6. PRIORITY PROJECT PACKAGES

6.1 Integrated Pasak River Basin Development (IPRBD)

6.1.1 Background

Pasak River Basin covers the area of 14,520 km^2 extending over the Changwat Sara Buri, Lop Buri, Petchabun and Loei. It covers the upland area of 4,960 km^2 in the UCR.

This upland area has high agricultural potential in the UCR for major upland crops such as maize, soybean, sugarcane and cassava as well as diversified crops of vegetables and fruits. It is endowed with good soil condition, together with good access to the domestic as well as international agricultural market. Particularly, rapidly increasing domestic consumption of livestock and dairy products is a strong market potential for forage production in this area.

The GSIC is situated in the Pasak River Basin. Further growth of agro-processing industries in the GSIC is another potential for agricultural development in this upland area. Without substantial irrigation, however, this area has been suffering from unstable agricultural production. Excessive expansion of farmlands has added to the unstability. Productivity in terms of yield per rai has been decreasing year by year due to deteriorating soil fertility, the changes in rainfall pattern caused by deforestation, and the inappropriate land use and cultivation using no fertilizer. The encroachment of farmlands in forest land has caused erosion. The area subject to the erosion is estimated at 600 km^2.

The unstable agriculture stems from insufficient investments at the farm level as well. Since farmland expansion has taken place in this area recently, farmers suffer from the insecureness of the land title which is essential to receive financial support for their agriculture.

Key to the development of this area is agricultural water supply. A number of small and medium scale water resource projects have been undertaken in tributaries of Pasak River, but many potential water resources have been left untapped. Water of Pasak River itself has not been tapped at all for this upland area.

In the meantime, His Majesty the King suggested, approximately two years ago, the investigation of the Pasak Dam, which was proposed long time ago without a firm action to implement it. Pasak Dam has been proposed for the purpose of BMR's water resources and flood protection, water resources for Bang Pa Kong basin, salt water prevention in Chao Phraya River, etc. At the beginning of 1990, the cabinet approved conducting a feasibility study of this project and a working group of Pasak Basin was established in the National Water Resource Committee to oversee and coordinate water resource development activities to be conducted by various agencies. This is a very timely movement of the government, if Pasak Dam Project is made fullest use for the benefit of the UCR.

6.1.2 Objectives

1) To rehabilitate environmental base of upland agriculture for its stabilization by introducing an integrated farming system in the Pasak River Basin. Development of small and medium water resource projects as well as Pasak Dam construction are the basis for this. Pasak Dam development needs to be designed as a part of the environmental management of the whole Pasak River Basin rather than as the project which alone aims at irrigation water increase and flood protection in the BMR.

2) To diversify agricultural and livestock production in order to make fullest use of good soil condition and the access to the agro-processing industries in the GSIC and to the increasing and diversifying domestic food market especially in Bangkok. Introduction of integrated farming system is proposed as an important base to stabilize income of the farmers engaged in the cultivation of major upland crops for domestic food supply as well as export. To be proposed in this connection is the promotion of dairy production.

3) To support urban and industrial development of the GSIC by providing water of Pasak Dam as a water resource option in addition to the water from Chai Nat - Pasak canal and groundwater in the GSIC.

6.1.3 Components and Phasing

This project package comprises the following components:

- Pasak Small and Medium Water Resource Development
- Pasak Integrated Farming System Development
- Pasak Dam Development
- Dairy Farming Promotion

1) Pasak Small and Medium Water Resource Development

The small and medium water resource development should be proceeded among other components of IPRBD because of their quick effect on agriculture, the supply of agricultural water for the onfarm ponds to be constructed as a basis in the Pasak Integrated Farming System Development and the effect of mitigating seasonal fluctuation of water flow volume in the Pasak River.

The target of small and medium scale water resource development is set to create storages for 10% of total annual run-off, which is equivalent to 200 million cubic meter (MCM) in dry season. The present level of storage, under the category of small and medium scale projects, is 4% of the annual run-off.

Table 6.1 shows potential medium scale projects in Pasak River basin and locations of the projects are shown in Fig. 6.1. For implementation of medium scale project, priority may be necessary to be attached to each project. High priority projects should include the beneficiary areas where paddy and a weir exist without storage facilities. No water is available in such areas during dry season. In such areas, implementation of the projects will stabilize water supply and enhance wet and dry season cultivation.

Table 6.1 Pasak River Basin Medium Scale Project for Water Resource Development

Project	Location		Type of work	Capacity of storage (MCM)	Irrigable area (rai)	Period of construction	Const. cost (million B.)
	Amphoe	Province					
Existing							
1 Klong Priow	Nong Sang	Saraburi	weir	-	91,900	1955-1973	
2 Huey Som	Pattananikom	Lopburi	reservoir	12.5	9,000	1956-1958	
3 Sao Hai	Sao Hai	Saraburi	pumping st.	-	434,000	1970-1981	
4 Sub Takien	Chaibadan	Lopburi	reservoir	8.6	9,000	1985-1990	128
Under construction							
5 Lam Sonthi	Chaibadan	Lopburi	weir	-	45,000	1990-1992	280
Potential sites							
6 Ban Moh-Kang Koy	Kang Koy	Saraburi	pumping st.		88,500	unscheduled	1000
7 Hua Hin		Lopburi	reservoir	3.4	2,400	unscheduled	unknown
8 Wang Kan Luang		Lopburi	reservoir			unscheduled	unknown
9 Khao Pang Hei		Lopburi	reservoir	40	16,000	unscheduled	unknown
10 Kud Ta Pet	Chaibadan	Lopburi	reservoir	32	40,000	unscheduled	unknown

Small scale projects serves for domestic water needs and wet season irrigation. There are many small scale projects without any water available in dry season due to the lack of the water storage with sufficient size of catchment area.

Table 6.2 shows potential small scale projects with the name of villages and districts. The projects in the table are among those requested, in principle, by local people. The RID Region 8 Office has examined, requested projects and listed technically feasible projects. There would be many more potential sites for small scale projects.

Though six potential small scale projects are in the expected beneficiary area of Pasak dam project, they should be complementary to it by storing the water from Pasak dam during the dry season. Two potential small scale projects in the expected inundating area of Pasak dam project should not be implemented.

2) Pasak Integrated Farming System (PIFS)

Objective of PIFS is to establish an environmentally sound agricultural farming system in the upland on the premises that water of Pasak river and its tributaries is utilized for the UCR's benefit. Through increasing the capacity of farmland to retain limited volume of water, PIFS aims of promoting mixed cropping at the farm level so that the economy of individual farm households and soil conditions can be maintained, and thus production of feed and other major crops can be sustained.

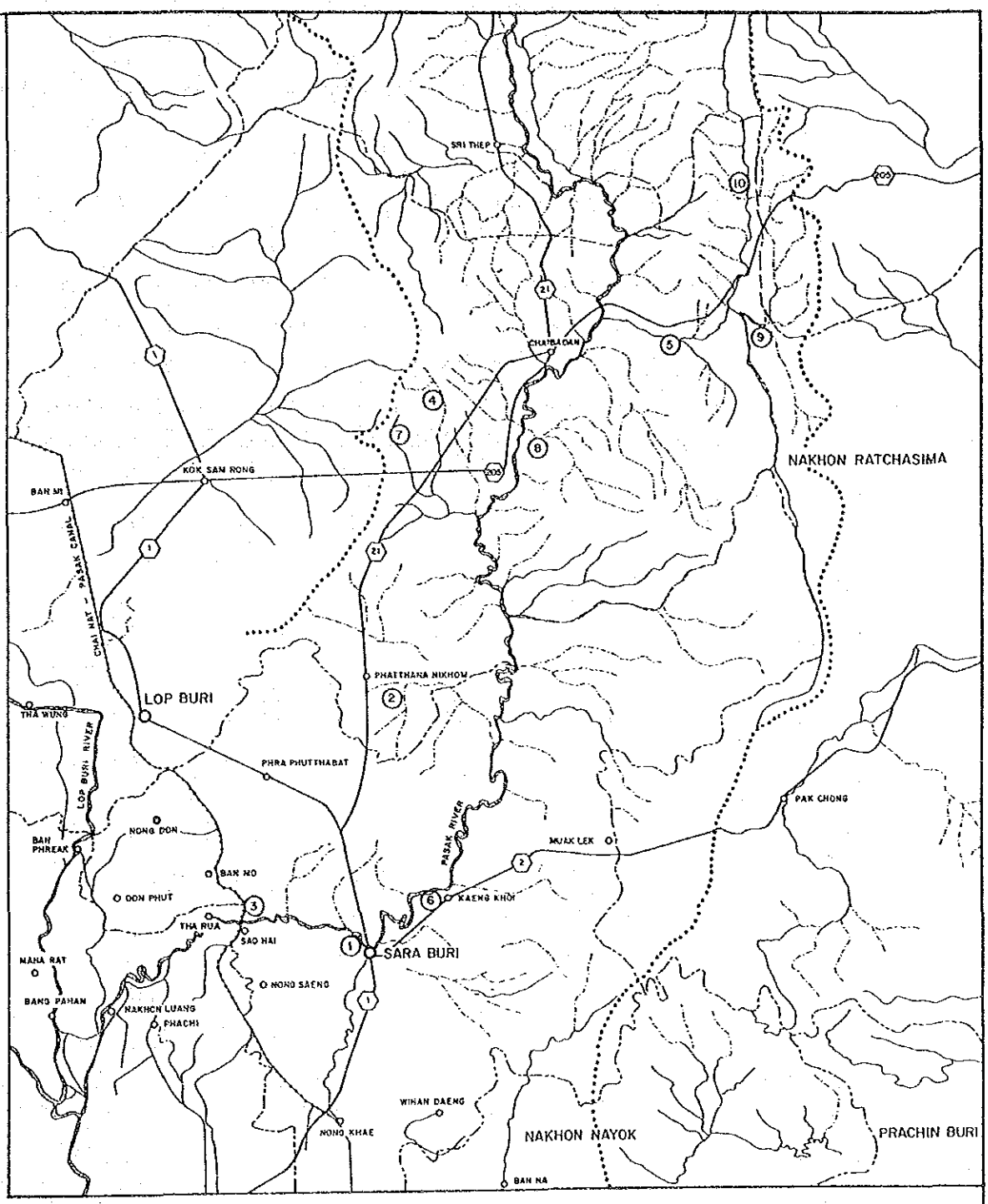


Fig. 6.1 Location of Medium Scale Projects for Water Resource Development

Expected effects of the PIFS is illustrated in the Fig. 6.2.

For this PIFS to be established. The following actions should be taken in a coordinated manner:

(1) On-farm Water Storage Construction

Water storage should be constructed onfarm to make more water available for agriculture and to improve the agricultural environment by increasing vegetation on the upland areas. The storage could either be farm pond or raised bed cultivation. It should be developed by individual or group of farmers with

Table 6.2 Small Scale Water Resources Projects in Pasak Basin

Project Name	Location			Project Type	Location
	Mu Village	Sub-District	District		
Ban Subtakien Noi Reservoir	2 Subtakien Noi	Subsomboon	Lumsonthi	Small	
Kao Noi Reservoir	6 Kao Noi	Subtakien	Chaibadal	Small	
Klong Tago Weir	6,7 Klong Tago	Nikomnarai	Chaibadal	Small	
Dredge Ban Subyang Reservoir	3 Subyang	Silatip	Chaibadal	Improve exsisting	
Dredge Kratum Swamp	4 Ta Madue	Nong Yai To	Chaibadal	Movil Service Center	
Dredge Hangtalad Swamp	9 Subpasuk	Silatip	Chaibadal	Movil Service Center	
Puek-o Dredging	2 Tasam	Ta Dindum	Chaibadal	Movil Service Center	
Dredge Huoy Takro Canal	2 Koh Rung	Koh Rung	Chaibadal	Movil Service Center	
Dredge Sublungka Canal	- -	Koh Rung	Chaibadal	Movil Service Center	
Dredge Kung Canal	1 Buachoom	Buachoom	Chaibadal	Movil Service Center	
Dredge Nongrakum Swamp	1 Buachoom	Buschoom	Chaibadal	Movil Service Center	
Ban Kaotambol Reservoir	2 Kaotambol	Nasom	Chaibadal	Movil Service Center	
Dredge Hinrap Canal	4 Subkaomaew	Buachoom	Chaibadal	Movil Service Center	
Dredge Lumnarai Canal	7 Sapankao	Lumnarai	Chaibadal	Movil Service Center	
Dredge Sungbadal Swamp	7 -	Chaibadal	Chaibadal	Movil Service Center	
Dredge Klongtaklen Weir	4 Subkaomaew	Buachoom	Chaibadal	Movil Service Center	
Construct a pond	7 Raipattana	Nikomnarai	Chaibadal	Movil Service Center	
Construct a supply canal	2 -	Ta Dindum	Chaibadal	Movil Service Center	
Ban Kaewsamduang Reservoir	2 Kaewsamduang	Chainarai	Chaibadal	Movil Service Center	
Dredge Puk Chado			Chaibadan		in beneficiary area
Dredge Huay na Canal	2 Makokwan	Makokwan	Chaibadal	Movil Service Center	in beneficiary area
Huay Ploo Weir	Manaowan		Pattananikom	Existing	in beneficiary area
Ban Manao Wan weir	Manao Wan		Pattananikom	Existing	in beneficiary area
Lam Goad Thong Weir			Chaibadan	Existing	in beneficiary area
Huay Phai Weir	Chaibadan		Chaibadan	Existing	in beneficiary area
Dredge Puk Yai	Chaibadan		Chaibadan	Existing	in inundating area
Dredge Nong Bua Swamp	Makok Wan		Chaibadan	Existing	in inundating area
Huay Yai Reservoir	7 Coke Sa-ad	Muangkom	Chaibadal	Movil Service Center	
Dredge Pukvan Swamp	1 Nong Pukvan	Nong Pukvan	Ta Luang	Movil Service Center	
Dredge Songton Swamp	2 Nong Pradu	Nong Pukvan	Ta Luang	Movil Service Center	
Dredge Sang Swamp	4 Hua Lum	Hua Lum	Ta Luang	Movil Service Center	
Dredge Jan Swamp	5 Nong Jan	Hua Lum	Ta Luang	Movil Service Center	
Dredge Po Ku Swamp	2 Bo Ku	Ta Luang	Ta Luang	Movil Service Center	
Kao Saladdai Reservoir		Silatip	Chaibadal	Small	
A reservoir	4 -	Huoy Hin	Chaibadal	Small	
Lumphrayamai Project	4 Sub Kaomaew	Buachoom	Chaibadal	Tend to be a medium size project	
Kao Lakkai Reservoir	13 Coke Samaesan	Mahapote	Srabos	Tend to be a medium size project	

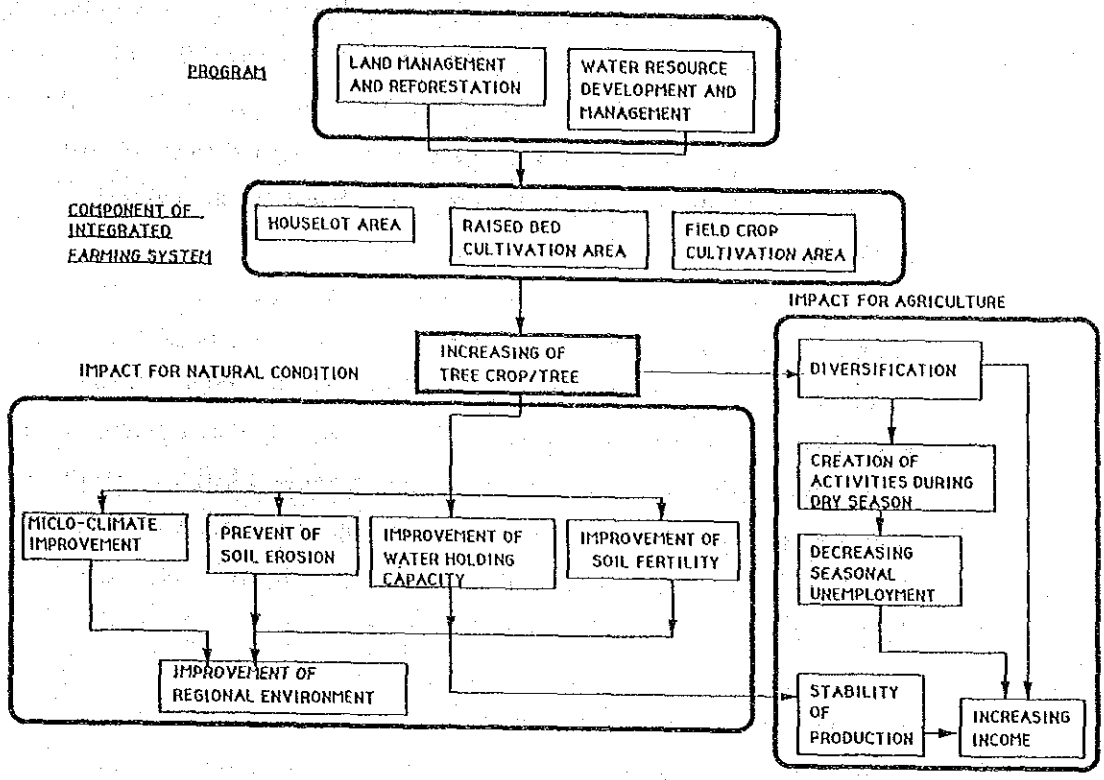


Fig. 6.2 Effects of Integrated Farming System

technical advice from the government. This development will stimulate farmers aspiration for planning and managing the small and medium size water resource projects which supplement dry season water for the onfarm ponds and, at the same time, raise the efficiency of government investments in water resource projects. Target area for the onfarm water storage construction is, therefore, the beneficiary areas of potential sites for medium and small water resource development projects.

(2) Upland Land Consolidation

For the water from onfarm pond or small and medium scale projects to be efficiently used in the upland area, it is necessary not only to improve ditches and dikes, ground leveling, soil maintenance etc. but plant trees and tree crops as wind breaker and shade trees to keep soil surface and strengthen water holding capacity of the soil. We propose the upland land consolidation

involves Royal Forestry Department in distributing more than 10 million pieces of tree seedlings for 20 years to the 10% of field crop cultivation area in the Pasak River Basin. Morcover, this tree and tree crop planting together with agro-forestry will greatly contribute to keep the proposed Pasak dam from sedimentation.

Another important aim of the land consolidation is the accelerated issuance of land title. Whereas the land title, regardless of ownership, is secured in most of the villages in the Chao Phraya Delta area, it is insecure in most of the villages in the upland area which has been development much later than lowland. Temporary right and certificate of use are predominant land title in the Pasak Basin.

Issuance of the title deed should be accelerated, for the purpose of investments by farmers in tree crop raising onfarm pond construction and other components of the land consolidation. Moreover, it should be noted that Pasak dam project (to be described later) can not be implemented without the issuance of title deed in the resettlement scheme which is a critical *component of the project.*

(3) Agroforestry

Specifically in the soil eroded area, agroforestry program should be accelerated. In the Pasak River Basin, there are 370,000 rai of the field crop areas subject to soil erosion and 240,000 rai of the reserved forest areas which have already been encroached. The program should be carried out by the Central Office of Land Consolidation in the field crop areas and by RFD in the reserved forestry area. This program is not only effective to recovering the environmental base of upland agriculture but also necessary to prevent the proposed Pasak dam from quick sedimentation.

3) Pasak Dam Development

We wish to propose Pasak Dam Project as a model which may be adopted for any size of the dam recommended by the upcoming feasibility study.

There are two sites proposed for the location of Pasak dam: Amphoe Pattana Nikom in Changwat Lopburi for the upstream site and Amphoe Kaeng Khoy in Changwat Sara Buri for the downstream site.

We selected the upstream for the following reasons. (1) Foundation problem seems to be less in the upstream site since Kaeng Khoy is a limestone area. (2) Much more villages, temples, and public facilities would be under the water if dam is built at the downstream (3) More benefits would be brought to the upland area of UCR if dam is built at the upstream.

At Pattana Nikom site, the following planning concepts were applied for the selection of dam scale:

(1) Minimize the social conflicts arising from inundation.

(2) Enhance agriculture in the basin by developing many small and medium scale water resources. Medium scale reservoirs in upstream tributaries will also help reduce floods in the BMR.

(3) Provide urban and industrial water to the Greater Sara Buri Industrial Core (GSIC).

(4) Although a large size reservoir will be beneficial for flood protection in the BMR, flood protection should be coped by not only a reservoir but by watershed management measures such as reforestation. Flood protection should be looked at from a basin-wide macroscopic view point. Without such measures, a large reservoir would soon be filled with sediment.

Based on these planning concepts, we employed the model at a limited scale. The active storage is 103 million cubic meter with storage level of

35 meter. This will inundate the area of 37 km^2 at the highest water level, and will cause minimal damages to existing settlements and public facilities (6 villages, 2 schools, one temple, one health station, one bridge, one police station and railway of 4 kms).

Assuming 103 MCM of storage is available at the beginning of low flow season, January, 10 m^3/sec can be released from the reservoir up to April. This discharge and flow volume should satisfy the water demands for economic activities of Changwat Lop Buri and Sara Buri. Water allocation for the demand from Pasak dam is as follows:

	flow rate	4-month volume
Lop Buri upland of 50,000 rai for the resettlement	3.0 m^3/sec	23 MCM
Ban Moh - Kaeng Khoy irrigation project (already planned to irrigate 17,500 rai)	3.0 m^3/sec*	50 MCM
GSIC urban water	1.3 m^3/sec	13 MCM
GSIC industrial water	1.2 m^3/sec	12 MCM
Total	8.5 m^3/sec	98 MCM

Note* : this is a maximum flow rate for high demand period.

There may be a dry year when Pasak dam reservoir is not filled up with water at the beginning of low flow season. Considering such situation, conjunctive use of various water sources such as Chai Nat - Pasak Canal, Pasak dam, and groundwater will become important especially for the urban and industrial use in the GSIC.

Location of Pasak dam development is indicated in the Fig. 6.3 showing beneficiary area of 124 km^2, of which 90% is suitable for cultivation, and inundating area of 37 km^2. The highest water level of reservoir with the selected scale is 36 meter and water can be pumped to 43 meter contour lines of the east and west sides of river bank. Main canals and laterals will be constructed by the RID; and even ditches may be constructed by the RID. Such ditches should be connected with farm ponds and raised-bed cultivation farms.

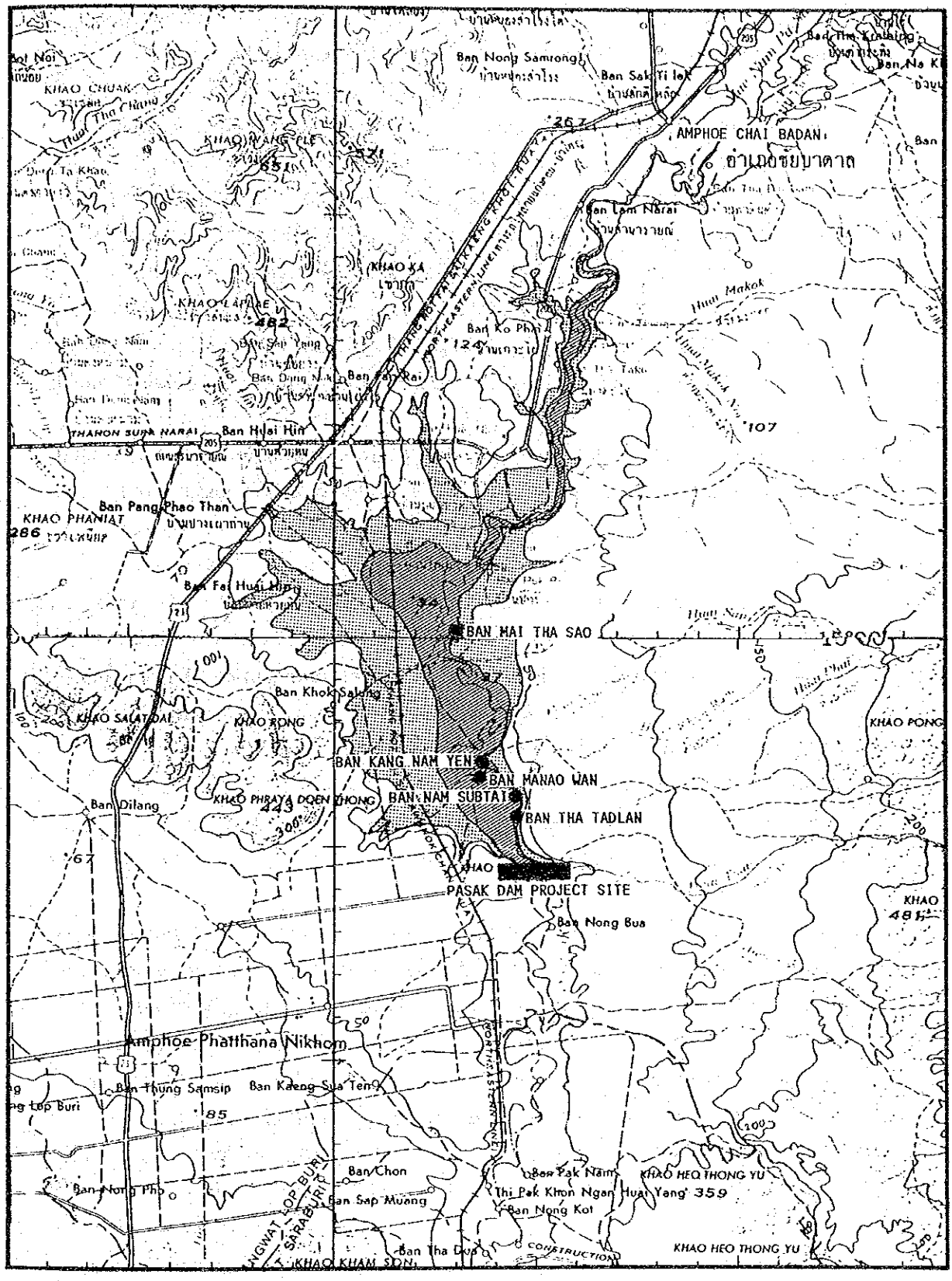


Fig.6.3 Inundating and Beneficiary Area by Pasak Dam

A basin-wide environmental base line study should be carried out particularly on the forest. For example, sediment yield is 46 tons/km^2/year according to a RID report; and this amount should be greatly reduced by implementing the integrated farming system development.

Pasak dam project cost may be nearly one billion baht including the compensation cost for public facilities and resettlement. In this amount, dam itself costs about 500 million baht and the land reform and land consolidation cost approximately 200 million baht. The rest may be invested for pumping stations as well as for main and lateral channels.

A medium scale water resources project cost approximately 100 to 300 million baht. A small scale project cost is likely to be less than 10 million baht.

Until water made available from the Pasak dam, altogether 10 years may be necessary to complete the cabinet approvals, feasibility study, resettlement survey and detail design, resettlement negotiation and construction. Construction itself will need 5 years. A medium scale project will take around 3 years to complete. Those medium scale projects should be implemented as soon as possible. A project is completed within one year and such projects should be implemented according to requests by local people.

While a large scale project of Pasak dam is being prepared, as many as possible small scale projects should be implemented in the upland areas. This will created the demands for provision of more stable water storages, which can be realized by medium and large scale water resources projects. This will results in a desirable condition where tertiary systems exist when major facilities area completed.

Resettlement scheme

In order to implement Pasak dam project, it is necessary to resettle people in the inundating area. The best place for such resettlement would be near the places where they used to live. There are already settlements and farm lands in such places and the resettlement should

involve land reform and land consolidation. The project area for land reform and consolidation program is 111 km^2

Land tenure of the Pasak dam project area of 161 km^2 has to be identified for resettlement planning. The population involved in the resettlement in 161 km^2 is calculated at approximately 11,000, of which farm population is about 8,800, while the number of people in the inundating area is estimated at approximately 2,500.

Since inundated area is approximately 23 % of total project area, the people already settled in the beneficiary area will have to lose approximately one-forth of cultivated areas. According to the Agriculture Land Consolidation Act, the size of reduction due to land consolidation should not be more than 7 %, whereas the needed reduction of 25 % is much more than the regulation; and the government has to compensate the difference of 17 %. The land reform and land consolidation program for the Pasak dam project may be carried out totally by governmental finance while current practice of land consolidation is financed partly (50% of construction cost) by farmers themselves. In this regard, it is essential to identify land titles for the farmers without secure title deed. If this scheme is carried out, government could implement the Pasak dam project.

4) Dairy Farming Promotion

One of the objectives of creating environmentally sound agriculture in the Pasak River Basin is to maintain and accelerate production of major field crops, especially feed crops. The increase in feed crops together with the natural forage specially for dairy cows will further strengthen the advantage of the UCR in livestock production.

Especially, we propose dairy farm promotion because of strong domestic demand for dairy products. In order to increase dairy cows, a center for breeding and distributing dairy cow and forage seeds should be established for the whole area of the Pasak River Basin. Proposed location of the center is Phra Phuttabat which is a central city to provide various urban services for the upland crop cultivation area.

Another proposal is to organize a system of efficient milk collection. Milk storage facilities should be distributed at the village level so that either agricultural cooperatives or milk processing industries can quickly collect milk.

6.2 Greater Sara Buri Industrial Core (GSIC) Development

6.2.1 Objectives

The objectives of the GSIC development are threefold:

1) To Create a Regional Urban Service Center

One of critical constraints for UCR development is the lack of matured urban service centers capable of serving hinterland economies and inviting new business investment. Looking into the regional money flows, the deposit-to-credit ratios in the UCR are always over a unity (1.0), which means that capitals accumulated in the UCR are floating out and not invested in the UCR.

Given some strategies to make use of the current movements of the economy of Bangkok, these shortcomings may be changed to advantages. One possibility is that because of skyrocketing of land prices in the BMR, some of investors' eyes are gradually looking at the potentials and the locational advantages of the UCR. If major infrastructures are improved and no serious water problems exists, the UCR would potentially have a chance to take off.

The magnet to induce such new activities is an urban center which is endowed sufficiently with administrative, financial, commercial, marketing, information, social services, educational and medical functions. Sara Buri should strategically be strengthen so as to play such roles.

2) To Create a New Inland Industrial Base

Thai industrialization has been encouraged, focusing on the seaboard development. However, Thai resources, most of the Thai industrial

materials exist in the inland. The industrialization for the second generation should highlight more on the crossing point between the sea and the inland activities, taking into account increasingly expanding domestic as well as export markets. The UCR is located at the gateway to the both activities. Having this in mind, we propose to develop a national inland industrial base in the UCR, centered on Sara Buri.

To support this argument, four points are noted: (1) the UCR is rich in agricultural resources with potentials of agricultural diversification; (2) a collection and distribution function of major agricultural products is located in the UCR with accesses to the vast hinterland; (3) the momentum of new industrial location has already been spread in the norther corridor over a 50 km radius zone from Bangkok; and (4) infrastructures to support industrial activities have been and will be improved.

3) To Create a Center for Integrating Inter-regional Projects

There exist three large scale inter-regional projects/ideas which will affect UCR development, i.e., (1) the Pasak River Basin development project; (2) Improvement of the access to the ESB by providing the Bangkok Outer Ring Road and the rail connection between Kaeng Khoi and Klong Sip Kao; and (3) Energy Center Project.

Effective utilization of these projects is a critical issue in the national context as well as in the UCR development context. For this end, a bowl is the GSIC to accept the integrated benefits from these projects.

6.2.2 Selection of Sara Buri and its Vicinities

A question may be raised: why should the location be in Sara Buri despite that Ayutthaya is another potential center? The reasons are given as follows.

The most critical constraint in Ayutthaya is the fact that Ayutthaya is environmentally sensitive and easily suffers from floods. Once the negative environmental impacts occur on the lower part of the Chao Phraya River Basin, Bangkok in particular, it will be very costly to recover the damages. On

the other hand, Sara Buri and its vicinities are more free from environmentally negative impacts due to their geological conditions.

Ayutthaya is located at the direct influence area of the expanding economy of Bangkok. From a planning point of view, however, the current economic and industrial movement in Ayutthaya and its vicinities are too rapid to depict a well-organized spatial structure in the long run. Since the land prices have already been so high, the public investment to direct the development in a balanced manner will hardly catch up with the actual movement.

Regarding the accessibility to the hinterland, the Sara Buri areas have almost same advantage as the Ayutthaya areas. More importantly, the Sara Buri areas have direct accesses to agricultural activities in the vast upland areas where agricultural diversification will be encouraged. The benefits from Pasak River Basin development will be made use of for the industrial activities in the Sara Buri areas.

Among the urban centers in the UCR, only Ayutthaya and Sara Buri cities have shown exceptionally high growth trend in the UCR. Ayutthaya, having a historical and cultural assets, has a considerable potential to be a tourism center, while Sara Buri is a traditional trading and marketing center for agricultural products. In addition, the Sara Buri city has an expandable spatial structure with less drainage and water problems, given the urban infrastructures to be improved in an appropriate manner, while the Ayutthaya city has spatial constraint. As such, Sara Buri is assessed to be endowed with more viable seeds and larger capacity for long-term industrialization.

6.2.3 Spatial Structure of the GSIC

The GSIC may not compose one core but four sub-cores, namely, the Sara Buri sub-core, the Kaeng Khoi sub-core, the Tha Rua-Tha Luang Sub-core, and the Nong Khae sub-core as shown in Fig. 6.4. The spatial structure of the GSIC will be described as follows:

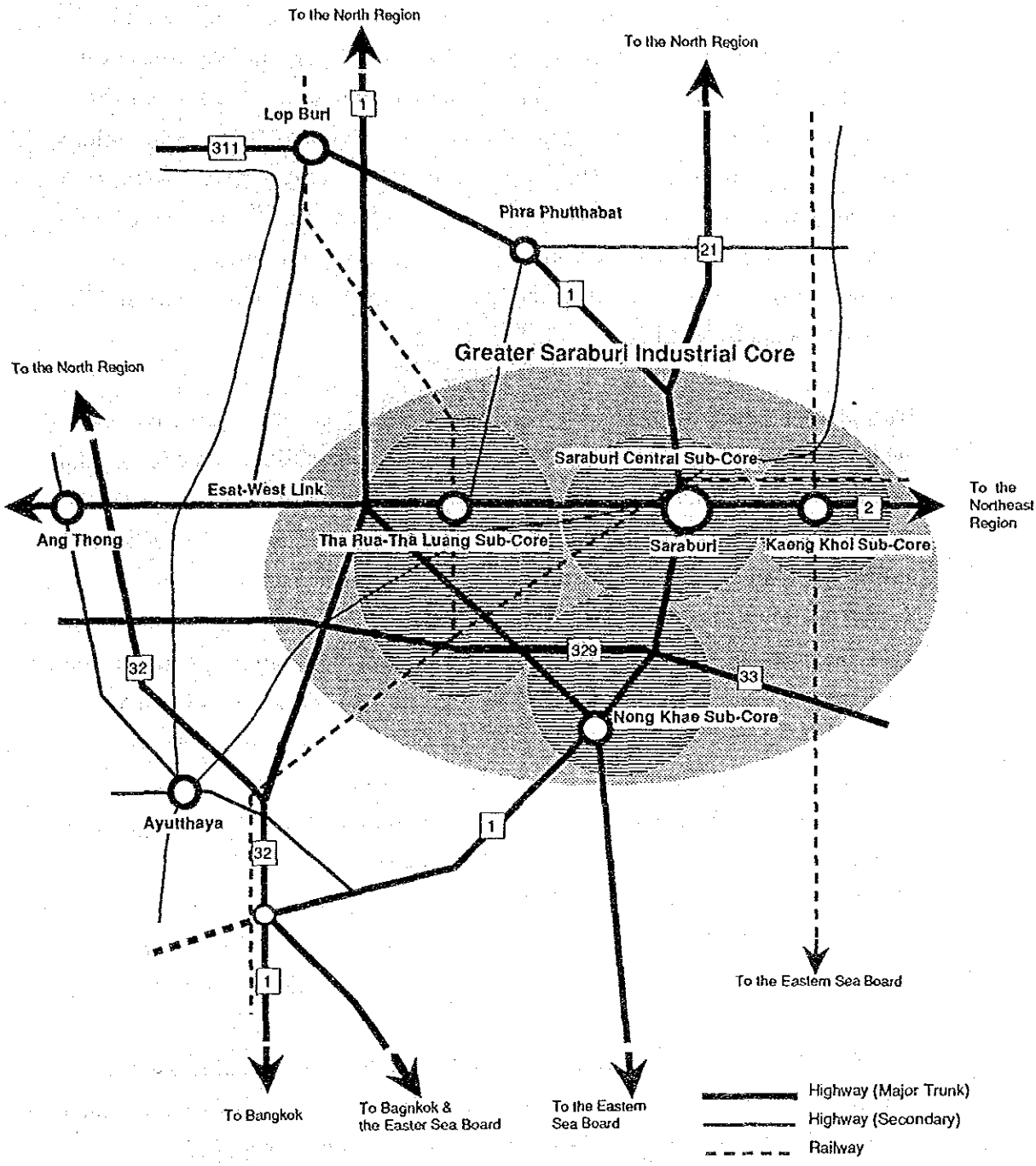


Fig. 6.4 Conceptual Structure of Greater Sara Buri Industrial Core (GSIC)

1) Area and Population

The GSIC is an integrated area covering eight (8) Amphoes, out of which 6 Amphoes are in the Changwat Sara Buri and 2 are in the Changwat Ayutthaya, with a total area of about 2,360 sq. km, or 14% of the UCR. And, fifteen (15) urban centers defined as municipalities and sanitary districts are located in the GSIC. A total of the urban areas (based on the present jurisdiction) is about 71.2 sq. km, which represents 3% of the area of the GSIC at the present. The urban area will expand in the future along with encouragement of the urban and industrial activities to almost double in 2010.

The present population, as of 1987, in the GSIC is about 389 thousand, of which about 153 thousand, or 35.4% is urban population. Based on our population projection, the total population in the GSIC will be 623 thousand in 2010 with the 1.6% growth rate, compared with 1.1% in the UCR. The urban population will increase at a higher growth rate of 3.3% to reach approximately 324 thousand. Accordingly, the urban population ratio will also increase up to 52% in 2010. The future distribution pattern of urban population in the GSIC is depicted as follows and shown in Fig. 6.5.

Sara Buri Central Core	: 150 thousand
Kaeng Khoi Sub-core	: 40 thousand
Tha Rua- Tha Luang Sub-Core	: 70 thousand
Nong Khae Sub-Core	: 50 thousand

2) Allocation of Urban Functions

The Sara Buri city has to play significant roles and functions as a central core. The central government policies are necessary to support the growth of this center. Relocation of the certain types of metropolitan functions existing in Bangkok into Sara Buri should be encouraged, e.g., higher educational facilities, research and development type institutes, higher medical facilities and headquarters of selected service industries.

The other centers should also be equipped with specific functions to share and be organized into an entire GSIC urban function. Fig. 6.6

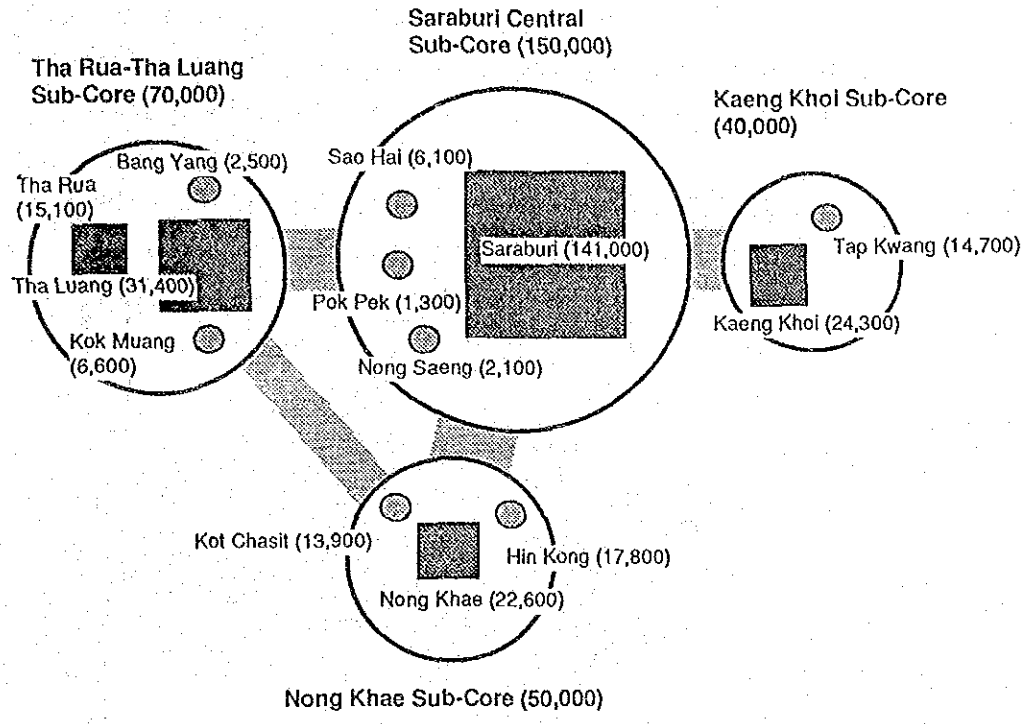


Fig. 6.5 Urban Population Distribution in the GSIC in 2010

shows a proposal of urban functions allocation system.

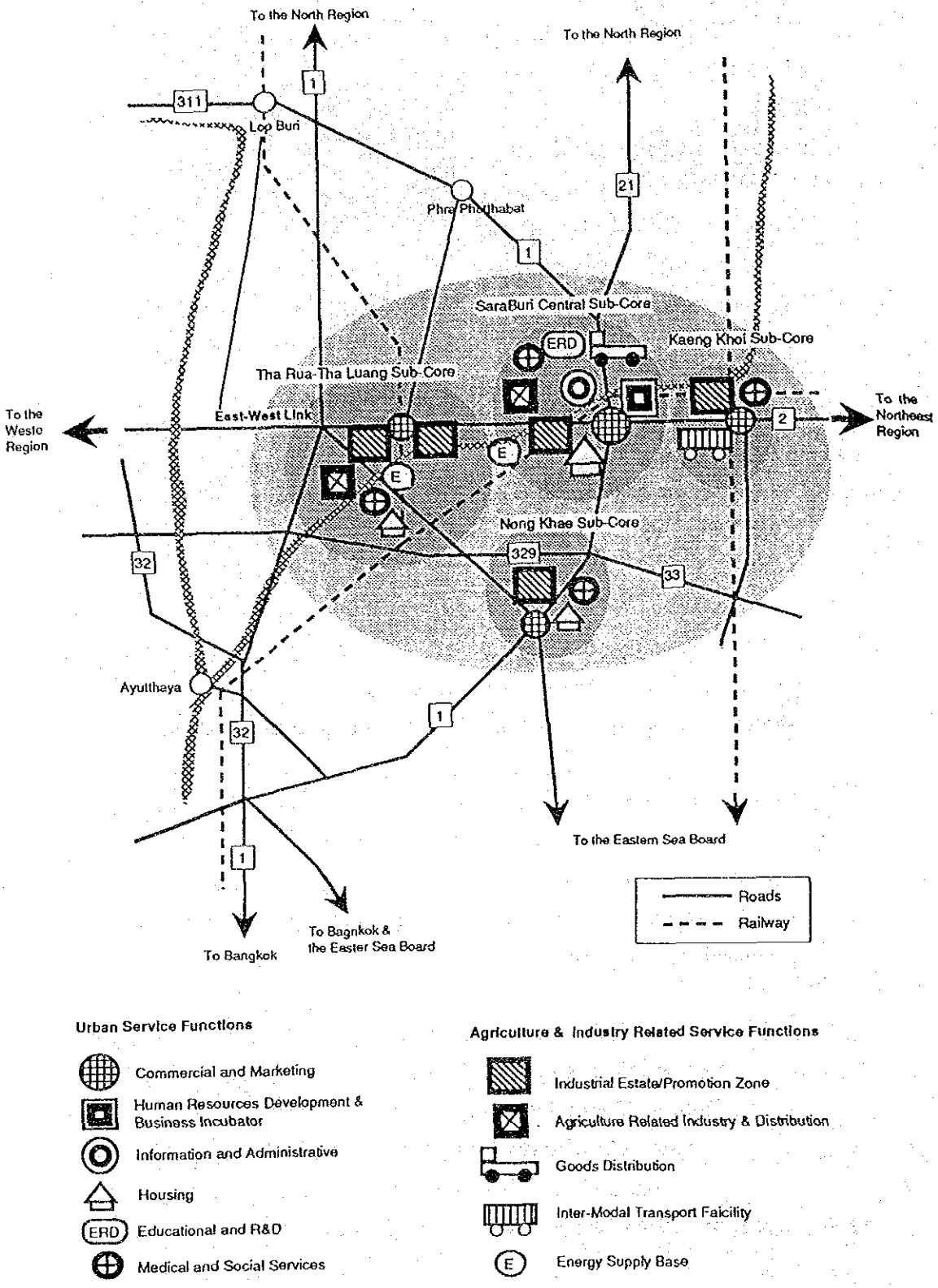
3) Industrial Support

Facilities and measures for industrial support should be associated with the development of the GSIC. The necessary facilities, for this end, are proposed as follows:

- Industrial Estate Development
- Industrial Promotion Zone
- Energy Supply Center
- Distribution Center and Truck Terminal

4) Transport Network System

For the GSIC development, the inter-regional transport linkage is crucial especially to utilize the human resources, capitals, and technologies accumulated in the metropolitan economics and basic



Urban Service Functions

- Commercial and Marketing
- Human Resources Development & Business Incubator
- Information and Administrative
- Housing
- ERD Educational and R&D
- Medical and Social Services

Agriculture & Industry Related Service Functions

- Industrial Estate/Promotion Zone
- Agriculture Related Industry & Distribution
- Goods Distribution
- Inter-Modal Transport Faicility
- E Energy Supply Base

Fig. 6.6 Urban Functions Allocation in the GSIC

materials and port functions in the ESB. Therefore, the links with Bangkok and the ESB should be emphasized. In the long run, a possibility of rapid transit system to link with Bangkok may be explored.

In the industrial development context, a particular attention should be given to the inland water way to Bangkok and the new railway link between Kaeng Khoi and the ESB. The inland water way has been a significant transportation to support the agro-products collection and distribution functions of the GSIC. Although large scale public investment would hardly be economically feasible, the importance of this transportation should be noted. In long term future, however, there is a potential that the existing inland waterway system may drastically be upgraded as a major component of the interregional cargo transport networks. On the other hand, the new rail link will provide several ideas to facilitate the goods distribution functions in the GSIC such as inland depot and container yard. These facilities hardly function as a magnet to attract new industries, but depend on a magnitude of the industries to use them. It is thus recommended that the land for them be reserved at an early stage.

Meanwhile, the East-West Links are important to integrate the dispersed regional activities into the GSIC economy. Furthermore, an intra-regional linkage among sub-cores should be structured in the GSIC.

6.2.4 Integrated Development System

GSIC development calls for both inter-regional and inter-sectoral project coordination and integration with a purpose that such large scale development will be implemented efficiently. In this regard, consideration should be given to the following projects:

1) Integrated Pasak River Basin Development

Integrated Pasak River Basin Development should be coordinated with GSIC development, in terms of water supply and the linkages between agricultural diversification and its marketing and processing, so that benefits from both development projects may be multiplied.

2) Inter-City Solid Waste Collection and Treatment System: Local Authority Association

Under the present system, each local authority has to be responsible for solid waste treatment by itself. This system is inefficient in terms of usage of manpower and equipment. An inter-city solid waste collection and treatment system should be explored based on the notion that the GSIC is one unity of urban development, pursuing the economies of scale. We propose that the Local Authorities Association (to be discussed further in Chapter 7.3 Urban Management of this report) be organized for this common objective. The work itself may be privatized under the management of that association.

3) Waste Water Disposal Development

The waste water disposal and management system in the Sara Buri urban core should be developed with a high priority. However, urbanization will spread over the present jurisdiction of the Sara Buri Municipality. Therefore, the plan covering the service areas of the anticipated urbanized area over the municipal boundary will be needed through coordination with relevant authorities.

4) Urban Gas Supply System

The natural gas pipeline has been brought in the UCR for industrial purpose and an inter-regional energy supply center will possibly be developed in the UCR based on this pipeline. For Sara Buri urban development, this energy source may be utilized for the purpose of creating urban amenity.

6.2.5 Sara Buri Urban Development Guidelines

The Department of Town and Country Planning (DTCP) has already prepared the Comprehensive (General) Town Plan which covers the Sara Buri Municipality and its vicinities with a planning area of 39.3 sq. km. The target year is 2005.

Though the basic structure delineated in the DTCP's Plan is not necessary to be altered so much, the development framework is needed to be reconsidered in our view that appreciates greater urban growth potential.

1) Urban Development Framework

The urbanized area will be more than 2 times as wide as that at present, or an area of additional 23 sq. km will be required by 2010. In turn, housing demands will increase as well, and a great emphasis should be placed on the provision of houses. We expect that the total of number houses will be about 33,700, compared with 11,623 in 1988. This implies that one thousand units of houses will annually be constructed by 2010. This will bring about a construction boom in the Sara Buri City.

2) Urban Structure

A major issue is how to separate the major inter-regional traffic flows on the national highway Route No.2 and Route No. 1 from the intra urban traffic flows in order to eliminate bottlenecks of these traffic flows as well as to avoid congestions in the city. As for the north-south traffic flow on Route No.1, the Sara Buri Bypass which is under construction will provide partial solution to this problem. As for the traffic on Route No.2, a bypass is hardly planned because of a strict land constraint. Some alternative solution is necessary, for instance, improvement of the intersection of Routes 1 and 2, or provision of another detouring route.

Regarding the urban structure, the Sara Buri Bypass will provide a new axis of urban structure and great potentials for land development. This new urban axis should properly be utilized for the future expansion of the urban area.

Fig. 6.7 shows a proposed conceptual structure, as a guideline, of the Sara Buri urban area, taking into account the DTCP's planning concept. A further study is required to for it be an authorized development master plan, involving local authorities concerned.

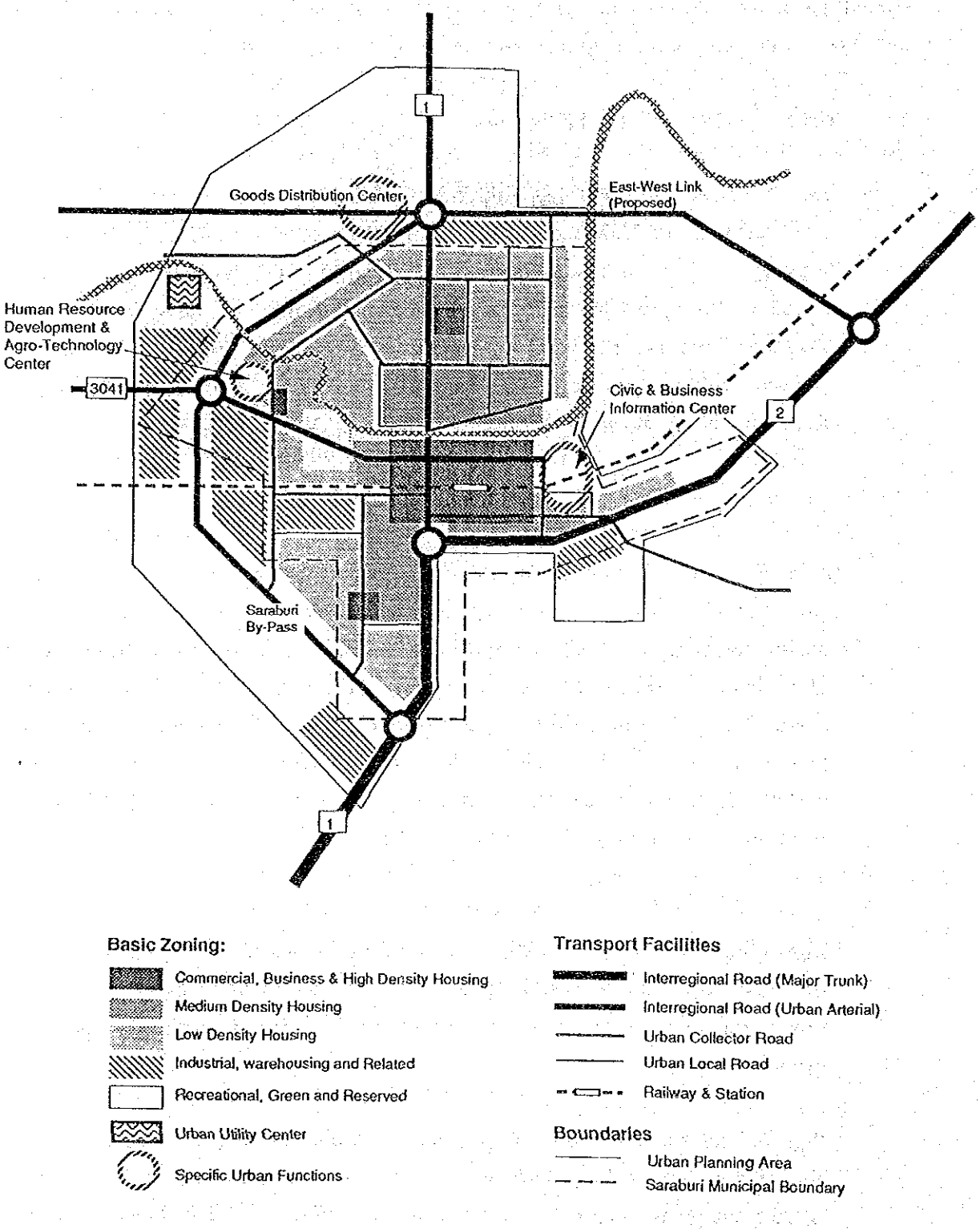


Fig. 6.7 A Proposed Urban Structure Plan In Sara Buri Urban Area

6.2.6 Strategic Regional Center Development Project

Urban development programs and projects are proposed to be undertaken under a package of "Strategic Regional Center Development". Table 6.3 shows a summary of the programs and projects.

Table 6.3 Programs and Projects for the Greater Sara Buri Industrial Core Development

Stage	Programs and Projects Component
(1)	Short-Term Programs and Projects
	A1 Implementation of Development Master Plan Study for the Greater Sara Buri Industrial Core Project (Investment Program and Feasibility Study)
	A2 Preparation of "Guidelines for Industrial Locations and Urban and Housing Development in both Ayutthaya and Sara Buri Sub-Regions
(2)	Medium-Term Programs and Projects
	A3 Implementation of Urban Utilities and Infrastructure Projects including:
	A31 Expansion of Water Supply Capacity and Facilities in the GSIC
	A32 Sewerage System Development in Sara Buri Urban Area
	A33 Acceleration of Urban Streets Network Development in Sara Buri Urban Area, Tha Rua-Tha Luang and Kaeng Khoi Sub-Cores.
	A34 Solid Waste Collection and Treatment System in the whole GSIC
	A35 Inducement of Urban Gas Supply System in Sara Buri Urban Area
	A36 Expansion of Telecommunication Capacity in the GSIC
	A37 Improvement of Inter-regional Bus Terminal in the Sara Buri City
	A4 Development of Housing Complex (Sara Buri New Town) by the Public Initiation, with the Private Sector Involvement.
	A5 Promotion of Redevelopment Projects in the Sara Buri Central Business District
	A6 Development of Goods Distribution Terminal and Improvement of Food Wholesale Market in Sara Buri City
	A7 Preparation of Guidelines for Relocation of Bangkok-Based Facilities to the GSIC
(3)	Long-Term Programs and Projects
	A8 Inducement of Higher Metropolitan Functions (Higher Educational and Medical Facilities)
	A9 Preparatory Work for A Rapid Transit System Development between Bangkok and Sara Buri

In the short run, the study for the Greater Sara Buri Industrial Core Development should be conducted in order to build a comprehensive investment program and examine the feasibility of urgent projects. At the same time, the guidelines for urbanization and industrial location should be prepared with environmental considerations.

In the medium term, basic urban infrastructures projects should be implemented, placing special emphasis on the sanitary utilities such as solid waste collection and treatment in the GSIC as a whole and the sewerage system in the Sara Buri urban area. Expansion of telecommunication capacity and water supply capacity as well as development of the urban roads network and inter-regional bus terminal are also essential projects. The redevelopment project in the central commercial zone should be encouraged through collaboration between the local authorities and the private sectors. In connection with strengthening of the commercial function, the regional truck terminal and goods distribution center project will be feasible. For provision of housing, housing complex development of a medium scale, or a satellite new town may be initiated by the public sector within the Sara Buri urban area. This attempt shall be a pilot effort to encourage and manage the private sector's housing development.

In the long run, the central government is recommended to push relocation of such metropolitan functions as higher educational and recreational from Bangkok to Sara Buri. In a longer perspective, a rapid transit system between Sara Buri and Bangkok may be considered.

6.3 Agro-Industial Linkage Development Program

6.3.1 Background

Closer and diversified linkages between agriculture and industry are one of the most important factors to realize comparative advantages of the UCR in the farming and livestock production and the transport accessibilities on various direction. The central concern of this program is the agricultural processing to be supported by the plans for agriculture, industry and urban development.

About 90% of the agricultural crops (rice, maize and tapioca) bound partly for Bangkok and partly for abroad through Bangkok, are either produced in or transported through the UCR (See Table 6.4).

Table 6.4 Flow of Major Crops to Bangkok

Major Crops	Crop Bound for Bangkok	of which those: Produced in UCR	Transported through UCR	The Rest
Rice	100.0	32.4	60.5	7.1
Maize	100.0	15.9	73.7	10.4
Tapioca	100.0	6.9	80.1	13.0

Source: Transport Statistics, 1988

Based on this flow, there are a variety of basic processing activities in the UCR such as rice milling, tapioca pellet manufacturing, maize drying and raw sugar refining. However, these processings are made mainly for the sake of convenience in transport and export of specific processed products so that substantial portion of raw materials are simply treated as wastes. No downstream production is undertaken in the UCR. There has been little effort to make new products by combining different materials at the primary processing stage. Accordingly, raw materials brought into the processing facilities have not been quality in the UCR. There is a great potential in the UCR to develop further processing of crops, especially five major crops of rice, maize, cassava, sugarcane and soybean. In contrast to the hilly areas such as Chaing Mai, Petchabun, Kanchanaburi and Chantaburi, where a variety in topographic, soil and climatic conditions enables high productivity in various crops such as fruits and vegetables, the UCR should be good, first of all, at such agro-processing that handles bulk volumes of low value added crops at a midpoint between production and consumption areas. Especially, expected growth of livestock in the UCR as well as elsewhere in Thailand provide the UCR with an opportunity to develop manufacturing and mixing of low-cost feed materials based on the combined use of these major crops. This type of processing is conducive to the agriculture in the UCR as well, because product diversification would mitigate fluctuation of the demand for these crops which have largely been dependent on the international market. It also has potential to absorb dry season unemployment in the wide range of labor intensive process such as transportation, loading/unloading, processing, mixing and packaging.

Another important implication of agro-industrial linkages is the proposed Integrated Farming System (IFS). We propose this system as a part of the Integrated Pasak Basin Development to establish environmentally sound

agriculture and thus to sustain major crop production. IFS can, however, be made possible only when market, either local, domestic or international, is assured for crop diversification at the farm level. We also propose a crop diversification through water conservation and groundwater use on some land in Chao Phraya Irrigation being idle in dry season, and this proposal, too, calls for market.

In order to channel the agricultural products to the market, distribution and processing needs to be improved. In case of rice, technology improvement is the issue to increase the yield rate in distribution and processing, and further to utilize wastes for product diversification. In case of major field crops, the quality control before agro-processing industries is important. In case of minor crops such as fruits and vegetables, distribution and processing is important in the field of classification of products, preservation and quick transportation.

In developing distribution and processing network in the UCR, the role of secondary order cities is essential. Changwat centers and some municipalities at strategic mode of transportation network have been developed as agricultural service centers.

Although public infrastructure investments for urban development have been spreaded out somewhat thinly among all secondary order centers, they could more effectively be utilized by allocating to the selected cities which are strategic at the secondary level in connecting agriculture and industry.

6.3.2 Objectives

Thus, we recommend to coordinate a certain aspect of agricultural, industrial, distribution and urban development activities under the Agro-Industrial Linkage Development Program with the following objectives:

1) To establish a link among major field crop production, agro-processing industries, and the recyclic and combined use of agro-processing byproducts and wastes for livestock.

2) To ensure industrial and consumer market for the farm-level agricultural diversification through the Integrated Farming System in

the Pasak river basin and for the dry season land utilization in the Chao Phraya Irrigation.

3) To develop selected secondary order cities as strategic points of distribution and processing and dry season unemployment absorption.

A concept of agro-industrial linkage for the UCR is shown in Fig.6.8.

6.3.3 Program Components

Components of this program are over five sectors of agriculture, marketing and distribution, transportation, urban development and industry with special stress on linking the proposed Integrated Pasak River Basin Development Project and the Greater Sara Buri Industrial Core (GSIC) Development. Structure of the program is schematically shown in Fig 6.9. An important national measures to support this program is the improved taxation system

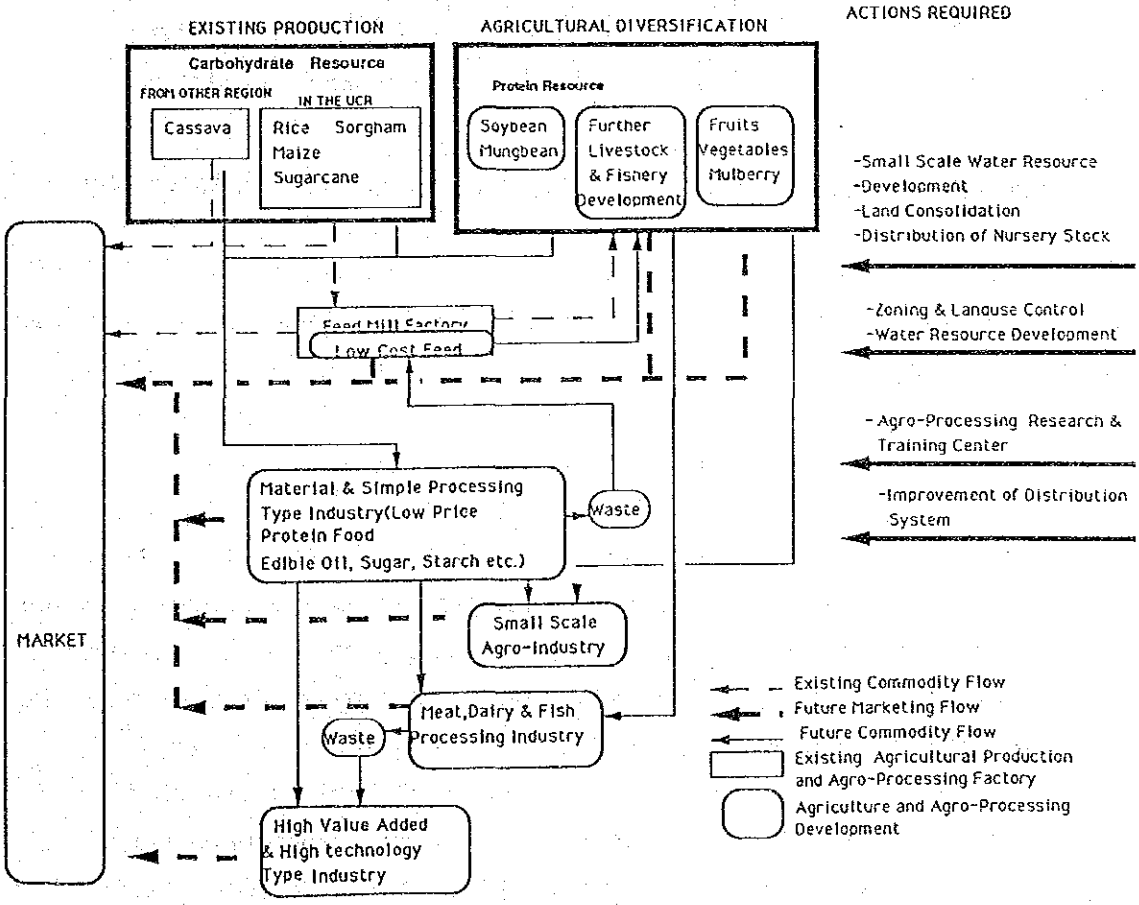


Fig. 6.8 Agro-Industrial Linkage for the UCR: A Concept

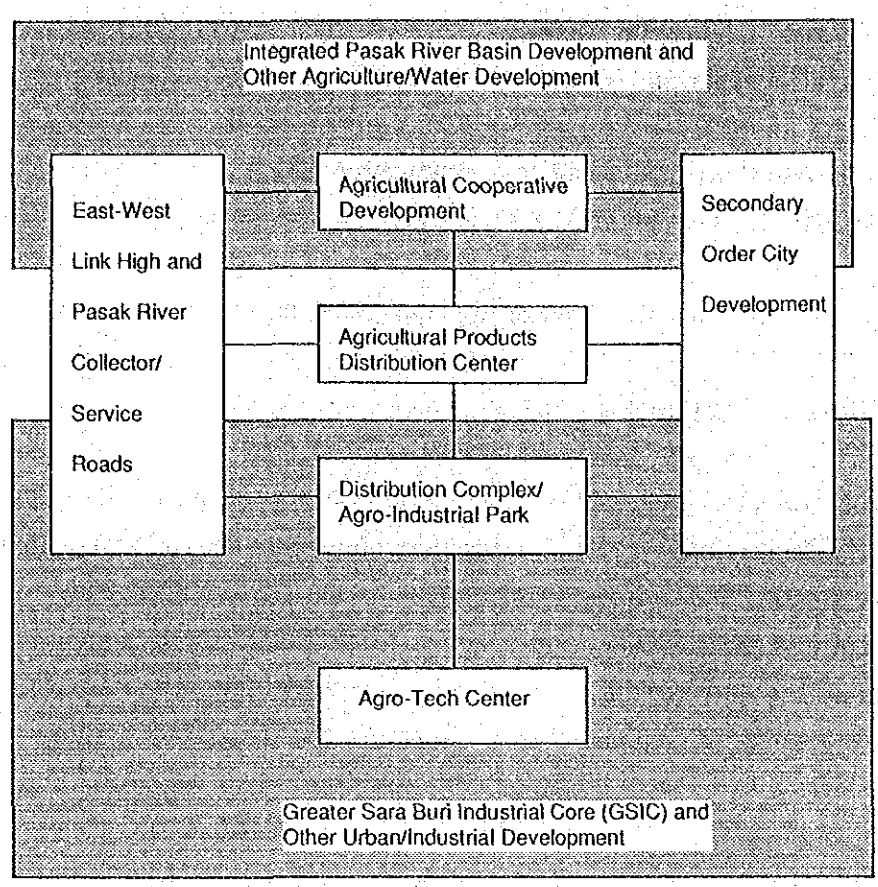


Fig. 6.9 Components of Agro-Industrial Linkage Development Program

such as the value added tax to promote diversification of backward and forward linkages.

1) Agricultural Cooperative Development

Although farm credit channelling is their major activities in most existing agricultural cooperatives, the agricultural cooperatives, should be strengthened as a basis of agro-processing with a stress on joint marketing. Joint procurement of agricultural inputs is now prevailing, and this momentum should be expanded to cover:

(1) Strengthening of logistics of agricultural cooperative to efficiently collect and store agricultural products at the Amphoe level, namely, provision of more trucks and storages with agricultural cooperatives.

(2) Increasing of the savings of farmers at the agricultural cooperative as a source of cooperative investment in joint marketing and procurement, and the low cost and flexible farm credit as an incentive for farmers to participate in the cooperatives.

2) Agricultural Products Distribution Center

Based on the agricultural cooperative development at the Amphoe level, agricultural products distribution center should be developed at each Changwat center, in order to attain the economies of scale being necessary in improving distribution and processing. The center shall consist of storage, grading and packaging facilities, while main type of facilities and functions should be different among Changwat depending on the types of crops to be mainly dealt with. Agricultural products are primarily processed, classified, packed at the centers and shipped out to either agro-processing industries, local market or Bangkok market. The center should be developed and managed by Changwat Federation of Agricultural Cooperatives.

3) Distribution Center/Complex and Agro-Industrial Park

The more agricultural products are collected, the more opportunities exist to diversify and upgrade the processed products. In order to attract agricultural products in a certain spot, we propose a combination of Distribution Center/Complex and Agro-Industrial Park at Tha Rua, which is the best place in the UCR to collect a variety of agricultural products not only from within the UCR but from the northeastern and northern regions.

Distribution Center/Complex is a space for distribution processing industries and common facilities including grading facility, packaging facility and storages. We stress the usefulness of cold storage facilities to attract perishable products for processing in Tha Rua.

Agro-Industrial Park is an industrial estate specialized in the agro-processing particularly of five bulky major products of maize, cassava, sugarcane, soybean and rice. This should be located immediate next to

the proposed Distribution Center/Complex. Important common facilities to be developed in the Agro-Industrial Park is waste water treatment space, water recycling systems and truck terminal.

4) Agro-Tech Center

In order to encourage diversification of agro-processing, we recommend the development of Agro-Tech Center in Sara Buri City to provide technological consulting services for agro-processing industries with an emphasis on the further processing, recyclic use, combined use of five major crops and wastes from their processing.

5) East-West Link Highway and Pasak River Collector Roads

Highway network in and around the UCR has fairly been developed but mainly in such a pattern to connect Changwat, Amphoe and villages with Bangkok as closely as possible.

As a strategic link to strongly connect neighbouring Changwat each other so that agricultural products are attracted to certain places, one of which is the GSIC, Tha Rua in particular, we propose the East-West Link Highway to be developed between Suphan Buri and Tha Rua, and between Tha Rua and Sara Buri.

Added to this link is Pasak River Collector Roads to be developed along both sides of Pasak River between Tha Rua and Nakhon Luang. These roads aim at expanding the interface between inland waterway and highways in order to enlarge the hinterlands of the proposed Distribution Complex and Integrated Agro-Industrial Park and fully utilize the Pasak inland water way.

6) Secondary Order Center Development

In view of the importance of some of the secondary order centers to support agricultural production and marketing and the mid-point distribution and processing, we recommend to allocate public investment intensively for the basic urban needs such as water, street, electricity and telecommunication in the following selected cities at the

secondary level.

(1) Centers in the upland area being important to bridge Integrated Pasak River Basin Development and the Greater Sara Buri Industrial Core Development: Lam Na Rai (Lop Buri), Phra Phuttabat (Sara Buri), Khok Samrong (Lop Buri) and Ban Mi (Lop Buri).

(2) Centers in the Chao Phraya Delta being important to collect rice and the minor crops to be grown through diversified use of dry season idle land: Wat Sing (Chai Nat), Sing (Sing Buri), San Chao/Rong Thong (Ayutthaya) and Sena/Cho Chet (Ayutthaya).

(3) Centers in the GSIC: Kaeng Khoi, Nag Khae, Phachi and Tha Rua/Tha Luang.

6.4 Human Resources Development : Focus on Non-formal Education

6.4.1 Background

Human resource development is the most important basis of national and regional development. At the national level, increasingly important issues for the human resource development are: (1) the diversification of human resource base for industrialization through strengthened secondary-level education, higher education of scientists, engineers and technicians and vocational training to be encouraged especially in the private sector; (2) the dissemination of basic and vocational educational opportunities especially in the rural areas in order to alleviate a large gap between the BMR and elsewhere in the quality of human resource base; and (3) the strengthening of the people education for development management.

From the viewpoint of UCR development, these three issues are important in the following meanings;

- Strengthening of secondary-level education not only for national industrialization but also for broaden the human resource base for regional development.

- Strengthening of the people education for development management peculiar to the UCR such as environmental conservation, local level water management, agricultural diversification, and tourism promotion.

It is in this context that we focus on non-formal education.

The non-formal education has been playing a major role in augmenting the basic formal education. However, the higher will be the quality of education needed by the Thai economy and society, the greater will be the need to restructure the whole system of primary and secondary level education, including the role and substance of non-formal education.

Present set-up of the non-formal education is shown in Tables 6.5 and 6.6 for the country and the UCR, respectively.

At present, the education system in Changwat; including those in the UCR is faced with the following issues:

1) In spite of increasing national needs for secondary level education, there is a great imbalance between primary and secondary education in terms of teaching staff and financial input. Average teacher-to-pupil ratio has reached 20 already at the primary level. Beside, many of primary school teachers are graduates of only secondary or even primary education. There is a great need to increase secondary school teachers in order to realize the government policy to compulsorize secondary education. A possibility is to divert surplus teachers in the primary school into secondary school, but this needs substantial retraining of them. Besides, there is a problem of compartmentalized administration for primary and secondary education, the former being managed by Provincial Primary Education Commission and the latter by Provincial Secondary Education Commission. This compartmentalization is practically a major obstacle to balancing and integrating primary and secondary education rather than rural peoples affordability and willingness of secondary education.

2) Non-formal education has not effectively been able to augment formal secondary education. Non-formal education originated from counter-illiteracy program some 50 years ago and transformed into a means to

Table 6.5 A Comparison of Non-Formal Education Programs by Various Organizations

Title	Objectives	Characteristics	Executing agency	Target group	Location
1. Basic Education Level 1 - 2 - 3	- Literacy - Numeracy - Life quality	5 month and 1° year program	Provincial Non-Formal Education Centers	Primary school dropouts, hill-tribe people	Varied-dependent on organizers
2. Basic Education Level 3 - 4 (classroom and corespondence)	same as formal secondary education	course study in learning units 1° years for Level 3 3 years for Level 4	Provincial Non-Formal Education Centers	Grade 6 achievers who do not continue formal secondary school	elementary, secondary schools, PNEC, Monasteries
3. Vocational Trainings (both in class and mobile and Interest Group)	To promote vocation education To promote people's career	short-courses ranging from 30 hours to 300 hours	Provincial Non-Formal Education Centers	The rural people Unemployed, Underemployed Interested people	Element and secondary schools, monasteries PNEC, Libraries
4. Trade Skill Training	To promote trade skills	mostly one year course of study	Institutes of Trade Skill Training, Dept. of Labor	Those who are interested in trade skills, the sixth grade achievers	Located in large cities
5. Vocational Training or polytechnic	To promote vocation education	mostly short course training, 3 months or more	Area Vocational Centers, Dept. of Vocation Education	Out of school learners, formal school students	located in large cities
6. Vocational Training	To improve people quality of life	Short courses and tour	Dept. of Rural Development	Youth, women and some groups of people	Rural areas especially in the villages
7. Vocational Training	To promote home-industry and Manufacture	Short courses	Dept. of Industiral Promotion	people concerning industrial work	Mostly at the district or Amphoe level
8. Agricultural Training	To promote agricultural vocation	Short courses	Dept. of Agricultural Promotion	farmers, and youth farmers	Rural at village level
9. Quality of Life Training	To promote the quality of life of rural people	Short courses	Office of Accelerated Rural Development	local leaders, youth	Rural at village level
10.Vocational Training	To improve people life	Short courses	Dept. of Social Welfare	young women, old age, etc.	Urban areas

Table 6.6 A List of Nonformal Education Programs in the Upper Central Region of the Department of Nonformal Education.

Nonformal Education Programs \ Provinces		Ayutthaya	Ang Thong	Sing Buri	Sara Buri	Chai Nat	Lop Buri
1. Function Literacy (class)		2 class	-	-	4 class	-	8 class
2. Continuing Basic Education							
Classroom[1/]	Level 1 - 2	-		15/1	30/2	-	30/2
	Level 3	20/1	-	20/1	40/2	-	60/3
	Level 4	180/9	140/7	40/2	380/19	40/2	360/18
Radio Correspondence[2/]	Level 3	250	150	80	170	175	350
	Level 4	245	150	180	700	180	280
3. Vocational Training							
Classroom[1/]		120/6	180/9	100/5	180/9	100/5	160/8
Mobile[1/]		540/27	740/37	460/23	720/36	420/21	640/32
Interest Group[3/]		113	72	48	18	58	126
Joint[1/]		140/7	60/3	120/6	-	-	80/4
4. Number of Village Reading Centers (2 newspapers per day)		156	74	95	101	84	112
5. Information Mobile Unit[4/] (Movies, Video, Slides)		46	60	50	70	30	51
6. Number of Libraries		14	5	6	7	11	4

1/ in number of adult learner/number of class
2/ number of adult learner
3/ number of group
4/ number of place

augment formal basic education with the curriculum revised to be consistent with formal education. With very limited number of teachers, however, the non-formal education can not be a replica of the formal education. In terms of basic education, what is effective and efficient is to strengthen the formal education itself, secondary education in particular. Meanwhile non-formal education needs to play its own clear role in the whole system of life-process education.

3) In the meantime, non-formal education has increasingly been overlapped with a variety of vocational training programs. In the UCR, vocational training is a major component of the non-formal education for the rural youth and women, but more or less the same groups of people are targeted for vocational training by Community Development Department, Department of Industrial Promotion, Department of Agricultural Extension, Office of Accelerated Rural Development and

Department of Social Welfare. It is inefficient that many government agencies are dependent on limited number of local instructors to provide vocational training for common target groups.

4) As the implementing agency of non-formal education at the local level, there is one Provincial Non-formal Education Center (PNEC) in one Changwat. However, it is limited particularly in terms of the ability to assess the local needs and design relevant educational programs and the effective number of instructors (one instructor for one Amphoe on average).

5) From the viewpoint of the people education, the current non-formal education system is not fully effective partly because the whole operation is in the hands of central government agencies themselves without sufficient involvement of local leaders, people, NGO's or local governments and partly because the curriculum and teaching materials are not specific to the issues and needs of locality but common to all over the country. Unlike basic education for children, the non-formal education for adults especially in people education, call for variety and local specificity in order to attract their interest.

In this regard, an attention should be paid to successful performance in the people education by some nongovernmental organization such as DELSILIFE (Development of an Effective Learning System for the Improvement of Life). DELSILIFE has been active in Nakhon Ratchasima and expanding its operation to other Changwat such as Kampaeng Phet, Chumphon, Chachoengsao, Chaiya Phum and Kanchana Buri. It aims at motivating and educating village leaders and people in the spirit to think and discuss together for the improvement of village life and in the problem solving skills for development and democracy. To be effective, specific fields such as fish-farming and chicken raising are focused depending on the potential and villagers interest, but primary objective of the education of this type is not vocational training of individuals but the education of people as group in development management capability at the village level.

6.4.2 Objectives

1) To enhance general educational level in the region in order to contribute to the national industrialization to broaden regional human resource base with special emphasis on the secondary-level education.

2) To strengthen willingness and capabilities of the local people to initiate local projects, to respond to and cooperate with government projects, and to monitor the private activities with special emphasis on environmental conservation, water management, agricultural diversification or farm level and cooperative activities.

6.4.3 Project Components

1) Trial Implementation of Compulsory Secondary Education

In order to adopt the compulsory secondary education as stipulated in the 6th Five-Year Plan, it should be effective to conduct a pilot project in some areas in order to assess the needs, response and feasibility of the compulsory secondary education. The UCR is a good region for the pilot project because rate of transition from primary to secondary schools is already high at 64% compared to the national average of 45%. Changwat Sing Buri is considered to be an appropriate place for its especially high rate of transition attained already and the size of its Changwat area.

Needed priority actions at the Changwat level are upgrade training of primary school teachers by making use of teachers college, and trial set up of Changwat Board of Education for the purpose of coordinating all the education programs at the Changwat level, including primary, secondary, non-formal and vocational education.

2) Strengthening of Provincial Non-formal Education Center (PNEC)

In activating non-formal education toward the people education, existing PNECs need to substantially be strengthened. Of particular action needed is, firstly, the strengthening of research function of PNEC to monitor and identify the local needs of non-formal education

and prepare basic Changwat strategies to meet the needs. Secondly, PNEC should prepare a data bank of local constructive leaders, local wisdoms and progressive activities initiated by local people for development. This will greatly strengthen the technical manpower base of PNEC for teaching programs, consultative activities and more effective use of existing channel between PNEC and the people; Amphoe libraries and village reading centers.

3) Audio-visual System Development for People Education

In spite of fast dissemination of televisions and video all over the country and shortage of instructors and leaders for people education, the use of an audio-visual system has been limited to the distance learning education through radio. While the distance learning education should be continued for basic education purpose, an audio-visual system should be used for the people education. It is recommended to make use of Amphoe Libraries and Village Reading Centers and audio-visual education centers at the local level. Provision of television and video tape recorder sets with cassette tapes for education purposes at these libraries and reading centers will encourage the use of these centers for the peoples education and discussion meetings among people.

6.4.4 Policy Recommendations

Education is basically a national matter. In order to support the projects above, the central government should consider the following points:

1) Launching of Compulsory Education at the Secondary Level

It should be realized that the compulsory secondary education requires reallocation and upgrading of teachers and coordination, and possibly, integration of administration for education rather than the affordability of people. It is obvious among people that industries and businesses will less and less recruit the primary education graduates.

2) Modification in the Direction of Non-Formal Education

By its nature, objectives of non-formal education can be changed as socio-economic structure changes. Non-formal education as a supplement of formal basic education should be limited to specific areas such as very poor or remote areas. It is also recommended to further facilitate the compatibility between non-formal and formal education, continuing education and secondary education in particular, by enabling the non-formal education experience to be registered in the secondary education. A greater emphasis of non-formal education should be placed on the education for development management at the local level. In this regard, various vocational training programs under different line agencies should be coordinated both at the central and Changwat levels.

In line with the emphasis on the education for the local level development management, positive role and successful experience of NGO's should full be recognized by the government as well.

7. MANAGING REGIONAL DEVELOPMENT

7.1 Water Resources Management

7.1.1 Issues

Agriculture and agricultural-based economy of the UCR depend highly on water resource management. In spite of its definate interregional comparative advantage in agriculture, rice production in particular, the UCR's agriculture has been unstable mainly due to a limited and seasonally as well as annually fluctuating volume of the agricultural water available for this region as well as due to a prevailing cropping pattern which has been subject to the international market price fluctuation to a great extent. In future, urbanization and industrialization in the UCR will become another challenge against the water resource management.

From the viewpoint of developing the UCR, issues for the water management can be summarized under the following major points:

- Limited and fluctuating volume of dry season water available for the UCR
- Inefficient use of available water
- Inadequate system to allocate water in response to changing needs and to adjust water demand

1) Limited and Fluctuating Water Available for the UCR

In the UCR, there is an irrigated area of 3,238,000 rai or 41.5% of the total irrigable area, but the area under irrigation is only 9.9% of it in the dry season. Beside, the area for dry season irrigation fluctuates from year to another: 1.3 million rai at smallest and 3.3 million rai at largest during the past ten years.

In the upland, there are potential water resources of Pasak River and its tributaries, but they have not fully been tapped so that the upland agriculture has mainly been unstable rainfed one. In future, increase in industrial and domestic water demand may intensify the water shortage problem in certain areas such as Sara Buri where industries are expected to concentrate.

These overall limit and fluctuation in the water volume for the UCR stems from three factors on top of limit and seasonality of the rainfall at the upstream of main rivers as well as within the UCR:

(1) The UCR is situated between the northern region and the BMR. In the northern region being upstream, agriculture water needs to be ensured, too. Water resource development is still ongoing. In the BMR, domestic and industrial water consumption is substantial, and it has long been an established and socially accepted policy of the government to ensure the water first of all for the BMR than elsewhere. Demand for water will continue to increase fast as long as the national economic expansion will entail growth and expansion of Bangkok. It is expected that the volume of water intake by Metropolitan Waterworks Authority (MWA) will reach about 30% of the total of wet and dry season irrigation water consumption in the UCR as of the year 2010. In dry season, the MWA's water intake from Chao Phraya River would be as large as more than 50% of the irrigation water for the UCR.

(2) The watershed areas of Chao Phraya River and its tributaries have been deteriorated due to excessive encroachment of farmlands in the forest of the northern region. This has aggravated the seasonal fluctuation of river water, draught and flood as well. As far as for this matter, Pasak River is under the same situation. Environmental conservation is essential in the tributaries, both outside and within the UCR, for Chao Phraya as well as Pasak Rivers.

(3) Potential water resources in the upland of the UCR have not fully been tapped due to inadequate investments in small, medium and

on-farm reservoirs. In the past, water resource investments have tended to concentrate in lowland for the purpose of rice production. In the upland, available storage capacity accounts for 40% of total run-off. Pasak River itself has not been tapped for agricultural purpose in the UCR. If a dam is constructed for the purpose of the UCR's benefit, additional water resource would amount to some 100 MCM.

2) Inefficient Use of Available Water

The irrigation water available from Chao Phraya River has not fully been utilized for the following three main reasons:

(1) There are only a few facilities in the UCR to retain wet season irrigation water for dry season agriculture. Intensive use of land in the Chao Phraya delta area prevents on-farm land storages from finding their space. This is an issue of land management as well.

(2) Irrigation facilities at the tertiary level such as ditches and farm turn-outs have not adequately been maintained. The reasons for this are mixed. First, all the irrigation facilities belong to RID and operated virtually by RID so that the farmers who are expected to participate in the maintenance of feeder facilities have limited willingness to rehabilitate such facilities, while RID has insufficient financial capacity to maintain all the facilities down to the tertiary level. Second, either RID or farmer's groups have not actually been able to collect the water charges necessary for such maintenance works. Third, there have been lack of strong effort through education and campaign to form a community concensus that irrigation facilities should be well maintained, that various rules should be kept to maintain irrigation water as public, community goods and that beneficially should make contribution for the maintenance.

(3) There is still room on the part of RID to operate the whole irrigation system more efficiently especially by improving its communication and data management systems.

3) Inadequate System to Allocate Water in Response to Changing Needs and to Adjust Water Demand

In dry season, irrigation water is allocated by RID through a rotation system. The system has not, however, fully been effective due to several reasons. First, in a large irrigation system in a flat land like Chao Phraya Delta, water tends to stay in canals and is difficult to control for artificial rotation and timely allocation. Second, substantial gap tends to happen between actually water demand of farmers and water allocation. In 1988, for example, actual dry season rice cultivation area in Regions 7 and 8 of RID exceeded the target area for water allocation by almost 80%. This is partly due to a highly centralized system of RID in spite of the arrangements institutionalized between farmers and RID to exchange information in water allocation, and partly due to inactive participation of farmers groups in the operation and maintenance of irrigation system, including water allocation. Third, increasing trend of agricultural diversification makes it more difficult for RID to timely supply water for different areas with different volume of water demand. Lack of adequate water demand management is another factor to this. Coordination has not fully been made between water allocation and crop planning, both at the national policy level and the local planning level. In future, increasing water demand of urban and industrial activities within the UCR would further increase the difficulty in water allocation.

7.1.2 Strategies

Water resource management strategies recommended for the UCR are the following:

- Basin-Wide Strategies,
- Chao Phraya Delta Irrigation Management Strategies,
- Upland Water Resource Development Strategies, and,
- Urban and Industrial Water Management Strategies.

1) Basin-Wide Strategies

Water resource utilization in the UCR depends not only the management within the region but, to a great extent on the management of the whole Chao Phraya River Basin. Important strategies in this regard are as follows:

(1) Watershed management in the northern region to keep the downstream, including the UCR, from draught and flood. Reforestation and nation-wide land use control are necessary.

(2) Early implementation of the plan by Metropolitan Waterworks Authority to intake water from Meklong River to minimize the pressures of water demand of the BMR on the water resources in Chao Phraya River Basin.

(3) Ensuring the UCR to be provided, at least, with the amount of Chao Phraya River water which has been allocated. The irrigation development in the northern region, which is the main beneficially, should be made with its own water resources development. As for the BMR, there is a possibility of decrease in the agricultural water use in the long run due to expansion of industrial and urban areas. This will enable the BMR to acquire more water for domestic and industrial water uses.

In addition, a possibility should be explored to divert the water of Mekong River to the Chao Phraya River Basin for a long term and fundamental solution of water problem in the basin.

2) Chao Phraya Delta Irrigation Management Strategy

In order to ensure more stable distribution of water for agricultural intensification, especially that of rice production and to enable more timely and frequent irrigation for the agricultural diversification in dry season, the following strategies are recommended:

(1) Increase in the flexibility of water management by constructing storage facilities at the lateral and on-farm levels. Especially,

this will enable the excess water in wet season to be utilized for dry season agriculture.

(2) Rehabilitation and improvement of feeder irrigation facilities by people's participation.

(3) Improvement of RID's system for water allocation, communication and data management system in particular. With this improvement, water use efficiency will rise by 5 to 10% in the whole delta.

3) Upland Water Resource Development Strategies

Upland of the UCR is endowed with good soil for agricultural diversification. This advantage should fully be utilized and, at the same time, maintained by mixed-farming system being environmentally sound. Key to this is the water resource development of Pasak River and its tributaries. Main strategy is to implement Integrated Pasak Basin Development proposed as a priority project in this study (see Chapter 6.1). The following is the main strategy for water management:

(1) Accelerated development of medium and small scale irrigation projects with the water conservation measures, including on-farm water storages, at the tributaries of Pasak River.

(2) Construction and utilization of Pasak Dam in such a way to maximize the agricultural benefit in the UCR.

4) Urban and Industrial Water Management Strategy

Domestic and industrial water demand of the UCR will not be so large to necessitate a large change in the present water use as far as water quality of the rivers and canals are maintained in a good condition, except in the GSIC where substantial activities would cause water shortage in draught year. The strategies would be as follows:

(1) Ensuring options of water resources for urban and industrial activities in the GSIC by combined use of Chai Nat-Pasak canal, groundwater and Pasak River water.

(2) Facilitate and control groundwater use by the industries to secure a source of water supply and, more importantly, to restrict the industries from excessive-exploitation of groundwater, since the UCR is believed to be a rechange area for the aquifers providing groundwater to the BMR.

(3) The increasing need for urban and industrial water should be ensured in many cities and their surroundings. Particularly, technical capability should be strengthened of the local level to maintain and operate the local water supply system.

7.1.3 Encouraging Local Participation in Water Management

In order to implement these strategies, especially those for agricultural development, it is essential to encourage local participation in water management with stress on the following points:

- Strengthening of water user's groups and cooperative as a basis for water management and agricultural promotion at the local level.
- Effective participation of water user's groups and cooperative in crop planning, irrigation, and water allocation.
- Water charge collection for operation and maintenance of irrigation.

1) Strengthening of Water User's Groups and Cooperatives as a Basis for Water Management and Agricultural Promotion at the Local Level

At present, operation and maintenance of Chao Phraya irrigation at the farm level are managed by the Water Users Group (WUG) which consists of the farmers who use irrigation water from the same ditch. WUGs in the same sub-lateral is grouped into Administrative Group for Using Irrigation Water (AGUIW) with its functions of the water management of sub-lateral/ditch level, agricultural extension and cooperative promotion.

In parallel with WUG/AGUIW, Water User Cooperatives (WUC) exist in the areas under the water resource development by Cooperative Promotion Department (CPD), pumping irrigation projects by National Energy Administration (NEA) and land consolidation projects. Main task of the WUC's are to manage water allocation and maintenance at various levels. In addition, they include other agricultural activities such as farm input and credit distribution as well as collection of electricity charges in pumping irrigation and the operation and maintenance fee in land consolidation. Their organizational structure and size of service area are similar to those of AGUIW.

In addition to WUG/AGUIW and WUC, Water Users Associations (WUA) have still been existing since RID set them up 25 year ago though they are largely unsuccessful mainly due to their too large area coverage and the lack of laws and regulations for enforcement.

WUGs were organized under the initiative of RID based on its assessment of unsuccessful experience in WUA. WUG is much smaller than WUA and simpler in organization structure. However, WUG has not yet fully been successful, with some exceptions, due to various reasons such as the lack of inadequate enforcement of regulations, the top-down approach to organizing people without the sufficient good community leaders who allocate water and maintain irrigation facilities and, eventually, the low confidence among farmers on WUGs.

As a result, water management activities of farmers group are quite limited. In the Chao Phraya Irrigation Project, there supposed to be 217 WUGs and one AGUIW which in total cover only 1% of the total irrigated area. Number of WUA's are 54 to cover 13% of the total irrigated area, but they are inactive.

Performance of WUC's is more satisfactory because they are organized practically in the land consolidation area with good irrigation services and market access. Their scale in terms of area coverage is, however, no more than 0.4% of the whole irrigated area.

In view of these situation and problems, water users groups and cooperatives should be strengthened under the following strategies:

(1) Simplifies the functions of existing WUG to be specialized in water management.
(2) Organize WUGs also under WUCs as a basic unit of water management common to any irrigation area.
(3) Encourage WUCs to be organized not only in land consolidation projects but wherever agricultural potentials are high.
(4) Streamline functions and organizational structure of WUC to comprise (A) irrigation activities and (B) economic activities.
(5) Take "step-by-step" and "learning-by-doing" approaches than top-down approach in organizing WUG and WUC, particularly with the stress on the following points:

- conduct, even in a simple form, the study on socio-economic conditions of the villages concerned
- identify viable community leaders
- promote the social education of community level water management activities through formal education, social campaign by making use of audio-visual aid and field observation tours.

2) Effective Participation of Water Users' Groups and Cooperative in Crop Planning and Irrigation Water Allocation

At present, water allocation is virtually in the hands of RID. Based on the information from the RID zoneman/water masters, Irrigation Project Offices prepare proposals for target cropping and they are all collected at the national level, where RID, Committee for Promotion and Supervision of Dry Season Crop Program (PSDCP) under the Ministry of Agriculture and Cooperatives and Electricity Generating Authority of Thailand (EGAT) assess the proposals. Based on the assessment, PSDCP determines water allocation, which is fed-back to irrigation offices with adjustment made at the level of regional and project office. This centralized approach has made it difficult for RID to let farmers follow the target crop plan and adjust themselves to the water allocation as well as to meet with the diversified needs of water in terms of area-specific timing and volume. Key to improvement of current system is greater participation of farmers in the water allocation. We recommend

to adjust the current crop planning process for water allocation through the following:

(1) Separate the process clearly into (A) the process of collecting and adjusting crop planning and (B) the process of implementing water allocation, and monitoring the crop planning. Both processes should be strengthened.

(2) In the process of collecting and adjusting crop planning,

- Organize WUGs and WUCs for them to participate in crop planning.
- Organize Zone Working Team (ZWT), at the zone level, to comprise RID Zoneman, DOAE Kaset Zone Community Development Officer and other relevant people in order to work closely with WUG/WUC especially until WUG/WUC become viable extensively.
- Make use of existing organizational set-up, at the Changwat and Amphoe level, of National Rural Development Program for the purpose of channelling between PSDCP and ZWT/WUG/WUC. Role of Changwat administration is particularly important in this regard.
- Strengthen role of RID in coordinating the crop planning process especially at the regional and project office level.

(3) In the process of implementing water allocation and monitoring the crop planning, strengthen RID in compiling data base and developing communication network for real time information exchange.

3) Water Charge Collection for Operation and Maintenance of Irrigation

Under the Irrigation Act and Agricultural Land Consolidation Act, the government is enabled to collect irrigation fee from owners of the land under irrigation systems. However, no irrigation fee is collected under the Irrigation Act, while it is collected under Land Consolidation Act to partly recover investment cost and meet with the cost of maintenance and operation.

Water charge collection is highly desirable in order to repair and maintain irrigation facilities particularly at the on-farm. This will also enhance physical reliability of feeder facilities of RID so that farmers will be more confident about the effect of crop planning and water allocation as well. The problem is only how to impose it. The success depends on the ability of farmers to pay; i.e. generations of sufficient incremental net farming benefits from irrigation to enable and justify payment. Quality of irrigation service is, therefore, one of the central questions on the part of government. The irrigation system should provide reliable and timely water supply service with reliable facilities and their operation.

In order to create a positive cycle between water charge collection and facility improvement particularly at the on-farm level, collected water charges should be used and managed by organization of water users.

A recommendation which naturally accompanies with this is to collect water charges from nonfarm water users.

All of the water resources which are made available by government investment should be proclaimed as those in the registered irrigation channel, if the water is used for non-agricultural purpose. So, the Irrigation Act can be imposed. The water charge should be collected from those whose use of water affects the base flow of the registered irrigation channel. The water charge should be imposed in direct way; and the other forms of charge such as land tax will not be suitable. It is too difficult to identify which areas receive irrigation water.

7.2 ENVIRONMENTAL MANAGEMENT

7.2.1 Environment in the Whole Chao Phraya Basin : Issues and Policy Guidelines

Environment of the UCR cannot be understood and planned without reference to a system of ecological environment of the Chao Phraya River Basin as a whole.

The basin can be divided into three sub-basins by their differing topographic, hydrologic, and soil characteristics: the upper, middle, and lower basins.

1) Upper Basin

This sub-basin has steep mountains and is covered by forest. The area serves as a watershed and is the headland for one of Asia's most important river systems.

2) Middle Basin

This sub-basin is made up of numerous small plains and mountainous areas. The area collects the water from tributaries to feed the main rivers originated from the upper basin.

3) Lower Basin

This sub-basin comprises both the ancient deltaic area and the surrounding upland. The upper delta floods during rainy season and allows it to serve as a regulator for the rivers which flow to the lower delta where Bangkok is located.

The role of these sub-basins is closely related in an ecosystem:

- Deforestation in the upper basin causes the unstable water runoff which adversely affects human settlements, agriculture and industry in the lower basin.

- Water pollution in the upper basin can be quite detrimental to water quality in the heavily populated lower basin.

From the environmental viewpoint, main roles of the UCR in Chao Phraya River Basin are as follows:

- The important role is contribution to the production of rice by using water from Chao Phraya River and its tributaries. The stable supply of water to agriculture is necessary for rice production and export of Thailand.
- At the same time, water supply for urban use in the BMR is also an important role of the Chao Phraya River. Water should not be polluted in the UCR. This is quite a distinct role of the UCR compared with other regions surrounding the BMR.
- The UCR has to maintain the flood retarding role. If flood retarding capacity decreases in the UCR, the government would have to invest much for flood control in the BMR.

As a premise for the environmental management in the UCR, we recommend an overall policy guidelines to be established for the whole Chao Phraya River Basin. Our proposal is summarized in Table 7.1.

In this context, the guidelines specific to the UCR are as follows:

1) Upland Area

Conservation of top-soil and appropriate land use are necessary to sustain agriculture on a long term basis.

2) Delta Area

Water quality control of the area along the river should be the first concern. The capacity of the area for water retention should also be maintained to control flooding in the lower basin.

Considering the roles of each area, overall environmental policy guidelines for the UCR are summarized in Table 7.2.

Table 7.1 Environmental Policy in Chao Phraya River Basin

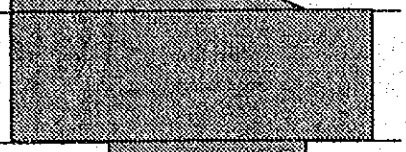
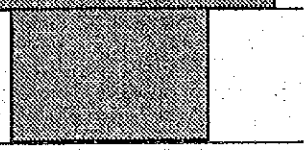
Environmental Policy	Role	Upper Basin / Middle Basin / Lower Basin Upper / Lower
Conservation of forest Any kind of development is not permitted	Stability of amount of water flow	
Conservation of soil Efficient land use	Prevention of erosion	
Maintaining water quality for using various purpose	water pollution control	
Efficient use of rain water and prevention from flood in the BMR	flood control	

Table 7.2 Environmental Policy in the UCR

Environmental Policy	Key Concept	Role
Natural Resource Management on Upland Area	Implementation of appropriate preservation, restoration and conservation in accordance with natural condition	Stability of flow Prevention of erosion Preservation of agricultural environment
Water Management on Chao Phraya Delta	Keeping the present water quality and quantity	Water supply for agricultural production in the UCR Water supply for urban, industrial and agricultural activities in the BMR Flood retarding function for the BMR

7.2.2 Critical Issues

1) Chao Phraya River Delta

The critical problem is the water quality in the Chao Phraya River which is gradually and consistently deteriorating. The water quality of Chao Phraya River varies by location: from 2 ppm to 10 ppm COD (measured by the study team, using a simplified method as shown in Fig. 7.1). In general, the level of contamination has already reached the maximum level allowed by the ONEB (refer to Fig. 7.2). Thus, no more pollution can be allowed.

The untreated effluent from households and industries is directly discharged into the rivers, thus more severe water contamination would accompany regional economic growth.

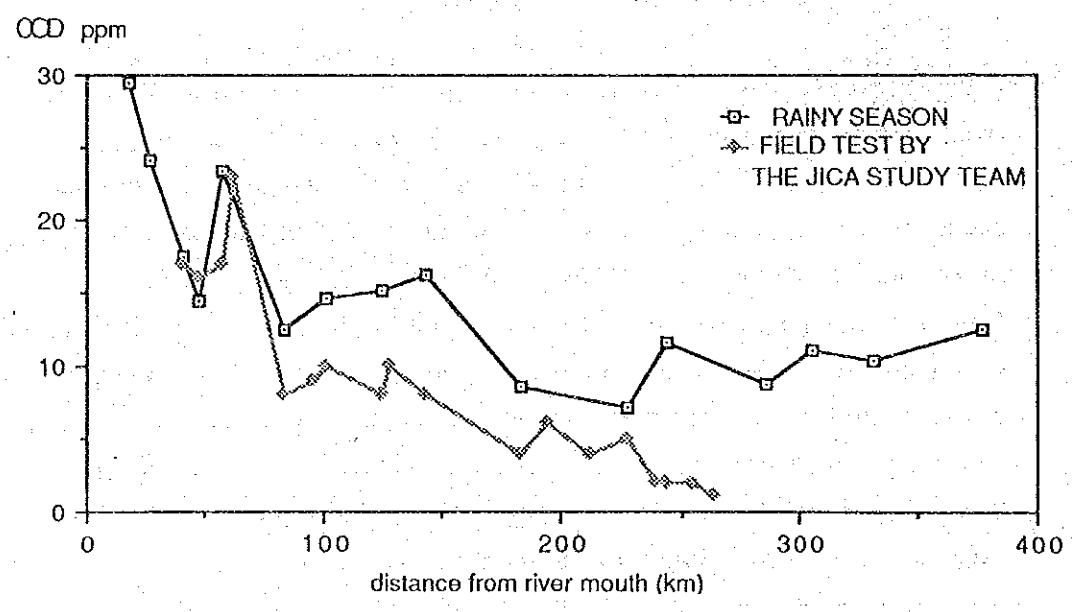
Although toxic substances from of agricultural chemicals have affected river bottom sediments, the damage to the water itself is not yet significant so far. However, in addition to the dangers of increased chemical based farming, livestock raising and fish ponds are beginning to be additional sources of water pollution.
However, if appropriate measures are taken right now, it is still possible to restore and preserve the quality of the river. On the contrary, if any measures are not taken now, serious water quality pollution would occur and affect the water supply not only in the UCR but also in the BMR. Thus, appropriate measures to protect the Chao Phraya River Basin, especially the delta area, are urgent.

2) Upland Area

In the upland area, the critical issues are inappropriate land use and disorderly development. From the environmental point of view, the slope land should be protected from excessive use for field crops. Otherwise, soil erosion would continue to expand to an unrecoverable extent. In addition, soil productivity is gradually deteriorating due to the inappropriate mono-culture.

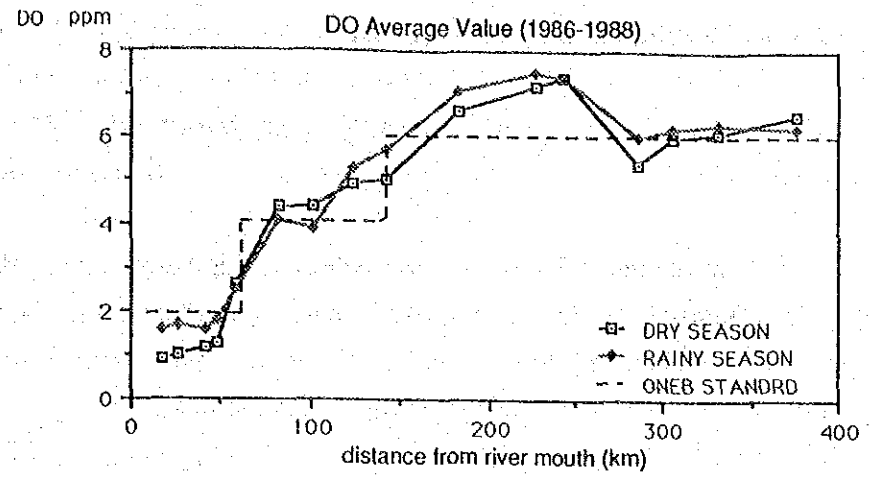
The remaining forests, largely located on the slope land, are both environmentally important and sensitive. Deforestation has been clearly documented as the primary cause of many environmental problems.

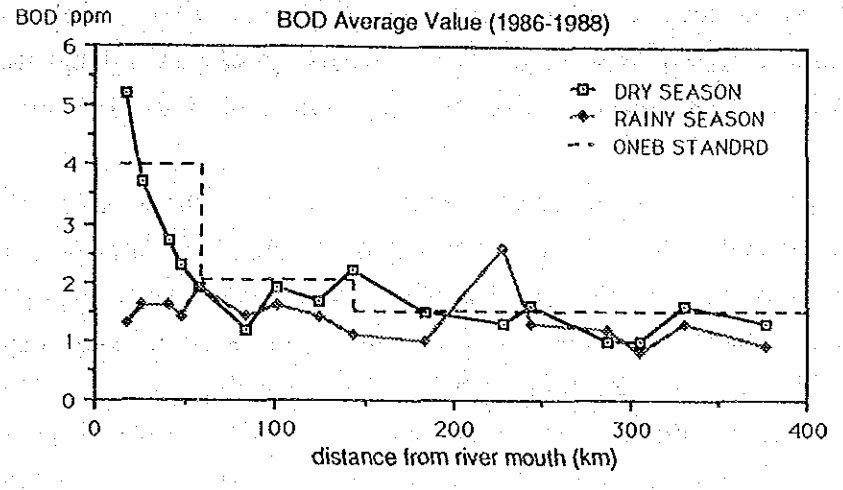
Although appropriate land use is critical in these areas, there is at present no land use control. To keep the Chao Phraya River basin environmentally sound, land use must have sufficient environmental control. Agricultural diversification should also be encouraged to maintain soil fertility so as not to encourage excessive use of chemical fertilizers.

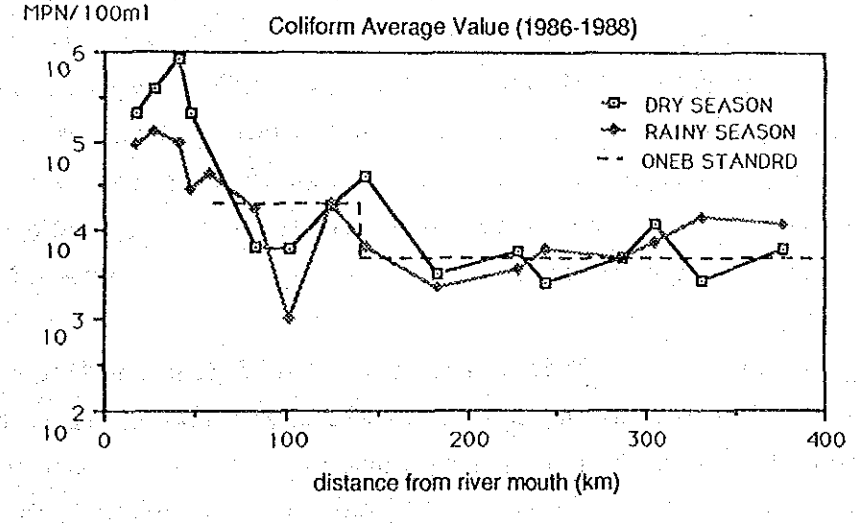


Notes : No standards have been set in terms of COD.

Fig.7.1 COD Average Value (ONEB) and Test Value by the Study Team







Source:ONEB

Fig. 7.2 Water Quality in Chao Phraya River

7.2.3 Guidelines for Environmental Management

We recommend the guidelines for environmental management at the following three levels:

1) The technical measures which can be taken by government agencies and present/potential polluters for the sector-specific and/or area-specific environmental problems, basically under the present administrative set-up for environmental management.

2) The environmental management measures which address themselves to the cross-sectoral and/or region-wide environmental problems, hence, the substantial reinforcement of existing government organizations, regulations and support becomes important.

3) The institutional arrangements which involve considerable change in organizational and legislative set-up of the government, and thus need to be considered at the national policy level from the viewpoint of overall balance between environmental conservation and development.

7.2.4 Technical Measures

1) Environment and Industrialization

Due to a rapid industrial dispersal from the BMR, large-scale industrial estates and industries such as light processing, precision machining, and electronic industries have started to spread especially over the riverside areas and flood prone areas in Ayutthaya. The followings are recommended measures to be taken urgently.

First, the 350 sq.km. restricted zone upstream of Sam Lae water intake should be extended to the upstream especially along the areas adjacent to rivers as well as in the flooding zones.

Second, an environmental impact assessment of existing factories should be undertaken.

Third, a regulation should be established to oblige the medium and large scale factories to install hazardous treatment facilities, and the small scale factories which discharge hazardous wastes should be relocated in the industrial estates with common hazardous treatment facilities.

Fourth, the use of underground water should be restricted and factories should be charged for its use in order not to cause the ground subsidence and flood occurrence.

Fifth, special guidelines should be provided for industrial location in the environmentally sensitive areas like Ayutthaya with reference to the types of industries to be promoted or prohibited, and the engineering methods to be used in land preparation (not polders but cut-and-fill method).

Sixth, a regulation should be enforced to let cement factories to equip themselves with appropriate dust-collecting systems themselves, whereby air pollution problem can virtually be solved.

Seventh, the incentive scheme of the Board of Investments (BOI) should be improved to incorporate environmental considerations more explicitly, crucial point is to introduce a more detailed zoning in the incentive scheme from an environmental viewpoint. Investment application should not be approved in the zone which is environmentally sensitive. On the other hand, greater incentives could be provided in the zone which is less environmentally sensitive. Possible incentive measures in such zone are tax reduction and accelerated depreciation for the investment in pollution control equipment.

2) Environment and Agriculture

The most significant problems are the mono-culture causing soil fertility decline and erosion in the upland, the fish farming and livestock as growing water pollution sources, the intensive use of chemical fertilizers in large scale field crop production causing the eutrophication of surface and ground water pollution and soil deterioration, and the excessive and inproper application of

agricultural chemicals causing water pollution, frequent accidents on farmers and food contamination. What follows are urgent measures to be taken.

Regarding the agricultural waste water, the waste water from livestock farming should be treated, possibly by oxidation pond method. Waste water from large scale fish ponds should be treated by an effective and economical biological treatment method of the pond waste water, using fish like phytoplankton as recommended by National Inland Fisheries Institution.

For proper use of agricultural chemicals and fertilizers, it is necessary to promote public relations and educational activities for the farmers and to undertake attentive monitoring and instructive activities by Department of Agricultural Extension.

In long term, a new upland farming system should be promoted, as proposed in the agricultural sector, with emphasis on environmental conservation. In this connection, a system should be promoted to recycle the urban waste water to supplement agricultural water and cultivate inland fish.

3) Environment and Urban and Human Settlement

Population in the UCR is expected to increase from 2.74 million in 1987 to 3.46 million in 2010. In 2010, the urban population will be about 1.29 million. With this increasing population, the pollution load will be heavier.

Particular problems are the backwardness of domestic waste water treatment system in major urban centers, the inefficient solid waste collecting system in the rural and urban areas where solid wastes are often disposed by dumping them into rivers, the lack of the consciousness of individual responsibility among people for water quality, and the settlements beside and over rivers with no urban management and no urban services. What follows are immediate measures recommended to be taken.

(1) Domestic Waste Water Treatment System

Domestic waste water treatment is the single most important measure to reduce the pollution load on the Chao Phraya River. The Public Works Department has developed plans for waste water disposal management in 65 cities.

In line with this basic policy of PWD, we recommend that the cities of Ayutthaya, Sara Buri, and Lop Buri should develop sewage treatment systems at an early stage.

The appropriate domestic waste water treatment processes and systems vary by size and density of settlements, in reaction to the easiness in operation and maintenance, the construction cost of treatment plant and pipes, the degree of daily and seasonal fluctuation in effluent volume and method of sludge treatment. In the UCR, we recommend the criteria for treatment methods to be adopted as shown in Fig. 7.3.

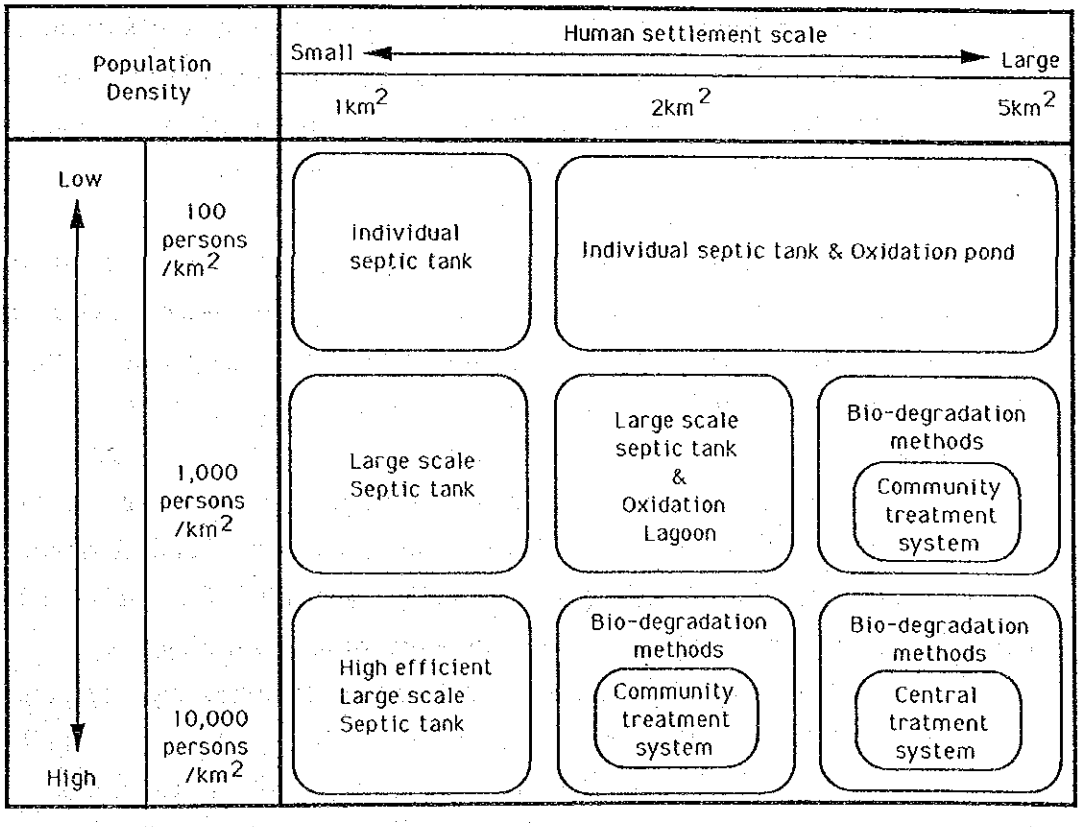


Fig. 7.3 Treatment Methods Corresponding to Population Density and Human Settlement Scale

In long-term, it is necessary to expand existing relevant organization into, or newly establish a public enterprise responsible for facilitating development of sewerage system development in major urban centers. At the same time, municipalities should be enpowered and encouraged to coordinate among others to quickly acquire the land for sewerage facilities.

(2) Solid Waste Collection and Treatment System

In the UCR, the service level and collection efficiency vary greatly from one municipality to another. Existing disposal systems are limited to open dumping and open burning. Beside, administrative bodies responsible for collection and treatment services do not coordinate among others, resulting in poor management system in Changwat as a whole.

In view of this prevailing sanitation, the development of an incineration plant is not recommended in this area, because the collected solid waste is too wet. We recommend a conventional sanitary land fill system with sufficient protection against pollution. Acquisition of space for land-fill is crucial. Reuse of the land damaged by rock mining is a possibility.

A privatization policy should be explored for a more efficient solid waste treatment system at the local level, such as concession method, Build-Operate-and-Transfer (BOT) method and public-private joint operation system.

Under the present administrative system, three authorities of municipality, sanitary district and Changwat Administrative Organization (CAO) are separately responsible for each territory limit the overall efficiency of solid waste collection and treatment and this system should be restructured by utilizing the private sector.

The overall picture showing the above arguments is illustrated in Fig. 7.4.

7.2.5 Environmental Management

1) Monitoring and Environmental Administration

Existing environmental regulations for water quality standards are not fully working due to the lack of effective monitoring systems at the local level, weak coordinating power of National Environmental Board (NEB) and the inadequate manpower, and technical capabilities in the environmental administration at both central and local levels. Added to this problem are the inconsistent policies among governments and agencies with respect to environmental control. What follow are the urgent measure to be taken.

First, it is necessary to re-organize the Chao Phraya River Environment Policy Committee, whose jurisdiction would include the Pasak River, in such a way to authorize basic national policies for the environmental preservation in the Chao Phraya River basin as a whole. The existing committee focused on the BMR is recommended to expand its area of jurisdiction.

Second, "Areas for special environmental attention" should be designated in the Ayutthaya Conservation Area, and Sara Buri Development Area. Local Environmental Monitoring Stations with sufficient personnel and equipment should be established, as a pilot project in order to monitor the environment in the areas in collaboration with Ministry of Industries, BOI, ONEB, the local governments, and academic institutes.

In long term, the functions of local governments (both Changwat and municipalities) should be strengthened in monitoring environmental influences and changes and implementing appropriate corrective measures. In parallel, strengthening the NEB's function is necessary to coordinate national environmental policies, train personnel in charge of environmental administration, render technical assistance to local governments and conduct research and development. In this

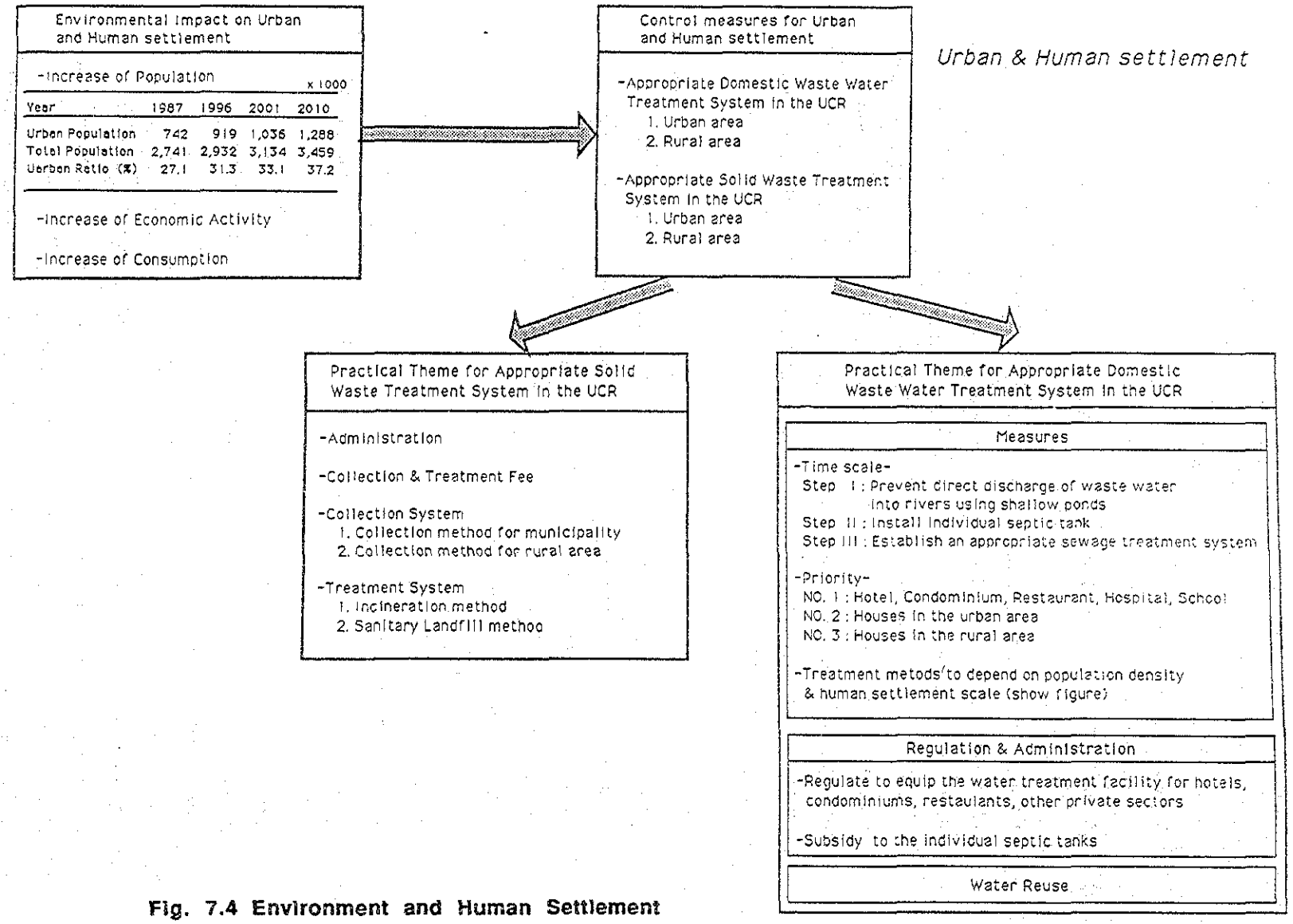


Fig. 7.4 Environment and Human Settlement

connection, the Environmental Research and Training Center which will soon start operation is expected to train not only technical but managerial personnel in relevant central line agencies, local authorities, private industries, NGOs and academic institutes.

A series of the administrations of issuing development permission, directing proper design standards and supervising constructions should be undertaken based on definite policies agreed among relevant agencies at all levels. A consistency in environmental policies is highly required. This task is to be assumed by the Chao Phraya River Environment Policy Committee proposed as one of urgent measures. On the practical ground, an effective multi-level environmental administration is required with the local authorities to play key role as illustrated in Fig. 7.5.

2) Land Use Control

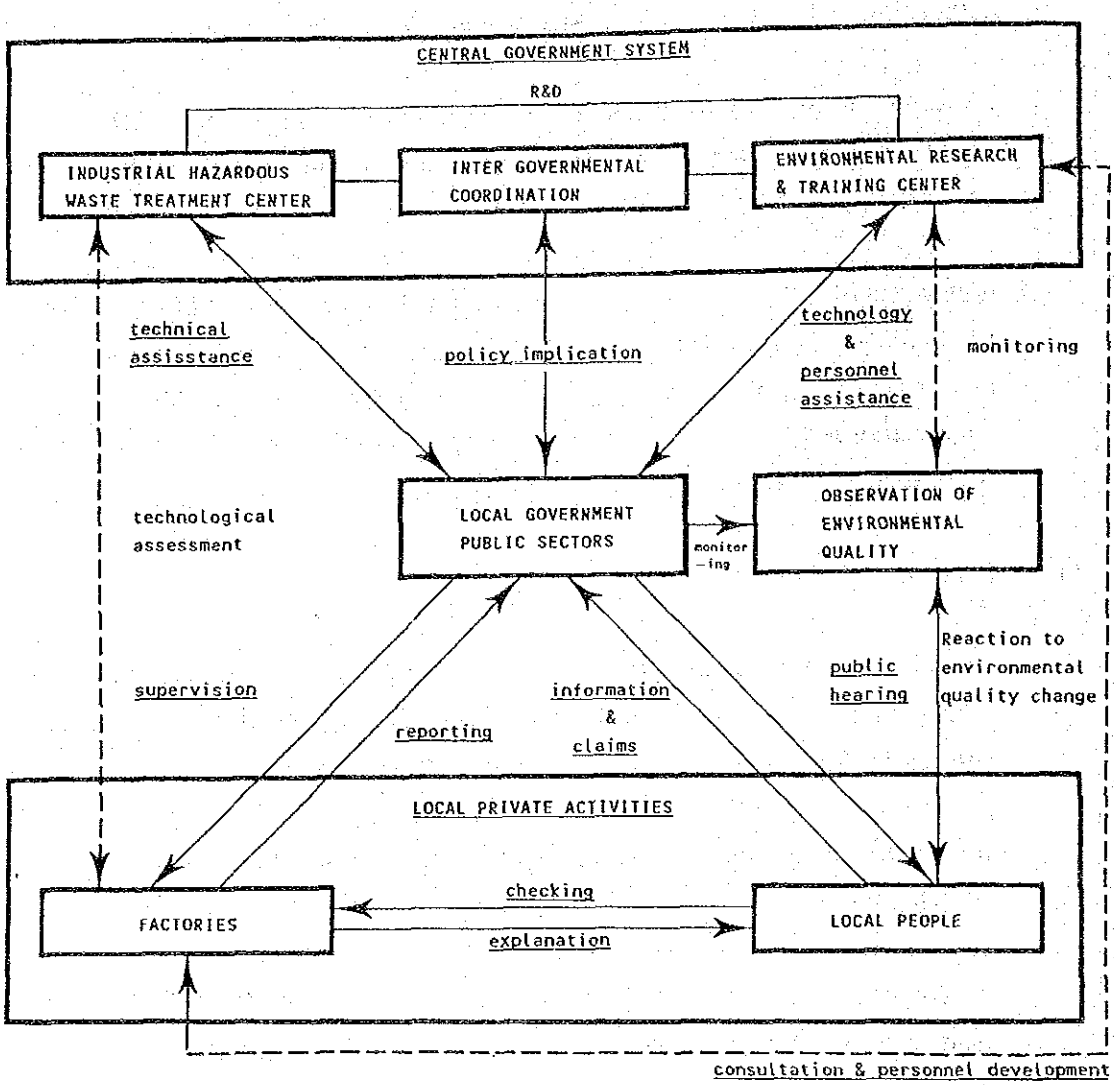
Disorderly development and resulting environmental deterioration are taking place especially outside the municipalities, where there is no consistent legislative measures to control land use.

It is most important to legislate national land use and zoning plans covering all of Thailand, and to give them legal authority. The establishment of a central office for land use management is necessary to coordinate the land development by various agencies and to prepare land use guidelines. The guidelines shall include agricultural development, industrial location and type, urban development and preservation requirements, within the framework of the national social and economic development plan. The guidelines should incorporate the existing land use regulations under a number of line departments.

Land use zoning should consist of the following three major categories:

(1) Preservation Area

Preservation area should be designated to preserve and rehabilitate the environment. Major roles and functions of the



SOURCE : THE JICA STUDY TEAM

Fig. 7.5 Proposal of Environmental Management System

area are to foster water resources, to preserve valuable flora and fauna and to prevent natural disasters and soil erosion.

(2) Conservation Area

Conservation area is designated in the areas which have development potentials but are environmentally sensitive. Major concerns in this area are the soil conservation for prevention of erosion, prevention of water pollution and maintenance of the flood retention capacity.

Location of large scale industries, including industrial estate, and urban development should be discouraged. Industries already located in this area (delta area) should be ensured with proper waste water and solid waste treatment plants.

(3) Historical and Cultural Conservation Area

Historical and cultural area is important not only as national assets but also as tourism resources. In the UCR, Ayutthaya and Lop Buri have historical and archaeological assets. Therefore, the areas containing these assets should be designated as the historical and cultural conservation area for restricting industrialization and urbanization.

(4) Development Area

Intensive development can be induced in this area. Distinct zoning of urban development areas and agricultural development areas is essential for efficient utilization of resources and minimum environmental deterioration. Provision of infrastructure and supporting services for full utilization of the natural resources should be emphasized for both agricultural and urban/industrial activities in this area.

Fig. 7.6 indicates the relative magnitude of each area category in the UCR. As a summary of these recommendations, Table 7.3

Table 7.3 Zone Specific Environmental Management Policy in the UCR

Area		Development area				Conservation area				Preservation area	Historical and cultural area
		Delta area		Upland area		Delta area		Upland area		Forest area	
Zone		Agricultural zone	Urban zone	Agricultural zone	Urban zone	Agricultural zone	Urban zone	Agricultural zone	Urban zone	———	Ayutthaya Zone Lop Buri Zone
Main Urban Center		———	-Chai Nat -Sing Buri -Ang Thong	———	-Lop Buri -Sara Buri	———	-Ayutthaya	———	———	———	-Ayutthaya -Lop Buri
Role		———		———		———		———		———	-Historical and cultural important resources -Important tourist site
1 Water supply in the UCR		2		1		2		1		1	
2 Water supply in the R/B		2		1		2		1		1	
3 Flood retarding function		1		———		2		———		———	
4 Ground water recharge		2		———		2		———		1	
5 Stability of flow		1		1		2		2		3	
6 Preservation of agricultural environment		2		2		2		2		———	
7 Prevention of erosion		———		2		———		3		3	
Environmental Impact		1		1		2		2		3	———
1 Water pollution		1		1		2		1		———	
2 Excess use of ground water		2		———		2		1		———	
3 Water resource depletion		———		2		———		2		3	
4 Soil erosion		———		1		———		3		3	
5 Destruction of forest		———		———		———		———		3	
Target		*Maintain the present water quality*		*Control appropriate land use*		*Prohibit any water pollution*		*Protect soil erosion*		*preserve forest*	*Conserve historical and archeological environment*
Land Use Management		-Control industrial estate (prohibit river side estate) -Restrict ground water use		-Manage appropriate land use for agriculture, industry, urban center		-Restrict industrial estates (restrict the estate on the flood retarding zone) -Restrict ground water use		-Prohibit excess use of sloped land		-Prohibit destruction of forest	-Conserve Ayutthaya and Lop Buri historical and archeological resources zone
Strategy	Agriculture	-Intensive rice cultivation	-Suburban agriculture	-Environmentally sound agriculture (recycling agriculture)		-Intensive rice cultivation	-Suburban agriculture	-Agro-forestry (only tree crop and terrestal crop)	-control	-prohibit	-control
	Industry	-Less or non pollution industry Handicraft industry Light-processing industry		-Agro-processing industry (recycling industry)		-Prohibit	-Non-pollution industry (handicraft industry)	-prohibit	-control	-prohibit	-restrict
	Urban and human settlement	-control (priority of sewage treatment facility)		-control (priority of sewage treatment facility)		-control (priority of sewage treatment facility)		-restrict		-prohibit	-restrict

NOTES: Indicate usual or possible magnitude of significant effects:
(3) = major, (2) = intermediate, (1) = significant.

shows an overall environmental policy concomitant with the land use zoning.

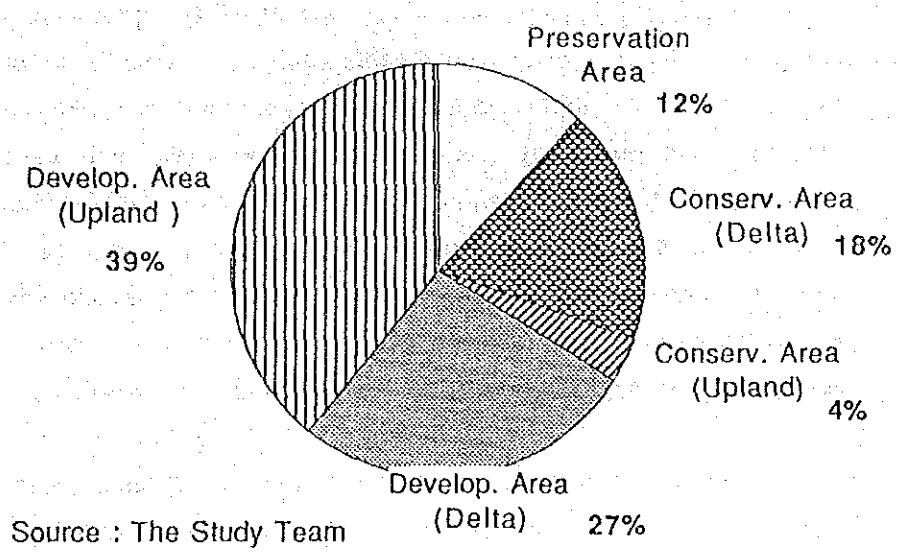


Fig. 7.6 Land Use Zoning in the UCR

3) Education for Environmental Awareness

Emphasis should be placed on social education and enlightening of people for better environment. Target groups are the local residents, school children and business people. Use of mass-media may be effective. It can effectively be incorporated in the non-formal education systems. Attention should also be paid to encouragement of cooperation with the NGO's and religious activities. To keep river environment well, any parties and peoples should join under a catch word. It can be recommended to promote "Love Chao Phraya" campaign, which is on-going by an NGO.

Another important measures is mobilization of local human resources to promote locally initiated activities. Teacher's colleges, provincial chambers of commerce, and similar local organizations should fully be involved for this purpose. Establishment of Local Environmental Center, attached to the existing community library at each Amphoe center is recommended as a part of environmental administration.

4) Institutional Arrangement

It is our basic understanding that the key to success in keeping the Chao Phraya River Basin environmentally sound rests upon the joint actions among government, private and communities. The government will have to play not purely regulatory but increasingly catalytic, supporting and promoting roles. The private sector will have to play a partnership role especially in financial investment for construction, operation, and maintenance on a self-supportive basis, having various supports from the government in the form of tax incentives and privileges. Local governments and local communities will play more active roles through building of trust among all parties.

In order to create a basis on which a well-coordinated system among the three parties works, some institutional arrangement is proposed to be explored as follows:

(1) Polluter-Pay-Principle

The concept of polluter-pay-principle and an acceptable level of total pollution loads is recommended to be employed in line with the policy for mobilizing resources for environmental management from the private sector.

This principle has been applied in industrialized countries in various forms such as "Effluent Charge System", "Environment Tax System" and "Tax-Surcharge System (on fuel oil, etc,)". In practice, however, introduction of, for instance, "Effluent Charge System" in Thailand may be faced with difficulties such as those in collecting charges from small-scale industries and setting an appropriate (or justificable from social welfare point of view) rate system acceptable by all sectors. This principle is recommended, but thus needs further arguments and in-depth studies aiming at the creation of social justice concerning environmental protection.

(2) Strengthening of Local Government Capabilities

For a well-functioning environmental administration system, adequate, practical and quick local solutions are indispensable. For this end, the following measures are recommended to be taken in long-term perspectives:

a. To establish provincial and municipal environment management offices, which are to be technically supported by the Regional Office of the NEB.

b. To identify the roles and authorities of governor and mayor in the environmental administration.

c. To train personnels of the local authorities so as for them to be capable of administering the environmental policies, and increase the number of those personnel through various opportunities such as in-service training, workshops, observation tours, provision of fellowships, and dispatching to the Environmental Research and Training Center (ERTC).

d. To strengthen the local financial capabilities for environmental administration through privatization, government guaranteed specific loans, and modification of tax structure.

(3) A Public Body for Chao Phraya River Basin Management

The Chao Phraya River Basin has been the center of history, culture and economy of the Kingdom, and the life-line of Thailand. Based on this recognition, the environmental management in the whole basin in very long term (more then one century) perspectives is necessary. For this end, a public body, which will fully be responsible for coordination between planning and implementing agencies regarding the environment and development in this basin, may be organized in the long run, involving all agencies concerned.

In the short run, the proposed Chao Phraya River Environment Policy Committee shall function as a significant part of the body.

In the long run, a public body is recommended to be organized for the basin management. Two alternative approaches are conceivable: an "authority" with legislative power or "center" with administrative function.

7.3 Urban Management

For the UCR development, encouragement of local governments' roles and enhancement of their implementing powers are extremely important, because of the following reasons:

- Unlike ESB development in which a package of national projects play a leading role for regional development, UCR development essentially calls for the coordinative function of the local authorities to maximize benefits of the region.
- UCR development requires strong promotive functions of local authorities, especially those as the suppliers of urban services to support diversification and integration of regional economies.
- Effective environmental and land management under an increasing pressure of industrial and urban expansion from the BMR calls for a strong initiative of the local authorities to monitor, regulate and guide such activities from the standpoint of local people.

In the urban development context, the 6th Five-Year Plan has focused on the importance of administrative coordination between the central and local governments and the roles of local authorities in order to lead to successful project implementation at the local level. This is a crucial issue and should increasingly be important during the 7th Five-Year Plan period in which local initiative would become a key component for regional industrialization and environmental management.

In view of specific needs for strengthening local institutional and financial capability of the UCR, a stress should be given to the roles of the local authorities, comprising Changwat Administration Organization (CAO), municipality and sanitary district, in urban development, provision of urban

services and the environmental/land management associated with urbanization and industrialization.

Hence, the central issues for the UCR are three fold:

1) How to organize a consistent multi-level system for planning administration, incorporating the inter-Changwat and inter-municipal coordination.

2) How to overcome a limitation of the existing urban management measures which are available with local authorities.

3) How to strengthen local financial base.

7.3.1 Restructuring of Local Planning Administration : A Premise for Improving Urban Management

1) Present Constraints

In the existing local planning administration, several central agencies are involved: NESDB and organizations under Ministry of Interior such as Office of Urban Development (OUD), Policy and Planning Bureau (PPB), Department of Town and Country Planning (DTCP) and Public Works Department (PWD). As an established planning administration, DTCP is fully responsible for preparation of "Comprehensive Town Plans" to direct land use zoning and road network in the area centered on municipalities. In the UCR, as of the end of 1989, seven (7) Comprehensive Town Plans have been established and the plan of Muang Ayutthaya (Ayutthaya) is under processing.

The present centralized system of planning administration is effective in the utilization of technical resources and the standardization of quality of plans, but the following problems can be pointed out:

(1) Since all plans are given by the top like gifts, the local authorities tend not to commit their responsibility for implementation, but to always call for central government's support.

(2) Locally significant and substantial aspects tend to be overlooked even if an appropriate direction is proposed in the plan from the national viewpoints.

(3) Such a centralized system tends to discourage the local authorities' planning minds and limit the opportunities for local officials' to enhance planning sense and analytical capability as practitioner.

(4) In regard particularly to the recent rapid urban expansion, the present system does not provide local officials with adequate opportunities to coordinate with neighboring local authorities not only from intra-municipal but from regional viewpoint.

(5) The centralized planning system hardly stimulates the competition among local authorities, which should be the source of innovative development management.

(6) Timely preparation of comprehensive town plans is hardly made because of the shortage of planners in the central department in charge, relative to a huge number of the cities for which plans need to be prepared and renewed.

2) Integrated Planning System: A Proposal

Taking into account the constraints as identified above, it is proposed that an integrated planning system be established in the long run as follows:

(1) Establishment of Long Term National Development Plan

Thailand needs longer term perspectives with a 20-year time framework for national development guidelines, on the basis of major issues identified through the accumulation of the past Five-Year Plan experience.

This plan should aim at articulating, among others, national land use zoning policies, a macro spatial structure at the national

level, directions on national economic and social development, development guidelines by region and major focuses of public investment.

(2) Preparation of Local Plans

The planning consistency between the top and the bottom is extremely important to make investment efficient. For this end, local master plans within a 10-year time framework are recommended to be prepared and authorized by the government with the following breakdown:

- Changwat Master Plan
- Comprehensive Town Plan (or Municipal Master Plan)
- District Master Plan.

This system would contribute not only to the strengthening of planning capability at the local level, but also to the effective management of multi-year local projects under the limited funds available to the local authorities.

A conceptual structure of the proposed planning system is illustrated in Fig. 7.7.

(3) Local Planning Administration System

For the preparation of local plans, an integrated planning system is proposed with an emphasis that the local plans be built by local authority itself.

The conceptual structure of this system is shown in Fig. 7.8 and important points are:

- "Regional Development Committee" to be set up at the central government level with NESDB being the secretariat.
- "Regional Committee of Governors" to be organized for inter-Changwat coordination

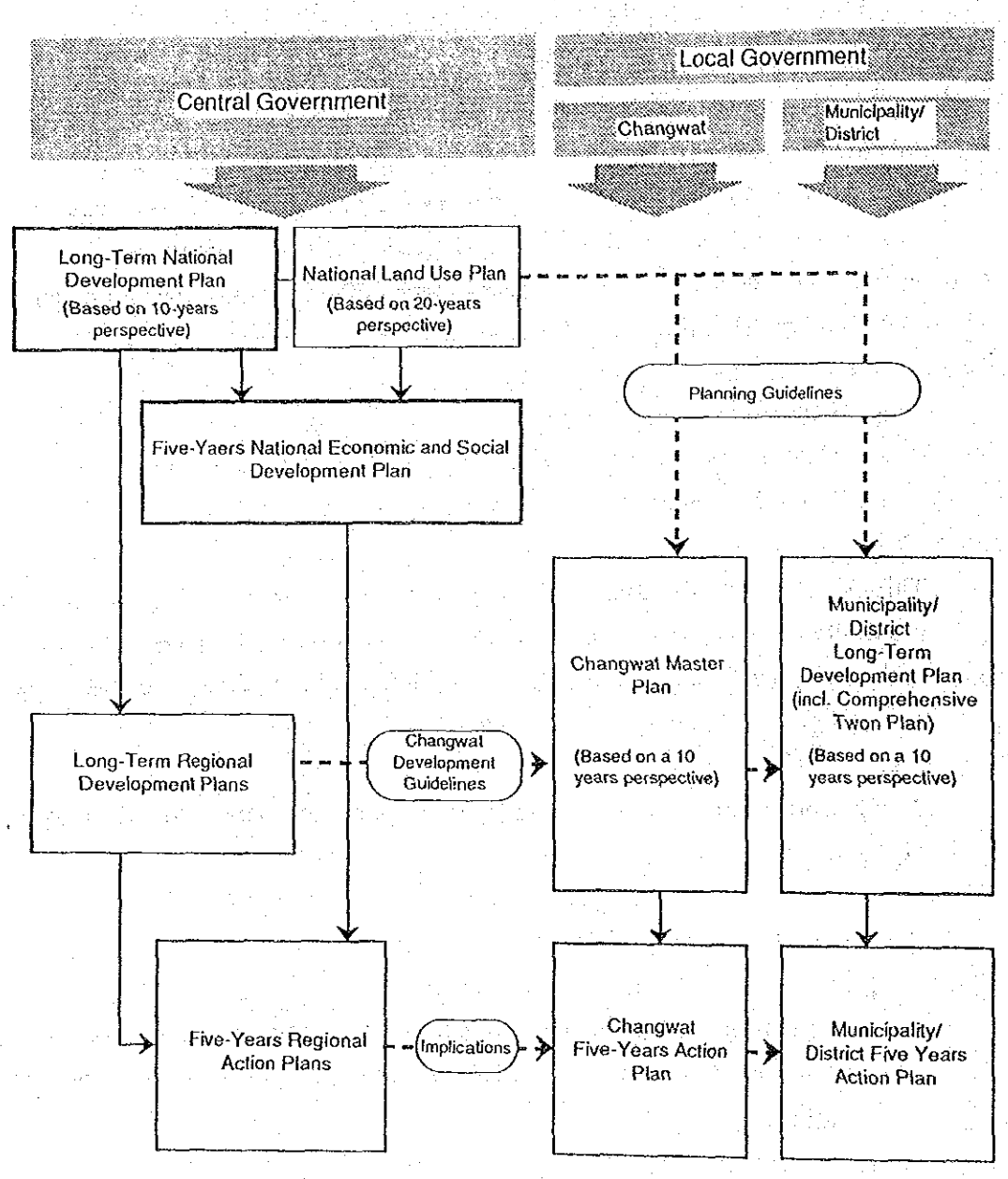
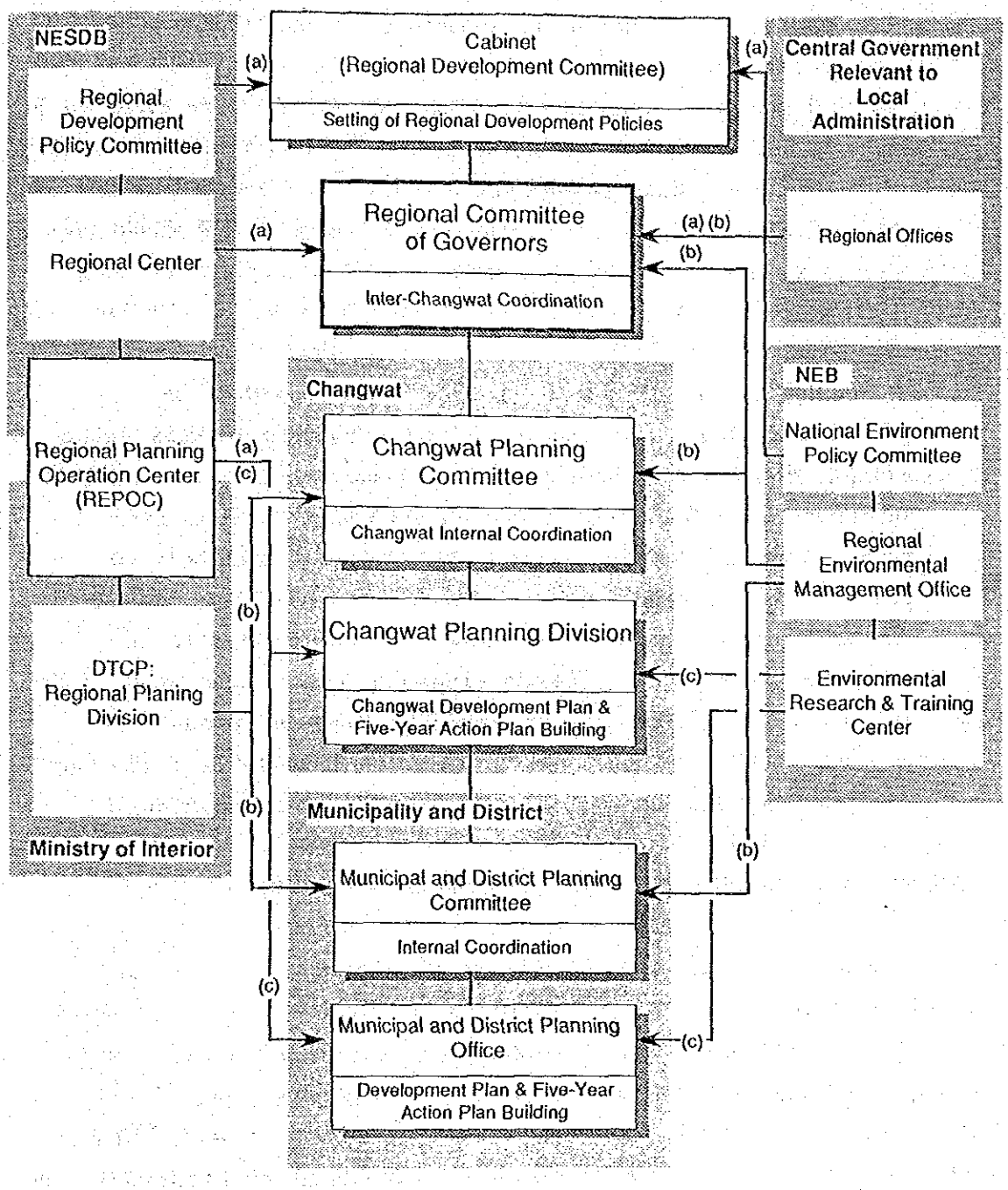


Fig. 7.7 Proposed Structure of National and Local Planning



Notes: Arrows stand for directions of:

(a) : Policy and Global Strategy Recommendations

(b) : Planning Guidelines and Technical Assistance

(c) : Personnel Training and Technical Research & Development

Fig. 7.8 Proposed Structure of Local Planning Administration

- "Municipal and District Planning Committee" chaired by the Changwat governor to be organized for intra-Changwat coordination.
- "Regional Planning Operation Center (REPOC)" to be organized by NESDB and DTCP for providing local authorities with the national policy directions and technical support in training and research. Based on the experience of town plan making, DTCP should play a key role in preparing, updating and extending the planning guidelines.

In addition to this multi-level planning structure within the government system, a channel should be established between public and private sectors for local planning purpose. At present, Joint Public and Private Consultative Committee at the Changwat level exists as a major channel of dialogue between the local public and the local private. This committee has not however, effectively been utilized in the local planning process. Particularly Changwat Chamber of Commerce could play key role in identifying local needs, providing data and disseminating local planners intention among the public. The Chamber could also be an effective organization to facilitate the inter-Changwat coordination and inter-local authority collaboration.

7.3.2 Key Administrative Measures for Urban Management

Local authority, especially municipality, has to respond to financial and technical requirements to cope with urbanization. Basic Urban Needs (BUN), should be satisfied through the improvement of solid waste collection and treatment, drainage and sewerage systems, electricity supply and telecommunication systems, and transport network system. Under extensive urbanization, however, ongoing municipal administration find difficulties in meeting these BUNs.

To minimize these difficulties, three administrative measures are proposed especially for the UCR as follows:

- Organizing local authorities associations
- Adjusting municipal boundaries
- Cost-sharing for local development

1) Organizing Local Authorities Associations

In rapidly urbanizing area such as Ayutthaya at present and the GSIC in future, municipalities can hardly find pieces of the land for public services such as solid waste dumping sites within their boundaries. They also have to bear excessive burdens for the public services, of which beneficiaries often exist outside the municipalities. Since population size of municipalities is so small that they can hardly make projects of public services economically feasible due to the lack of economies of scale.

In order to cope with this situation, "Local Authorities Association (LAA)" is proposed as cooperative of the local authorities which are mutually related or could share benefits from the cooperatives for specific programs and projects.

Major functions of the LAA are to coordinate urban management and attain the scale of economies in such a way that all members (local authorities) can solve their common problems for specific targets, and, collect their funds to reduce the administrative costs for operation and maintenance. An important concept underlying this proposal is that LAA is not a committee, but a juristic body which is endowed with the limited administrative authority to finance and manage specific public services such as solid waste management, sewerage, fire-fighting, social education and higher medical care.

We recommend LAAs be set up in a strategic development area such as the Greater Sara Buri Industrial Core (GSIC) as well as in a rapidly urbanizing area such as the area under the Ayutthaya Comprehensive Town Plan, comprising Ayutthaya Municipality, Amphoe Muang and Amphoe Uthai.

2) Adjusting Municipal Boundaries

The second recommendation is to adjust municipal boundaries so as to meet with their substantial urbanized area and make local authorities get "economies of scale" in their financial base.

Given no explicit guidance of the central government, this must be a considerably difficult work since expansion of a municipal area means a partial shift of the financial base, administrative power and post allocation. During the Fifth Plan period, the municipal boundary expansion of Chiang Mai and Nakhon Ratchasima has been completed and Chon Buri municipality is in the process. In the UCR, Ayutthaya and Sara Buri will need this arrangement sooner and later.

3) Cost-Sharing for Local Development

As far as the facilities are located in the areas administrated by local authorities, even if they have been developed by central government agencies, the local authorities must fully or partially be responsible for managing the facilities so that they may benefit local people as much as possible. Therefore, instead of being fully subsidized, local authority has to pay cost in accordance with the benefit it receives. For this end, strengthening of its financial power is indispensable, but at the same time, without this cost-sharing concept, the local authorities would loose the rational of strengthening their financial bases.

As one of the most critical urban projects, sewerage system development, which is 100% financed by the central government at present, is taken for a case.

Construction cost of a sewage treatment facility can roughly be estimated at 3,000 baht per head (population), compared to the municipal annual revenue of 1,200 baht per capita in the UCR in 1987. This facility costs 2.5 times as much as the total municipal revenue on average. An argument to be raised here is not that municipalities can not bear the cost at all because of such a huge amount of cost, but that even for such a huge amount of cost, they will be able to share a part of the costs, given certain strategies.

A financial model can be shown, based on the assumptions that the central government shares two-thirds of the cost and a municipality shares the remaining one-third by using 5% of the annual revenue which will increase at 7% per annum and that the shortfall of the

municipality share will be met by introducing a low interest loan from a certain financial institution. The results are:

(1) With the loan carrying an interest rate of 8%, the municipality will be able to recover the loan in 17 years after the construction.

(2) As far as the loan is available at an interest rate lower than 13%, this project can be recovered within 30 years, being the project life.

(3) Given a more strict local condition that the ratio of repayment to the municipal revenue is 3%, an 8% interest loan would result in the project recovery within 29 years.

Based on this argument, a recommendation can be made, i.e., a cost-sharing system should be employed between the central and local authorities for selected projects with the provision of financial institution suitable for urban projects. This is effective not only for reducing the central government's financial burdens, but also for strengthening the local authorities' financial base.

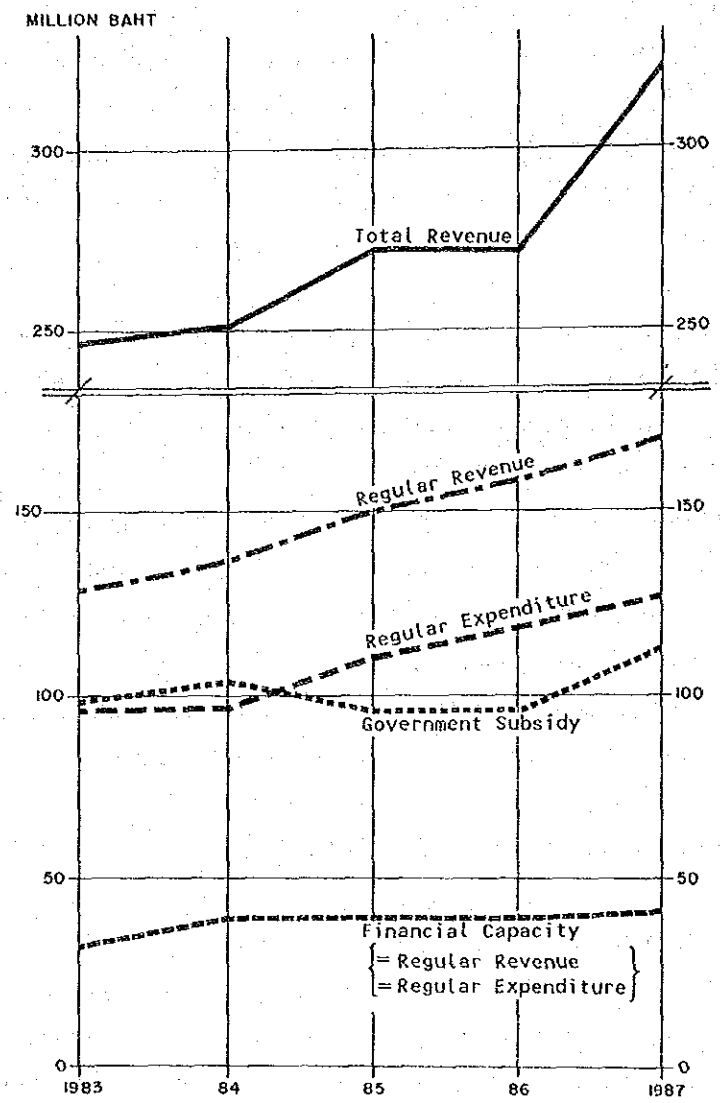
7.3.3 Strengthening Local Authority Finance

1) Present Constraints

Financial base of the Thai local authorities has been very shallow and narrow as a result of the historical background which always gravitated toward centralization of power. However, the Fifth and Sixth National Economic and Social Development Plans have placed considerable emphasis on the strengthening of local administrative and financial power to mobilize local resources and to formulate and implement sound development.

Recent trend in the revenue and expenditure of 14 municipalities within the UCR suggests the following points (See Fig. 7.9):

Regular revenue such as taxes, fees and other independent financial sources have favorably increased. However, regular expenditure that



Source: Same on Table 7

Fig. 7.9 Financial Trend of Municipalities in the UCR 1983-1987

includes personnel, maintenance and other expenses has also increased. Therefore, the amount of the regular revenue minus the regular expenditure, which is assumed to indicate "financial capacity", meaning the capacity of municipalities to invest for their development by themselves, does not show much increase. Municipalities have no more than 3 million baht of financial capacity on average.

Consequently, municipalities have to depend largely on subsidy from the central government. About 72% of their investment budget were financed by the subsidy in 1987. In addition, the amount of the central government subsidy for each municipality fluctuates very much from one year to another depending on the results of annual budget negotiation in the central government. Therefore, municipalities can hardly take an action which require a couple of years and more.

Looking into the financial capacity on per capita basis, it is observed that the capacity is more limited in large municipalities, including Changwat urban centers than small municipalities.

2) Introduction of A New Lending Scheme

(1) Limitations of Municipal Development Fund (MDF)

The first recommendation is to set up a new fund flow framework in order to enable the local authorities to utilize low-cost money from internal as well as external financial institutions.

Municipal Development Fund (MDF) set up in the Department of Local Administration (DOLA) in 1955 is and should be a possible main supplier of such loans, but it can not fully play such roles because of its limited original purpose, which is to direct, in the form of loans carrying no or low interest, the financial surplus collected from municipalities at a certain percentage of their budget to the municipalities which demand more funds for development.

Looking into the projects funded by MDF in the UCR, kind of projects and size of fund are limited: mostly pawnshops with 1.5 million to 2.0 million baht loan as working capital. Since MDF has no professional appraisal system, finance is not made based on proper examination of project feasibility. Moreover, since MDF is merely an internal institution, it hardly functions as a borrower of other financial institutions in order to expand its financial capability.

In view of the needs of the local authorities to carry out multi-year projects such as sewerage, the following four options can be conceived:

Option 1: Modification of MDF

Option 2: Arrangement of a new independent bank by reforming MDF (it may be renamed "Municipal Bank")

Option 3: Utilization of existing government banks such as Industrial Financing Corporation of Thailand (IFCT) and Bank for Agriculture and Agricultural Cooperatives (BAAC)

Option 4: Establishment of a new institution which may be called the "Urban and Environmental Development Fund (UEDF)".

Regarding Option 1, MDF was set up just to supply marginal loans to the local governments, and has been operated for over 30 years. Therefore, it should be the most suitable to channel the new money into local authorities, if the following points are met, though difficult, to improve its management and introduce new money:

- Strengthening of project evaluation system,
- Development of exclusive staff and organization,
- Expansion of information and promotion activities, and
- Disclosure of financial statement.

Option 2 has an advantage in making use of the MDF's base which has been created historically. However, the problem would be that it requires a long time to change the main legislative purpose of MDF from the mutual aid among local authorities to increasing their investment capacity, and to accordingly restructure existing institutional systems in connection with MDF.

Option 3 is to utilize one of the present development banks which have plenty of experiences in mobilizing external loans and dealing with two-step-lending and have few problems in management skills as financial institution. Although IFCT is now diversifying its operation territory, its founding purpose does not necessarily fit local authorities' finance.

Option 4 is to establish a completely new institution named "Urban and Environmental Development Fund (UEDF)". At present, there is no independent financial body for local authorities in Thailand.

Based on the above considerations, it is recommended that possibility of the Option 4 be explored.

(2) Urban and Environmental Development Fund (UEDF)

The major objective of UEDF is to supply low-cost and long-term loans with a considerable flexibility for local development. UEDF is structured so that it may be a completely independent and purely financial institution under supervision of the Ministry of Finance.

The functional overlaps and conflicts with MDF may occur somewhat in the short run, but, in the medium run, MDF may shift its target programs and projects to more social development-oriented ones. MDF may also take part in this UEDF scheme as a founder and/or as a financier under the MDF's diversification policy.

Scope for UEDF's finance should be flexible and cover the followings:

- Infrastructure development projects
- Municipal enterprises/business
- Public and private joint type projects
- Private sector's investment projects to equip facilities for environmental protection (particularly for small- and medium-scale industries)
- Land acquisition for public service facilities
- Other programs and projects to be provided by local authorities.

The fund sources of UEDF could come from various forms of contributions by: (a) local authorities; (b) the central government; (c) MDF; (d) the private financial sectors; and (e) foreign and international financial sources.

When the security market in Thailand will be matured and the financial viability of municipalities will gain acceptance, UEDF may also extend its service in municipal bond floatation in order to provide local authorities with another new source of finance.

3) Local Taxation : Reform and Rearrangement

(1) Improvement of Tax Collection Administration

There exists a great difference in the tax collection between the best performing municipality and the worst performing one: the per capita tax revenue of Sena Municipality is about 6 time as much as that of Ayutthaya. It is supposed that local authorities, in general, are levying annually only 30 to 40% of the total taxable amount. Major obstacles to improving local tax collection administration are as follows:

a. Local revenue officials are not so properly trained as to meet objectives of revenue collection by using tax maps and tax rolls, assessing taxes, and convincing the people of their obligation to pay tax.

b. The yields of tax collection (tax coverage ratios) have not definitely been identified by either the local authorities or the central government. This indicator is administratively important and may be used for the comparison of self-sustainability among local authorities.

To cope with the above problems, the following measures are recommended:

a. A nation-wide campaign to promote people's understanding of local taxation and revenue improvement programs.

b. Training programs for the local officials in charge of tax collection.

c. Guarantee by the local authorities that newly identified taxable land and buildings are not subject to back taxes.

d. Up-to-date assessment of property value. The application of new assessed value must be gradual.

(2) Tax Reform and Rearrangement

a. The base of the existing land and building tax may be expanded to include owner-occupied houses.

b. Since public enterprises benefit from the local public services, they may be taxed for the use of services.

c. In longer term, a possibility should be explored to integrate tax rolls of land tax, building tax and local development tax.

d. Rate structure of the land tax should be adjusted so that the tax is not regressive with respect to land value.

e. Signboard tax should be modernized in terms of higher rates, expansion of the tax base and greater administrative effort.

f. The entertainment tax is proposed to be transferred to a local tax.

g. The land (ownership) registration tax needs to be improved in favor of the local authorities.

(3) Introduction of New Taxes

A number of ideas of new tax sources have been proposed from academic circles, but needs further arguments at the national level. The following are selective ideas for strengthening the local finance.

a. Specific Assessment Levy: Owners of the properties of which the value is increased by public investment in urban infrastructures should contribute the specific assessment levy. The "Urban Planning Tax" linked with the property tax is popular among the industrialized countries. This levy or tax revenue shall be earmarked exclusively for urban development and planning.

b. Surcharges on utility bills (telephone, electricity and water) may be imposed as new sources of local revenues.

c. Lottery Revenue: Lottery revenue should be earmarked for social welfare development by the local authorities.

4) Improvement of Administrative Efficiency in Local Finance

It is a fundamental task for the local authorities to improve their local administrative management systems through a "Plan-Do-and-See" cycle. The administration for tax collection is a case. Presently no systems have been established even to catch the accurate figures of how much percentage they are now levying taxes to the amount to be levied and the indicators to show the actual social service levels which they have provided compared with those in the previous year. For this end, it is proposed that the government introduce an "Unformed Performance Indicator System (UPIS)" to local authorities with the following purposes:

(1) Improvement of management systems and staff capabilities of the local governments themselves,

(2) Streamlining of the instruction and monitoring systems by the central government, and

(3) Proving and demonstrating the efficiency and effectiveness of the local governments" management to citizens, businesses, the central government and lending agencies.

UPIS is meant by utilization of a uniformed measurement that local authorities can monitor and evaluate their financial conditions, the efficiency of their operations and the sufficiency of infrastructures and services. The initial effort to realize this system has been made by the Department of Local Administration (DOLA).

5) Arrangement of the Subsidy System

(1) General Subsidy

The general subsidy is determined on a per capita basis (60 baht per capita for the municipalities). Given a fixed amount for a long time, however, monetary value of the general subsidy is virtually decreasing year after year. A total size of the budget earmarked for the general subsidy for the local authorities should be determined at a certain percentage, not in terms of per capita amount of the national major tax revenues, but in terms of the percentage of it. Nextly, the total amount of the subsidy should be allocated to the local authorities, on the basis of "fundamental financial shortfall" defined as a difference between the fundamental revenue and the expenditure. This allocation system needs a more sophisticated process using the proposed UPIS.

(2) Specific Subsidy

Specific subsidy is the one which is given for the prescribed specific programs and projects proposed by local authorities.

Definite guidelines for specific subsidies are recommended to be prepared as an integral part of the proposed cost sharing system with respect to types of programs and projects.

(3) Compensation Grant

This grant serves as a kind of rebate for the extraction of local resources upon which the central government secures its revenue in the forms of loyalty, concession fee, taxes from the production and sale of the extracted resources. The UCR is based largely on the mining and quarrying activities and suffering from environmental deterioration. This grant should therefore, be earmarked for the restoration of environment especially in the UCR.

6) Enhancement of Non-Tax Revenues

Promotion of municipal enterprises is strongly recommended not only to expand the financial sources, but also to foster the urban management capabilities of local authorities' officials through the business. Types of the conceivable business other than those being presently in operation are radio broadcasting station, parking lots, market place, toll roads and tourism/recreational attraction. For establishment of efficient operations, participation of the private sector should be taken into account.

Public Health Act B.E. 2484 sets a upper ceiling for fee rate of municipality. The fee rate should continuously be adjusted to the cost covering level at least.

7.3.4 Land Issues for Project Implementation

Most local authorities have faced difficulties in land acquisition for project implementation due to rising of land prices. Since the jurisdiction of municipality is limited to a relatively narrow area in general, once the municipality experienced rapid urbanization, available space with comparatively low land prices tends to be extremely limited within its jurisdiction.

When the land prices are affected not by directly productive activities but greatly by speculation, it could be accepted that the land acquisition by public sector must be rendered at the bear market price reduced by the speculated portion. In practice, however, this would yield difficult and time-consuming negotiations with landlords. A possible way to resolve this problem is to prepare an official guideline for land prices and land transactions which are authorized, announced to the public, and periodically amended. This guideline presents standard prices for land transaction. The standard prices must be based not on subjective judgement of the government but on objective appraisals of "market land prices" in the municipality by officially qualified appraisers. The local authorities may start negotiations with landlords with the prices presented in the guideline.

Regarding the limited land availability within municipalities, arrangement should be promoted so that municipalities may provide land for the services outside their jurisdiction in coordination with the neighboring local authorities. Organizing of "Local Authorities Association" proposed in Section 7.3.2 could be one of the solutions.

To make land acquisition easier, the following policy ideas should be taken into account:

(1) Provide certain tax incentives in case that landlord sell land to the public sector.

(2) Explore a land pooling system. In this system, a local authority purchase lands anywhere within its jurisdiction, and in anytime regardless of the existence of project. The purchased land is pooled. Once a project has matured for implementation, a part or all of the lands pooled is utilized as a seed for exchange with the targeted land on which the project is planned. This system would be effective in two meanings: one is that increase in land prices could be covered to a considerable extent by the exchange of lands, and the second is that, having the seed land, government negotiation with landlord could be easier.

(3) Effective utilization of the publicly owned land should be considered in line with the above land pooling system.

(4) Application of a more sophisticated system, named the "Land Readjustment System" may be explored. This system is effective to creating the land for public use by extracting a certain portion from

each individual land. This extraction is possible when land price increase is expected to be large enough to offset physical reduction of land.

7.3.5 Public and Private Coordination in Regional Development

Public and private coordination in the UCR is important particularly in the provision of local infrastructure and urban services, the provision of supporting services for productive activities and the management of natural resources and environment. The type of coordination varies by program and project. The general guidelines for inviting private participation in the above fields can be described as follows:

(1) Objective, basic plan and beneficiary of the project that the public sector intends to launch should be clear-cut. Provision of incentive scheme is necessary. Thus the public sector has an important task to arrange the institutional conditions with which the private sector is not reluctant to participate.

(2) As a basic rational for promoting the private participation in public services, a concept of "*Beneficiaries-Pay-Principle*" needs to be understood properly by the local people.

(3) Public investment might be essential at the initial stage. The public sector should be responsible for basic components and regulations, while the private sector should be responsible for feeder components and local level participation.

(4) In the short run, a greater emphasis should be given to the public and private joint undertakings to combine the financial and technical capabilities of both sectors rather than to the promotion of privatization at the local levels. The public and private joint undertakings will provide local authorities with opportunities to foster the personnel capabilities in urban management.

(5) Effort for organizing private sector not only at the national but also at the local level should be made, through involving various fields such as banking, financial, manufacturing, commercial and services sectors.

The provincial chambers of commerce would be a core of the organizing.