Chapter 2
Literature Review

2.1 Pricing Water

Providing irrigation services for free or little charge places a great financial burden on the government to the extent that the irrigation schemes in many countries may not be sustainable in future years. Moreover, growing demand for irrigation water is threatening environmental sustainability of water resources. The present subsidised prices encourages the demand for irrigation water to far exceeding available supply in most developing, and also developed, countries (Asian Productivity Organisation, 1991).

For countries like Thailand where the supply of water is limited, restructuring of irrigation water pricing schemes has been discussed as a potential solution. Pricing water at higher rates could be an effective economic measurement to control the growing demand and reform the irrigation schemes toward more effective and efficient water management practices. Pricing water has two essential benefits:

1. It will encourage farmers to use water more efficiently; and
2. It will raise revenue for operation and maintenance of irrigation systems to improve their services (ESCAP, 1996a).

In recognising the benefits of pricing water, however, the difficulty remains in determining appropriate prices for irrigation water. In theory, if treating irrigation water as a market good, then it should be priced at the level where the costs of developing and delivering irrigation water resources can be recovered. The World Bank's paper, *Water Resource Management: A Policy Paper*, among other similar reports and studies, advocates full economic pricing of water to be applied where feasible in order to allocate scarce water rationally (Jones, 1995). On the other hand, an important question is how much farmers, the consumers of irrigation water, would be able to and willing to pay for water. Irrigation services in many countries have been part of the government assistance to rural development. Therefore, in developing countries, irrigation agencies are concerned more about farmers' affordability than sustainability of irrigation projects (ESCAP, 1996b).

2.2 Willingness to Pay, Affordability and Equity

Willingness to pay concerns how much monetary value farmers would give to water where irrigation services have been provided for free or for small charges. Farmers, who lack the knowledge about the costs of water resources development and are unfamiliar with the idea of paying for irrigation water, might not indicate any figures close to what irrigation water really costs. Some suggest that farmers would be willing to pay for better managed irrigation services. In many cases, irrigation water is free or almost free, but at the same time, the supply of water is often unreliable. If timely supply of the necessary amount of water could be assured, farmers would be willing to pay for water (ESCAP, 1996a). Water availability is beyond water users' control under many large scale irrigation systems, which give farmers strong incentives to refrain from contributing to O&M of the systems (Ostrom, 1992).

Besides how much farmers value water, another important factor determining their willingness to pay is their ability to pay (Perry, et al. 1997). It has been a controversial issue whether farmers can afford to pay for the costs of water resources development and management. Some argue in favour of farmers' ability, while others believe the opposite. For example, a World Bank evaluation study of irrigation projects reports that empirical estimates of the value of irrigation water supports farmers' ability to pay in implementing cost recovery programmes for irrigation development and rehabilitation projects (Young, 1996). On the other hand, many large scale irrigation projects have not been sustainable due to projects costs exceeding project benefits (Ostrom, 1992). There is a study on irrigation systems in five Asian countries, which concluded costs would exceed benefits if farmers were paying full costs of irrigation water (Wade and Seckler, 1990).

There is also the issue of equity in relation to farmers' willingness to pay and affordability. Under free irrigation water supply, everyone can have water as much as they need, at least in principle. When water has certain prices, financially better-off farmers can afford to buy than poor farmers. This is where the equity issue comes in. Equity is a vague concept and there might be no agreed definition of equitable distribution of irrigation water. A study on irrigation describes the complexity of the equity issue in irrigation management.

> Does equity simply mean all users are entitled to an equal amount of water per unit area. Or, does equity imply that all users are entitled to enough water per unit and to meet the unstressed needs of their crops and, when water is short, all users' crops are stressed equally (Asian Productivity Organisation, 1991).

2.3 Types of Water Charges

Besides considering how much water should be priced at, there needs to be research to explore practical measures of collecting fees from water users (Asian Productivity Organisation, 1991). There are many ways to charge for water, and each irrigation scheme should develop a fee collection mechanism that suits local conditions. Some major factors that should determine water fees may include the following:

- Purpose of water use/type of crop
- Type of water resource
- Level of services
- Water quality
- Season in the year and time in the day
- Distance from water source
- Topography
- Other criteria depending on the economic use of water and the ability of the user to pay for the water

(ESCAP, 1996B).

Irrigation water charges can be divided into two major categories: fixed charges and volumetric charges. Fixed charges could be set based on areas irrigated, crops to be grown and/or seasons.

Examples are:

1. Payment per unit of irrigated land, where the farmer will receive all the water he wants, but will pay only according to the area served. The main disadvantage of this method of pricing is that it does not encourage farmers to use water efficiently;
2. Payment on the basis of crop, where a fixed price per crop per hectare is charged and collected at the end of the season. Crop rates are often imposed by the Government to encourage the production of certain crops and discourage that of others. There are good reasons for this, since some crops require much more water than others;
3. Payment per season, which reflects the difference in the value of water between the rainy season and the dry season (ESCAP, 1996B).

On the other hand, volumetric charges are collected according to the actual amount of water withdrawn, and therefore, can be used only where the amount of water withdrawal can be measured at the farm level. Volumetric charges are applicable to pumping and tube-well irrigation where individual meters can be installed to measure each farmer's consumption of water (ESCAP, 1996B). Compared to fixed charges, volumetric charges have an advantage of encouraging farmers to use water efficiently. On the other hand, disadvantages are that the charges can be applied to only limited types of irrigation systems, and necessary equipment and

management costs are expensive. Some argue that for small-scale irrigation systems, volumetric metering at the farm level is too costly (Perry, et al. 1997).

2.4 Management Regimes

In order for the water pricing schemes to be effective, irrigation management issues must also be addressed to complement the improvement of irrigation schemes. There are two major management issues often discussed: decentralisation of management responsibilities to local water users' groups; and improvement of institutional capacity of the water users' groups.

Irrigation systems in most cases are managed by state irrigation agencies, whose performance in O&M of irrigation systems is often found to be of poor quality. Many studies on irrigation schemes indicate inefficiency of the government in water resources management. For example, a paper published by the International Irrigation Management Institute (IIMI) concludes that with a few exceptions, the public sector has failed in irrigation water management due to, among other reasons, rent seeking, the divorce of incentives from performance and "by the book" administrative operations (Perry, et al. 1997).

Poor O&M causes low productivity of irrigation systems, which is, as stated earlier, one of the main reasons for wasteful use of irrigation water. Poor O&M is partially caused by insufficient budget allocation to O&M. While planning, design and construction of irrigation systems are normally well financed, inadequate funds are allocated to O&M (Wade and Seckler, 1990). Some argue that when adequate water charges are collected, it will raise enough budget for O&M of irrigation systems. Others question the causality between water charges and O&M. There are two reasons why collecting adequate water charges may not assure good O&M: collected charges are normally sent to the central treasury, thus there is no financial link between water charges and O&M; secondly, even where the financial link exists, the irrigation agency may not have an incentive to link between the O&M budget and good O&M for the irrigation agency (Jones, 1995).

As a solution for the poor O&M and inefficiency of irrigation systems as a consequence, decentralisation of irrigation management from irrigation agencies to local water users' groups is suggested. Transferring O&M responsibilities from the public bureaucracy to the users of small irrigation systems seems to increase efficiency in irrigation management (Asian Productivity Organisation, 1991). A study on irrigation projects conducted by the International Irrigation Management Institute also supports the idea of decentralising the administration of irrigation projects to one agency to handle O&M of the main irrigation system and water users' groups to be responsible for the rest of the system (ADB, 1986).

Decentralised management at the field level is expected to be more effective and efficient compared with management by the central irrigation agencies.

Transaction costs, such as the cost of collecting water charges, are much higher for large-scale projects compared with small-scale projects in which face-to-face communication is not so difficult (Ostrom, 1992). Furthermore, when a water users' group is given financial autonomy to collect fees and use them for O&M, O&M is likely to improve (Jones, 1995).

In many cases, those water users' groups existed even before irrigation agencies came in to manage irrigation systems. Sociologists and anthropologists tend to recommend that new irrigation systems be built upon the basis of the existing organisations unless equity is hindered by preserving traditional arrangements (Cernea and Meinzen-Dicks, 1995). Ironically, however, many irrigation specialists are unaware of traditional water users' organisations and their rules and regulations regarding allocation of irrigation water (Perry, et al. 1997). Therefore, few traditional water users' groups have been encouraged to take a significant role in water resources management. In Thailand, especially in the North, traditional water users' associations used to manage local water use and allocation. Many of these associations, however, have lost their function in water management due to land use modification, modernisation of agriculture and other socio-economic changes.

In order to achieve effective farmers' participation, irrigation management institutions at different levels should have favourable basis for farmers' participation:

1. the national policy level where the participatory approach is made legitimate;
2. the agency level where government officials must develop a close working relationship with farmers; and
3. the village level where villagers organise to solve local problems and become more involved in implementing "their" irrigation project (Wade and Seckler, 1990).

It may have to be clear that collected water charges will be used for O&M of the irrigation facilities (Wade and Seckler, 1990). This is one of the accountability issues of the management of water users' groups.

In order to collect water fees, irrigation agencies need to have adequate data on area irrigated and crops grown (Wade and Seckler, 1990).

If water users contribute their labour for O&M of irrigation systems, it will reduce the financial burden on irrigation agencies and increase water users' capacity to pay for water (Wade and Seckler, 1990).

2.5 Institutional Arrangements

In recognising the potential roles of water users' groups in irrigation management, institutional arrangements of those groups become more important. Traditional water users' groups mentioned above might have lost their institutional

strength since their roles in irrigation management has diminished after expansion of large scale irrigation development by the state. On the other hand, there exist relatively new water users' groups that were formed under state irrigation schemes. These groups lack a long history of communal water management and therefore need to develop their capacity to take over the responsibility in water management from irrigation agencies. Many have discussed types of institutional arrangements that are necessary to assure the sustainability of irrigation management. Some important components of the institutional arrangements, among others, are summarised below:

1. clear boundaries of the field served by the irrigation system;
2. membership of the water users' group who receive the benefits of irrigation water and bear the costs of irrigation management;
3. secure property rights to use irrigation water;
4. autonomy of the group in managing irrigation to prevent interference by the state;
5. effective monitoring of physical conditions of the irrigation system and group members' water use;
6. appropriate sanctions for the members who violate the rules; and
7. conflict resolution mechanisms to solve disputes among members.
   (Asian Productivity Organisation, 1991, Jones, 1995, Ostrom, 1992, Perry, et al. 1997) .

1. Clear boundaries of the field served by the irrigation system

The Northeast Small Scale Irrigation Project (NESSI), for example, divided irrigation systems into two boundaries, namely the main system and the on-farm system, and the Royal Irrigation Department was assigned O&M responsibility for the former, and while water users' groups were assigned responsibility for the latter. Operation criteria were adopted as follows (Team Consulting Engineers, 1989).

Main canal: by RID staff
- rotation within canal
- discharge to be adjusted on a monthly basis
- constant flow during each month

Main ditch: by water users
- full supply flow
- fixed supply duration, variable supply interval
- no rotation within main ditch; all farm ditches receive water from the main ditch at the same time

Farm ditch: by water users
- full supply flow
- rotation within farm ditch

O&M responsibilities divided between RID and water users' groups based on two clearly defined boundaries of irrigation systems eased RID's staff and budget

shortage and resulted in relatively reliable water supply delivery and equitable water allocation (Team Consulting Engineers, 1989).

2. Membership of the water users' group who receive the benefits of irrigation water and bear the costs of irrigation management

Four alternative principles for organising water users into groups are suggested as follows.

1. hydrological: field neighbours sharing water from a common facility, such as a turnout or watercourse;
2. residential: village neighbours, such as those from a given settlement;
3. social unit: membership in user groups based on primary ties, such as kinship;
4. ownership: membership based on joint investment (Cernea and Meinzen-Dicks, 1995).

Under the NESSI Project, water users were organised into groups at three levels, namely chaek groups, main ditch groups and main canal groups. Chaek groups adopted elected leader for each group, who were assigned to develop a water delivery plan, schedule for water rotation and a maintenance plan, supervise O&M activities on the farm ditch, resolve conflicts over water or refer to them to RID staff, oversee the collection of O&M and other fees, and convene group meetings as necessary. About six chaek groups on average formed a main ditch group, which would meet and discuss labour mobilisation and main ditch maintenance. Main ditch groups belonging to the same main canal were then organised under a main canal group that takes care of issues of the particular main canal. A study on the NESSI Project commented that the management structure including water users' groups was too complex (Johnson, 1989).

3. Secure property rights to use irrigation water

Land tenure and water rights are important factors to encourage farmers to invest in management and improvement of irrigation facilities (Wade and Seckler, 1990). Water distribution rules also need to clearly define how water is distributed to users; it is recommended that the rules contain the following:

- The persons or groups of people to whom water is to be delivered (the user)
- The amount of water to be delivered to each user (water quantity or discharge)
- When water is to be delivered to each user (delivery period)
- The person(s) or group(s) empowered to make decisions about water deliveries (the system managers) (Brewer, et al. 1997:2).

4. Autonomy of the group in managing irrigation to prevent interference by the state

The NESSI Project was designed to let water users' groups make decisions in irrigation water management. In practice, however, the function of water users' groups remained to maintain irrigation facilities, except for one main ditch group whose leader sometimes had access to the key to open the water gate. Otherwise, RID officials controlled water distribution (Johnson, 1989).

5. Effective monitoring of physical conditions of the irrigation system and group members' water use

Farmers active participation in O&M of irrigation systems can be expected when other farmers' contribution is assured (Wade and Seckler, 1990). The Northeast Water Management and Systems Improvement Project (NEWMASIP) is an example of well functioning water users' groups that have a better record in preventing overuse by head land farmers (Rice, 1997).

6. Appropriate sanctions for the members who violate the rules

If irrigation rules are viewed to be legitimate by water users, there may not be many cases of violation, and therefore serious sanctions may not be needed (Ostrom, 1992). Some even propose that in cases where strong community pressure to pay water fees exists among water users, a direct penalty may not be necessary (Wade and Seckler, 1990).