

## IMPACT OF IRRIGATION TANK RECOVERY – AN ANALYTICAL STUDY OF ON-FARM AND OFF-FARM ACTIVITIES IN PERI-URBAN TANK

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### **Abstract**

*Tanks as a common property resource are the smallest water bodies in villages constructed across a shallow valley to conserve water for irrigation, drinking, fish rearing, duck rearing, sheep or goat rearing, tank bund tree plantation, washing and bathing for human and animals and other off-farm activities. Subsequently purpose of tank rehabilitation was not only paid attention on enhancing agricultural activities but also its associated livelihood options. Hence an analytical study was attempted to assess the improvement on livelihood status of a selected peri-urban village during post tank rehabilitation period in several non-farm and off-farm activities. Result shows that income per capita from non-farm and off-farm activities have been increased by and large.*

**Keywords:** Tank recovery, Peri-urban, Non-farm, Off-farm, Livelihood

### **INTRODUCTION**

Non-farm alludes to those exercises that are not essential agriculture or forestry and fisheries. In any case, it includes exchange or preparing of agricultural products (regardless of whether, on account of small scale handling exercises, they occur on the homestead). Barrett and Reardon (2001) stress that this definition is sectoral, for example it follows the show utilized in national bookkeeping frameworks where a qualification is made between essential production, auxiliary (producing) exercises, and tertiary (administration) activities. It doesn't make a difference where the movement happens, at what scale or with what innovation. The term 'non-farm' ought not to be mistaken for 'off-farm'. The last by and large alludes to exercises embraced away from the family unit's own farm and a few creators (Ellis 1998) use it to allude solely to rural working on another person's territory, so 'off-farm' utilized right now not fall inside the typical meaning of 'non-farm'.

Occupation expansion is regularly described as being driven by two procedures: trouble push, where the poor are headed to look for non-farm work for need of satisfactory non-farm openings; and request pull, where townspeople can react to new chances. In the previous circumstance, enormous numbers might be brought into ineffectively compensated low section obstruction exercises, while the last are bound to offer a heading to improved jobs. This two-way categorisation is without a doubt a distortion yet it is a valuable update that investment in non-farm exercises may get from very various conditions and have very various results. Many farm family units today have complex association and structure and take part in both homestead and off-farm exercises (Katchova 2008). Work may all things considered be significant from a government assistance viewpoint (Lanjouw and Feder 2000). Off-farm work salary may serve to diminish total disparity, where there exists regular or longer-term joblessness in agribusiness. Family units may profit even from low non-farm profit and for certain sub-gatherings of the populace that can't take part in the rural work advertise, non-farm earnings offer a few way to financial security. Economically better endowed groups could benefit more from the farming to non-farming transformation as compared to the less awarded groups like landless labourers and marginal farmers. This crucial linkage between asset ownership and the economic potential for income and employment diversification is an important point that needs to be kept in mind while evaluating the impact of transformation on various local communities in terms of occupational diversifications (Maria Saleph 1997). The impact of irrigation on the total incomes of marginal farmers, agricultural labours, artisans and other non-cultivating households was found to be even less; being statistically not significant. The impact was significantly felt only on cultivators other than the marginal (Nadkarni 1984). In view of increasing population pressure on agriculture, diminishing land frontiers, declining employment, elasticity in agriculture and urban organized manufacturing sector, higher incidence of

unemployment and poverty, and excess supply of labour force etc., nonfarm activities are expected to play an important role in combating the problem of unemployment (Birada and Bagalkoti 2001). Agricultural productivity does not have a significant effect on size of non-farm sector once the consumption effect has been controlled Vibhooti (1991). Generally the younger household members who migrate in search of off-farm, income-earning opportunities, and he points out that age is a factor synonymous with moving into the off-farm sector more broadly Smith (2000). Gender orientation boundaries and obstructions to youth contribution in the off-farm area are declining Bryceson (1999). Role of small towns in the rural hinterland in the employment of rural workers and in promoting off-farm employment in rural areas is prominent Papola (1992). Agricultural industry has a significant influence of the agricultural sectors performance on the non-farm sectors Nachane et al 1989; Unni 1998).

There is a growing body of literature on a variety of multiple uses of tank water and tank area and those notable among the available publications at the global level give an idea about the concept. Tanks serve as Common property resources, especially in the third world (Ostrom 1992; Tang 1992; Ostrum et al 1993; Mosse 1997; Sankardass and Balamurugan 2018; Ahluwalia, (1997). The land and water resources of a tank provide not only irrigation but also products from trees as well as support fishing, domestic water supply, brick making, livestock, and a number of minor uses (Palanisamy and Meinzen-Dick 2001; Meinzen-Dick and Van Der Hock 2001). The status of Common property resources is indicated in terms of availability of fodder and fuel wood, as a major portion of these needs, especially fuel wood are met by common property resources, notably for the poorest groups (Moli and Guna 2007; Swaminathan, 1988; Saint 1995; Kerr 1996). Some non-farm activities enhance livelihood options for marginal farmers and landless poor which are directly related to tank rehabilitation such as livestock rearing and selling of milk products, fishing, preparing organic manure, pottery and brick making (Sophia and Anuradha 2006).

## **METHODOLOGY**

### ***Study area***

Somangalam village is located in Sriperambathur taluk, Kundrathur block of Kancheepuram district in Tamil Nadu. Out of the 700 households, landless category is high of about 45.73%. This is the reason for villagers migrating temporarily to nearby cities for want of jobs. Somangalam Peria Eri is a non system tank situated in Adyar minor river basin which receives the runoff from its upper catchment areas namely, Amarambedu, Nallur and Poondandalam. Chembarambakkam lake, an important source of water supply for Chennai city is situated around 15 km away from this village. The tank has four sluices, out of which three are located in higher levels and the fourth one is in the middle at the deepest level

### ***Data collection***

Interviews were conducted with landholding farmers, landless poor, women and other vulnerable groups. The entire proceedings were recorded in a tape recorder and a handy camera. This helped to retrieve the material and analyse as and when new thoughts generate about the type of analysis. This is an added improvement due to the availability of electronic equipments. Landless respondents were grouped with respect to their livelihood options and data were collected through focus group discussion. Information collected regarding multiple uses of tank was documented for interpretation. In the rural tank, non-farm and off-farm activities are highly prevailing. apart from agriculture. Increased net income per capita from non-farming and off-farming activities was calculated.

### ***Non-farm and off-farming calculation***

After the tank rehabilitation, percentage of increased income from non-farm and off-farm activities other than farming activities is computed as (Anuradha 2009)

$$I_{nfp} = [(I_{nif} - I_{nin}) / I_{nit}] \times 100$$

where  $I_{nip}$  is percentage of increased per capita net income from non-farm and off-farming activities;  
 $I_{nif}$  is increased per capita net income from farming;  
 $I_{nin}$  is increased per capita net income from non-farm and off-farm activities;  
 $I_{nit}$  is increased per capita total net income from farm, non-farm and off-farm activities;

## RESULT AND DISCUSSION

### Non-Farm Activities in Somangalam

#### *Duck rearing*

Almost, 10 groups of Vettaikara Naiker people group in Somangalam are engaged with duck raising as their fundamental wellspring of occupation. They have at least 150 to 300 ducks/family. Ducklings are bought for Rs.7,000/- for 100 ducks at the pace of Rs.70/duck from the town called Ponmar, which is situated a ways off of 12 km from Somangalam. As indicated by the respondents, ducks accomplish grown-up stage and starts laying eggs only one month subsequent to buying. Duck raising period, as rehearsed right now, regularly from the long stretch of November to April. Respondents educated that water accessibility in the tank had expanded for two seasons and hardly any farmers raise two harvests after the tank restoration Sakthivadivel et al 2004; Anuradha et al 2009; Karthikeyan and K. Palanisami, 2011; Karthikeyan and Swathilekshmi 2017). This provides ducks nutritious supply of intake both from the tank and from the harvested fields. Duck raising seems to have been confined to individual herders in village where rice was the predominant crop (Arivudai Nambi 2001). During this period since the admission of ducks is acceptable, each duck could lay eggs for almost 3 to 4 months constantly. The market rate, in the year 2005-2006, was Rs.2/egg. On a normal, the aggregate sum one gets from the eggs laid by 100 ducks in 3 months time frame is Rs.18,000/- . Selling back the ducks will win Rs.5,000/- . Thus, duck raising gets Rs.23,000/- as a complete salary from 100 ducks in a half year time frame. Notwithstanding, Rs.700/- is spent on transportation from Ponmar to Somangalam. What's more, if the feed isn't adequate it is enhanced with Karukka (least evaluated paddy), which costs around Rs. 2,700/- for a half year time span. A measure of Rs.100/- is likewise spent on wellbeing dangers for 100 ducks and Rs. 300/- paid to town Panchayat at the pace of Rs.3/- per duck. Now and again, if the ducks are taken to the neighboring towns for need of feed in paddy fields they should pay Rs. 300/- as Panchayat charges for brushing. Out and out, the absolute consumption in a half year time frame for 100 ducks may come around Rs. 4,100/- . Deducting the consumption from pay, the net profit by 100 ducks is Rs. 18,900/- . During the staying a half year, few favor different works for their job while not many others keep on doing likewise dodge raising in the event that they can meet out the consumption of Rs. 5,000/- for the feed. On the off chance that water in the tank is low, the admission of ducks gets decreased and around 50 out of 100 ducks just lay eggs on a normal for 45 days. Along these lines, the pay gets radically decreased to Rs.1,000/- in the wake of deducting the consumption.

In spite of the fact that there may not be an increase during lean periods when there is no adequate water in the tank, innate practice may propel them to proceed. In the event that if an equivalent individual takes part in some other activity like structure development work he/she could get just 150 days work out of 180 days with a most extreme compensation pace of Rs. 70/day. Most extreme sum one could gain in a half year time span through structure development work is Rs.10,500/- . Subsequently, duck raising is felt to be more gainful than going out for a physical work. The net expanded pay after the restoration for 100 ducks is Rs. 5,000/- . All out number of ducks claimed by 10 families in Somangalam town is around 2000, which help them to gain an expanded measure of Rs. 1, 00,000/- . This shows half effect of the tank restoration on duck raising in the Somangalam town. An examination right now likewise completed by Sophia and Anuradha (2005), and distributed in the Asian Development Bank report. As indicated by them, the huge parts of duck raising are: sexual orientation fairness, adaptability of work culture and social settlement of the duck raising families. Either the spouse or wife takes the ducks to the tank or fields. In the event that one takes the ducks for touching, the different brings nourishment and the jobs are traded regardless of the sexual orientation. The typical social obstructions in carrying out family responsibilities are broken and the adaptability in appointing works in the family unit advances agreement. In the Somangalam town, all the duck raising families

live in a road as they have a place with a specific position and all happen to them under landless gathering.

### ***Fish rearing***

The village Panchayat wanted to take up an income generating activity for the maintenance of the tank through fish rearing in Somangalam. This activity is possible only during the availability of dead storage in the tank near the deepest sluices. After tank rehabilitation eutrophication got diluted and helps fishes to grow well (Muller and Stadelmann 2004; Panabokke 2002; Akbulut 2011; Anne 2005; Berejikian et al. 2000, 2001; Panabokke et al 2002; Karthikeyan and K. Palanisami, 2011). During fish rearing, sluices should be completely closed and no water is released for cultivation. It is conceivable these more slowly developing fish are more dynamic and utilize more vitality than the fish with the steady stock of nourishment in the plain tank (Ryer and Olla 1997). Sale must be taken by the one own townspeople by paying Rs. 7,000/- to the Panchayat, which is utilized for minor tank fix works, though the Panchayat pays Rs.1,500/- to the Government. No underlying speculation will be made for fish raising, since fish starts by its own during spillover. Restraint of townspeople forestalls burglary and harm to angles subsequently no exceptional costs should be assigned for the security. Kinds of fishes raised in Somangalam tank are virral, keluthi, kendai, katla and jelabi. Anticipate Fridays (promising day for the Hindu religion) in each of the 78 days out of 3 months time frame, angles are gotten and sold. Since the salesperson has his own family work the whole advantages exclusively go to him. He can catch and sell on a normal consistently 5 kg of virral for Rs.150/kg, 5 kg of keluthi for Rs. 60/kg, 5 kg of kendai for Rs. 60/kg, 6 kg of Katla for Rs. 20/kg for multi month time span. So the gross salary comes to associate with Rs. 1,03,040/- . A few times, the barker may need to offer fishes to companions, family members and higher authorities at liberated from cost, which may decrease the gross pay by 5%. Subsequently, the net increase for the time of 3 months is Rs. 90,888/- in the post recovery period. In pre-restoration period since the dead stockpiling was accessible just for one and a half to two months, the total compensation was just Rs. 50,000. This shows the positive effect (82%) of the tank recovery on fish raising in the Somangalam town.

### ***Livestock rearing***

In the Somangalam village, households which solely depend upon livestock rearing do not exist. Instead of that, owning one or two for the personal use is in practice (Naveena et al 2014; Panabokke et al 2002; Karthikeyan and K. Palanisami, 2011; Ashraf et al 2012). Before the rehabilitation, there were few groups specially engaged for rearing livestock. These groups used to collect livestock from each household and take them to forest areas from 8.00 a.m. to 4.00 p.m. Entry pass were given by the Forest Department. These groups were being paid either by cash or in kind. This practice was slowly diminished due to the migration of these groups to the nearby cities in search of better jobs. This was attributed as one of the major reasons by the villagers for the reduction in livestock population. Reduction in grazing land due to tank bed encroachment, lack of labour for maintenance and lack of time due to the involvement in outside jobs are also reasons revealed for the reduction in livestock (Karthikeyan and Swathilekshmi 2017). Only a few other category farmers who are economically good own maximum of 20 cows and sell milk to two leading ice cream company, which is located 7 km away from the Somangalam village. Depending upon the fat level, each litre of milk costs about Rs.13/- to Rs.15/-. The feeding is with a good quality grass grown in their fields and hence the fat level of the milk is high. Even though the livestock population was high earlier, benefits were very low due to the lack of a milk society. But, after the rehabilitation, two private milk societies were established in the Somangalam village helping the villagers with assured marketing. An interesting information is that, three respondents (wealthy farmers) are collecting milk from the villagers in cans and sell it to nearby hotels for a better price. Hence, they can earn Rs. 2/litre of milk. Total number of cows in Somangalam village before rehabilitation was 2350, which was reduced to 1935 now. The pre-rehabilitation milk price was Rs. 8/litre, which was increased to Rs.15/- in the post rehabilitation period. Hence, the net income earned was Rs. 18,800/- and Rs. 29,025/- in the pre and post rehabilitation periods respectively. This shows 54.38% of impact of the tank rehabilitation on livestock rearing in the Somangalam village.

### ***Tank bund plantation***

Tree plantation along the bund improved the ecology and reduced soil erosion along the bund. In normal watershed programmes, the production of fuel, fodder and timber are given much importance in the wastelands (Panabokke 2002; Karthikeyan and K. Palanisami, 2011). If such wastelands are not available in the watersheds, the foreshores of tanks may be considered as suitable places for plantation (Panabokke et al 2002; Palanisami and Flinn, 1988; Jodha, 1990; Kumar, Bren, and Ferguson, 2000; Ajay kumar and Puri 2004; Srivastava, 1999). Species like tamarind, casuarina and other fodder and fuel trees will be planted based on the people need and priorities. In the Somangalam village, juliflora tree is planted along the tank bund. It is lent for auction once in two years. The amount received through the auction is used for minor tank repair works and other temple related works. The Local Village Panchayat is responsible for this income generating activity. The Panchayat paid Rs. 5,000/- and Rs. 10,000/- to the Government during the pre and post rehabilitation periods and obtained the rights for the auction. A person from the same village, who have taken the auction, paid Rs. 25,000/- and Rs. 43,000/- during the pre and post rehabilitation periods to the Panchayat. According to the respondents Rs. 75,000/- was the profit before rehabilitation and it is increased to Rs. 2, 00,000/- during the post rehabilitation period. This is because of increased moisture content on the tank bund with increased tank storage for a longer period. Hence, the net income coming from the auction is Rs. 50,000/- and Rs. 1, 57,000/- in the pre and post rehabilitation periods respectively. The tank rehabilitation thus increased the tank bund plantation in the Somangalam village by three times. Non-farm activities in Somangalam such as Duck rearing, Fish rearing, Livestock rearing, Tank bund plantation and Sheep (or) Goat rearing are shown in Figure 5.24.

### ***Sheep or goat rearing***

There are 12 families in Somangalam village solely depending on sheep and goat rearing as their livelihood options. They are all landless poor and belong to Schedule Caste. Each household owns 15 to 20 number of sheep or goat for rearing on an average. Once the tank gets filled up, three months grazing is possible for the livestock (Karthikeyan and Swathi lekshmi 2017;). Otherwise, it is reduced to one and a half month. If sufficient grazing is available for a lamb, it will attain its adult stage within four months period, since the growth purely depends upon nutritious intake. If not, it will take more than six months to reach the matured stage. Moreover the rate is fixed on the basis of its weight when a sheep or goat is sold. With sufficient grazing is available, each one may weigh around 40 kg and the rate fixed may be as high as Rs. 2,500/goat. Otherwise, the maximum rate given per livestock is Rs. 1,500/-. Extra feeding and other medical expenses may cost around Rs. 500/goat or sheep. The net amount gained in Somangalam as a whole, by those twelve groups before the rehabilitation was Rs. 2,40,000/-. But, after the rehabilitation it was increased to Rs. 4,80,000/-.

Another interesting income from this goat or sheep rearing is its excreta. It is considered as nutritious manure for paddy and other types of crops. It can be only collected during night time, as they will stay in one place. Since excreta will be scattered during day time, while grazing in the field, grazing time is restricted from 6.00 a.m. to 3.00 p.m. It is estimated that a group of 10 goats can give about 7 tippers (a type of vehicle) of excreta per year. Each tipper of excreta costs around Rs. 100/- and Rs. 400/- in pre and post rehabilitation periods respectively. Therefore, the total income earned by these groups before and after rehabilitation periods are Rs. 2,26,000/- and Rs. 5,47,200/- respectively. Thus the impact of tank rehabilitation on goat or sheep rearing is more than 100% in this village. Not only had their livelihood status increased with increased income in the post rehabilitated period, but also the conflicts arised within the villagers reduced considerably (Panabokke et al 2002; Palinisami and Amarasinghe 2008). Before the rehabilitation since the dead storage was available for less than two months they were forced to search drinking water for their livestock in the command area wells (Anbumozhi, et al 2001. Sometimes, the livestock may cause damages to crops, which made land owners to quarrel with owners of livestock. Female headed groups were the worst sufferers since few male land owners use abusive words while scolding. This was greatly avoided during the post rehabilitation period due to the increase in dead storage of the tank water.

**OFF-FARM ACTIVITIES IN SOMANGALAM VILLAGE**

***Cement concrete block manufacturing***

The term brick refers to small units of building material, often made from fired clay and secured with mortar, a bonding agent comprising of cement, sand, and water. Introducing low embedded energy building materials are very important to improve sustainability within the context (Niachou et al 2001; Reddy et al 2003; Saghafi and Teshnizi 2011; Thormark 2006). Cement block contains a large amount of non-renewable energy (Burnett 2001). Six cement concrete block manufacturing companies are established in Somanglam village after the tank rehabilitation. Large farmers who own garden land are involved in this kind of business with the help of few politicians residing in urban areas, as claimed by the respondents. Increased water table in their wells is the motivating factor for starting such companies. These blocks require a large quantum of water for curing (minimum 15 to maximum 21 days with the frequent supply of water in a day is essential). Not only the quantity should be high, but also the quality should be good enough as that of drinking water. Both these criteria were attained after the tank rehabilitation. They use 10 hp pump set to pump water and mixed it with fly ash, cement, gravel and stone chips to manufacture hollow and solid blocks of size 40cm length, 20cm width and 22cm thick.

Accelerators influence the rate of cement hydration, leading to a reduction in setting time reduces and an increase in early age (Sathyanarayanan and Ramamoorthy 2012). Each blocks cost around Rs. 16/- and Rs. 22/- for hollow and solids respectively. It is possible to make 3000 blocks/ week. Labourers are employed from the same village and with a wage rate of Rs. 3,000/month. Nearly, 100 labourers are engaged in this job from this village. Labourers are satisfied with this job since they are provided with assured working days throughout the month with a better salary (Rs. 3,000/month) than agriculture labour work (Rs. 1,800/month at a wage rate of Rs. 60/day), medical insurance, less physical strain and transport facility at door steps. Net benefit earned is Rs. 5/- to Rs. 8/- per block leading to get Rs. 7,20,000/annum/company. Hence, the net income/annum of all six companies is Rs. 43,20,000/-.

There is a chance of increasing such companies in future because of the demand for these blocks in nearby city builders activities. According to the builders, concrete blocks are highly preferable for construction because of its durability, energy efficiency, design flexibility, fire resistance, termite resistance, and weather and storm resistance. More over comparing with bricks, it is very cheap as claimed by the respondents. For example, total number of bricks required for constructing 3m × 3m room needs 4050 bricks costing about Rs. 20,250/- (Rs. 5/- per brick), whereas 600 cement concrete blocks are sufficient at the cost of Rs. 12,000/- (Rs. 20/ block). Hence, the demand from the builders made this business well established in Somangalam village with assured well water supply throughout the year and is expected to be increased in future.

***Water packing company***

The dramatic heave in bottled water consumption has laid a global industry. Parag and Roberts (2009) fight that this decay risks faucet water quality and further quickens the move toward the private arrangement of filtered water, at any rate for those ready to bear the cost of it. There are two water packing companies in Somangalam village started in the year 1997 (after the rehabilitation). Improved quality of water in the post rehabilitation period motivated some of the villagers to begin this business. In order to cross check their statement, water quality analysis was done during the data collection phase. Water quality data before the rehabilitation were not available. However, the current status of well water quality is presented in Table 4

Table 1 Well water quality standards in Somangalam village

S. No	Parameters	Unit	Value	Permissible limit
				Drinking
1	pH	-	7.4	6.5 – 8.5

2	Total hardness	mg/l	122	300 – 600
3	Sulphate	mg/l	56	20 – 400
4	Turbidity	NTU	5	5 – 10
5	Fluoride	mg/l	1	1 – 1.5
6	Dissolved solids	mg/l	250	500 – 2000
7	Chloride	mg/l	42	250 – 1000
8	Calcium	mg/l	30	75 – 200

The well water extracted for water packing business is absolutely fit for drinking and with primary and secondary treatments it may attain the ISO water quality standards for marketing. Influent quality of 300mg/L BOD, 600mg/L COD, 375mg/L suspended solids and 45mg/L NH<sub>4</sub>-N (British Water 2005). Irrespective of gender, 15 members are appointed as labourers from the village at a wage rate of Rs. 70/day. Also, one chemist and one microbiologist are employed at the wage rate of Rs. 5,000/- each/month. They check the quality of water before filling in packets and cans at regular intervals. Both 250 millilitres packets and 20 litres cans are manufactured and marketed at the rate of Rs. 0.50/- and Rs. 7/- respectively. During a normal season (July to February), 10,000 packets and 300 cans/day are distributed to agents from each company for a minimum 200 days in a year. But during the summer (March to June), production and distribution may be doubled. Since it is an off-farm activity, current charges (Rs. 10,000/month) should be paid to the Tamil Nadu Electricity Board (TNEB). Production costs for each 250 millilitres packet and 20 litres cans will be around Rs. 0.30/- and Rs. 4/- respectively. Therefore the profits are marginal at Rs. 0.20/- and Rs. 3/- per packet and a can in that order. Hence, the net income earned by each company/annum is Rs. 5,80,000/- and the total income earned by two companies/annum is Rs. 11,60,000/-. Since the initial investment cost (providing carbon filter, sand filter, reverse osmosis plant etc. for treatment) is very high, only wealthy farmers are able to start and continue with this profession said by the respondents. Also, few labourers working in these companies disclosed the fact that these treatment plants are installed just for the sake of receiving ISO certificate. Hence, it may be concluded that quality of water after rehabilitation plays a major role in water packing business in Somangalam.

### ***Water market through lorries***

This type of water market is increasingly common in peri-urban areas. Due to some extent to this developing emergency of access, water is progressively seen as "blue gold" (Barlow and Clarke 2002) and has come to speak to a gainful ware to be sold at advertise rates to customers. Water supplies can be moved or sold for different utilizations and the worth is higher than the benefit of utilizing the water to create greatest yields, selling the water can build the homestead pay (Trout 2010). The exchanges here commonly include offer of water by well proprietors (for the most part ranchers) either legitimately to ventures or to tanker organizations who at that point convey to the end clients (lodgings, inns, little enterprises, business foundations and family units). The promotion and formalisation of this type of water markets have, however, been advocated as a potential mechanism for meeting the needs of urban areas, such as Chennai. Such arrangements may help to avoiding both costly long distance transfer projects and the political difficulty of administratively reallocating supplies from existing agricultural users (Briscoe 1996). The resoluteness of the permitting framework was likewise uncovered all the more for the most part by the rise of unlawful water-rights exchanging and 'bootleg trades' in water in a portion of the water-poor areas during the most recent decade (Moral, 1999). The effect of move on rural clients is presumably the most questionable purpose of discussion in regard to these water markets (Janakarajan 1993). Somangalam private water showcase works through tanker trucks that convey water from a predetermined number of wells inside the urban fringe to the end clients. The private tanker advertise has created because of the disappointments of the Municipal stock framework Water from private tankers varies in cost depending on the water quality, the location of the customer and size of the truck. In Somangalam a small tanker delivers 12 m<sup>3</sup> of water remunerating Rs. 60/- to Rs. 80/- for well owners and Rs. 650/- to Rs. 750/- for lorry owners. Around 50 households (owning garden land and tail end) are involved in water transfer business in this village. Tail reach farmers are also doing water market with the available farm road facility.

Water transfer to cities is in peak during the summer (April to June) for nearly 100 days. Each day some 5 to 8 trips are in practice. Hence, the total amount earned in Somangalam village from water market is Rs. 15,00,000/- for 50 households. Apart from this lorry owners are also getting benefited as Rs. 110/ trip. If the distance to be covered is within 10 to 15 km, lorry owners charge Rs. 650/- to Rs. 750/lorry of 12 m<sup>3</sup> of capacity. Diesel consumption for 20 to 30 km (up and down runs) is 10 litres. Each litre costs Rs. 38/-. Hence, total fuel consumption cost/trip is Rs. 380/-. Lorry driver and cleaner charges are Rs. 50/- each/trip. They also pay Rs. 60/lorry to farmers for extracting water from their wells. On an average maintenance and other repair charges will cost about Rs 50/trip. Therefore, the total expense per trip is around Rs. 590/-. So, the average net income earned by lorry owners for 500 lorries (5 trips/day for 100 days) is Rs. 70,000/-. According to the respondents, selling water from Somangalam village touched the highest point during the year 2003-2004 (drought year) since the Government of Tamil Nadu itself gave permission for this business to meet out the urban needs..

Table 2 Work sheet for estimation of percentage of increased income through non-farm and off-farm activities during post-rehabilitation period in Somangalam village

S. No	Description	Unit	Somangalam
1	Command area	ha	191
2	Rehabilitation cost	Rs.	49,04,100
3	Village population	number	3,514
4	<b>Benefits</b>		
5	Increased paddy yield	bags/ha	10
6	Increased sugarcane yield	tons/ha	0
7	<b>Gross income</b>		
8	Paddy @ Rs. 500/bag	Rs./ha	5,000
9	Total gross income	Rs./ha	5,000
10	By product (5%)	Rs./ha	250
11	Total increased expenses	Rs./ha	1,000
12	Increased net income	Rs./ha	4,250
13	Net income for 91 respondents from increased cultivated area of 15 ha	Rs.	63,750
14	Wages for 120 days at Rs. 60/day for increased cultivated area of 15 ha	Rs.	1,08,000
15	Increased net income from farming activities	Rs.	1,71,750
16	Employment generation in rehabilitation works	persons days	8,959
17	Wage at Rs. 70/day	Rs.	6,27,130
18	<b>Total increased net income from farming activities</b>	<b>Rs.</b>	<b>7,98,880</b>
19	<b>Increased income per capita from farming</b>	<b>Rs.</b>	<b>227</b>
20	<b>Increased net income from non-farm activities</b>		
21	Duck rearing	Rs.	1,00,000
22	Fish rearing	Rs.	40,888
23	Livestock	Rs.	10,225
24	Tank bund tree plantation	Rs.	1,07,000
25	Sheep or goat rearing	Rs.	3,21,200

26	<b>Increased net income from off-farm activities</b>		
27	Cement concrete block	Rs.	43,20,000
28	Water packing company	Rs.	11,60,000
29	Water market through lorries	Rs.	3,00,000
30	<b>Total increased net income from non-farm and off-farm activities</b>	<b>Rs.</b>	<b>63,59,313</b>
31	<b>Income per capita through non-farm and off-farm</b>	<b>Rs.</b>	<b>1,809</b>
32	Total increased net income from farm, non-farm and off-farm activities	Rs.	71,58,193
33	Income per capita from farm, non-farm and off-farm activities	Rs.	2,037

Table 2 presents the work sheet for estimation of percentage of increased income through non-farm and off-farm activities during the post-rehabilitation period in Somangalam village (Sakthivadivel 2006). It is evident from the Table 5.80 that increased net income from non-farming and off-farming activities in Somangalam village is 697% higher than the net income from farming activities during the post rehabilitation period. Increase in yield/ha is very less in the post rehabilitation. There is a raised production of 10 bags/ha on an average in paddy cultivation. Hence the increased gross income for paddy at the cost of Rs. 500/bag is Rs. 5,000/ha. There is an additional income of 5% of the total gross income i.e. Rs. 250/- through paddy byproduct called straw (CWR 2000). Increased expense/ha for enhanced production towards fertiliser and pesticides cost is approximately Rs. 1,000/ha. Hence, increased net income from farming activities is arrived as Rs. 4,256/ha in Somangalam. The increased net income for the increased cultivated area of 15 ha by 91 respondents is Rs. 63,840/-. There is also an increased working days for farm labourers for one season (120 days) at Rs. 60/day. Therefore, for 15 ha the increased wage rate is Rs. 1,08,000/- during the post rehabilitation period. Consequently, the total increased net income from farming activities is Rs. 1,71,750/-. During the tank rehabilitation, local villagers earned Rs. 6,27,130/- for 8959 person days at the wage rate of Rs. 70/day. Since the tank rehabilitation project was done with the concept of increasing agricultural productivity, this amount was taken into farm income account (Mosse 1997). Total increased net income from farming activities is Rs. 7,98,880/-. Hence, with the village population of (3514), the increased net income per capita from farming is found out to be Rs. 227/-. The increased net income from non-farm activities like livestock, duck rearing, fish rearing, sheep rearing and tank bund tree plantation and off-farm activities like cement concrete block, water packing company and water market through lorries is calculated as Rs. 63,59,313/-. With the existing village population, the increased income per capita from non-farm and off-farm activities is evaluated as Rs. 1809/-. From the above value, percentage of per capita increased net income from non-farm and off-farm activities than farming activities is been very high. This shows that indirect tank users are the most beneficiaries with the tank rehabilitation program. At the same time, most of them depend upon the direct users (farmers) for their livelihood options (Balasubramanian and Selvaraj 2004; Meinzen-Dick, Ruth and Margaretha Bakker. 2000. Off-farm activities are high and no way are they related to agriculture.

## CONCLUSION

In the contemporary situation it is necessary to recover all the degraded irrigation tanks for the sake of water management not only for agricultural activity purpose but also for various livelihood activities. Disaster management should be carried out regularly by anticipating the water scarcity problem in spite of taking action during the crisis period. Hence water conservation through existing tank rehabilitation plays a major role in peri-urban areas to solve nearby city acute water scarce pressure especially during peak summer. The increased net income from various non-farm activities like livestock, duck rearing, fish rearing, sheep rearing and tank bund tree plantation and off-farm activities like cement concrete block, water packing company and water market through lorries are remarkable. The result show positive impact of irrigation tank recovery and hence it is recommended to explore on non-rehabilitated water storage structures and necessary action should be taken for reducing water crisis.

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