

Assessment of Community Capacity to Sustain the On-going Mangrove Rehabilitation Programme in Park Phanang Bay, Nakhon Si Thammarat Province, Southern Thailand

Siriwan Siribon¹⁾, Nittharatana Paphavasit²⁾, Busarin Bangkaew¹⁾ and Chanettee Milintangul¹⁾

Abstract: Pak Phanang estuary in Nakhon Si Thammarat Province, located in the southeastern coast in the Gulf of Thailand, was once the productive area in term of agriculture and fishery. This study aimed to understand the complex ecological-social-economic linkage which was necessary to determine suitable approach for mangrove rehabilitation programme. It was found that coastal and mangrove resources utilizations have direct impacts on the environmental quality, estuarine productivity and quality of life of local people. There were evidences of declining fishery production, degrading water and sediment quality as well as increasing labour migration in the area. In order to battle the declining coastal and mangrove resources, more than 80% of the local communities expressed the urgent need to conserve and rehabilitate the coastal and mangrove resources in Pak Phanang estuary. The findings from the study lead to the critical review on factors determining suitable development of coastal and mangrove resources. Evidently, it was suggested that "Adaptive Management" should be adopted to sustain the on-going mangrove rehabilitation programme. The adaptive approach involves exploring alternative way to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions. Adaptive management focuses on learning and adapting through partnerships of all stakeholders. In order to conserve and maintain long-term sustainable yields from valuable coastal and mangrove resources, full cooperation among tripartite namely; the governmental sectors (both national and local levels), the non-governmental sectors and public participation are ultimately required. Most importantly, the local leaders and administrators should play the active roles as the facilitators/coordinators of the management plan. Networking within and outside associated organizations are necessary. In order to achieve the application of adaptive management, the six REs namely REvalue, REstrategy, REprocess, REstructure, REcondition and REsearch were proposed as underlying factors determining sustainable development of mangrove resources.

Keywords: Community capacity, Public participation, Adaptive management on mangrove rehabilitation

1. Introduction

Pak Phanang estuary in Nakhon Si Thammarat Province, located in the southeastern coast in the Gulf of Thailand, was once the major fishing ground due to the rich pristine mangrove forests lined the estuary. There were evidences of declining fishery production, degrading water and sediment quality in the area. While most communities needed to pursue livelihoods and regain a minimum quality of life, attention should be focused on the rehabilitation of coastal resources and mangroves on sustaining basis. Several restoration and resource development programmes have been carried out in the province. However, the lack of collaborations among several sectors involved has resulted in conflicting management priorities. Many research works have shown that the success of many development programmes depend

upon public participation and awareness. (Suwannodom et.al, 1998; Siribon, 2000). It was suggested that adaptive management approach should be implemented. In order to provide the useful information for the planner and concerned staff in the improvement and assessment of the programme most suitable to capacity building in public participation to sustain the on-going mangrove rehabilitation programme in Pak Phanang estuary, our research aimed to elucidate;

1. The demographic, socio-economic and ecological conditions of the coastal communities
2. The community perception and awareness on the importance and benefits of mangrove and rehabilitation programme in Pak Phanang estuary based on the complex ecological-social-economic linkages
3. The underlying factors determining the community

¹⁾ College of Population Studies, Chulalongkorn University, Bangkok 10330, Thailand

²⁾ Department of Marine Science, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand

participation in the mangrove rehabilitation programme and management

2. Research Methodology

Both the qualitative and quantitative methods for data collection were utilized to understand the complex ecological-social-economic linkage and to assess the information on community capacity to sustain the on-going mangrove rehabilitation programme in Pak Phanang estuary.

1. Quantitative Approach: The sampling survey was conducted by the College of Population Studies, Chulalongkorn University. Three questionnaires were administered in this survey, namely the community record, household schedule and the individual questionnaire for the head of household or his/her spouse.

1.1 Community record: The community questionnaires were mailed to community leaders of 27 communities in Pak Phanang district to collect the base line information of the communities on the demographic and socio-economic status of people in the study areas. In addition, the level of community participation on the coastal resources restoration and management was also detected from the questionnaire. The 17 questionnaires out of 27 were sent back with the response rates of 63 percent.

1.2 Household schedule: In this study, the sample unit was the households in the community. The sample for this study was 6 communities with 329 households. The structured interview with questionnaire provided quantitative information of the household members on demographic and socio-economic status of household members which allow detailed information on age and sex structure of the population, household size, educational level and occupational pattern.

1.3 Individual questionnaire: The head of household or his/her spouse from household sample was interviewed. The structured interview with questionnaire provided quantitative information on the perception of community members on coastal and mangrove resources conditions, the impact of degradation of coastal resources, mangroves and environment on the well-being and quality of life of community members, the level and trend of community participation on the mangrove rehabilitation programme as well as the level of community awareness on the benefit and value of coastal and mangrove resources.

2. Qualitative Approach: Two methods of data collection, namely in-depth interview and focus group discussion, were applied. There were 22 key informants from 5 groups, namely governmental group, non-governmental group, local administrators group, local community

leaders group and community members group. The qualitative data obtained from the two methods were another alternative method to add up some more detailed information on the process of constructing public participation and awareness on mangrove rehabilitation activities. Moreover, the information on the beliefs, values, attitude and opinion of people together with the information on social control, social organization, socialization process as well as social network towards the community participation and awareness on the activities related to mangrove rehabilitation programme were defined. The SWOT analysis provided necessary information to assess the underlying factors namely Strength, Weakness, Opportunity and Threat of community participation on the mangrove rehabilitation programme.

3. Demographic, socio-economic and ecological conditions of the Pak Phanang estuary

The information on demographic socio-economic and ecological conditions derived from community record revealed that the population were mostly fishermen, lead a simple lifestyle following the self-sufficiency philosophy. Therefore, the degrees of dependency on coastal resources and coastal environment were very high among the villagers. They were small-scaled fishery of estimated 6,000 baht per month for income. Approximately 60% of the fishery households were with debts related to money loans for occupational purposes. At present, the male and female ratio is in balanced with the average of 5 people in each household. Only 60% of the total population finished the primary education level. More than one-third is in the educational system (Paphavasit *et al.*, 2008).

From individual questionnaire, the perception of the coastal communities on the changes in coastal resources and environmental condition in Pak Phanang estuary was elucidated in the last 15 years of the 3 major periods; before the construction of the Uthokvibhajaprasid Dam (before 1988), during the dam construction (year 1999-2000) and after the dam operation (from year 2003 onwards) as in Table 1. The fishery production showed the steadily declining trend since 2000. This also coupled with the deteriorating water and sediment quality in the Pak Phanang estuary. Water resource allocation and irrigation played the major role in declining fishery resource and environmental condition.

The degradation of coastal resources and coastal environment were one of the major threats to community well-beings and quality of life through their occupations and economic stabilization. It was evident that the

Table. 1 Perception of the Pak Phanang coastal villagers on changes in coastal resources and environment quality during the major periods relating to the Uthokvibhajaprasid Dam construction and operation

No	Before the construction of the dam (before 1988)			During the dam construction (Year 1999-2002)			After the dam operation (Year 2003 on wards)		
1.	Fishery production	percent	number	Fishery production	percent	number	Fishery production	percent	number
	Highly abundance	90.9	299	Increasing trend	0.6	2	Increasing trend	2.7	9
	Abundance	7	23	Declining trend	63.8	208	Declining trend	88.4	291
	Less abundance	2.1	7	Not change	36.2	119	Not change	8.8	29
	Total	100.0	329	Total	100.0	329	Total	100.0	329
2.	Fish species	percent	number	Fish species	percent	number	Fish species	percent	number
	Rich and highly diverse	89.7	295	Increasing trend	1.2	4	Increasing trend	1.5	5
	Diversed	8.8	29	Declining trend	46.5	153	Declining trend	71.4	235
	Few/not diverse	1.5	5	Not change	52.3	172	Not change	27.0	89
	Total	100.0	329	Total	100.0	329	Total	100.0	329
3.	Fish size	percent	number	Fish size	percent	number	Fish size	percent	number
	Large	78.7	259	Increasing trend	0.9	3	Increasing trend	0.9	3
	Medium	18.2	60	Declining trend	49.8	164	Declining trend	57.5	222
	Small	3	10	Not change	49.2	162	Not change	31.6	104
	Total	100.0	329	Total	100.0	329	Total	100.0	329
4.	Water quality	percent	number	Water quality	percent	number	Water quality	percent	number
	Good quality	90.9	299	Improvement	2.4	8	Improvement	0.9	3
	Moderate	3.0	10	Degradation	55.0	181	Degradation	88.1	290
	Poor quality (Color)	5.8	19	Not change	42.5	140	Not change	10.9	36
	Poor quality (smell)	0.3	1	Total	100.0	329	Total	100.0	329
	(Both color and smell)			Type of change	percent	number	Type of change	percent	number
	Total	100.0	329	Color	1.1	2	Color	1	3
				Smell	17.5	33	Smell	10.6	31
				Both Color and smell	81.5	154	Both color and smell	88.4	259
				Total	100.0	189	Total	100.0	293
5.	Soil quality	percent	number	Soil quality	percent	number	Soil quality	percent	number
	Good quality	86.6	285	Improvement	1.8	6	Improvement	1.5	5
	Moderate	8.5	28	Degradation	43.2	142	Degradation	69.0	227
	Poor quality (Color)	2.7	9	Not change	55.0	181	Not change	29.5	97
	Poor quality (smell)	0.6	2	Total	100.0	329	Total	100.0	329
	Poor quality (both color and smell)	1.5	5	Type of change	percent	number	Type of change	percent	number
	Total	100.0	329	Color	1.3	2	Color	3.0	7
				Smell	6.7	10	Smell	3.4	8
				Both Color and smell	92.0	138	Both color and smell	93.5	217
				Total	100.0	150	Total	100.0	232

Table .2 Number of migrants and reasons for migration classified by sub-districts and villages

	Sub-district	Village	In Migrants (cases)	Out Migrants (cases)	Reasons for moving in			Reasons for moving out		
					Work/economic reasons	Follow family members	Buy land & house	No job/eco reasons	No land	Others
01	Klong Noi	Ban Peanoeri	10	0	✓	✓				
02		Ban Bangluk	21	28		✓		✓	✓	✓
03	East Pak Phanang	Ban Chaitalay	0	0						
04		Ban Noen	20	0	✓	✓		✓		✓
05		Ban Gongkoend	1	2		✓		✓		
06		Ban Nuennamhak	0	4		✓		✓		✓
07		Ban Kohchai	10	1	✓			✓	✓	✓
08	Laem Taloompuk	Ban Plaisai	0	30				✓	✓	
09		Ban laem	4	2	✓					✓
10		Ban Laentaloompuk	n.d	n.d						
11	Bangphra	Ban Bangvour	n.d	n.d			✓	✓		
12		Ban Bangkrud	31	16			✓	✓	✓	
13		Ban Khanted	10	10	✓			✓	✓	
14	Taphya	Ban Takhem	0	6				✓		
15	Kantabnak	Ban Sasrimuang	3	6		✓		✓	✓	
16		Ban Nagrod	n.d	n.d		✓		✓	✓	✓
17	Hoolong	Ban Khlongsukhum	n.d	n.d		✓	✓	✓	✓	

proportion of fishermen was declining through time. The pattern of occupational changes in the Pak Phanang coastal communities during the year 1997 to 2007 reflected the high proportion of fisherman changed their job to employee and labor since being employee or labor does not need high skill. The main reasons for changing jobs in fishermen were due to the decline in fishery production. The information on migration obtained from community record as shown in Table 2 and additional information from the in-depth interview indicated that the degradation on quality of coastal resources and environment such as polluted water, poor quality sediment and low fishery product acted as push factors for migration. The reasons for moving out of community were due to unemployment and searching for job outside community. These lead to the vital impact on the population structure and social ties of the community.

Pradit: The most important factor is the quality of water. The polluted water resulted in the declining of fishery production. We could not get profit from fishing. We could not fish near-shore. It means that we have to spend more. When fishermen could not go fishing, they have to change their job. They have to move outside the village. In some places, there hardly on one left in the village. Villagers had to move far away from home. They will be back only during the holiday such as New Year celebration, Songkhran festival and traditional ceremony in the tenth month.

4. Public Participation in the Integrated Coastal Resources and Mangrove Rehabilitation

In order to battle the declining coastal resources, more than 80% of the local communities expressed the urgent need to conserve and rehabilitate the coastal resources in Pak Phanang estuary. The information from community record indicated that the local communities already on voluntary basis have shown good sign in cooperation in the conservation and rehabilitation activities. They have learned from their direct experience that mangrove ecosystems

Table. 3 Perception of the Pak Phanang coastal villagers on changes in mangroves conditions during the major periods relating to the Uthokvibhajaprasid Dam construction operation

No.	Before the construction of the dam (before 1988)			During the dam construction (Year 1999-2002)			After the dam operation (Year 2003 on wards)		
	Amount of Mangroves	percent	number	Amount of Mangrove	percent	number	Amount of Mangroves	percent	number
1.	Large	71.7	230	Increasing trend	12.2	40	Increasing trend	22.2	73
	Moderate	22.8	75	Declining trend	18.5	61	Declining trend	32.8	108
	Small	5.5	18	Not change	69.3	228	Not change	45.0	148
	Total	100.0	329	Total	100.0	329	Total	100.0	329
2.	Mangrove Abundance	percent	number	Mangrove Abundance	percent	number	Mangrove Abundance	percent	number
	Highly abundance	76.9	253	Increasing trend	9.1	30	Increasing trend	11.9	39
	Abundance	17.6	58	Declining trend	24.3	80	Declining trend	42.2	139
	Less Abundance	5.5	18	Not change	66.6	219	Not change	45.9	151
Total	100.0	329	Total	100.0	329	Total	100.0	329	

have provided a variety of goods and services to coastal communities and the larger society. Mangroves form a protective buffer, stabilize sediments, reduce shoreline and riverbank erosion, regulate flooding and recycle nutrients. In the local communities point of view the benefits of mangrove forests were listed as animal breeding ground, fishery resources for food, coastal barriers for protecting wind and wave stress, source of income, protecting coastal erosion and the maintenance of the good environment quality. It was suggested that the rehabilitation of mangrove forests will have benefits not only on future safety of coastal communities, but also will contribute to their long-term socio-economic development by enhancing livelihood opportunities and provision of needed resources. Therefore, it was found from Table 3 that the amount of mangrove forest and the mangrove abundance in Pak Phanang estuary were increasing during the last decade.

The data collected from qualitative research revealed that the reforestation activity held only once a year and types of activity arranged were in occasional basis such as reforestation programme in commemoration of the Royal family, the exhibition during the visit of high level officers etc. Even though the activities was conducted for almost a decade and combined other activities such as disposal of young fishes and crabs through mangrove ecosystem, the arrangement was not under sustaining basis. The participation limited only among a group of fishermen who had direct benefit from mangroves. The programme

on mangrove rehabilitation was still not sustained.

Assanee: The activities arranged by local administration organizations were arranged in occasional basis. It's not sustained. They could do better than this if they received financial support from the government continuously.

5. Application of Adaptive Management to Sustain On-going Mangrove Rehabilitation Programme

It is clear in this study that the level of participation in any mangrove rehabilitation activity was highly correlated with the degree of mangrove-dependency. Villagers whose economic well-being was not depend on the existence or the pristine of mangrove pay less attention on any programme related to mangrove rehabilitation. Even though there was an attempt to promote mangrove rehabilitation programme in the community, the activities were arranged in occasional not sustaining basis. Villagers joined the programme in the form of cooperation not participation. Therefore, it was suggested that a so called " Adaptive Management " should be adopted to sustain the on-going mangrove rehabilitation programme. Adaptive management focuses on learning and adapting through partnerships of all stakeholders who learn together how to create and maintain sustainable mangrove resources system. Community members together with governmental

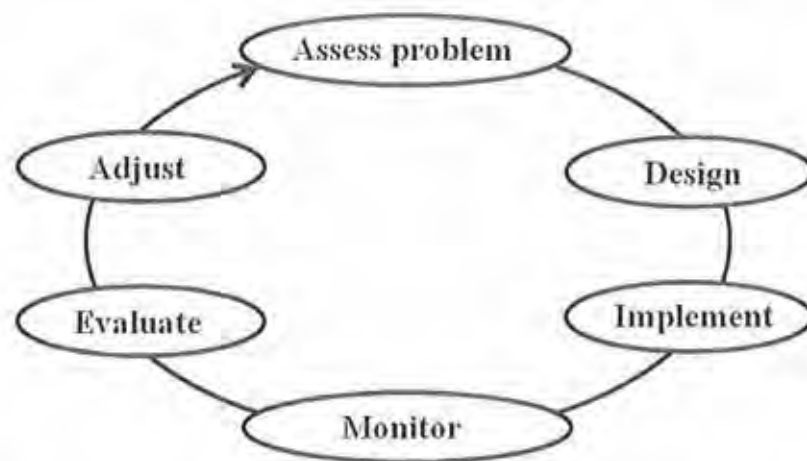


Figure. 1 Diagram of the Adaptive Management Process

organizations, non-governmental organizations, and relevant organizations should be involved in the whole process starting from assessing or formulating the problems together, thinking or designing the ways to solve the problem together, working or implementing together, analyzing together, monitoring together, evaluating together and planning together as shown in Figure 1. Any activity arranged, therefore, will be no longer in the form of occasional participating, superficial or window dressing in nature.

The information derived from qualitative research through in-depth interview from all stakeholders revealed that each step of adaptive management can be achieved through the following underlying factors as follow.

1. *Assess problem* Problems on mangrove and coastal environmental degradation should be formulated by all stakeholders. It was seen that the current direction of community and national development focused on the material and monetary profit which resulted in natural exploitation. It is recommended to have a revalue on the concept of materialization to self-sufficiency. The concept of self-reliance concentrated on the principles of producing enough to live on while preserving the integrity of the environment which is the most essential for sustainable development (Milintangul, 2007, Bangkaew and Siriboon, 2007). The villagers voiced out that the new generation is the important future human resources to play a major role on mangrove conservation. The socializing process for constructing consciousness should be held in the community. The school curriculum should

be revised urgently since it could not provide appropriate knowledge to solve local problems and management. The present curriculum was set as a standard for all as national policy. The local curriculum was in need to cope with the real local situation.

Suntad: We need to teach and make our young people well aware of the importance of coastal resources because they are like new seeds. If they grow up and have a positive value on the coastal resources and environment, they will have a sense of belonging and would continue their activities on the conservation of the resources and environment. Teaching young generation is easier than teaching the old. If the young accept the idea, they will work on it.

Sommai: We need local curriculum not standard curriculum for our young generation. Students needed to know about the conditions of natural resources and coastal environment of the area where they grew up. Household, schools, temples and mosques should work hand in hand to solve problems of coastal resources and environment.

Assanee: We lack of knowledge on coping the problems of coastal resources and environment. Our education failed to provide knowledge for local people in order to understand the real situation on natural resources and environment in their communities. Students here studied the same subject as student in Bangkok. We should arrange local curriculum that can answer the problem of local communities.

2. *Design* There is the need for the design of coastal resources and mangrove rehabilitation scheme which is site-specific to suit the objectives of the coastal communities. With different goals and objectives for mangrove restoration, the same basic blue print cannot be drawn as had been done before. Local communities should have the right to use and manage the resources under their community regime. The community rights, however, can be attenuated by the governmental organizations, such as the Ministry of Natural Resource and Environment or governmental agencies in provincial level, which should retain the rights to monitor and sanction in order to protect the misuse of the coastal resources. Even though, many times the community was not allowed by law to punish people who encroached upon the coastal resources. The social control through community mandate and social sanction should be encouraged to preserve and maintain the community resources and environment. In addition, the law enforcement should be practice strictly and continuously.

Pradit: Solving the degradation of coastal resources and mangroves should be based on the problems of each community. Local officers do not need to please their boss by following all the action plans conducted by central office. Each community has its own problem that cannot be solved by the same mandate or rule.

Sommai: Don't forget that punishment is also an effective tool to control people. We cannot be optimistic that most people will follow rules and regulations. Sometimes we need to punish them. If we told them not to cut mangroves, not to use destructive fishing gears, they might listen but might not follow. Even though, we were not allowed to punish people by law, we should have social sanction as a social control.

3. *Implement* The findings revealed that the communication on coastal resource and environment is not effective. One-way communication as top-down management is still in practiced. The community leaders reported that the government officers did not pay attention to the problems and suggestions voiced by the communities. In their point of views, the officers should listen more to the locals and work along side with them. The villagers have stayed in the community for long duration and knew well the problems and needs of their communities.

Chetawut: Governmental organizations should communicate and provide more information on coastal resources and environment to local people. They did not listen at all to the locals. They just concentrated on what they should do or they had to do. Some activities were not accepted by the villagers. They should listen to the locals because local people were born in the areas or lived in the communities for so long. Locals knew very well the problems and needs of their communities.

Local leaders suggested that two-way communication flows in drawing the coastal resources rehabilitation programme should be encouraged in the replacement of existing one-way communication dialogue between the governmental sectors and the local communities as the top-down management plan. Local communities have limited knowledge and information to cope with the rapid change in socio-economic conditions. The cooperation among tripartite namely the governmental organization, non-governmental organization and local community together with the network building both within and outside the community would provide the opportunity for the communities on arranging coastal resources rehabilitation programme. Two-ways communication is recommended since the locals view communication as the process of learning, thinking and working together not just one group listening to the other.

Wattana: Knowledge and base line information on the technique used for coastal resource and environmental reservation is crucial. Even though we have learned from direct experience and utilized our local wisdom to solve the problems, we found that it's not enough. The world is changing very fast. We needed to know about the outside world and adapted our local wisdom to solve the problems. We could not work alone. We needed to work together with the government officers, academic persons and business sectors. Cooperation among people from different fields will result in the progress and success of the management.

4. *Monitor* The information obtained from quantitative research indicated that 20 percent of local communities reported no mangrove monitoring process in their communities. According to the community opinions derived from in-depth interview, the local leaders and administrators should play the active roles as the facilitators/coordinators of the management plan

since they lived in the community for long and they knew the factors involved that result in the strength, weakness, opportunity and threat of local communities on management.

Pradit: Local leaders such as village headmen, heads of sub-district or staff of local administration organization should be the key persons on arranging management plan. They worked in the communities. They knew the strength or weakness of the communities very well. Local officers should work hand in hand with the villagers and also listen to them. Officers should not focus only on the plan or policy from the central office because sometimes those plans or policy was not related directly to the real situations of the local communities.

5. *Evaluate.* About one-fifth of community members reported that the evaluation process on coastal resource management was developed in their communities. Community leaders point out that monitoring and evaluating the coastal resources rehabilitation programme are essential since the information derived from them could help the local communities to examine factors affecting the success of the rehabilitation programme in the communities. It was found that community leaders asked for the help from academic persons and they realized that research on mangrove resources should be conducted to provide the knowledge-base data and information for formulating and adjusting the mangrove management plan.

Wattana: Community members should involve in monitoring and evaluation activities in order to examine the strength, weakness, opportunity and threat of the rehabilitation programme that would help us to adjust our rehabilitation scheme.

Santud: Academic persons should work with local and provide knowledge for locals. Local people need some explanation about the coastal resources degradation and causes from academic staff. All coastal problems have an impact on quality of life and well-being of the communities. If local people understand the cause and effect, I am sure that they will cooperate in the restoration and rehabilitation programme. That will be great.

6. *Adjust.* Local communities indicated that the cooperation among tripartite namely the governmental organization, non-governmental organization and local community together with the network building both

within and outside the community would provide the opportunity for the communities on arranging coastal and mangrove resources rehabilitation programme. Working together among all stakeholders can be viewed as learning together which could be resulted in adjusting the rehabilitation programme.

Wattana: Government officers, staff of private sectors and locals should get together for better understanding on coastal resource management. I think that learning together is the important issue. Local people need to learn more. At present the government officers know far better than us. Local people need to keep track with the government officers and staff from private sectors. We should walk together hand in hand.

Pradit: All direct stakeholders from all areas no matter where they are from should come together and work together. Local communities could not work solely to solve the coastal problems. The problems are too complicate for locals to work alone.

6. Conclusion and Recommendation.

There were evidences of declining fishery production, degrading water and sediment quality as well as increasing migration among people in labour force age in Pak Phanang estuary during the last 3 decades. In order to battle the declining coastal and mangrove resources, more than 80% of the local communities expressed the urgent need to conserve and rehabilitate the coastal and mangrove resources in Pak Phanang estuary. The findings from the study lead to the critical review on factors determining suitable development of coastal and mangrove resources. Evidently, it was suggested that "Adaptive Management" should be adopted to sustain the on-going mangrove rehabilitation programme because it is a learning-based process to improve management decision. Adaptive management focuses on learning and adapting through partnerships of all stakeholders. In order to conserve and maintain long-term sustainable yields from valuable coastal and mangrove resources, full cooperation among tripartite namely: the governmental sectors (both national and local levels), the non-governmental sectors and public participation are ultimately required. The adaptive approach involves the whole process starting from assessing or formulating the problems, designing the ways to solve the problem, working or implementing, analyzing, monitoring, evaluating and adjusting the management. In order to achieve the application of adaptive management,

the six REs namely REvalue, REstrategy, REprocess, REstructure, REcondition and REsearch were proposed as underlying factors determining sustainable development of mangrove resources as followed.

1. *REvalue*. The revalue is an important factor that has a significant impact on the problem assessment or problem formulation on mangrove condition. It was seen that the current direction of community and national development focused on the material and monetary profit which resulted in natural resources exploitation, including over utilization of mangrove forests and over harvesting of mangrove products. The findings from this study suggested that the revalue on the concept of materialization to self-sufficiency guided by His Majesty King Bhumibol Adulyadej should be introduced. His Majesty's vision on self-sufficiency is the important step toward a balanced development that will sustain both human being and the natural environments. The concept of self-reliance concentrated on the principles of producing enough to live on while preserving the integrity of the environment which is the most essential for sustainable development.

Our findings also suggested that it is needed to revalue the benefit from mangroves as perceived by local communities. The benefit of mangrove was not limited only on direct use values from the mangrove outputs that can be directly consumed. The benefit from the forests was also on indirect values that are mainly functional benefits. They are more concerned with ecological functions such as breeding and nursing grounds, maintaining coastal productivity, natural pollution control as well as shoreline stabilization and shore line protection. These ecological values are usually interrelated and difficult to quantify. Moreover, option values which can be values from biodiversity that can be used in the future as well as the culture and heritage values of maintaining mangroves for the next generation should be informed or distribute to the community members.

Human resource management is one of crucial factors that should be concerned. The new generation is not only the future of human resources but also the key actors for managing mangrove resources and environmental conservation. The socializing process for constructing consciousness should be held in the community. Cooperation among households, schools and temples/mosques are the key success factors in strengthening the public participation. The school curriculum should provide appropriate knowledge to solve local problems and management. The success of one generation would become a good model to be replicated for consecutive

generation. The continuity of activities conducted in the community will lead to sustainable development of mangrove rehabilitation programme.

2. *REcondition*. The condition on mangrove rehabilitation is an important factor for the design process of adaptive management. The findings from this study suggested that there is no specific model or blue print for the management of mangrove forests. The model will have to vary with the unique ecological and socio-economic conditions in each area. Therefore, there is the need for the design of mangrove rehabilitation scheme which is site-specific to suit the objectives of the coastal communities. With different goals and objectives for mangrove restoration, the same basic blue print cannot be drawn as previously carried out.

Moreover, the continuity of support from government in terms of technical, educational and financial support for the local community organizations that have the fundamental responsibility in encouraging participating in mangrove management were the ultimate need (Siriboon and Paphavasit, 2006). The co-management system is required and it is not just passing all the responsibilities between the governmental agencies and local communities. Local communities have the right to use and manage the forests under their community forest regime. The community rights, however, can be attenuated by the government organizations, in particular the Ministry of Natural Resource and Environment or the governmental agencies at provincial level. They should retain the rights to monitor and sanction in order to protect the misuse of the forests.

Even though, many times the community was not allowed by law to punish people who encroached upon the coastal resources. The social control through community mandate and social sanction should be encouraged to preserve and maintain the community resources and environment. In addition, the law enforcement should be practised strictly and continuously.

3. *REstrategy*. In the process of implementation, the strategy on mangrove management both in macro and micro levels needed to be redefined. The development of nations that emphasized only on the macro economic development should be reviewed. It was suggested that the strategy in terms of top-down management or centralization should be reformed and changed to bottom-up management and decentralization. There should be the two-way communication flows in drawing the mangrove resources management plan.

It was clear from this study that the success of mangrove reforestation programme depended upon the

public participation and awareness. This suggested that resource partitioning or sharing the mangrove resources should not solely be the government responsibility. The decision to allow local management efforts should be based on the capability of communities to enforce their local rules or mandates effectively in order to manage the forest sustainability. Moreover, such community rights should not involve the full ownership of the forests, but should be in the form of user rights. Governmental organizations should act as supervisors not executors. Management of the forests should be the joint responsibility of the local communities and the government. Local communities should have responsibility to conserve mangrove resources and environment with their own wisdom. The activities on planning, implementing and monitoring of the rehabilitation programme should be done through local leaders or groups. The learning process from each sector experiences should be promoted in order to share and implement in the management plan.

4. *REprocess*. In implementation process of adaptive management, the respondents voiced out that a successful community forest management regime could not be done solely by each community. The co-management was proposed and required active participation from all stakeholders with joint responsibility among the tripartite namely, governmental organization, non-governmental organization and local communities. Such effective co-management will require the active participation of existing coastal community organizations. This would allow the representatives of such organizations to have the right to express their opinions and make decision regarding to the management plan and regulations on the utilization of mangrove resources.

The findings also suggested that the process of co-management should be channeled from individual level, community organizations or groups within community up to the network building outside the community. Community capacity building should be commenced from human resource development. Local wisdom together with village intellectuals needed to be promoted. The awareness of young generation on the consciousness in mangrove conservation and rehabilitation should be initiated. The co-management process should begin within the community and expand to the network outside the community particularly the network building with other nearby communities.

5. *REstructure*. For monitoring process, the findings indicated that some villagers still were not satisfied with the community mangrove management since the management was still limited only in the form of

cooperation not participation. Many mangrove activities arranged in the community with numerous villager efforts, the so called "participation" still not existed. Joining the activities was only in temporary or occasionally cooperation as social functioning. Sometimes this was not on voluntary basis. Therefore, it was suggested that joining in any mangrove activities should be restructured from cooperation to participation under the concept of civil society. From the key informants' point of views the civil society will lead to the success of mangrove rehabilitation programme since it involved voluntary associations and informal networks in which individuals and groups were engaged in public activities.

The community capacity building should be done starting from human resource development. Local wisdom together with village intellectuals needed to be promoted. The community members, particularly direct stakeholders on coastal management, should be trained to do monitoring as well as pilot survey to design the key indicators in mangrove monitoring programme. Such capacity building will reinforce coastal communities with potential for reducing future vulnerability, increasing economic and social well-being through mangrove rehabilitation programme.

6. *REsearch*. Research work on mangrove resources and management is an important part on evaluate and adjustment processes of adaptive management. It was recommended that integrated management plan should be drawn based on knowledge bases researches and organized planning according to local geography livelihood and cultures of local communities in order to sustain the efforts. The multidisciplinary researches on ecological risk assessment and socio-economic conditions of communities are essential. These data can be integrated onto public awareness programme. Moreover, the time series data was needed for the analysis on changes in ecological and socio-economic conditions in the areas over time. There is an urgent need to increase the capacity building through dissemination of knowledge based researches and information and practical training appropriated to the problems and geographic location in the areas.

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