CHAPTER 1

INTRODUCTION

1.1 GENERAL

In the Brundtland Report, which was also known as Our Common Future (WCED, 1987), the world was alerted to the importance and urgency of making progress toward economic development that would have an aim of being sustained without destroying the natural resources or harming the environment. In the report of the World Summit on Sustainable Development (WSSD), which builds on the UN Millennium Development Goals, water has been identified as a priority area for human development. Scarcity of water is most prominent issue of discussion worldwide, concerned with its sustainable development. Over the next two decades, it is expected that the world will need 17% more water than the present availability to grow food for the increasing population in developing countries and that total water use will increase by 40% (UN, 2002). In addition, there will be a tremendous pressure to meet the water requirements for other purposes, such as drinking, industrial use, environmental and ecological management. It is estimated that by the year 2025, as much as two-third of the world population will be living in areas facing water stress conditions (WMO, 1997; UNEP, 1999). By the year 2050, the population projected to be living in water-scarce countries will rise to between 1.06 Billion and 2.43 Billion, representing roughly 13% to 20% of the projected global population (WR, 1996).
Water as a scarce and commonly shared resource may become a cause of conflict. To provide water of acceptable quality to the users in right quantities at the right places and at the right time by applying environmentally sound techniques and procedures is the challenge in this decade. Hence, there is an immediate need for the effective management of this vital resource. Water is the most complex natural resources demanding a comprehensive understanding of its inherent features in its occurrence and distribution for an integrated planning aimed at an optimum national development for agriculture, health, industry, power and transport to mention a few. Demand for water is constantly increasing with increasing population, better living conditions, and increasing irrigation facilities, industrial, nuclear and space programs.

Irrigation accounts for more than 80% of the total water resources utilization in India (Shah, 1993). On the other hand, domestic and municipal sectors consume about 5% of the total water use. Almost all monsoon countries in the semi-arid tropics have small water bodies like tanks (Sengupta, 1985). Tank irrigation systems contribute nearly one third of the total irrigated area in South India and hence their management is an important practical need. The major deficiencies that influence the sustainability of the tank irrigation system are inadequate maintenance, reduction in storage capacity, heavy seepage losses in the delivery system and poor water management techniques. There is a pressing need to evolve and implement appropriate strategies that management be sound on technical, social, institutional, and economical dimensions for sustainable development and management of tank irrigation systems.

1.2 TANK IRRIGATION

Tank irrigation contributes significantly to agricultural production in the parts of South and Southeast Asia. Especially in South India and
Sri Lanka, tank irrigation has a long history and many currently used tanks were constructed in the past centuries. Irrigation tanks account for over 30% of the total irrigated area in South India and over 40% of the irrigated rice in Sri Lanka (Palanisami and Flinn, 1988). Traditional irrigation tanks, for centuries, formed the cornerstone of cultural, economic and environmental life in rural areas. In India, tanks are the traditional irrigation facilities commonly situated in many parts of Indian sub-continent to capture monsoon runoff in the arid and semi arid areas. However, large concentration of tanks are found in the three southern states of Andhra Pradesh, Karnataka and Tamil Nadu and the union territory of Pondicherry, which account for nearly 60% of India’s tank-irrigated area (Sakthivadivel et al, 2004). At present, nearly 80% of the people either directly or indirectly depend on an agro-based activity. Tank plays a dominant component for agro-based activities. Tank is a low, earthen bund constructed across a shallow valley to hold the runoff from its catchment area. Irrigation tanks are eco-friendly. They serve as flood moderators at times of heavy rainfall and as drought mitigating mechanisms during long dry spells. They recharge groundwater, which is a major source of drinking water for numerous rural and urban communities.

Tank management problems tend to fall into two distinct categories: provision and appropriation. The provision problems relate to those associated with bringing adequate water to the tank and making it available for use at the outlet. It involves multiple tasks such as conservation of the catchments, maintenance of supply channels, removal and prevention of encroachment into tank water spread areas, de-silting, maintenance and repair of the bunds, surplus weir and sluices. Appropriation problems, on the other hand, relate to sharing of various benefits from tanks such as water for agriculture and non-agricultural purposes, fishes and trees grown in tanks, silt collected from the tank bed, grasses and other minor benefits from tanks (Balasubramanian, 2006). In ancient days, tanks were considered to be the
property of rulers. The farmers paid a portion of the produce to the ruler. Farmers also were in charge of the maintenance of the tanks and supply channels. Zamindars ensured proper maintenance of the tanks and channels, since they reaped the benefits of farming in large areas. Traditionally, tank systems were providing protective irrigation on a limited scale. They were maintained by village communities, which were nurtured by the benevolent local rulers. Institutional arrangements such as Dasabandam and Kudimaramat were in place to protect the tanks.

1.2.1 Tank irrigation system

Traditional water harvesting systems comprise of mostly small scale water bodies like irrigation tanks, farm ponds, anicuits (diversion weirs with off take channels) and Ooranis (drinking water ponds). These systems were built by the ancient kings, zamindars and chieftains, with the rural people living in the respective regions over the past 10-15 centuries. They were not only planned and constructed by the local people but were also managed by them locally. Almost every village had at least one or more such structures. One of the most ingenious technologies appropriate to the peninsular India has been the creation of tank irrigation systems. ‘Ingenious’ because, the tanks capture the runoff, resulting from the unpredictable monsoon rains having a wide diversity of distribution, conserve the water for the multifarious uses like irrigated agriculture, drinking water for cattle and domestic uses and augment ground water resources through subsurface recharge. ‘Appropriate’ because the terrain of peninsular India with its undulating topography is ideally suited to impound the rainwater by a simple technique of forming an earthen embankment across the slope and providing a surplusing structure to direct the excess water to flow down to the next tank below. Water required from the tank for irrigation is released according to the needs of the crop through sluice outlets and regulated by simple wooden
shutters designed for economic use of the water. Water flows down the tanks by gravity through field channels and does not need any kind of energy for the supply of water to the crops raised in the command area (Shanmugham, 2001)

Tanks are one of the oldest man-made ecosystems. A tank system consists of water spread area, physically constructed structures namely bund, sluices, surplus weirs and water flow structures like feeder canals surplus courses and other natural elements such as, wetlands, flora ,fauna and inland fishes. They are found in all types of soils except in sand, but found in all socio ecological, agro-climatic and rainfall areas of the country. They are in existence for several centuries serving the water needs of underprivileged communities namely small and marginal farmers. Tanks are, however, disappearing fast due to heavy siltation over time, poor organization and management.

Some of the causes for the decline are decline in compulsory labour contributions to the maintenance work, inadequate maintenance of budgetary provisions by the government, meager revenue from tank-based activities, growth of wells in the tank commands and encroachments. Tanks were silted up and supply and distribution channels nearly choked. The storage capacity of the tank has been decreased due to factors such as siltation of supply channels, tank bed and irrigation courses, and inadequate maintenance of tank.

In order to restore storage capacity, desilting of tank has been chosen as rehabilitation work. These factors call for the need for protection of tank irrigation system to rural livelihood improvement, which is possible only through proper tank irrigation system management to conserve the basic natural resources, (agricultural land and water) and thus uplift the socio-economic condition of the people by providing health, a hygienic atmosphere, improved water quality, flood and drought control.
Managing a tank irrigation system is a complex problem. Therefore, its management requires a variety of physical, social and economic policies and techniques, all aimed at minimizing the adverse consequences of natural disaster events, to improve and enhance the quality of life of the dependent community.

After independence, there has been a widespread recognition that the tanks are on a decline. This decline is both in the form of decrease in the relative importance of tanks vis-à-vis other modes of irrigation and a decline in the actual area irrigated by tanks. Many reasons such as silting of feeder channels, encroachments in the tank bed, interruption in the catchment, poor maintenance, and development of well irrigation in tank commands are attributed for the decline in the tank-irrigated area.

Rehabilitation of a tank irrigation system results in an augmented supply of irrigation water, better recharge of groundwater, improved quality of drinking water, increased production and productivity, enhanced employment opportunities and better well-being of the stakeholder communities.

1.2.2 History of Rehabilitation of Tanks

During the past 2 decades, South Indian states like Tamil Nadu, Karnataka and Orissa have started rehabilitating the tanks. European Economic Community (EEC) now known as European Union (EU), National Bank for Agriculture and Rural Development (NABARD) and World Bank has provided financial assistance for tank rehabilitation in these states. Besides this, the Governments of Tamil Nadu and Karnataka carried out repairs to the tanks from their own funding either directly or with the support from Non-Government Organizations (NGOs) (ADB, 2006). There are NGOs who had rehabilitated through contribution from tank users and other donor
agencies without getting any funds from the Government (Gomathinayagam, 2005).

The Government of Orissa had taken the rehabilitation of tanks in a big way with the assistance from World Bank and European Union (EU). During the early 1980s, the Government of Tamil Nadu approached the World Bank for funding the rehabilitation of tank systems (ADB, 2006).

The focus of tank rehabilitation was different among the above states. Objectives of tank rehabilitation in Tamil Nadu started with increasing agricultural production through better conveyance and on-farm development works and water management. Hence, moved to water augmentation by tank water supply coupled with increasing agricultural production.

Later, it aimed at improving livelihood of the local community through multiple-use of the tank and its water. In this process, catchment treatment and augmenting water supply, multiple use of water, groundwater recharge and conjunctive use of surface and groundwater have all assumed significance.

In Orissa, improving the storage structure and increasing the productivity through better water management were the basis of rehabilitation. Increasing the Rabi irrigated area and improving the gross tank product was one of the basic objectives of tank rehabilitation.

In Karnataka, focus has been shifted to poverty alleviation through increased agricultural production (World Bank funding in Karnataka for JSYS). Multiple uses of water and tank beds and bund for income generation were given importance in these rehabilitation projects.
Funding for income-generating activities through Self Help Groups (SHG) was provided for the tank rehabilitation budget. Institutional strengthening of Tank User Groups (TUG) through NGOs was included as a component in the tank rehabilitation.

1.2.3 Lessons Learned from Rehabilitation of Tanks

Tank rehabilitation projects had undergone many changes over the years in terms of their objectives of rehabilitation, funding pattern and physical components selected for rehabilitation and institutional changes. Tank rehabilitation was started three decades ago purely as physical to increase the agricultural productivity with very little emphasis on institutional strengthening and poverty alleviation. The practice previously adopted in expending the entire allocated budget to physical rehabilitation work without providing funds for training, capacity building and minor modifications of the rehabilitated system has a deleterious effect on the functioning of rehabilitated structures (ADB, 2006).

A major complaint in most of the rehabilitated system is that rehabilitation is considered a one-time activity and when the stipulated period of rehabilitation is over; neither the implementing agency nor the NGO revisits the system to provide advice and/or to carry out minor modifications and repair, if any. Moreover, no fund was left for making any small modifications in the rehabilitated system to make it work smoothly. Also, the time-bound activities left works unfinished in several tanks when the implementing agency left the site. The TUGs did not have adequate funds or the capacity and training to complete the work in all aspects. The result is an unfinished system functioning poorly. Instead of a top down approach, a grass root approach right from the beginning of a project formulation has been found to be desirable by establishing a dialogue with the community leaders and discussing with them the tentative plans and options.
However, the local people were not at all consulted in the design of top-down approach, which resulted in failure of projects in achieving the project goals. The Government planned and executed the tank rehabilitation without involving the farmers in the process. This top-down approach was not concessive for including the stake holder’s participation in designing the programs that are targeted to their improvement. There was a lot of mismatch between the needs of the stakeholders and the activities for implementation of tank rehabilitation. Such projects often failed to achieve the intended targets in the absence of peoples' participation.

Peoples’ participation in the development of tank irrigation system was expected to contribute towards more decentralized governance and increased participatory approaches to water resource management that will rise to face the new challenges by strengthening the capacity of local people. The approaches of rehabilitation of irrigation tanks in India are only the blue print or top down but there is no demand need, hence the result is unsustainable. To have an effective rehabilitation and continued sustainability, farmers should be consulted before planning and involved in the rehabilitation process.

1.2.4 People Participation in tank rehabilitation

Farmers’ involvement with their contribution in labour and cash in the rehabilitation processes are important for their complete involvement. They must understand what the rehabilitation project is going to offer to them and what their specific roles are in decision making, implementation and maintenance and management of the rehabilitated system.

In many tank rehabilitation projects, farmers have proved capable of carrying out rehabilitation work in an effective way, in terms of quality and cost effectiveness. However, they need more time and training to carry out the
rehabilitation work due to their inexperience and for want of adequate financial resources. In this connection, they require adequate advances and training to complete the work in time.

In the event that the TUGs are not willing to implement the work, they suggest that rehabilitation work be allocated to a contractor approved by the general body of the TUG. Experience shows that these contractors recruited from within the village or from neighbouring villages do the work more satisfactorily than others from far-off places. Formation of SHGs at the hamlet/village level is fast spreading. The training as SHG members considerably help them to actively participate in tank rehabilitation work. The SHGs had taken a contract of tank rehabilitation and completed the work in a satisfactory manner under Jala Samvardhane Yojana Sangha (JSYS). SHGs formed at the village level should actively participate in tank rehabilitation work and subsequently make use of tank infrastructure to support their livelihood through usufruct income from tank bed and bund and fishery and forestry. For a successful tank rehabilitation project, a grass root organisation fully involved in planning and implementation is a prerequisite.

The Government or other agency’s role will then be limited to necessary technical and/or financial support and facilitation. A proven technique to enlist peoples’ participation has been by appealing to the individual or collective interests of the local people in such a way that there is effective response to action. This concept has been used in a number of projects all over the world with encouraging results (ADB 2006).

1.2.5 Restoration scheme of tank irrigation system and its characteristics

In Tamil Nadu, most of the tanks have been rehabilitated with financial assistances from EEC, NABARD, World Bank etc., However, many
of these tanks have been degraded into open access resources due to weak property relations.

Encroachments, privatization and Government appropriation of the tanks have been the main outcomes of failures of the local authority to enforce the institutional arrangement under the common property resource management. Due to rainfall uncertainties, the tank performance has declined over the years. In addition, there are problems such as poorly maintained structures (bund, surplus weirs) above the outlet. Catchment is mismanaged and forest land adjacent to the catchment has already been converted to human settlement by the Government. There are severe encroachments in the tank foreshore. Siltation of tank beds has reduced their water storage capacities (Palanisami, 2006). In the case of problems below the outlets, channels are not maintained resulting in heavy water losses.

Now, it may not be possible to construct new irrigation tanks. But the existing tanks have to be saved from the above issues to maintain irrigation, agriculture and other uses. Tank rehabilitation is multidimensional, which needs to take into account all the activities concerned with tanks. The various components of rehabilitation are listed below:

(i) Restoring the storage capacity of the tank by desilting, maintaining the tank bund and repairing the surplus weirs;
(ii) Improving the supply channels to the tank by bringing them to the required cross section;
(iii) Providing control structures at suitable places for efficient canal operation;
(iv) Selective lining of the channels to minimize conveyance losses;
(v) Systematic channel operation and scheduling to ensure equity, adequacy and reliability in water supply;
(vi) Educating the farmers in proper water management practices to increase the efficient use of water;

(vii) Improvement and reconstruction of sluices, providing screw gear shutter arrangement for more effective water regulation; and

(viii) On farm development works i.e. new field channels are introduced to eliminate field to field irrigation with the field channels that are proposed to be lined to reduce the losses and increase their conveyance efficiency.

In certain cases, complete rehabilitation may not be possible as the irrigation structures are ancient and old. Also, it may not be a cost effective process. In such cases, partial rehabilitation may be possible such as partial desilting of tank beds and supply channels which may yield the expected benefits.

Most, if not all, planned restoration of tank irrigation system programmes failed due to lack of involvement of people in the projects. Peoples’ participation appears to be crucial in planning restoration programmes as local people are close to the real problems.

1.2.6 Demand Driven Approaches for Tank Rehabilitation

The main objective of peoples’ participation of demand-driven approach is to make the rehabilitation work in an effective way in terms of quality and cost effectiveness for development to be sustainable, among others by ensuring community participation in selection, planning, implementation, and operation.

A rehabilitation work cannot be successful without the involvement and co-operation of the real benefitees i.e. farmers. Farmer’s involvement in the rehabilitation work or in the water users’ association has
become a social problem, as the participation has been extremely low. Lack of participation on the part of the farmers may have something to do with the way the social system behaves.

The status of landless labourers in general and women in particular, their social backwardness, and the extent and nature of gender participation in irrigated agriculture are few of the social issues concerned with tank rehabilitation works.

The following are the some of the benefits of participatory approach:

(i) As farmers are involved, their felt needs are taken into account;
(ii) It creates a sense of ownership and contribution for sharing the operation and maintenance responsibility;
(iii) Water distribution, under the control of WUA, is carried out in a disciplined manner assuring equity in distribution;
(iv) People gained confidence to work by themselves;
(v) Less conflict among the farmers; and
(vi) Structures constructed by farmers are maintained well by them.
(vii) Farmer participation is considered to be an important component for the successful implementation of water conservation programme.
(viii) Overcome conflicts and reach a consensus when there are different points of view with respect to project components, such as encroachment eviction in tank bed and supply channels, catchment area development and alignment of distribution channels in the tank command.
(ix) The people who are involved in planning & implementation of works to gain confidence in its operation and maintenance
(x) The people to take care to distribute the water equitably and economically among themselves, and in accordance with the crop water requirements.

The present study aims at investigating the conditions under which sustainable tank irrigation system management through restoration scheme is possible in Tamil Nadu, more particularly to explore the restoration schemes, which have been executed with the involvement of people participation leading to sustainable improved agricultural production. In Tamil Nadu, there was no fund has been allocated for desilting of tank during the period of 2008-09 by Public works Department (PWD) but at the same time in Thiruthani District, maintenance works have been done in some of the tanks in Ponpadi tank, Nallathurtank and Madhurtank done by PWD by using the maintenance fund. In this maintenance works, desilting of a tank in particular location (partial desilting) and tank bund strengthening was done only in Ponpadi tank.

The National Rural Employment Guarantee Act was enacted in September 2005, which guarantees 100 days of employment in a financial year to any rural household whose adult members volunteer to do unskilled manual work. The field requirement of Tamil Nadu has been given good thought and priority works such as formation of new ponds, renovation of existing ponds, kuttais, kulams, ooranies, temple tanks, etc., desilting of channels, desilting and strengthening of bunds of irrigation tanks, formation of new roads and other water conservation/soil conservation measures / flood protection measures. In kancheepuram District, NREGA scheme was launched in 2008-09 however, the tank renovation work has been taken under the NREGA scheme in Avalur tank, Puliambakkam tank, Sankarapuram tank and Ullaavur tank but restoration work of partial
desilting of tank, tank bund strengthening and channel desilting have been done only in Avalur and Puliambakkm tank.

Three typical study tank irrigation systems of Ponpadi, Avalur and Puliambakkm have been chosen for this investigation. The restoration works like desilting of tanks, desilting of channels and tank bund strengthening have been done on these three tanks during the period 2008.

Among these three tanks, one tank of Ponpadi is a non system tank. In this tank, desilting work was carried out by PWD scheme. Already the rehabilitation work had been done under EEC scheme. In this tank, the government official was interested to do the maintenance work. Even though silt deposition was high in the tank, the government did not carry out the desilting work because they felt that it could be a high risk while doing that work and also did not get the expected benefits from the work. However the officials decided to do the restoration work like partial desilting in this tank. Other two tanks of Avalur and Puliambakkm are system tanks in Kancheepuram district. In these two tanks, desilting of tanks and channel desilting were done under NREGA scheme. People participation was good in Avalur and Puliambakkm tanks. Even though there was no water in these tanks, the people were kept it well in advance and maintained regularly. In many villages in kancheepuram district there was no good thought about NREGA scheme, i.e., land lord people were felt that labourers demand for their land work and councilor felt that the labour was not working properly they are coming only for getting salary. But in these two villages, people and councillor were felt differently and also they are involved to take this restoration work under NREGA scheme. In the above three villages the landholders said if the tank has full of water surely we have harvested at two to three seasons. Hence these three restoration work carried out tanks, have been chosen for this investigation, among these tanks one tank the govt
official was involved and other two tanks people were involved to execute the work. Hence these results will very helpful for implementation of restoration works of irrigation tanks.

The stakeholders have been involved to implement the restoration programmes in these three study tank irrigation systems and the works have been carried out under the following approaches:

(i) Need based demand sensitization of Restoration (NREGA Scheme);
(ii) Localization based on Balancing Restoration Scheme with Utilization (NREGA Scheme); and
(iii) Different alternatives to rehabilitate the tank irrigation system with short and long term perspectives (PWD Scheme)

Framework for tank irrigation system management through restoration schemes has been developed based on the lessons learnt. The impact of the above three typical restoration schemes of tank irrigation system projects has been evaluated by using the developed framework, which may pinpoint at the factors that constrain their sustainability.

1.3 SCOPE OF STUDY

The present study attempts to examine the impact of restoration of irrigation tanks though a comparative analysis between, “before restoration” and “after restoration” of the selected study tanks. The study highlights the performance of tank irrigation system management through restoration schemes in agriculture through various parameters like cropping pattern, cropping intensity, crop yield, income pattern etc. Socio economic impact of restoration was analyzed and financial feasibility investment was also analyzed. The end results of the research may help in analyzing the sustainability of the benefit and economic viability of the investment.
Therefore, the results of the study may help the policy makers and planners to assess the performance of various tank irrigation system development and management under restoration schemes and generate suitable policy for its effective utilization. It may also help the researchers to further refine the research methodology towards sustainable irrigation tanks systems.

1.4 OBJECTIVES

Based on the evaluation of impact, a policy guideline has been developed for the sustainable tank irrigation system management through restoration schemes in the state of Tamil Nadu.

The major objectives of the present study are:

(i) to develop a conceptual framework for implementation of restoration scheme of tank irrigation systems and to find out problems and prospects in the management of tank irrigation system in Tamil Nadu; and

(ii) to select a typical tank irrigation systems restored through different participatory approaches and use the framework to evaluate the impact for restoration work of irrigation tanks.

However, the specific objectives of the study are:

(i) to assess the changes in socio economic characteristics before and after the implementation of restoration schemes;

(ii) to compare the cost benefit effect of farmer income due to restoration of irrigation tank;

(iii) to evaluate the financial feasibility of investment in restoration of irrigation tank.
to find out the strengths and weaknesses of the restoration work under different schemes

(v) to recommend the suitable management options for protection of tank irrigation system through restoration scheme to sustain the rural livelihood.

1.5 STRUCTURE OF THE THESIS

The thesis comprises of eight chapters including the first chapter, which presented the introduction, containing general statements, scope and objectives. Second chapter will review the literatures pertaining to studies related to tank irrigation system and its characteristics, decline of tank irrigation systems, rehabilitation of irrigation tanks and sustainable development and management of tank irrigation system. The third chapter describes the framework of concepts and techniques adopted to evaluate restoration scheme of tank irrigation systems. In the fourth chapter, the characteristics of the study area are described. The methodology used in the study is presented in the fifth chapter. The sixth chapter deals with the estimation of restoration scheme of tank irrigation system under different approaches. The seventh chapter describes the discussion of concepts and techniques adopted to evaluate restoration scheme of tank irrigation systems. The summary and conclusion of the study is presented in the final chapter.