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An appraisal of rural tanks and their role in sustainable rural development: a study in the Deccan plateau

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ABSTRACT

Rural-tanks based irrigation is a significant method of agricultural food production. It is an essential factor in Indian agricultural economy. But the usage of rural-tanks was extinct in most of the southern states of India. Instead of rural-tanks, the modern-reservoirs are replaces for agricultural usages & food production. Rural tanks were lost their peculiarities due to silting, weeding, encroachment and the people's attraction towards modern types of irrigation and also the launch of large level irrigation projects - Dams. In this stage, this perspective aims to map-out the overall rural-tanks and their significant impact on the farming and society structure in Southern states of India. The rural-tanks are the key resource of water as a life saving mechanism that only provides the sustainable development in the rural regions of Southern India. A plan has been proposed to save and conserve the rural tank's efficiency.

Keywords: Socio-economic; Agriculture; Sustainability; Rural development

1. INTRODUCTION

In India, irrigation is one of the most important factors in agricultural production as well as important determinant of the country's economy. The irrigation sources of canal, wells and tanks have existed since the evolvement of the farming practice of the people. Among such sources, rural tanks are the traditional technology made by our forefathers in order to store and save the precious resource of water. They are called smallest water bodies behind earthen dams constructed by kings and regional chieftains, for the purpose of irrigation to crop production and use of rural community. Rural tanks are the conserver of rainwater by storing. They have the ability to irrigate the cropland in their surroundings as well as to recharge the ground water. Locally the rural tanks provide multiple benefits directly and indirectly to the rural community and rural environment, through the extent of irrigation and distribution of water. They bring many things to the rural people in terms of water for animal breeding and maintenance, drinking water through recharging ground water and benefits from the trees planted in and around the tank. Rural tanks create natural vegetation in rural areas, when they have the optimum level of water that leads to maintain the favorable climate. They determine the climate change of the particular region.

Rural tanks are also known as Common Property Resource (CPR), which constitutes the command area, supply and feeder channels, catchment area, tankbunds and foreshore area. The classifications of tanks vary from region to region on the basis of catchment, water flow and purpose of use. However, the rural tanks have been classified into major types as system tanks and non-system tanks. The system tanks receive water from both the nearby canals / rivers and their water catchment area and rainwater is the only source for non-system tanks. The physical structures of rural tanks are mainly determined by the size of bund, areas of catchment extent of tankbed and length of the command area. These physical structures mainly depend on various factors like nature of the tank, purpose, location and geographical area. Due to various immense uses of rural tanks, several physical and socio-economic reasons inhibit their reduction and retrenchment. This resulted in the reduction of area irrigated by rural tanks.

Various measurers and schemes have been launched by Government and NGOs in order to restore such rural tank systems, such as various schemes of tank renovation and rehabilitation, desiltation, minor irrigation works and few rural development programmes of Jawahar Rozgar Yojana (JRY) and Sampoorna Gramin Rojgar Yojana (SGRY) that concentrate on renovation of the rural tanks. The tank restoration works are concentrated through the Mahatma Gandhi National Employment Guarantee Programme (MNEGP), in almost all villages of throughout India.

Earlier Studies

To understand the background of the present research, various select studies were considered and scrutinised in order to understand the gap and missing points in research on rural tanks. They are as follows: Mosse (1997) has conducted a study on Tank Irrigated Landscape to examine the historical and cultural impact of two cultural ecologies on tanks in South India. The study points out that the society related tank serves to acquire resources to lobby and forge external links as much as for the management of village resources. The study recommends that knowledge and strategies on traditions of tanks should be identified to restore the existing tanks in South India. Von Oppen and Subba Rao (1987) studied Tank irrigation in Semi-Arid Tropical India, focusing on the economic impact of tank irrigation and their alternatives for tank development. The study emphasizes the human pressure on land transform, alternative source for irrigation and neglecting the administration of irrigation tanks as the major reasons that lead to decline in tank irrigation in the region. They have also recommended the establishment of Tank Irrigation Authority (TIA) at the state level to train and supervise the water controllers and those responsible for tank management. Sankari (1991) has conducted a study on tanks with major problems, which outline the problems associated with tanks in Chittoor district, Andhra Pradesh. The study also confirms through the survey of 40 tanks in the region that the problems are inadequate supply of water, encroachment, tampering of water course, repairs of bounds and sluices, heavy siltation and weeding. The study suggests that the Government should adopt a need-based approach in promoting ayacutdars' (Tank users) association, which will help to protect the tanks in the region. Chattopadhyaya (2003) has undertaken a study on Futile Replacement of Tanks and Ponds, focusing on the economic importance of tanks in the Malabar district of Kerala. He notes the problems among the tanks that over the last few decades, many such tanks have become derelict due to the implementation of the larger irrigation projects. The study suggests that the scientific improvements can improve the old systems by identifying locations and means for water harvesting and desirable land use patterns. William Easter (1981) has studied the Tank Development in the Northeastern Thailand mainly to understand the performance of tanks and their need for modernisation for the five select tanks in that region. He suggests that the rehabilitation of irrigation tanks provides supplementary irrigation for rice crops. Sing et al. (2004) have undertaken a study on Traditional Tank systems that investigates the scale of utilization of tanks in Karnataka state, India. The study high- lights that the utility of the tank has declined for the activities of crop cultivation and community purpose. It also recommends that the explicit account of strategic level and village level decision-making process should be taken to integrate water resource management in the region. The study (1988) on Tank Irrigation and Integrated

Rural Development conducted by Govindiah aims at an assessment of economic efficiency of tank irrigation for rural development. The study discloses the fact that rich farmers can afford to have artificial irrigation facilities by making huge investments while neglecting the tank system, which stands to be the only source of irrigation for the small and marginal farmers. The study recommends that the tank system should be restored and maintained for the future generations. Palanisamy and Easter (2011) have studied Tank Irrigation in Asia to gain a better understanding of the potential for tank irrigation with the concentration on ten tanks in Ramanathapuram district in Tamil Nadu. The study reveals that the total water supply has actually dropped as the tank falls into disrepair resulting in a decline of storage capacity. The study suggests that the tank rehabilitation work should be adopted to increase tank water supply to their ayacut area. Chirunjeevelu (1988) has conducted an elaborate study on Tank Irrigation and Agriculture Development, which mainly focuses on water distribution, repair and maintenance problems under tank, irrigated situation. The study analyses the problems of water management at the field level for 10 small tanks and 10 large tanks in Srikakulam district of Andhra Pradesh. The study concludes that the physical conditions of the tanks are found to be unsatisfactory. Tank bunds, sluices and surplus weirs are highly damaged in addition to inadequate water supply, lack of field channels, siltation and encroachment of foreshore area. The study recommends that the Government should initiate the farmers' forum in the village to organize them and assist them in forming irrigation committees at the village level. The studies clearly state that rural tanks are important sources for cropping as well as all other purposes of rural community. They have been reduced due to various reasons, which resulted in reduction in cropland, ground water level and environment degradation. Based on the above facts the present paper aims to highlight the regional distribution of Rural Tanks, their various issues and their importance to Rural Development in South India.

Objective of the study

The objectives of this paper are

- to trace the distribution of rural tanks in the various parts of South India.
- to highlight the importance of rural tank systems in sustainable development of rural area in South India.
- to identify various issues that inhibit the rural tank declension and
- to suggestions measures to overcome the problems related to rural tanks and also develop a plan for effective conservation.

2. METHODOLOGY AND STUDY AREA

The present paper focuses on the rural tanks and their importance to sustainable rural development in South India. This work has been undertaken on the basis of secondary sources of data, which includes the distribution of rural tanks in various states of South India such as Tamilnadu, Karnataka, Andhra Pradesh, Maharashtra and Kerala. The data were obtained by consulting various documents, books, government reports and statistics department of states concerned. The data include the cropping rotations, irrigated area, and profile of rural tanks and so on. The collected data were analysed and tabulated carefully to highlight the various dimensions of this study. The present study covers the five states of South India as study area. These states largely depend on agriculture and major rivers of Cauvery, Palar, Hubli are Gothavari. These major parts are known as Deccan plateau, where the paddy, sugarcane, maize and wheat are major crops. The rural areas of these states predominantly are farm based where the canal, tank and borewell are the major irrigation modes. Majority parts of the region receive 600-900 mm rainfall annually. The black cotton soil covers all the parts of this region. The present research mainly focuses on rural tanks in south India especially the status of RTs in various five states. It is important to register note here the largest rural tanks in each state (Table 1).

Table 1

The Largest and Major Rural Tanks in the Five Study States of South India

Sl. No.	State	Name of the Largest Rural Tanks
1.	Andhra Pradesh	Cumbum, Nandyal Owk, Timmanayanipet and Pakhal
2.	Tamilnadu	Veeranam, Madurantagam, Rajasingamangalam and Mamandur
3.	Karnataka	Marikanave, Sulekere, Somambudhi, Amanikere, Jannaghatta, Bethamangala, Ramasagara
4.	Maharashtra	Nawegaon, Seoni
5.	Kerala	Tanks in South Travangore, Eraniel, Kalkulam, Vilvankulam

Table 2

State wise Distribution of Rural Tanks and Their Extent of Irrigation in South India (Area in hectare)

Sl. No.	State	Total No. of Rural Tanks	Net Area Irrigated by Rural Tanks	% of Net Area Irrigated by Rural Tanks to India
1.	Andhra Pradesh	60,745 (45.21)	7,77,000	25.15
2.	Tamilnadu	36,523 (27.18)	5,10,000	27.07
3.	Karnataka	20,152 (15.00)	5,98,000	19.05
4.	Maharashtra	12,539 (09.33)	2,81,000	12.71
5.	Kerala	04,390 (3.28)	0,44,000	16.99
	Total	1,34,349	2,21,000	74.0
	Total RTs in India	2,08,000	-	100

Source: 1. Agarwal, A. & Narain, S., Dying Wisdom, Centre for Science & Environment, New Delhi, 2003, p.378-380
2. Vaidyanathan, A. Tanks of South India, Centre for Science & Environment, New Delhi, 2001, p.03-04

3. ANALYSIS AND DISCUSSION

This section brings out the analysis on the distribution of rural tanks, their importance to sustainable rural development and various issues, which inhibit the declension of rural tanks, situated in various five study states of South India.

Distribution of Rural Tanks in South India

As stated above, the states of Andhra Pradesh, Karnataka, Tamilnadu, Maharastra and Kerala depend chiefly on rural tanks for the irrigation. The majority rural tanks located in such states represent 64.59% percent of total rural tanks in India, which irrigate 2210000 hectare, which represents (74 percent) total cropland irrigated by rural tanks in India (Table 2). Among all these states in the South India, Andhra Pradesh is the dominant state in irrigation from rural tanks. Majority rural tanks (45.21 percent) in South India irrigate 7,77,000 hectare cropland. The state has been broadly divided into three natural regions of coastal plains, Eastern Ghats and Andhra plateau. In these regions, as many as eight districts have been declared as drought-prone, in which rural tanks were the main source of irrigation as well as water supply for all other purposes of the rural community. In Tamilnadu, there are 36,523 rural tanks in total, which irrigate 5,10,000 hectare land where rice, sugarcane and cereal crops are grown in 21 districts, Rural tanks irrigate the majority crop land in the eight districts and 15-25 percent of average net irrigated area in six other districts. The rural tanks in this state has been divided into five-river basins. They are the Palar, the Pennar, the Vaigai, the Tambaraparani and the little tank system chained with the Cauvery basin. In the case of Karnataka state, rural tanks are extremely important irrigation system in eight districts of Bijapur, Shimoga, Kodur, Bellary, Hassan, Tumkur, Kolar and Bangalore. In these districts, majority rural tanks are located (73.0 percent) and their water is used mainly for irrigation purpose to 65.0 percent cropland of the districts. The state Karnataka owns 38128 tanks, accounting for the631000-hectare of croplands irrigated. Maharashtra state holds 80 percentage of rural tanks in the Wainganga plain, which includes the districts of Chandrapur, Bhandra and Nagpur. These districts receive heavy rainfall, so that the majority rural tanks are situated in the region. The remaining rural tanks are located in all other parts of the state. The area under rice cultivation in the region is dependent on RTs for irrigation. Rural Tanks in Kerala state are totally 4396 in number, which are mostly system tanks and rainfed base. The state receives heavy rainfall, the diversion and storage structures have been constructed. However, the majority RTs situated on the basin of three rivers of Palayar, Kothayar and Pazhayar. Majority RTs are linked with these rivers containing just enough water to cultivate the few acres of land dependent on them. Few rainfed tanks as non-system RTs have been used for irrigation and percolation purpose in the southern region, which includes Earniel, Kalkulam and Vilavankod taluks of the state. The distribution of rural tanks in these five states of South India shows that majority RTs are the sources for irrigation of cropland. Tamilnadu state in the semi-arid tropical parts of South India experiences more RTs for the purpose of irrigation as well as all other purposes of the local community, followed by the number of RTs and their irrigated area in both Andhra Pradesh and Karnataka. Maharashtra and Kerala States have also little irrigation benefit from the RTs situated in their area. About 40 to 70 percent of the net shown area is irrigated by RTs in these five states of South India (Figure 1).

Role of Rural Tanks in Sustainable Rural Development

Currently sustainable rural development has been focused by Government, Voluntary agencies and International Development Organisation in order to restore and conserve the existing natural resources, which extend their benefits to both rural area and rural people for a long-term period. As already noted, rural tanks are the traditional mechanism for saving of rural livelihood. In the five states of South India, the benefits of RTs have been harvested by the rural community for their survival. According to Mukundan,

rural tanks have played several important roles in maintaining ecological harmony as flood control system, preventing soil erosion and wastage of run-off during periods of heavy rainfall, and recharging the ground water in the surrounding areas. RTs are ideally suited to the environment, with the provision of a continuous flow of water. They supply many villages with drinking water but their primary purpose is irrigation, especially of paddy fields (Anil Agarwal & Sunita Narain-2004). A record from the Government of Andhra Pradesh has clearly pointed out RTs feed wells by percolation and they fertilize the surrounding area and encourage the vegetation. Majority rural tanks in all these states are rice based which irrigate usually three to five months after one filling. Thereafter, their water is used for livestock and local sanitation for the remaining one to three months. RTs in all the states bring betterment to villages, through their dedicated benefits extent to their neighbourhoods (Table 3). The importance of rural tanks is much high in the all round development of rural community which leads to sustainable rural development, by their valuable benefits as the ingredients to betterment of rural environs for long-term livelihood.

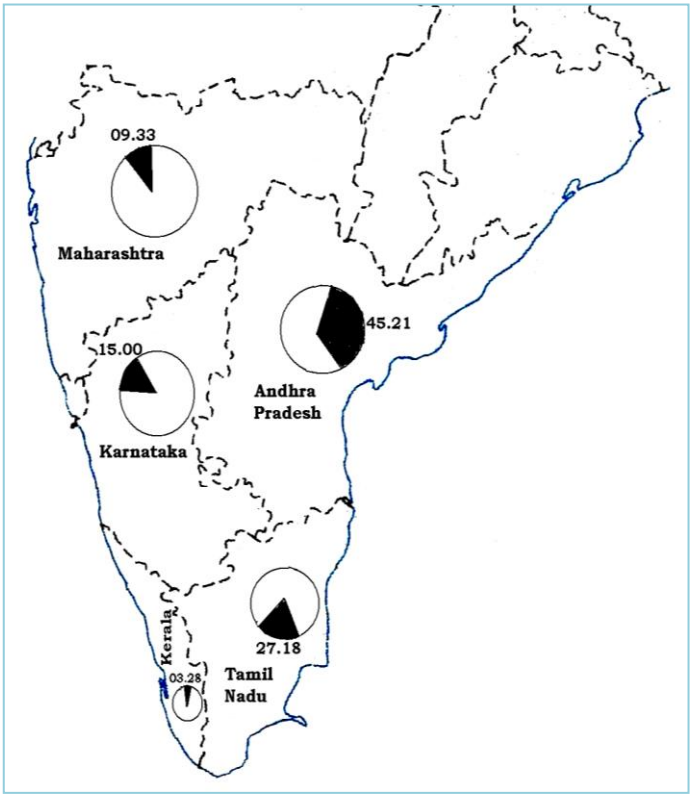

Figure 1
Map showing the percentage of rural tanks situated in various study states of South India

Table 3
Role of Rural Tanks in Sustainable Rural Development in the Deccan Plateau

S. No.	Importance Indicators	Utility of RTs by States in South India				
		Andhra Pradesh	Tamil Nadu	Karnataka	Maharashtra	Kerala
1.	Irrigation	✓	✓	✓	✓	✓
2.	Percolation	✓	✓	✓	✓	✓
3.	Sanitation & Public Health	NA	✓	✓	✓	NA
4.	Livestock	✓	✓	✓	NA	NA
5.	Drinking Water	✓	✓	✓	✓	
6.	Employment Opportunities to Rural poor	✓	✓	✓	✓	NA
7.	Fisheries	✓	✓	*NA*	✓	✓
8.	Shelter for Birds	✓	✓	✓	NA	NA
9.	Afforestation & Social Forestry	✓	✓	✓	✓	✓

10.	Fuel Wood Generation	✓	✓	✓	NA	✓
11.	Waste land Development	✓	✓	NA	✓	NA
12.	Horticultural Production	✓	✓	✓	✓	✓
13.	Rural Industrial Promotion	✓	NA	✓	✓	NA
14.	Women Entrepreneurship Development	NA	✓	✓	NA	NA
15.	Organic Farming Practices	NA	✓	NA	NA	✓

Source: Various documents related to Rural Tanks in South India.

Note: NA – Not Available.

Table 4

Factors Affecting Declension of Rural Tanks in South India

Sl. No.	States	% of Rural Tanks Affected	Select Major Factors
1.	Andhra Pradesh	40-60	Heavy silting, leaking & weak bunds, leaky sluices, dilapidated surplus weirs, unmaintained distribution, encroachment, deforestation & denudation in the catchment area, urbanisation and discrimination use
2.	Tamilnadu	35-65	Extensive Encroachment in the catchment & foreshore area, fragmentation of land holdings- lack of institutional arrangements - heavy silting & weeding - weak bunds.
3.	Karnataka	45-60	- Encroachment and unauthorised cultivation in tank foreshore area by the village community, - Siltation - High rate of Deforestation - Neglect of RTs by rich / big farmers who can afford to avail alternative irrigation by huge investment
4.	Maharashtra	40-75	- Population Density - Irregular maintenance of supply channels - Improper management of surplus weirs - Urbanisation - Severe Encroachment of foreshore area for House construction - Siltation & weeding - Cut in Embankment - Unauthorised Cultivation in tankbed - Improper maintenance
5.	Kerala	35-55	- Depending upon the Dams and modern irrigation methods - Technological advancements in Irrigation - Implementation of large level irrigation projects.

Sources:

1. Anil Agarwal & Sunitha Narain, Dying Wisdom, Centre for Science & Environment, New Delhi, 2003
2. Govindaiah, T., Tank Irrigation and Integrated Rural Development, Institute for Research in Social Science, Bangalore
3. Vaidyanathan, A., Tanks of South India, centre for Science & Environment, NewDelhi, 2001

Note: Percentage of rural tanks affected has been calculated on the basis of careful analysis of statistics and information available in the references.

Various Issues pertaining to Declension of Rural Tanks

In these five states, rural tanks were given more importance before independence. After the introduction of Five Year Plan, the priority was given to major irrigation systems like dams. Thereafter RTs were neglected and the Governments concentrated on the construction of dams and encouragement of borewells by extending credits and subsidies to the farmers. This resulted in the

deterioration of rural tanks. Several physical reasons also inhibit the deterioration of RTs. They are accumulated silts and weeds; inadequate and irregular water supply to the rural tanks; encroachment of in-let channels and tankbed area; poor and damaged conditions, regulatory structures such as sluices and surplus weirs, erosion of tank bunds and also inadequate funds for maintenance work. There are other important social, economic and cultural factors which also contribute to the tanks declension, changes in the landowners pattern in terms of caste and class, mode of cultivation, development of productive forces, development of groundwater irrigation and other types of modern irrigation and disintegration of traditional village level institutions, etc. The factors related to eco-environment also have a direct bearing on rural tank system. They are unavoidable natural calamities like flood, storm, etc. The problems and issues related to declension of RTs are the same in all the five states. However, based on the life style of local people, use of RTs and the tank level local institutions, the RTs deterioration factors varies, which resulted in reduction in water storage, decreasing of land under crop cultivation under the irrigation sources of rural tanks (Table 4). It is therefore that majority rural tanks have been declined due to heavy siltation, severe encroachment in tankbed and foreshore area, fragmentation of land holdings, improper maintenance of surplus weirs and supply and feeder channels, weak bunds, etc. However, in Kerala and Maharashtra, the rural tanks have been used for the purpose of percolation, as followed by alternative irrigation sources as well as few modern types of irrigation.

Proposed plan of Action to overcome various issues related to rural tanks in the Deccan Plateau

Based on the discussion, it is aimed to propose a plan of action for alleviation of all the constraints related to rural tanks, with effective participation of rural tank residents (RTR). The main aim of the proposal is to ensure the provision of required quantity of water to landholders (cropland) at the required time in order to achieve higher productivity. The proposed plan is a strategy as designed for the development of rural tanks through modernization. The steps are deepening and deweeding of tanks' feeder and supply channels, strengthening of bunds, repairing/constructing of surplus weirs and water regulators, on-farm development and organising farmers for their effective participation. The plan will help both farmers and the public for the systematic approach for the continuous maintenance and follow-up action of rural tanks through modernisation. The plan is also to ensure the participation of farmers for the development and management of rural tanks. Hence, the proposed plan is a strategy to promote effective conservation of rural tanks in South India that lead to promote and save natural resources. The Planning methodology of the proposed plan includes a series of steps starting with

- A benchmark survey of rural tanks with certain criteria to know the constraints and difficulties that make rural tanks inefficient and defunct.
- Selecting eligible tanks for conservation and listing all activities to be carried out.
- Preparation of budget for finance and time.
- Ensuring the participation of farmers and village public through organising them in a cooperative way.
- Implementation of plan through the organisation of farmers.
- Monitoring and regular follow-up action for the conducting work on regular maintenance of rural tanks.
- Evaluation of completed works for modernisation in order to find out the maximum benefits to be reached by tanks and their users, through regular feedback system.

The plan will have the steps of implementation, monitoring and evaluation of various aspects in the maintenance of rural tanks, in the following manner.

Stage 1: Preliminary Works

Stage 2: (a) Excavation and Deweeding of Tankbed, Feeder and Supply Channels
(b) Strengthening of Existing Tankbunds
(c) Construction/Repairing of Existing Surplus Weirs and Regulators
(d) On-farm Development

Stage 3: Organisation of the village level irrigation committee (or) tank users (farmers) association will look after and supervise such monitoring work in consultation with the implementing body.

Stage 4: After completion of all scheduled work, the progress of work will be evaluated through an assessment of progress of various activities completed.

Figure 2 shows the model behind the process of conservation of rural tanks through the participation of farmers, towards sustainable rural development.

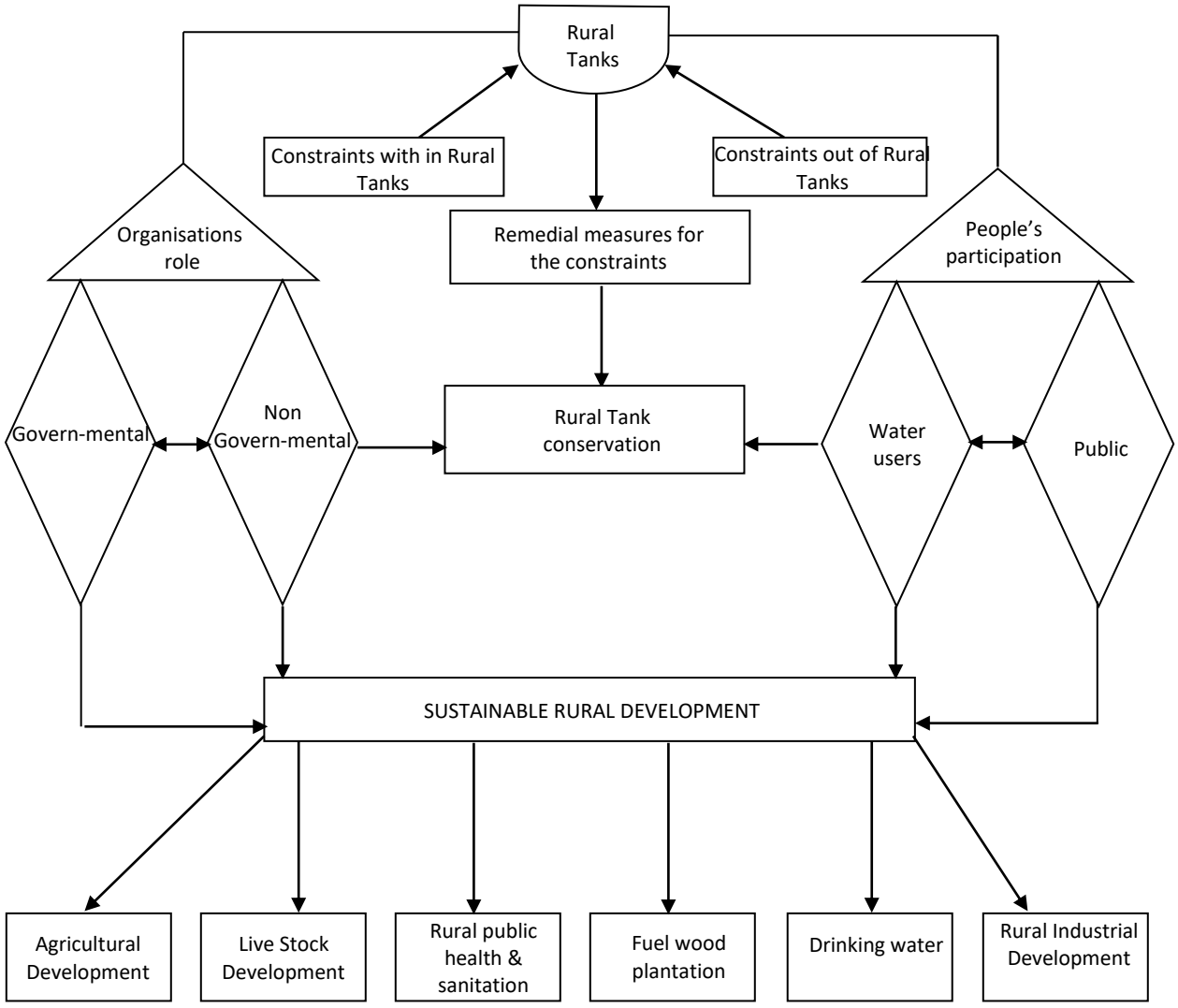

Figure 2

Rural Tanks Conservation towards Sustainable Rural Development

4. SUMMARY, SUGGESTIONS AND CONCLUSION

Rural tanks have been the community assets gifted from the nature constructed by the ancient generations. According to environmental scientists, rural tanks are the smallest water bodies in the rural areas of semi arid tropical parts of south India, which helps agriculture sector by irrigating croplands and supplying water to the people as well as to the living beings for all purposes of life. The study aimed to analyse the village level traditional irrigation systems viz., rural Tanks, their importance and factors that inhibit their efficiency, in the five states of South India. Rural tanks were the main source of irrigation long ago, but they were neglected by encouraging all other alternative sources of irrigation. They have been reduced due to various socio-economic and physical reasons, which resulted in reduction in area irrigated by rural tanks and affected the eco-environmental system. But the many benefits and various opportunities from rural tanks are laid down and undertaken by their users, farmers and neighbourhoods. In all five states, rural tanks bring betterment to villages, for long period, in terms of crop production, afforestation, ground water recharge, livestock maintenance, employment generation, people's participation and cooperation, rainwater conservation etc. The RTs should be given periorities to renovate and modernise in order to increase the capability of RTs to irrigate more cropland and extend more benefits to rural people of their surroundings. In South India, irrigation from RTs is an important and precious natural resource which helps both society and environment.

In order to restore and strengthen the rural tank systems, the government should consider to set-up a NATIONAL LEVEL RURAL TANKS AUTHORITY /BOARD, which enables officials concerned with rural tank maintenance as well as the people who benefit from

RTs to look after the entire system of RTs periodically. If the RTs are protected, there is no need to interlink the rivers in India. Interstate disputes on water sharing will not become a matter of discussion. In addition, rural people, rural development practitioners, officials, political representatives, researchers and scientists should come forward to identify the water bodies in their villages in order to protect and conserve them, to save the water needs of our future generations. It is concluded that rural tanks are the gift of nature, which provide sustainable development to villages, with good preservation of environmental resources.

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Conflict of Interest

The authors declare no conflicts of interests any matter related to this paper.

Data and materials availability

All related data have been presented in this paper.

Peer-review

External peer-review was done through double-blind method.

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