CHAPTER 4

OPERATIONAL ASPECTS OF IRRIGATION

4.0 INTRODUCTION

In the Chapter 3 an attempt is made to assess the Irrigation Department of Tamilnadu using the Organisation Assessment Instrument. The Irrigation Department has two level of functionaries viz., Managerial and Operational. Managerial functions are done by the Superintending Engineers, Executive Engineers and Assistant Executive Engineers. Their functions and interactions between them are also analysed earlier.

For the proper function of the system, the managerial decisions are to be made operational. This task is accomplished by operational staff. Assistant Executive Engineers are also functioning in the operational level. Section Officers and Lascars (gate operator) are the operational staff. For a holistic view their functions should also be studied and evaluated. Therefore it is decided to select a representative irrigation system in Tamilnadu and conduct the study.

4.1 IRRIGATION SYSTEMS IN TAMILNADU

Tamilnadu is situated at 8° 5' N and 13° 35' N and 76° 15' E and 80° 20' E. It is bounded by Karnataka and Andhra Pradesh on the North, Indian ocean on the South, Kerala on the West and Bay of Bengal on the East. Generally it is sloping from West to East. The major rivers are Palar, South Pennar, Vellar, Cauvery, Vaigai, Tamiravaruni and Kodaiyar. There are two major river basin transfers benefitting Tamilnadu. The Periyar, a
west flowing river was dammed across and diverted through a tunnel to Tamilnadu to bring dry tracts of Madurai district under irrigation in 1887-97. It is the first major inter basin transfer attempted anywhere in the world. The Parambikulam-Aliyar Project (1959-67) was executed by interconnecting a number of small rivers through a series of reservoirs to divert water towards east.

Most of the rivers are originating on the western ghats and benefitted by Southwest monsoon rains during June to September. Since Tamilnadu lies on the rain shadow region, the effect of SW monsoon is very limited. But it receives copious rains during Northeast monsoon during October to December.

4.1.1 Water Resources Development

Irrigation Department of Tamilnadu classified the entire state into thirty four micro level river basins. Micro level river basins are shown in Figure 4.1. Water resources development in the eight major river basins are discussed briefly below.

4.1.1.1 Palar Basin

There is no storage reservoir across this river. But a large number of river diversion works combined with system tanks provide irrigation to a large extent of land. The river is famous for its spring channels and ground water potential.

4.1.1.2 South Pennar Basin

There are two medium sized reservoirs- Krishnagiri (3,642 ha) and Sathanur (18,211 ha) constructed in series at the same period (1954-58).
Figure 4.1 MICRO LEVEL RIVER BASINS OF TAMILNADU
Below these reservoirs a number of diversion weirs are supplying to the system tanks.

4.1.1.3 Vellar Basin

Wellington reservoir (1913-23) was constructed across Periya Odai in the Vellar basin to command 11,198 ha. Karia Koil reservoir (1982-92) was constructed across Karia Koil river to irrigate 11,457 ha. In addition to these reservoirs, a number of minor irrigation works are developed in the basin.

4.1.1.4 Cauvery Basin

Cauvery is the largest river in this state. Its delta is considered as the granary of Tamilnadu. In the delta the main river is divided into 36 branch rivers. It is believed that this delta was developed as a run-of-the-river during pre-Christian era. Two major reservoirs Krishnaraja sagar and Mettur were constructed (1925-34) in Karnataka and Tamilnadu respectively. The total command area of Mettur reservoir in Tamilnadu is 0.645 million ha.

During the post independent period a number of reservoirs are constructed across its various tributaries. Bhavani sagar (1948-55) across Bhavani river commands 83,772 ha. Amaravathi reservoir (1953-58) across Amaravathi river irrigates 8,700 ha. Similarly tributaries in the Karnataka viz. Hemavathi, Kabini are also dammed up and developed. For sharing this river water, the two state governments are fighting a legal battle for more than two decades.
4.1.1.5 Periyar-Vaigai Basin

Periyar reservoir diverts water through a tunnel towards east which joins the Suruliyar a tributary of Vaigai river and commands 57,871 ha through diversion weirs. The Vaigai reservoir (1954-59) across Vaigai river was constructed to store Periyar releases to extend the Periyar command and to develop new areas. The total command area of Vaigai reservoir in its Tirumangalam main canal is 9,646 ha.

4.1.1.6 Tamiravaruni Basin

Tamiravaruni basin is functioning as run-of-the-river system for many centuries. Papanasam reservoir (1944) was constructed as a multi purpose reservoir. Manimuthar reservoir (1956) was constructed across Manimuthar tributary to stabilise Tamiravaruni command and to supplement water to rainfed tanks. Across the Servalar tributary another reservoir was constructed in 1986. The total command area of Tamiravaruni system is 34934 ha.

4.1.1.7 Kodaiyar Basin

Kodaiyar basin lies on the southern tip of the state and the country. Kodaiyar reservoir (1895-1906) is irrigating 25,900 ha. During the post independence period, few small reservoirs are constructed across the tributaries and inter-connected.

4.1.1.8 Parambikulam-Aliyar Basin

This is a well conceived water resources development project involving three river basins of West flowing rivers. In the Periyar basin, Nirar river is dammed at Upper Nirar(1970-75) and Lower Nirar(1974-82) and diverted water to Aliyar reservoir(1959-62) and Thirumurthi
reservoir (1962-67) in the Bharatha Puzha basin. From Chalakudi basin the reservoirs at Sholayar (1961-71), Parambikulam (1963-65), Thunakkadavu (1963-65) and Peruviripallam (1965-71) are also diverting water to the Aliyar and Thirumurthi reservoirs. These reservoirs are constructed mainly for power production. Releases from Aliyar and Thirumurthi reservoirs command 82,713 ha in dry western part of the state.

4.2 RAINFALL

The hilly regions of the state which are the parts of western ghats receiving maximum rainfall during the Southwest monsoon periods. The coastal area in the East receive more rainfall during the Northeast monsoon. In the plains the rainfall is decreasing from East to West and North to South. The annual average rainfall of the state is 925 mm.

4.3 CROPPING SEASON

The catchment area of all the rivers lies in the western ghats. Therefore all the systems are benefitted by the Southwest monsoon rainfall. The command area is benefitted by the Northeast monsoon. Almost in all the command area, two rice crops are cultivated corresponding to the two monsoons. These cropping seasons are called differently viz. kar, pishanam, navarai, samba, kuruvai, swarnavari etc.

4.4 SELECTION OF THE SYSTEM

All the irrigation systems in Tamilnadu are being operated under similar conditions, such as rainfall at the catchment, rainfall at the command area, crops cultivated and cropping seasons. Therefore the study of the operational aspects in any one of the systems can be considered as the representative study for the state. For undertaking the study, historical data
is essential. Taking all the above into consideration the Tamiravaruni system is selected for the study of operational aspects of irrigation.

4.5 TAMIRAVARUNI SYSTEM

Tamiravaruni river originates from the southern part of western ghats and flows towards East and passes through two revenue districts of Tirunelveli-Kattabomman and Chidambaranar and joins Gulf of Mannar. The system was developed as a run-of-the-river system. There are eight anicuts (diversion weirs) and eleven channels are taking off from them (Figure 4.2). First seven anicuts were constructed during pre-British period. The last anicut was constructed in 1871. People of this area were motivated to participate in the construction by way of contribution of rupees 20,000. Since the anicuts are placed on solid rock foundation and reconstructed at different periods, they do not have any definite shape and size. From the anicuts, water is conveyed to the fields either direct by means of supply channel or through tanks to command 34,934 ha. Details of area commanded by each channel are furnished in Table 4.1.

The channels are designed as flood carriers to divert maximum possible water into the system. There are 187 system tanks fed by them. Many tanks are tank-in-channel type. In the head reach the tanks are small in number. In the middle reach they are large in numbers and medium in size. In the tail reach they are few, but have large storage capacity. Some of the tanks can store water to feed its ayacut for a crop period. The system is narrow in the upper reaches and spread out at the tail reach. The channels are designed as contour channels. The return flows reach the river directly or to the channel running below it.

The first reservoir was constructed with the storage capacity of 156 M.cum at Papanasam (1944) as a multi purpose one. The power house develops 28 MW power. In 1956 the second reservoir was constructed across
Figure 4.2 TAMIRAVARUNI RIVER SYSTEM
Table 4.1 TAMIRAVARUNI SYSTEM DETAILS

<table>
<thead>
<tr>
<th>S.no.</th>
<th>Name of Anicut</th>
<th>Name of the Channel</th>
<th>Length in Km.</th>
<th>Command Area Direct Tank in ha</th>
<th>Total Tanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>KODAIMELALAGIAN</td>
<td>South Kodaimelalagian</td>
<td>8.64</td>
<td>357</td>
<td>357</td>
</tr>
<tr>
<td></td>
<td></td>
<td>North Kodaimelalagian</td>
<td>18.51</td>
<td>532</td>
<td>925</td>
</tr>
<tr>
<td>2.</td>
<td>NADHIYUNNI</td>
<td>Nadhiyunni</td>
<td>11.55</td>
<td>1053</td>
<td>1053</td>
</tr>
<tr>
<td>3.</td>
<td>KANNADIAN</td>
<td>Kannadian</td>
<td>33.95</td>
<td>4182</td>
<td>5058</td>
</tr>
<tr>
<td>4.</td>
<td>ARIYANAYAGIPURAM</td>
<td>Kodagan</td>
<td>29.04</td>
<td>1295</td>
<td>2428</td>
</tr>
<tr>
<td>5.</td>
<td>PALAVOOR</td>
<td>Palayancottai</td>
<td>42.46</td>
<td>1862</td>
<td>3845</td>
</tr>
<tr>
<td>6.</td>
<td>SUTHHAMALLI</td>
<td>Tirunelveli</td>
<td>29.14</td>
<td>1022</td>
<td>2594</td>
</tr>
<tr>
<td>7.</td>
<td>MARUDUR</td>
<td>Melakkal</td>
<td>19.84</td>
<td>1843</td>
<td>5173</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keelakkal</td>
<td>17.92</td>
<td>1202</td>
<td>3154</td>
</tr>
<tr>
<td>8.</td>
<td>SRIVALIKUNDAM</td>
<td>South Main</td>
<td>33.87</td>
<td>1090</td>
<td>5166</td>
</tr>
<tr>
<td></td>
<td></td>
<td>North Main</td>
<td>36.32</td>
<td>1331</td>
<td>5181</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>TOTAL 15769</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19165</td>
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<td></td>
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<td>34934</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>187</td>
</tr>
</tbody>
</table>
the tributary Manimuthar to store 155 M.cum. It has to supply water to its original ayacut of 1,100 ha and to stabilise the Tamiravaru command by supplying 51 M.cum every year. Its main canal located at 24.4 m above the sill level has to feed 347 rainfed tanks, if storage level reaches 27.0 m (83 M.cum). Third reservoir was constructed across the tributary Servalar in 1986 to store 35 M.cum and generate 20 MW.power. It is interconnected with Papanasam reservoir by a tunnel. Now all the releases are made through this reservoir only.

4.5.1 Cropping Pattern

Rice is the main crop in this system. The rice crop cultivated during the Southwest monsoon (June-September) is known as kar crop and raised during Northeast monsoon (October-March) is pishanam. To make use the left over storage in the large tanks under the last two anicuts, and power releases during summer, limited area under the last two anicuts with certain priority are authorised to cultivate a crop called advanced kar during April-July. The area authorised for advanced kar will not be eligible to cultivate kar crop. In those lands pulses are cultivated during the kar season. In 1970s banana crop was introduced in tail end area. Due to the economic returns, easy marketability and availability of cultivation loans from the traders, made the banana crop more popular. Now about eighteen percent of command area is under this crop. Betalvine is also grown in small pockets.

Initially this system catered to the need of small industries only. When an industrial complex was developed in the tail end, the ID has entered into an agreement with them to supply 0.09 M.cum (20 MGD) of water per day to them. For the industrial supply water is carried through an open channel throughout the year. Running of channel all the days also induced the farmers to switch over to banana crop.
4.5.2 Sub Divisional Officer

Tamiravaruni system is managed by one Executive Engineer (EE), who is stationed at the Centre of the system. He is assisted by three Assistant Executive Engineers (AEE) otherwise called Sub Divisional Officers (SDO) located at Cheranmahadevi, Palayamcottai and Srivaikundam, who are looking after head, middle and tail reaches of the system respectively. Apart from them, two more SDOs, one who is managing the Manimuthar Dam and its appurtenant works and another one at Moolakarai patti to look after Manimuthar Main canal command area, are under the control of the Executive Engineer.

These SDOs have to handle both managerial and operational functions of the system. They have to assess the demand for their Sub Division and send their indent to the Executive Engineer. Based on the total indent, the Executive Engineer takes decisions to operate the Papanasam-Servalar complex which is under the control of Tamil Nadu Electricity Board and or Manimuthar Dam to release the water and informs the SDOs about the quantum allocated to each of them. Based on this, the SDO decides about the quantum to be allocated to various channels and inform his decisions to the respective section officer.

The decision taken by the SDO has direct bearing on the performance of the system in the distribution of water. Therefore it is decided to have a close look at the decision making function of the SDOs. Decisions may be classified according to their potential contribution to water delivery performance of the organisation (Nijman 1992).

4.5.2.1 Levels of Sophistication

Kamfraath (1981) introduced the concept of level of perfection as a performance indicator for decision making process which gives
quantitative guide lines for analysing the relation between uncertainty in the process and the management condition. The scale used by Kamfraath to monitor the level of perfection/sophistication is discussed in detail in Chapter 2.

Based on this concept, a questionnaire was developed for different concerns on maintenance management and modified to irrigation system management (Nijman 1992).

The SDOs are functioning as the major decision making centres in managing the Tamiravaruni system. The SDOs who are actually operating the system i.e., SDO Cheranmahadevi, Palayamcottai and Srivaikundam are interviewed with the questionnaire prepared by Charles Nijman.

4.5.2.2 Levels of Attainment

Charles Nijman describes this concept as level of perfection and level of sophistication. But the word sophistication gives an impression that modern gadgets/instruments/equipments are being used for seasonal and intra-seasonal planning and implementation; for example automatic canal operation, use of remote sensing technique to assess the cropped area and stress and hence the demand etc. But the questions used to assess them are indicating, how various alternative ways and means are used to matching the supply and demand, implementation of decisions made, and monitoring and evaluation. It indicates only the level of attainment achieved by the system managers in each one of the functions. Therefore term level of sophistication is replaced by the term Level of Attainment and used in this study.
4.5.3 Structure of the Questionnaire

The questionnaire is developed to provide information about alternate ways of decision making so as to enable the respondent to choose the question appropriate to his system and to evaluate the decision process in a scale of 0 - 100. The questionnaire deals with seasonal and intra-seasonal allocation and flow regulations.

4.5.4 Preseasonal Planning

Before the commencement of cultivation season, the manager has to plan about the commencement of cultivation season, anticipated inflows into the reservoir and the demand. Therefore questions are asked:

- To state the level at which - i.e, Lascars, Section Officer, Sub Divisional Officer or Executive Engineer- the decision are taken about the commencement of the cultivation season.
- Whether the request of individuals or small sub system are considered when the water availability is plenty.
- Existence of operation policy and its implementation.

4.5.5 Seasonal Application Decision

Seasonal planning decisions are taken depending on the agricultural and maintenance plans of the system and preparation of weekly operation plan and its implementation. Therefore questions are asked to state,

- How the availability of agricultural input affects the starting dates of the crops and the lag period
- Priority under implementation of plan
- Availability of written weekly schedule for implementation
• Any central planning officer is available to execute the implementation plan

4.5.6 M & E Implementation of Seasonal Allocation Plans

In this section, questions are asked to ascertain whether the monitoring and evaluation of starting up of cultivation is done by field level officers or higher level officers at regular intervals and documented properly; whether the verification of released water is done and compared it with the planned one and the cost of M & E.

4.5.7 Matching Supply and Demand

In this section, questions are dealt on the levels at which the quantum of allocation for the system and its duration is determined. Level of request from farmer for water allocation and the policy of water allocation is spelt out.

4.5.8 Implementation of Intra-seasonal Allocation

Questions are framed to find out the basis which forms the implementing scheduling for different subsystems, existence of weekly allocation, implementation of schedule and the authority planning implementation of the schedule.

4.5.9 Monitoring and Evaluation Intra-seasonal Planning

Level at which progress monitoring and evaluation on the actual water delivery and its documentation and cost of M & E form the basis for the questions in this section.
4.5.10 Flow Regulations

Flow regulations can be evaluated based on the preparation of operational methods and plans, and control over staff utilization.

To assess this, questions are asked to state

a) Who is actually deciding on the gate setting and frequency of operation
b) The basis /knowledge form gate setting procedures
c) How the gate operator's time is controlled
d) How the norms are prescribed for work schedule

4.6 INTERVIEW

All the three SDOs are interviewed with a schedule and responses are recorded and evaluated according to the weightages allocated to each question and its sub divisions.

The maximum score under each section is 100. The grading is done as follows.

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>Very low</td>
</tr>
<tr>
<td>21 - 40</td>
<td>Low</td>
</tr>
<tr>
<td>41 - 60</td>
<td>Average</td>
</tr>
<tr>
<td>61 - 80</td>
<td>High</td>
</tr>
<tr>
<td>81 - 100</td>
<td>Very high</td>
</tr>
</tbody>
</table>

The scores obtained by each one of the SDO is furnished in the Table 4.2.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Details</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Av</th>
<th>Level of Attainment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I 1</td>
<td>Preseasonal planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Matching supply and demand</td>
<td>44.50</td>
<td>46.00</td>
<td>51.50</td>
<td>47.30</td>
<td>Average</td>
</tr>
<tr>
<td>b)</td>
<td>Implementation of seasonal allocation</td>
<td>25.00</td>
<td>25.00</td>
<td>41.75</td>
<td>30.58</td>
<td>Low</td>
</tr>
<tr>
<td>c)</td>
<td>Monitoring and Evaluation</td>
<td>35.00</td>
<td>22.00</td>
<td>40.00</td>
<td>32.33</td>
<td>Low</td>
</tr>
<tr>
<td>II 2</td>
<td>Intra seasonal Planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Matching supply and demand</td>
<td>67.00</td>
<td>55.00</td>
<td>53.75</td>
<td>58.58</td>
<td>Average</td>
</tr>
<tr>
<td>b)</td>
<td>Implementation of intraseasonal allocation</td>
<td>60.00</td>
<td>10.00</td>
<td>37.75</td>
<td>35.90</td>
<td>Low</td>
</tr>
<tr>
<td>c)</td>
<td>Monitoring and Evaluation</td>
<td>7.50</td>
<td>5.00</td>
<td>20.75</td>
<td>11.08</td>
<td>Very Low</td>
</tr>
<tr>
<td>III 3</td>
<td>Gate setting</td>
<td>5.00</td>
<td>30.00</td>
<td>29.50</td>
<td>21.00</td>
<td>Low</td>
</tr>
<tr>
<td>IV</td>
<td>Time Utilization</td>
<td>9.50</td>
<td>10.00</td>
<td>39.00</td>
<td>19.50</td>
<td>Very Low</td>
</tr>
</tbody>
</table>
From the Table 4.2 it can be seen that matching the supply and demand both in pre-season planning and intra-seasonal planning, the levels of attainment are of the average level only.

In the implementation of both seasonal and intra-seasonal allocation planning, the levels of attainment are of low level. In the Monitoring and Evaluation, the levels of attainment are in the range of low to very low.

In planning for gate setting, the level of attainment is also low. The time utilization of lascars for gate setting is also very low.

4.6.1 Seasonal Planning

The levels of attainment in the seasonal planning in the Tamiravaruni system is compared with the other systems of Morocco, Sudan, Sri Lanka and the Philippines as reported by Nijman (1992) are shown in Figure 4.3.

4.6.1.1 Matching Supply and Demand

In Morocco the farmers have to submit their indent for water before the commencement of the season. The department allocates the water as demanded by the farmer and bill for that. Therefore it indicates higher percentage level of attainment.

In the Philippines the pre-seasonal planning is absent. But in Sri Lanka, though they prepare a pre-seasonal plan, the managers never accept any changes proposed by the farmers during the "kanna" pre-seasonal plan meeting. In Sudan, though they are not preparing any pre-seasonal plan, they are enforcing certain higher level of discipline in the cropping pattern,
Figure 4.3 LEVEL OF ATTAINMENT IN SEASONAL PLANNING
hence the level of attainment is higher than the Asian countries studied by Nijman (1991).

In the Tamiravaruni system (India) the level of attainment is average. The Executive Engineer is preparing a pre-seasonal plan for the advanced kar based on the storage available in the reservoirs and system tanks and anticipated inflows during the season. It has well defined allocation procedure to various sub systems viz advanced kar priority area, Manimuthar old and new ayacut. Further allocation planning is done by the Central planning officer i.e, Executive Engineer. The combined effect of these resulted in higher level of attainment in the pre-seasonal planning.

4.6.1.2 Implementation, and Monitoring and Evaluation

Implementation of the seasonal plan, and Monitoring and evaluation of it in all the countries are in the level of low and very low level, since the allocations are made on adhoc basis. In Tamiravaruni system, since there is a central planning officer comparatively higher level of attainment is observed.

4.6.2 Intra-seasonal Planning

Intra-seasonal planning is done during the cropping season itself in response to the rainfall that occurred. Level of attainment observed in intra-seasonal planning in Tamiravaruni system is compared with other systems in respect of matching supply and demand, implementation, and monitoring and evaluation and shown in Figure 4.4.

4.6.2.1 Matching Supply and Demand

Level of attainment observed in matching supply and demand is 59 percent. It is less than the level attained in Morocco, but very high
Figure 4.4 LEVEL OF ATTAINMENT IN INTRA-SEASONAL PLANNING
compared to Sudan, Sri Lanka and the Philippines. Central planning officer and fixed allocation priority helped to rise the level of attainment in Tamiravaruni system.

4.6.2.2 Implementation

According to Charles Nijman the implementation of allocation decision in the Philippines and Sudan are based on adhoc request and urgencies of water users. In Sri Lanka important rules and rules of thumb are laid down in the schedules and hence higher level of attainment than in Sudan and the Philippines. In Morocco, many rules are prescribed and applied and hence higher level of attainment. In Tamiravaruni system the level of attainment is the highest. One of the respondent has estimated very high level of attainment (60 percent) in his area. This has caused to boost the average value.

For the scheduling of water allocation, indent from different sub systems forms the basis for implementation. During the investigation it is found that the ID's lower level staff are not properly assessing the area under crop. Proper assessment of area under different crops is essential to arrive at the requirement of the system. Therefore the level of attainment in implementation of intra-seasonal planning observed here has to be looked into for a detailed study.

4.6.2.3 Monitoring and Evaluation

The level of attainment in monitoring and evaluation is in the range of very low in all countries except in Morocco. There also it is in the range of average only. In Tamiravaruni system also it is in the order of very low only. The above shows that nowhere the managers are interested to monitor their plan of implementation and evaluate their own performance.
Monitoring and Evaluation is given very low priority in the irrigation systems. Is it due to over confidence? Or is it due the fear complex to face the reality of his level of performance?

4.6.3 Flow Regulation

Flow regulation is done by the operating staff with regulators. Operation of regulators includes gate opening setting, frequency of operation. Levels of attainment in gate setting and the time utilisation of gate operators in various countries are shown in Figure 4.5.

Charles Nijman stated that both developed and developing countries have fixed procedures for gate operation. Flow regulation or co-ordination of operation along the canals is weak in all cases. In Sri Lanka and the Philippines higher level staff are not giving instructions for flow regulation. But in Sri Lanka, standing orders are there to maintain certain water levels at the cross regulators.

In the Tamiravaruni system the level of attainment in flow regulation is 21 percent only. This system is run-of-the-river system supported by small storage reservoirs. There are 187 system tanks fed by the channels taking off from the anicuts. Some of the system tanks are large enough to store water for one full cropping season. So there is a specific rule to guide the head sluice lascar (gate operator) to operate the sluice and allow as much flood flows coming from the tributaries to be stored in the system tanks. As the channels are designed as flood carriers such diversion does not cause any damage. As the respondents are thinking that the gate operation means head sluice operation only and hence the higher scoring. In real sense, gate operation includes operation along the channel through direct and in direct sluices that supply to direct and tank command area. As the large number of direct sluices are either with damaged shutters or
Figure 4.5 LEVEL OF ATTAINMENT IN FLOW REGULATION
without any shutter, such gate setting and regulation is next to impossible. Then the score will slide down for Tamiravaruni system.

4.6.4 Time Utilization

The level of attainment in control over time utilization is very low in all the cases. In Tamiravaruni system also it is very low. But its score is the highest. Nijman reported that very low score in all the systems is mainly due to very large distance traversed in most irrigation systems. Tamiravaruni system is naturally developed as a compact system and hence less travel time for the gate operators and hence easy gate operation. Their immediate superior-section officers- are meeting them daily in most cases. Further it is reported that working norms are developed by means of historical data. This may be one of the reasons for higher scoring.

According to Nijman, higher level of attainment does not directly mean higher level of performance. A very low level of attainment may still lead to a cost effective satisfactory performance. But when performance is unsatisfactory, higher level of attainment may lead to improved performance. The performance of the Tamiravaruni system is evaluated with the performance indicator Delivery Performance Ratio (DPR). The various levels of performance achieved are discussed in Chapter.8.

Further the level of attainment in the seasonal and intra-seasonal planning and implementation in this system ranges from low to very low except for the task of matching supply and demand. This indicates that there are possibilities to increase the level of attainment by which the system performance can also be increased considerably.
4.7 OPERATORS OF SUBSYSTEMS

The interviews with the Sub divisional officers showed the very low to low level of attainment in the seasonal and intra-seasonal planning implementation and monitoring and evaluation of Tamiravaruni system management. To identify the causes for the above, it is decided to interview the lower down functionaries also.

4.7.1 Section Officers

Section officer is the immediate officer below sub-divisional officer. The section offices are managed by Assistant Engineers (Engineering Degree holder) or Junior Engineers (Diploma holder) or Overseers (certificate holder). In the Tamiravaruni system all the section offices are classified as overseer sections and manned by Diploma holders or certificate holders. There are eight section officers in the command. Their area of operation varies for 2500 ha to more than 5000 ha.

These section officers form part of the pivotal links in the ID. They are expected to plan and operate the system with the assistance of lascars (gate operators).

4.7.2 Lascars

Lascars belong to the last rung in the Irrigation Department. But they play the role of linking pin between the farmers and department's higher level officers. The lascar who is in charge of the head regulator of the main channel is designated as Head sluice lascar. They have to look after the anicuts, sand vents and head sluices. They have to operate the head sluice as per the instructions received from the section officers and furnish feedback back to them through canal phone.
To distribute the water from the main channel directly to the field channel or through the system tanks, lascars are employed.

The duties of sluice lascars are:

- To operate the sluices of the main channel or tank and regulate the supply
- To assess the water requirement for his reach and submit it as the demand to the section officer
- To look after canal banks and sluices
- To act as a messenger to convey the decisions of the department about the opening and closing dates of the channel to the farmers and the demand for water from the farmers to the section officer.

In the Tamiravaruni system, there are 50 sanctioned posts of lascars. Ten lascars are earmarked to look after the eleven channels. Due to the policy of Government not to fill up the posts, that fell vacant due to retirement or transfer, only 29 sluice lascars are in position at present to operate the sluices.

4.8 INTERVIEWS

The function of sluice lascar and head sluice lascar are different in nature. Therefore different sets of questionnaire are used to elicit information from them. The section officers are also interviewed with different sets of questionnaire.

The responses of lascars and section officers are classified under the following categories

a) Operation of the system
b) Distribution of water below sluices
c) Interaction with farmers  
d) Interaction with officials  

4.8.1 Demand Assessment

Operation of the system encompasses the function of demand assessment, indent for water and allocation.

The lascars are expected to assess the demand for their reaches and send it to the section officer who in turn consolidates the demands and send it, to the sub divisional officer as his demand assessment. The perception of the sluice lascars in the demand assessment is shown in Figure 4.6.

Most of them informed that they are assessing the demand based on type and stage of crop. But they have only the knowledge of qualitative difference between the demands at various stages of the crop. All are aware that the type of crop, say, rice and banana requires different irrigation requirements and it differs depending on the stage of the crop. Therefore they made some rough estimates based on their experience to assess the demand.

Four section officers have stated that they are assessing the demand based on type and stage of crop. Two are based on type, stage of crop and adhoc basis and the remaining one is based on type and stage of crop and duty of crop. Even the section officers are not aware, how to compute the crop water requirement based on the meteorological data. However, they are heuristically computing the water requirement based on the duty of water concept. i.e, how much area could be irrigated by the continuous supply of water at the rate of one cubic feet per second (cusec).
Figure 4.6 METHODS OF DEMAND ASSESSMENT
4.8.1.1 Assessment of Cropped Area

Irrigation demand in any system is the major demand, which is depending on the type of crop and extent of land cultivated. As already stated, in Tamilnadu ID supplies water to the farm lands, but it is not collecting any water charges from the users. Revenue Department which collects land tax, collects water cess along with it. The Village Administrative Officer who maintains land records, prepares the list of survey numbers and extent of land cultivated and levy the water cess accordingly. Agricultural Department and Statistics Department collect the crop production statistics. There is a Government order instructing all these department staff to reconcile their figures at various levels. This is not done seriously and each one blame the other for the discrepancy.

To have a cursory check on the figures adopted by the ID and Revenue Department, village level details are collected in the Tamiravaruni system from the VAOs. The ID is having a component register which gives the details of land commanded by each sluice and the total area commanded by each channel. They are also adopting a figure as the registered ayacut area under each channel. Details collected from the Revenue Department and ID for the year 1990-91 are shown in the Table 4.3. It may seen that there is a lot of variations between the two sets of figures adopted by the ID itself. In the Marudur Melakkal channel alone the difference is 1128 ha. When this was brought to the notice of the engineers, they admitted and explained that this is mainly due to double accounting of certain tank commands come under this channel. But they are not prepared to change their register. Though every one is in doubt about the figures of Revenue Department, their figures are nearly tallying with that of component register of ID. This clearly indicates more than 1200 ha has to be reduced in the registered ayacut of ID.
### Table 4.3  COMMAND AREA ASSESSMENT BY IRRIGATION AND REVENUE DEPARTMENTS

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>NAME OF CHANNEL</th>
<th>AS PER COMPONENT REGISTER</th>
<th>REGISTERED AYACUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SINGLE</td>
<td>DOUBLE</td>
</tr>
<tr>
<td>1</td>
<td>NORTH KODAIMELALAGIAN</td>
<td>205.595</td>
<td>660.465</td>
</tr>
<tr>
<td>2</td>
<td>SOUTH KODAIMELALAGIAN</td>
<td>0.000</td>
<td>357.000</td>
</tr>
<tr>
<td>3</td>
<td>NATHYUNNI</td>
<td>78.480</td>
<td>963.590</td>
</tr>
<tr>
<td>4</td>
<td>KANNADIAN</td>
<td>108.870</td>
<td>4571.705</td>
</tr>
<tr>
<td>5</td>
<td>KODAGAN</td>
<td>110.270</td>
<td>2192.770</td>
</tr>
<tr>
<td>6</td>
<td>PALAYANCOTTAI</td>
<td>202.800</td>
<td>3546.655</td>
</tr>
<tr>
<td>7</td>
<td>TIRUNELVELI</td>
<td>337.920</td>
<td>2053.300</td>
</tr>
<tr>
<td>8</td>
<td>MARUDUR MELAKKAL</td>
<td>360.890</td>
<td>3611.080</td>
</tr>
<tr>
<td>9</td>
<td>MARUDUR KEELAKKAL</td>
<td>111.345</td>
<td>2982.955</td>
</tr>
<tr>
<td>10</td>
<td>SRIVAIKUNDAM NORTH MAIN</td>
<td>1355.505</td>
<td>3449.750</td>
</tr>
<tr>
<td>11</td>
<td>SRIVAIKUNDAM SOUTH MAIN</td>
<td>742.530</td>
<td>4604.470</td>
</tr>
</tbody>
</table>

3614.21  28993.74  1062.19  33670.14  34934.00  33131.09
The Irrigation Department engineers approximately estimate the cropped area or report that all the registered area is under cropping. They are not maintaining the extent of land cultivated by different crops. Therefore, their demand assessment is not based on the actual crop needs.

4.8.2 Indent for Water

Based on the demand assessment, indent has to be submitted by all the staff at any level to the next higher officer. Advance submission of indent is necessary for proper planning for operation of the system. The details of advance indent placed by lascars and section officers are shown in Figure 4.7.

Twenty five and twenty per cent of lascars in the head and middle reaches respectively are sending their indent one day in advance. 25, 80, and 47 per cent of lascars from head, middle and tail reaches respectively are sending their indent at least 2 to 3 days in advance. 50 and 53 per cent of lascars from head and tail reach respectively are sending their indents one week in advance. This shows that the head or tail reach does not have any bearing on the placing indent in advance. Since there is no time limit specified to send the advance indent, it becomes mainly dependent on the individual rather than on the location.

4.8.3 Distribution of Water

Based on the indent each lascar is allocated with certain amount of water. This quantity has to be distributed by them to the various sluices under their control. When the allocation is less than demand then comes the various options for distribution of water. There again the competition is different during the normal period and the scarcity period. The methods of distribution adopted by the lascars during the normal and scarcity period are shown in Figure 4.8 and Figure 4.9 respectively.
Figure 4.7 METHODS OF PLACING INDENT FOR WATER BY LASCARS
Figure 4.8 METHOD OF WATER DISTRIBUTION DURING NORMAL PERIOD

Figure 4.9 METHOD OF WATER DISTRIBUTION DURING SCARCITY PERIOD
For adopting rotational water supply someone has to operate the sluice at the appropriate time. For the query, who operates the sluice gate, all the lascars have stated that they operate the sluice gate and distribute water. They also stated that wherever no shutters, the farmers open or close the sluices with improvised method of paddy straw and mud.

From the sample survey conducted at South Kodaimelalagian and Kodagan channels the data are furnished in Table 4.4. Majority of the sluice shutters are under repairs or without shutters. These damages are caused within two years after rehabilitation. Further 19 out of 29 lascars reported that farmers too operate the shutters without their knowledge. The above clearly indicates that the operation of the sluices are not solely controlled by the lascars. This results in wastage of water since all the farmers do not care to close the sluices as soon as they complete their irrigation. Similar experiences are reported by Chambers (1988).

4.8.4 Farmers Demand for Water

Farmers are approaching the lascars and request them for water. But they adopt different ways to fulfill the request. To find out the same, lascars are asked specific questions.

For the question, who will contact the lascars for the water, the responses provided by the lascars are furnished in Table 4. 5.

The above table reveals that the farmers are using various combination of approaches to meet their demand.

4.8.5 Conflicts

From the Figure 4.9, it is clear that the rotational water supply becomes a must during scarcity period. To assess whether this causes any
### Table 4.4 DETAILS OF CONDITIONS OF SLUICES

<table>
<thead>
<tr>
<th>Reach</th>
<th>S.No of Sluice</th>
<th>Condition of system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>DIR Tank</td>
<td>DIR Tank</td>
<td>DIR Tank</td>
</tr>
<tr>
<td>South Kodaimelalagian Channel 1</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Head</td>
<td>1 - 20</td>
<td>14</td>
</tr>
<tr>
<td>Middle</td>
<td>21 - 41</td>
<td>14</td>
</tr>
<tr>
<td>Tail</td>
<td>42 - 55</td>
<td>14</td>
</tr>
</tbody>
</table>

Kodagan channel

<table>
<thead>
<tr>
<th>Reach</th>
<th>S.No of Sluice</th>
<th>Condition of system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIR Tank</td>
</tr>
<tr>
<td>Head</td>
<td>1 - 39</td>
<td>29</td>
</tr>
<tr>
<td>Middle</td>
<td>40 - 75</td>
<td>27</td>
</tr>
<tr>
<td>Tail</td>
<td>76 - 88</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 4.5  FARMERS METHODS OF INDIENTING FOR WATER

<table>
<thead>
<tr>
<th>Contact Person</th>
<th>HEAD %</th>
<th>MIDDLE %</th>
<th>TAIL %</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Individual farmer</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>b. Group of farmers</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>c. Association representative</td>
<td>0</td>
<td>10</td>
<td>'7</td>
<td>7</td>
</tr>
<tr>
<td>d. People representative</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>e. Through superiors</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>f. a &amp; c</td>
<td>-</td>
<td>-</td>
<td>34</td>
<td>17</td>
</tr>
<tr>
<td>g. a &amp; e</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>h. a b c</td>
<td>25</td>
<td>-</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>i. a c e</td>
<td>-</td>
<td>20</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>j. a b e</td>
<td>0</td>
<td>60</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>k. a b c e</td>
<td>-</td>
<td>-</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>l. b c d e</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
conflict among the lascars, specific questions are asked to state whether he has experienced any conflict with fellow lascars about the drawal of water and how the conflict is resolved. All lascars and section officers except one lascar categorically stated that no conflict has arisen in connection with water distribution. One lascar from the tail reach who reported about the occurrence of conflict stated that the conflict is resolved by the section officer amicably. This shows that there is some conflict. The nature of responses indicate the protective nature of respondents. In the organisation assessment "conflicts within the unit" is identified as one of the principal factor.

During the discussion with lascars, section officers and assistant executive engineers, existence of conflicts between them is revealed. As stated by one lascar disputes are solved then and there by the unit supervisor. Presence of system tanks and the return flows from the upper reaches helps to minimise the conflicts in water allocation and distribution.

4.9 INTERACTION WITH OFFICIALS

Head sluice lascars are provided with canal phone. They have to receive instructions from the section officer about the flow regulation and send the feedback to him. Therefore they have frequent contacts with each other. Regarding sluice lascars, those who are having the same headquarters as that of the section officer, they meet the section officers daily. Those who are living away, meet him once in 2 to 3 days; so also the meeting between the section officers and the subdivisional officer.

As most of them meet their superior daily, the information flow also takes place on one to one basis. But they also reported that bypassing of the immediate superior is also done whenever the immediate superior is on leave or camp and during the inspection of higher level officials. This has
also been confirmed by the managers in the organisation assessment instrument as discussed in Chapter 3.

4.10 FARMERS ORGANISATION

Tamiravaruni command area is spread over two Revenue administrative districts. If we divide the command area into three reaches; the head and middle reaches fall under Tirunelveli-Kattabomman district and the tail reach falls under Chidambaranar district. Village is the basic unit in the administrative set up. There are 224 villages in this command area. Out of the 224 villages, 51, 60 and 113 villages are located at the head, middle and tail reaches respectively.

In the Tamiravaruni system, the farmers are participating in the water acquisition, distribution and maintenance phases of irrigation management.

4.10.1 Water Acquisition

In 1860, when the British Government had proposed to take up the construction of Srivaikundam anicut, the people of Srivaikundam area contributed Rs. 20,000. As the Government felt that the farmers may ask for remission of kist, if their contribution is used for the construction of the anicut, the same was used to construct a bridge over the anicut. In the post independence period, when the Manimuthar reservoir was planned, the then Hon'ble Chief Minister of the State, C. Rajagopalachari stated that, if the farmers of the command area come forward to contribute substantial amount to the Government as loan, the project can be taken up immediately. The farmers responded well and contributed a sum of Rs.30 million as loan to the Government and the project was included in the first five year plan itself (CWR & IMTI 1993).
4.10.2 Water Distribution

For distribution of water and maintenance below the outlets in many villages Water User Association (WUA)- locally known as Oppidi Sangam - are functioning. They engage common irrigators known as Neerkatti for the equitable distribution of water for the fields and watchers for protecting the crops from cattle and theft. For these services each farmer has to pay to WUA in cash or kind according to the extent of his land holding. During scarcity period, WUA engages labourers to patrol the channel to bring their share of water from the upstream without any diversion. Sengupta (1991) documented the functioning of such Oppidi sangam at Chattram- Pudukulam village of Kodagan Channel and Thulukkankulam of Srivaikundam South main channel.

4.10.3 Kudimaramathu

Kudimaramathu practiced in early days in Tamilnadu is based on the principles of self reliance and self discipline and it encompasses all maintenance activities below the minor. It is the act of maintaining water sources required for irrigation and other community purposes by the people who benefit from such works. Though during British rule, the practice of maintaining irrigation system through Kudimaramathu was formalized by Government order, the practice was gradually vanished.

4.10.3.1 Maintenance

The Irrigation Department controls the physical system upto the sluice level. Below the sluice, the farmers have to maintain and manage the system. In this system almost all fields are provided with separate supply channels. When the lands are divided due to partition or sale, separate supply channel will be demarcated so that each field will have a supply channel. These channels are maintained by the farmers' group. They even
take up the maintenance work of the main canal to ensure free flow of water as the Irrigation Department is allocating limited funds for such maintenance works. For example, the Vagaikulam, WUA, which is located at the tail end of North Kodaimelalagian channel is spending money every year from their association funds for the upkeep of the channel. During the year 1992-93 they spent a sum of Rs 10,000/ for desilting and clearance of weeds. Kothankulam is a tailend village in the Kannadian channel. Due to siltation and weed growth water did not reach their village. Their WUA engaged 15 men for two days to clear the obstruction during June 1992. In 1992, the farmers of Athoor supply channel which is a branch of south main channel have spent Rs 28,000 over and above the allocation of Rs 1,43,500/ made by the ID by engaging a bulldozer for additional 80 hours. Such actions are given more prominence in the local vernacular dailies. This results in more spread effects. Wade(1979), Elumalai (1980) and Singh (1981) have reported such activities in Andhra Pradesh and other parts of Tamilnadu.

4.11 WATER USERS ASSOCIATION (WUA)

According to Tamil Nadu Society Act, a group of 7 or more persons can join together and start an association. The WUA can be registered under Tamil Nadu Societies Registration Act 1975, by framing necessary adhoc rules and electing their representatives after paying a nominal fee of about Rs.80.

In the beginning of the century, only 2 villages had WUAs, that too, informal associations. Both these associations are located at the tail reach. One of them has been functioning for more than a century. During the pre-independence period there was not much growth. Upto 1950, the total numbers has risen upto 12 only. Thereafter, the formation of WUA picked up and the number reached 120. Out of which, only 32 are registered associations. They prefer to function informally, because they do not want
to be controlled by rules and regulations. Further the procedure to be gone through for registration of their association is also cumbersome. Further for registration of the society, only one subregistrar is empowered for the entire district. This causes for the farmers to travel a long distance for the registration purpose which kills the urge to register the societies. The time involved in the registration process is also too long. Growth of WUA in Tamiravaruni Command since 1900 is furnished in the Table 4.6. Now 53.5 percent of villages have either formal or informal WUAs. The distribution of the formal and informal associations is shown in Figure 4.10. Their distribution in the head, middle and tail reaches are 39, 35 and 70 percent respectively. The more number of WUAs in the tail reach can be mainly attributed to the essentiality of the existence for making up the deficient in supplies during closure period.

4.11.1 Interaction with Irrigation Officials

Lascar of the Irrigation Department is the major contact person for the farmers. They get information about the date of opening and closing of the channel from lascars. When they need water, they approach the lascar who will manage to release the water during normal and above normal supply period. During the below normal supply period, they contact the section officer to allocate more water to their reach. They even meet the Assistant Executive Engineer, or Executive Engineer or Superintending Engineer to request for more allocation depending upon the need and circumstances.

During scarcity period, they even bring pressure on the officials through local Member of Parliament (MP) and or Member of Legislative Assembly (MLA). During severe scarcity period they do not even spare the minister to bring pressure on Secretary to Government and Chief Engineer. The WUA provides the resources required for this. At times, the WUA is
Table 4.6  GROWTH OF WATER USERS ASSOCIATIONS IN TAMIRAVARUNI SYSTEM

<table>
<thead>
<tr>
<th>Decade</th>
<th>With WUA (Registered)</th>
<th>Without WUA (Un Registered)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head</td>
<td>Middle</td>
<td>Tail</td>
</tr>
<tr>
<td>Upto 1900</td>
<td>2</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>1901-1910</td>
<td>-2</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>1911-1920</td>
<td>-2</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>1921-1930</td>
<td>-2</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>1931-1940</td>
<td>6</td>
<td>8</td>
<td>51</td>
</tr>
<tr>
<td>1941-1950</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>1951-1960</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1961-1970</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>1971-1980</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>1981-1990</td>
<td>2</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>1991-1994</td>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Table shows the growth of water users' associations in the Tamiravari system, categorized by decade and whether they were registered with WUA (Water Users Association). The table includes totals for each category.
Figure 4.10 DISTRIBUTION OF WUA IN TAMIRAVARUNI COMMAND AREA
used to bring pressure on the officials to release water even during the closure period.

4.12 GROUP PRESSURE

A single WUA or a group of WUA is able to bring pressure on the officials to redress their grievances successfully.

4.12.1 Pressure for Rehabilitation of Channel

Kodagan channel takes off from the fourth anicut, to command 1229 ha through direct sluices and 1200 ha through 17 tanks and 53 sluices. The tanks are small in size at the head reach and medium in size at the tail reach. Capacity of the tank varies from 0.04 M.cum to 0.53 M.cum. The total capacity of the tanks is 3.15 M.cum. The length of the channel is 29.04 km. Rice is the main crop in this command. Until early eighties the lag period for the water to reach the last tank was 20 - 30 days. Even during that time, the tail end WUAs engage labourers to patrol the channel bank to bring water to their tanks without any intermediate tapping.

Due to the growth of aquatic weeds and silting up of channel the lag period gradually increased to 60 to 90 days. During 1988, the water did not reach the tail end tank. Their efforts to persuade the engineers to clean the channel did not bear any fruit. Adding salt to the injury, the Pettai municipality situated on the bank of the channel started to dump the garbage into the channel. Their representation to the municipal commissioner and then to the District collector, who is the administrative head of the district also had no effect.

As the last resort, they served a notice to the Collector and obstructed the traffic on the trunk road near Thatchanallur town to press their demand for water. This had a desired result. The collector rushed to
the spot and arranged for a meeting with officials and farmers' representatives. During the meeting, the officials of Irrigation Department informed that the Tamiravaruni command has since been included in the National Water Management Project (NWMP) sanctioned with the assistance of World Bank, the rehabilitation work could be taken up early. But the closure period of 2 months of April and May not be sufficient to complete all the works. They sought the co-operation of the farmers for a longer closure period. The farmers representatives agreed to forego 1990 Kar crop in lieu of rehabilitation of the entire channel length.

With the assured co-operation from the farmers, the Department was able to complete the work in record time and brought the channel to its original shape and size; repairs to structure and sluice shutters. Thereafter the water reached that tail end without any problem. The lag period is reduced back to twenty days. The sub divisional officer stated that before rehabilitation, he used to arrange for placing sand bags over the weir to create an additional head to push water through the channel. Now water is flowing freely. This episode reveals, how the farmers used the group pressure so effectively to solve their problems.

4.12.2 Restoration of Rights

Papanasam - Servalar complex and Manimuthar reservoirs are feeding the Tamiravaruni command through eleven channels taking off from the eight anicuts. Since Manimuthar joins the Tamiravaruni river just above the third anicut (Kannadian anicut), the first three channels viz North and South Kodaimelalagian channels and Nadhiyunni channel can receive supply only from the Papanasam-Servalar Complex. To safe guard the interest of these three channels, the Government of Tamil Nadu, while fixing the priority area for advanced kar in the G.O. MS NO. 2011 PWD dated 12.11.69, ordered that a minimum storage of 15 M.cum (500 M.cft)
should be retained in the Papanasam reservoir to commence the kar season in these three channels on June first, every year.

Cropping pattern at the tail end channels has changed from rice to banana in a considerably large extent of command area. The banana requires water throughout the year. The farmers have not developed any captive source of irrigation such as private and or community wells, to meet the demand during the closure period of April to May. So the farmers, with their well established WUA have started to exert pressure on the agency to authorise more area under advanced kar, so that they can utilize the release to their banana crop also. When their channels are not given authorisation for advanced kar, they get government orders for special releases for saving the standing banana crop using their political influence. This resulted in depletion of storage in the Papanasam reservoir complex during the closure period. This causes the delay in commencement of the immediately succeeding kar crop.

During the eighties the storage is depleted below 15 M.cum in 7 out of 10 years. Though there are a number of WUA -formal or informal- their representations could not prevent depletion of the storage in successive years, due to the political clout of the lower down WUA. Since, this adversely affected the farmers of the first three channels, they formed a federation of WUA and named it as "Mukkal (Three channel) Association". On behalf of this federation a civil suit was filed against the Executive Engineer, Tamiravaruni division and prayed orders for restraining the EE from depleting the storage below 15 M.cum during the closure period so that they can commence their cultivation operation during the first week of June and harvest the crop during September itself before the onset of Northeast monsoon rains. Though the Executive Engineer has argued that the federation of WUA has no rights to demand exclusive right for the storage in Papanasam complex, the Ambasamudram Munisif has accepted the demand of the federation and ordered the Executive Engineer on 23.8.92 to
maintain a minimum storage of 15 M.cum as on June first every year. This ensured the farmers to commence their Kar cultivation without waiting for the Southwest monsoon which normally sets in during first or second week of June.

This reveals that the farmers of Tamiravaruni command united together to establish their rights and get their due share of water.

4.12.3 Bypass Channel

As already stated, the system comprises of direct sluice command and tank command. There are 187 tanks in total, in this system. Most of the tanks are tank-in-channel type. Upper tank in these cascade of tanks surpluses to the lower down tank after it filled up. Some of the tanks are very large in size and take a longer time to fill up. The period is further extended due to simultaneous drawal of water through the sluices by the farmers. This results in abnormal delay in commencement of cultivation operation in the lower reaches. Many times it results in the loss of crop either due to scarcity of water or flooding due to monsoon rains.

The Irrigation Department felt that this delay could be avoided by providing a channel going around the periphery of the large tanks. They proposed the following bypass channels under NWMP project.

<table>
<thead>
<tr>
<th>TANK</th>
<th>CHANNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Piranchery</td>
<td>Kannadian Channel</td>
</tr>
<tr>
<td>2. Sivakalai</td>
<td>Marudur Kilakkal</td>
</tr>
<tr>
<td>3. Kadamba</td>
<td>Srivaikundam South Main</td>
</tr>
</tbody>
</table>

Kadamba bypass channel met with a litigation from the Kadamba Tank WUA. Farmers of Kadamba tank, which irrigates 1400 ha, felt that,
though their tank is situated very near the head sluice, they may face some water shortage problem in the future if the bypass channel is excavated and filed a suit at Tuticorin sub divisional judge's court in the year 1988 even at the project formulation stage. They further pursued the matter at all administrative and political levels.

But the irrigation department pursued the matter consistently for more than 5 years and convened a number of farmers meetings and explained the proposal. The transparent approach of the department helped to remove all the apprehensions of the farmers and they agreed to the implementation of the project and excavation of the bypass channel is started during 1994.

4.12.4 Marketing

Sale of the produces are done by the individual farmer to the merchants who are coming to their village or taking the produce to the Tirunelveli or Tuticorin town markets. For banana, merchants from Kerala state used to come and pay in advance even in very early stage of the crop or during maturity period. Very few farmers only take them to the town market. Betal vine crop is cultivated in about 100 ha under Srivaikundam channels. The betel vine cultivators formed a separate association, which not only looks after the water supply but also collection of the produce and send the produce even to the remotest places in northern India to get better returns to the farmers. It also supplies necessary inputs for the cultivation of the crop.

4.12.5 Conflict Resolution

Peikulam is a tank fed by the Srivaikundam North Main Channel. The farmers of this tank command formed a WUA more than 100 years ago. This WUA is functioning very well and had documented all the events in the
association. It also recorded, how the conflicts of land boundary disputes or any other arising in between members are resolved without going to the civil courts. Such things are not new for many WUAs.

4.13 CONCLUSION

The subdivisional officers are interviewed through a questionnaire, to assess how they are planning for seasonal and intra-seasonal operation. It is found that their levels of attainment in them are in the range of very low to average. But their attainment, when compared with that of Sri Lanka, Sudan, and the Philippines is high. Morocco stands above this system. It may be due to operation of the system on-demand basis.

To identify the reasons for this low level of attainment, the lower level functionaries such as section officers and lascars are interviewed with separate questionnaires on their way of assessing demand and placing indent for water, distribution during normal and scarcity periods, and their interaction with officials and farmers. Though they claim that they are assessing the demand, based on the type and stage of the crop, it is mainly a heuristic approach. They place their indents for water one day to one week in advance. The location of the lascar has no bearing on this. They adopt rotation among the sluices or among the sub systems. But the rotation is not a fixed one as in the case of warabandi or RWS. The conflicts in water sharing are mainly resolved by hierarchial authority. Tamiravaruni system has a well organised WUA in almost in all villages to look after irrigation related matters. They prefer to function informally than as registered organisations due to some administrative hurdles. The farmers organisation try to use all ways and means to solve their problems. They are even prepared to get judicial remedies to establish their rights.