system

Intercropped fruits are economically valuable fruits of southern Thailand, which include durian, rambutan, rongkong, champada. Normally several types of fruits are grown. These represent 11.09 per cent (424 farms) of the total rubber growers and fall into two patterns of plantations: (1) Rubber multi-cropping. Fruit trees are cultivated in the same plot as rubber, that is, grown between rubber rows. (Nissapa *et al.*, 1994). The objective is to harvest fruit at the same time as rubber production, although farmers tend to postpone the rubber collection if the price of fruit is higher than rubber; and (2) Rubber and orchard. Fruit trees grow in a separate section of the rubber plantation. These farmers are normally more experienced and skilled in fruit tree cultivation than rubber multi-cropping farmers and this pattern is more like a normal business. It also requires a higher capital investment and more family labour. Constraints on this pattern include water shortages, complex management, and deficiency of capital for investment.

However, this pattern has yielded the highest economic performance due to greater farm income than other farm types.

Type R₅ : Small holding rubber-livestock farming system

A very small proportion, some 2 per cent (75 farms) of the total rubber farmers use this system. Livestock are normally reared within both immature and mature rubber areas. Types of livestock include cows, poultry, swine, goat and sheep. The main constraints are the high cost of production and a deficiency of farm labour and feed. In immature plantation, the rubber plants normally must be above 2m in height and at least 18 months old before livestock raising commences. Usually, the average number of livestock ranges between 6-8 animals per hectare. Small holders of this type normally have many years of experience in livestock raising; however, livestock under rubber is only a supplemental occupation to enhance the family income (RRIT, 1999).

**Type R₆ : Small holding rubber-integrated farming system
(or rubber-integrated activity farming system)**

These comprise 5.77 per cent, or 220 farms. There are four patterns: rubber-fruit tree-livestock, rubber-rice-livestock, and rubber-rice-fruit tree and rubber-fruit tree-fish. The main constraints facing these farms are a shortage of family labour, fluctuating prices, deficiency of capital for investment and lack of management skills. However, this is one of the better alternatives for increasing family income due to its excellent economic performance.

Methodology

By purposive sampling we selected 26 representative small holding rubber-based farms representative of the six main types, just described (Somboonsuke and Shivakoti, 2000). The sampling was from three communities in Songkhla Province: Khao Phra, Phijit and Klong Phea communities. Our criteria for selection were: (1) all communities were a

Table 1 : The number and percentage of small holding rubber-based farming system in three communities, 1999

Farming System Type	Agro-ecozone I Khao Phra Community		Agro-ecozone II Phijit Community		Agro-ecozone III Khong Phea Community		Total No. of Farms	Percentage
	No. of Farms	Percentage	No. of Farms	Percentage	No. of Farms	Percentage		
	1. Rubber-monoculture Farms (R1)	434	22.60	149	16.30	224		
2. Rubber-intercrop Farm (R2)	578	30.00	196	21.40	233	23.20	1,007	26.36
3. Rubber-rice Farm (R3)	374	19.40	466	50.90	447	44.60	1,287	33.69
4. Rubber-fruit Tree Farm (R4)	376	19.70	16	1.70	32	3.30	424	11.09
5. Rubber-livestock Farm (R5)	31	1.60	14	1.50	30	3.00	75	1.96
6. Rubber-integrated Farm (R6)	130	12.70	75	8.20	15	1.50	220	5.77

Source : Secondary data and key informant technique.

target area of the provincial rubber development plan, according to the Rubber Development Strategic Plan 1999-2003; (2) they all had at least several rubber-based farm types; (3) each community had a large number of small holdings, more than 70 per cent of which were involved with rubber production; (4) there was appropriate topography for comparison of farms between agro-ecozones; and, (5) small holders, in all three communities, faced various constraints from the production system (Department of Agricultural Extension, 1999). To study the functioning of rubber small holdings both secondary data and Rapid Rural Appraisal (RRA) with a semi-structured interview form (Trebuil *et al*, 1983 : Conway, 1985), identifying constraints to rubber production and their causes that the small holders have faced in their operation, and also, identification of the potential solutions to these constraints. We also used Problem Tree Analysis techniques with a farm group, secondary data, and Strategic Factor Analysis Summary (SFAS) techniques (Turban and Meredith, 1981).

FUNCTIONING OF SMALL HOLDING RUBBER-BASED FARM AGRICULTURAL PRODUCTION SYSTEMS

We compared the small holding APS among the six identified types of small holding rubber-based farming systems (Somboonsuke, and Shivakoti, 2000) undertaken in terms of farm objectives, farm implementation strategies, and farm constraints (summarised in Table 2).

FARM OBJECTIVES

All small holdings have a main objective of increasing productivity. Increased yield and biodiversity are also important in rubber-fruit operations. The use of new farming practices and technology aid such objectives. Sustainability is also a concern of most.

FARM IMPLEMENTATION STRATEGY

All small holding farms use a similar fertiliser for rubber in the 15-15-15 formula due to its widespread availability in the local area. They also

use this formula for fruit trees. For crop breed, all of small holding farms used a high-yielding breed of rubber. They also used indigenous breeds of rice due to their appropriateness for the local area (resistant to local diseases). Under the small holding rubber-livestock farming system, small holding farms use both high yielding breeds and indigenous breeds. The majority of systems use chemical treatment especially for cattle, goat and poultry. The results show that the greater a farm's biodiversity, the more opportunity use of chemicals; especially this is true of the small holding rubber-fruit tree farming system and the small holding rubber-integrated farming system as they have more to manage in practice than other systems. All small holdings use natural sources of water such as rain or underground pools, since irrigation is not available in their area. In small holding rubber-fruit tree farming system, the mixed fruit tree crop is the most widespread found in the study area, since small holders can harvest all year, making this system more profitable than other systems (Somboonsuke and Shivakoti, 2000). In the small holding rubber-rice farming systems, especially in different plots of the rubber area, there are two patterns of planting - transplanting of paddy seedlings and broadcasting of seed. In the small holding rubber-integrated farming system (which some call the small holding rubber-integrated activity farming system), farmers use one of four main patterns of farming system: (1) rubber-fruit tree-livestock, (2) rubber-rice-fruit-livestock, and (3) rubber-fruit tree-fishery and (4) rubber-rice-fruit tree.

FARM CONSTRAINTS FACED

All small holding farms face the main constraints of low production and prices, diseases and pests due to the use of vulnerable breeds (i.e. RRIM 600), and insufficient capital for farm investment. In addition, the results show that the small holding rubber-fruit tree farming system and the small holding rubber-integrated farming system face more constraints than other small holding farms.

Table 2 : Comparison of Small Holding Rubber-based Farms' APS in Songkhla Province

Farming System	Farm's Objectives and goals	Implementation Strategy	Constraints
(1)	(2)	(3)	(4)
(R ₁) Small Holding rubber monocultured farming system	Increase farm income and maximise farm production	<ul style="list-style-type: none"> * The fertiliser is formula of 15-15-15 two times/year * The membership of farmer's group for bargaining price in local market * Use chemical for weed control 	<ul style="list-style-type: none"> * Low product and price (Rubber) and * Insufficient capital for farms investment * Disease pest (non-resistance Rubber breed such as, RRIM600GT1)
(R ₂) Small holding rubber intercrop farming system	Increase farm income and maximise use of farm area	<ul style="list-style-type: none"> * Use fertiliser 15-15-15 and also, use manure * Use chemical control * Crop as intercrop; pineapple, corn, rice, vegetable and mug bean * Use natural water resource, rainwater 	<ul style="list-style-type: none"> * Insufficient capital for investment * Disease and pest * Deficient input factor * Low production price and quality * Deficient production knowledge

Table 2 : (Contd.)

(1)	(2)	(3)	(4)
(R ₃) Small holding rubber rice farming system	Increase farm income and maximise farm product towards sufficient standard of living	<ul style="list-style-type: none"> * Use fertiliser (15-15-15 for rubber and 16-20-0 for rice * Two patterns of rice plantation: transplanting of paddy seedling and paddy is sown without transplanting * Fertilisation : two times/year of rice plantation * No use chemical * Use indigenous breed (rice) that is resistant to environment and high product 	<ul style="list-style-type: none"> * Disease and weed * The shortage of family labour * Low product price (rice) * Deficient water resource and non-appropriate soil (low soil fertility)
(R ₄) Small holding rubber-rice farming system	Increase farm income/ use high technology in implementation strategy/ enlargement farm size toward more activity/ increase product and yield	<ul style="list-style-type: none"> * Mixed fruit tree crop for decreasing of risk and disease * Use similar fertilisation 15-15-15 both rubber and fruit tree 	<ul style="list-style-type: none"> * The shortage of water resources * The deficient of the capital for input factor

Table 2 : (Contd.)

(1)	(2)	(3)	(4)
			* The efficient extensional system and management
		* Have pond in fruit tree area	* Inconvenient Communication
		* Use equipment and method in harvest	* Low quality of product and price
			* Much disease and natural harm
			* Little agricultural knowledge
			* Deficient family labour
(R ₂) Small holding rubber-livestock farming system	Insufficient farm product/increase farm income towards increase standard of living	<ul style="list-style-type: none"> * Plan for livestock production * Sale cow at least 8 bodies/year average * Use indigenous breed that is resistant to environment and more appropriate than high breed 	<ul style="list-style-type: none"> * Insufficient feed resource (grass for animal feed) and vaccine * Disease * Low product and price (rubber)

Table 2 : (Contd.)

(1)	(2)	(3)	(4)
(R ₀) Small holding rubber-integrated farming system	Increase farm income/ improve existing farm's implementation strategies/ improve farmer's ability/ increase farm's saving money improve the efficiency of farm management/decreasing farm dept.	<ul style="list-style-type: none"> * Contact local livestock officer for support of input factor such as vaccine, additional feed, toward decreasing the cost production * Manage working time for farm activity 	<ul style="list-style-type: none"> * Low quality of product and price
		<ul style="list-style-type: none"> * Land use efficiency by means of trying to increase biodiversity and there are four farms types such as <ul style="list-style-type: none"> - Rubber + fruit tree + livestock - Rubber + rice + Fruit + tree - Rubber + rice + Fruit tree + livestock - Rubber + Fruit tree + fishery 	<ul style="list-style-type: none"> * Disease and Pest * Insufficient capital investment
		<ul style="list-style-type: none"> * Use fertiliser in similar form (15-15-15 in both rubber and fruit/tree) 	<ul style="list-style-type: none"> * Pattern less in practice * Inefficient extension system

Table 2 : (Contd.)

(1)	(2)	(3)	(4)
		* Fertiliser for rice 16-20-0	* Little knowledge in management
		* Use chemical for weed control Try to use family's labour for decreasing the cost of production	* Shortage of water resources
			* Shortage of family labour
			* Use indigenous breed

Sources : Secondary Data and Participatory Rural Appraisal (PRA) Techniques.

Constraints and their impact on Small Holding Farms

MAIN CONSTRAINTS FACED BY SMALL HOLDING FARMS

The most serious constraint that all types of farmers face is low product price. In addition, deficient production knowledge, diseases and pests, insufficient capital for farm investment and a poor market system are also important constraints on all types of farms and farmers (Table 3). Like other primary commodities, the rubber price fluctuation depends on both supply and demand factors in the market and external events. During the last twenty years, the rubber price fluctuated greatly, and affected small holding farms in Thailand. For example, in 1995, the world's rubber production was in excess of consumption and the rubber price dropped. This had bad effects on the small holder and was a major reason for small farmers to leave their farms to search for off-farm employment (Juman, 1987; Somboonsuke and Rattanachai, 1997). Inevitably, this led to under-utilisation of land and productivity further declined in Thailand, and as in Malaysia and Indonesia. The problem is made worse by the farmer's low level of education, lack of access to credit and low adoption of new agricultural practice and innovations. The market constraints which include the low type and grade (normally 80% of RSS grade 3 and 4) also reflect the inefficiency, complexity and constraints of industry (Somboonsuke and Rattanachai, 1997). Also, small holders get an unfair price in the local market, and marketing becomes difficult and complicated for these small holders to comprehend (Thipayakul and Promdej, 1987). The market structure and rubber prices are complementary to each other in determining the final price paid to small holders, who are the original producers of raw material. The price paid to the producer in local market is residue of the FOB price, after deductions for export and other taxes and marketing margins. The constraints of, high cost of production and input such as fertiliser, seed and chemicals for weed control and also low farm-gate price are the causes of insufficient capital for investment.

Table 3 : The Main Constraints of Small Holding Rubber-based Farming Systems

Constraint	Percentage
1. Low production price and quality	25.4
2. Deficient capital for farm investment	13.8
3. Disease and pests	11.2
4. Deficient input factors and high cost of inputs	10.9
5. Inefficient local marketing system	10.2
6. Deficient agricultural knowledge	6.8
7. Shortage of water resources	6.8
8. Low soil fertility	6.1
9. Shortage of family labour	5.1
10. Inefficient local extension system	3.7

Sources : PRA, Secondary data and Problem Tree Analysis

The comparison constraints faced between the current systems of small holding rubber-based farms

Biological and economic constraints are more serious constraints than physical and social constraints. This indicates that the government should concentrate on the economic and biological aspects in the development of the small holding sector. Table 4 shows that small holding rubber-integrated farming system (R6) and small holding rubber-fruit tree farming system (R4) face many constraints, especially economic constraints such as shortage of labour, cost and quality of production and deficient capital investment, and biological constraints such as disease and pests as these systems require more intensive management practices.

**Table 4 : Comparison of constraints faced
by small holding rubber-based farms**

Constraint	Small holding rubber-based farming system					
	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆
(1)	(2)	(3)	(4)	(5)	(6)	(7)
* Physical constraints						
1. Deficiency of water resources			X	X		X
2. Non-appropriate soil (low fertility) ¹			X			
3. Natural harm and climate				X		
4. Inconvenient infrastructure				X		
* Biological constraints						
1. Disease/pests and weeds	X	X	X	X	X	X
2. Low yielding breed (crop/livestock)						X
3. Deficiency of input factors (i.e. fertiliser)		X	X		X	
* Social constraints						
1. Inefficient local farmers' groups or organisations						X
2. Inefficient local extension system and management				X		X
3. Deficient production system knowledge		X		X		X
* Economic constraints						
1. Deficiency of capital for investment	X	X		X		X

Table 4 : C

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2. Low product price and quality	X	X	X	X	X	X
3. Inefficient local marketing system						X
4. Deficiency of family labour and equipment			X	X		X
5. High cost of inputs						X

Sources : Participatory Rural Appraisal (PRA) and Secondary data

Remark R : Small holding rubber-based farm

R₁ : Rubber-monoculture farming system

R₂ : Rubber-Intercrop farming system

R₃ : Rubber-rice farming system

R₄ : Rubber-fruit Tree farming system

R₅ : Rubber-livestock farming system and

R₆ : Rubber-integrated farming system

The causes of main constraints faced

Here we use the problem tree analysis to analyse the main constraints. (Figure 1):

LOW PRODUCT PRICE AND QUALITY

Prices fluctuate in local markets. This is due to over-supply of production; and, local markets are inefficient. As for fluctuating prices, we found that small holders have little influence in bargaining for better prices in the local markets and the government plan and policy is inefficient as

there is no plan for price insurance system. Small holders normally sell their production individually and inefficiently through a local farmers' group system. Concerning the oversupply, the government has no production plan or production control system. In addition international trade for agricultural production is generally inefficient with little knowledge of good practices, and an insufficient extension system in local area, farm practices are also inefficient because there is little interest in the crop production system. The inefficient local markets, continue as the government has no plan or policy to strengthen local market system.

DEFICIENT CAPITAL FOR FARM INVESTMENT

Three factors contribute to deficient capital for investment: lack of saving, use of capital for other activities, and the high costs of input. Since small holders normally, have a low income, often have to service debts, and they usually sell their production at a low price, they save very little. Using capital for other activities means that small holders find it necessary to use what money they have for living expense, which are quite high. Finally input costs for fertiliser and herbicides. Also, input prices are high compared to the past.

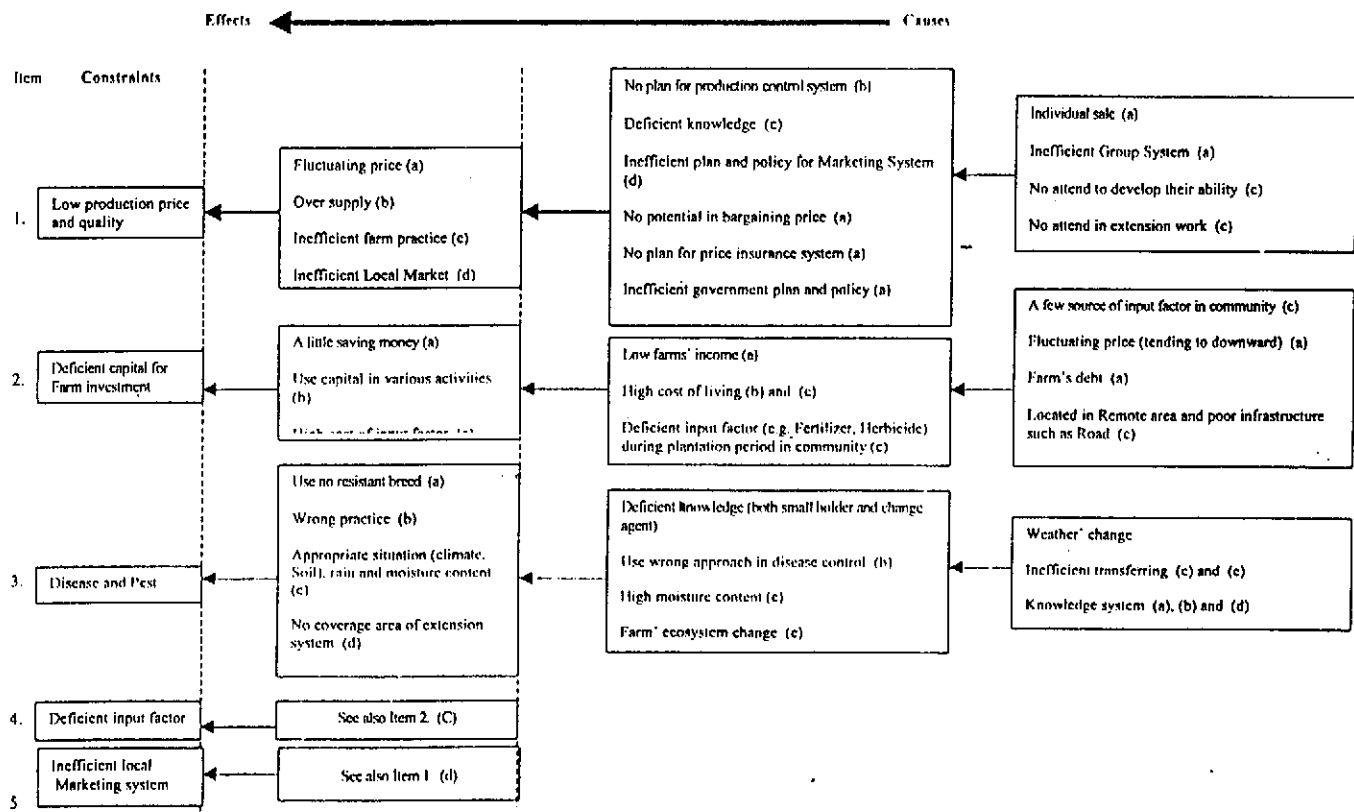
PESTS AND DISEASE

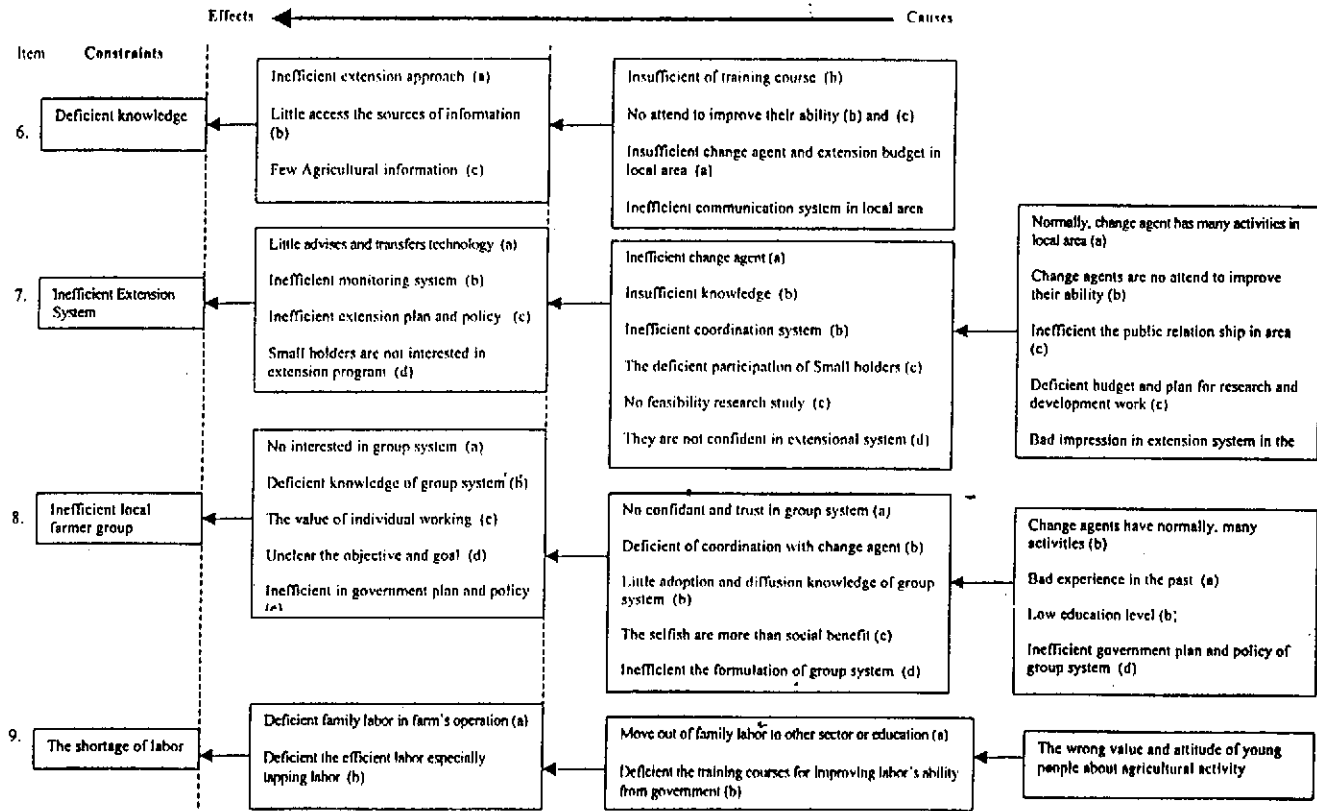
We found that using vulnerable breeds, agronomic practices not appropriate for the climate, inefficient use of the extension system led to more epidemic pests and diseases in the area. Both small holders and exchange agents have little knowledge of pests and diseases control and their management. Also, the changing farm ecosystem is a main cause of new epidemic of pests and diseases.

DEFICIENT INPUT FACTORS

The high cost of inputs under the present situation is the main source of this constraint. There are few alternative sources of inputs in the community.

Figure 1 : The Causes of Main Constraints of Small Holding Rubber-based Farming System





INEFFICIENT LOCAL MARKETING SYSTEM

The government has no efficient plan or policy through a local marketing system to protect the small holder against price fluctuations. Small holders normally get an unfair price in the local marketing system.

DEFICIENT KNOWLEDGE

Deficient knowledge of good farming practices results from an inefficient extension system. There is little access to new or reliable sources of information in the community. Due to insufficiency of training courses, small holders do not improve their ability. There are not enough exchange agents, nor is there sufficient budget to improve community communications.

INEFFICIENT EXTENSION SYSTEM

An inefficient monitoring system, inefficient extension plans and policies, and inefficient change agents and non-participatory small holders are the main causes of this constraint. The inefficient monitoring system is the results of deficient change agents. Due to their multiple role in the local area without sufficient participation and coordination between small holders and change agents, or feasibility studies, extension plan and policies remain inefficient. Inefficient change agents and small holders both fail to fulfill their responsibilities. Small holders are, normally, not confident enough to participate in the local extension system.

INEFFICIENT LOCAL FARMER GROUP

Small holders not being interested in a group system, high value for individual work, deficient knowledge of group systems, and inefficient government plans and policy are the main causes of this constraint. At present, small holders are not confident about entering a group system, for they believe that a group system can not solve their problems because some small holders had bad experiences in the past. They value individual work as, they normally work individually to sell their production and decide their own management strategy. They are afraid that they will lose their benefits

if they participate in a group. Small holders are more concerned with self interests than social benefits. Regarding deficient knowledge of group systems, we found that inefficient coordination systems and little adaptation to group system of knowledge were the main causes of this constraint, primarily due to the low educational level of small holders and change agents who normally played various roles in the community.

SHORTAGE OF FARM LABOUR

It was found that leaving the farm to work in the non-agricultural sector results in deficient family labour and deficient transfer of knowledge concerning improving labour abilities and are the main causes of this constraint. Young labour especially place a higher value on industrial over agricultural work for higher income and more education.

The impacts of farm constraints on small holder adjustment

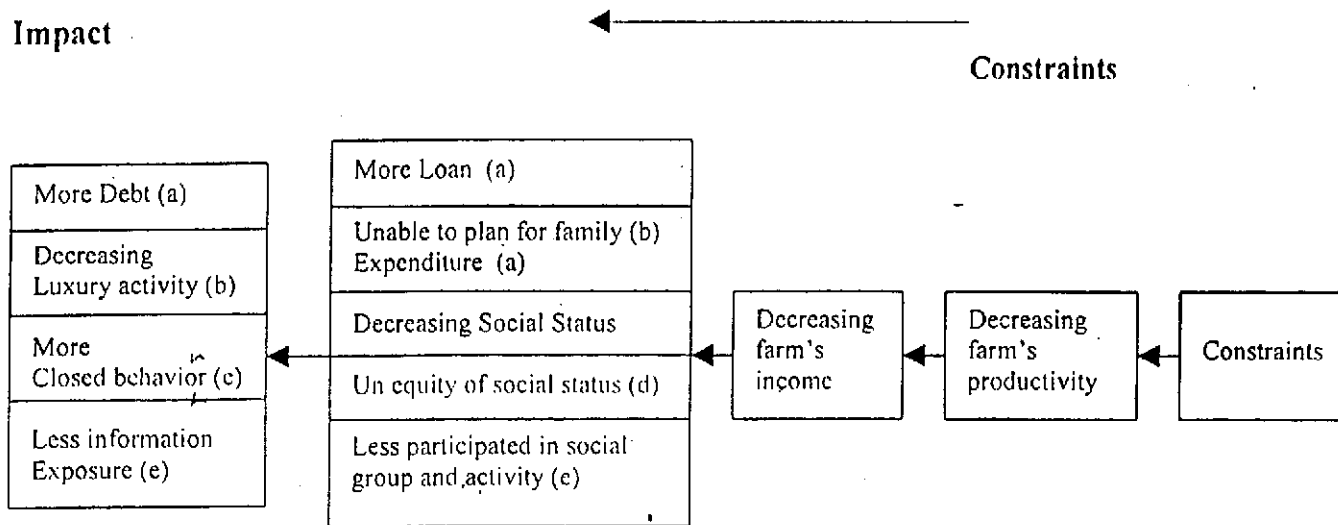
The constraints faced by small holders and their causes as previously mentioned result in decreasing farm productivity and decreasing farm income. This has impact on small holders' adjustment, especially in the socio-economic realm. We found that the changing socio-economic aspects of small holders to be more serious than the changing bio-physical aspects for small holders: i.e., (1) small holders have to borrow more than in the past; (2) they are unable to plan for family expenditures, causing them to decrease leisure activities; (3) they experience decreasing social status; (4) inequity in social status is rising in communities; and, (5) they participate less in social groups and activities in the community, since they are more isolated and have less information, respectively (Figure 2).

Strategic factor analysis summary (SFAS) evaluation and possible solutions

SFAS' EVALUATION CRITERIA

From the constraints faced by small holders and their causes as previously mentioned, we can understand the constraints of each system

Figure 2 : Impact of Farms Constraints on Small Holders' adjustment

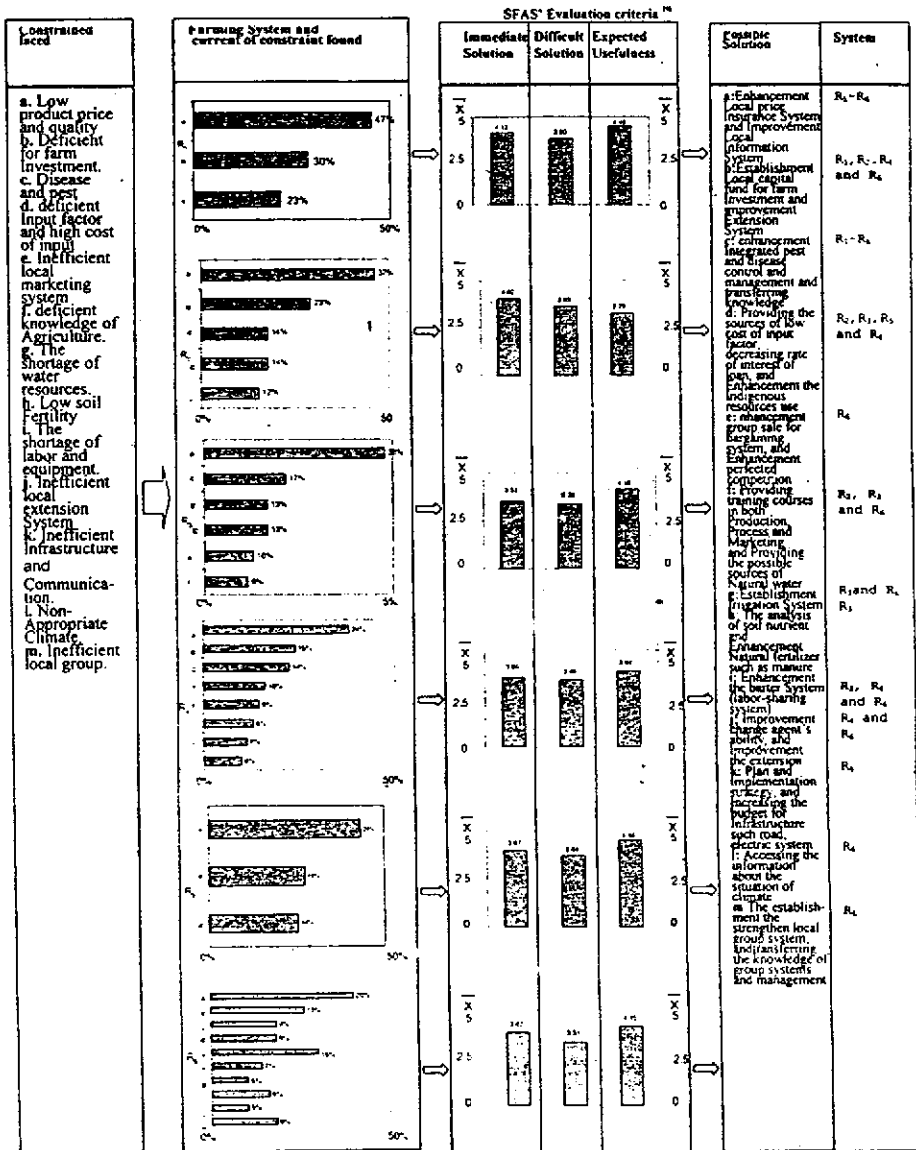


Source : Problem Tree Analysis Technique

and the degree of seriousness of these constraints. We attempt an analysis of these constraints leading to a plan and policy and eventual, possible solution by means of a Strategic Factor Analysis Summary (SFAS). The results are shown in Figure 3 (Turban and Meredith, 1981). In the SFAS, three criteria were used for evaluation: immediate solution, difficult solution and expected usefulness. All of these criteria were measured in terms of the average of opinion of small holders, local officials and researchers, as given by means of an interval range following Miah (1993): (1) average (χ_c) opinion between 1.00-1.80 meant never, or the lowest level, (2) average (χ_c) opinion between 1.81-2.60 meant little, or low level, (3) averages (χ_c) opinion between 2.61-3.40 meant moderate or middle level, (4) average (χ_c) opinion between 3.41-4.20 meant much or high level, and (5) average (χ_c) opinion between 4.21-5.00 meant very much or the highest level.

The results were that the immediate solution criteria, all the small holding systems have the degrees that fall in the level of immediate solution (χ_c between 3.41-4.20) in this criterion. This indicates that the current constraints faced under all systems are important and necessary for solution and affect decreasing farm productivity. In the difficult solution criteria, only the small holding rubber integrated farming system has a degree of moderate level of difficult solution ($\chi_c = 2.61-3.40$); otherwise, they have the degree of level of difficult solution (χ_c between 3.41-4.20). These constraints are plan and policy constraints. The deficient budget for solution of the constraints is one of the important limiting factors. In the expected usefulness criteria, the small holding rubber-monocultured farming system and small holding rubber-livestock farming system have the degree of very much expected usefulness (χ_c between 4.20-5.00) if their constraints, otherwise such as the small holding rubber-fruit tree farming system, small holding rubber-rice farming system and small holding rubber-integrated farming system have the degree of level of expected usefulness (χ_c between 3.40-4.20), while, the small holding rubber-intercrop farming system has the degree of moderate level of expected usefulness (χ_c between 2.61-3.40). From the SFAS evaluation, it can be said that the constraints faced, founded in this research study, are actual and important constraints that effect, directly on decreasing farm's productivity.

Figure 3: SFAS' Evaluation and Possible Solution of Rubber-based Farming system



Sources: SFAS' technique (Turban and Merlidith, 1981) and PRA techniques

Possible solutions

Figure 3 presents the constraints analysed for setting a strategic plan and policy for development of the small holding rubber-based farming system and suggestion for a possible solution.

STRATEGIES FOR IMPROVING FARM'S PRODUCTIVITY

The strategies for improving farm productivity are: (1) providing a credit system to meet the cost of cultivation, including a subsistence incentive, (2) encouraging the establishment of community capital funds for investment, (3) providing soil and leaf analysis and fertiliser recommendation, as well as disease and pest control information, (4) providing infrastructures and financial incentives based on the socio-economic position of the small holders in general, or in specific areas, such as land acquisition schemes, (5) providing information on high-yield varieties and other modern planting techniques, (6) strengthening research and development and dissemination of this information to small holders through change agents and local community groups, (7) improving access to water through water resource infrastructure assistance and management, (8) encouraging exchange agents of technology transfer to be more supportive of small holders, (9) improving the rubber-processing technology available to small holders so they can provide a better grade of rubber sheet, and (10) encouraging the establishment of value-added businesses in local communities to process some of the rubber there, and thus increase overall community prosperity.

STRATEGIES FOR IMPROVING SMALL HOLDERS' ABILITY AND POTENTIAL

The strategies for improving small holders' ability and potential include (1) emphasising the needs of small holders and encourage the improvement of small holders' ability, aspiration, skill and knowledge by providing appropriate training courses such as breeding technique, harvesting techniques such as tapping, marketing and processing, and (2) motivating small holder to become more self-reliant.

Conclusion

Small holders face many constraints in trying to maintain a profitable farming operation, including low product price, deficient production knowledge, disease and pests, and insufficient capital for farm investment. Low product price has been the largest single problem for small holders in all small holding systems. These various problems all have an effect on the small holders' life style and status in their community. Following the economic crises, small holders have had to adjust their attitudes towards their traditional ways of farming and doing business, to become more efficient, leading them to take steps to (1) improve their managerial ability through government training courses, (2) be sure they access current information on their farming activities, and (3) join local farmers groups to share knowledge and bargain collectively when necessary with a stronger voice. Various possible solutions are offered to overcome these constraints, in certain cases, and public policy options also suggest helping small holder make the change. What is certain is that rubber will remain an important commodity in the world, and Thailand is an important world supplier of this commodity. So with a positive attitude and willingness to work to adapt, the rubber industry can remain an economic engine for growth of southern Thailand.

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