

# Transaction Cost in Irrigation Tank Management: An Institutional Economic Analysis

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## ABSTRACT

Irrigation tanks formed the lifeline of village economy. The Government of Karnataka amended its Irrigation Act in 1965 and Participatory Irrigation Management (PIM) was brought under the domain of Cooperative Act and Water Users Cooperatives were formed to manage and operate the tanks. The present study was undertaken to assess the transaction cost in irrigation tank management in central dry zone of Karnataka. Two tanks Bukkarayanakere (farmers managed) and Ayyanakere (Minor Irrigation Department managed) were considered for the study. The results revealed that, total transaction cost incurred was high in Minor Irrigation Department managed tank or defunct water users association (₹ 1,06,085 per year) than farmers managed tank or active water users association (₹ 61,480 per year). This is because of free riding problem that prevailed in the Minor Irrigation Department managed tank command. Educating the farmers regarding the benefits of collective action is necessary to reduce the transaction cost.

**Keywords:** Transaction cost, irrigation tanks, collective action, free riding, water users association

Irrigation tanks formed the lifeline of the rural communities in providing irrigation to crops and local ecosystem in South India (Gandhiraj, 2007). Irrigation systems in India are mostly open access resources/common property resources. Common property resources are often subjected to the problem of free riding and lack of collective action. Collective action problems arise when farmers have an incentive to use more water and invest less in the system. Allocation of water and provisions are two major sources of collective-action problems. Problems of collective action are more predominant in irrigation systems when compared to other types of common property resources (Ostrom *et al.* 1994). Realizing the needs, States took efforts to foster participation of farmers in the management of irrigation systems in India. Karnataka State amended its Irrigation Act in 1965 (Anon, 2000) and Participatory Irrigation Management (PIM) was brought under the domain of Cooperative Act. "Irrigation management transfer" was one of the reforms under this policy which emphasizes

paradigm shifts in irrigation management from state management to Water Users Association (WUAs). Each WUA has distinct institutions (rules and regulations) in managing, operating and distribution of water.

Transaction costs are incurred during the formation of WUAs i.e. the expenses incurred in mobilizing the participators and developing institutional framework. Transaction costs are also incurred annually for the functioning of WUAs. Institutions (WUAs) are often referred to as transaction cost reducing mechanisms. Despite this, there exists some transaction cost in collective action. Nevertheless, transaction cost varies from institution to institution based on the collective action. Operation and governance of the WUAs has a direct impact on the transaction costs.

Analysis of transaction costs helps in designing the recommendations for water related institutions. With this backdrop, study focuses on estimation of transaction cost involved in governing the tank

institutions in Bukkarayanakere and Ayyanakere (managed by farmers and Minor Irrigation Department, respectively) in Central Dry Zone of Karnataka. In this study it was hypothesized that, transaction costs of governance are less in the tank managed by farmers than by MID.

## METHODOLOGY

### Study area and sampling

The study was carried out in the Central Dry Zone of Karnataka during the agriculture year 2017-18. Two tanks in Central Dry Zone of Karnataka were selected purposively, one under farmers management (Bukkarayana Kere) and the other tank managed by the MID (Ayyana Kere). Farmers were selected based on random sampling technique. Data was collected from 90 farmers using pre-tested well-structured schedule through personal interview method. After omitting outliers, data of 80 farmers from each management regime was considered for the analysis.

### Transaction cost

Transaction cost includes information cost, contractual cost and enforcement cost as enunciated by Coase (1960). The analysis considers the cost of gathering information regarding the formation of WUA, cost of preparing documents and submitting them to the concerned office, rent seeking (if any) in order to receive the benefit from any Governmental programme. Besides, establishing one's bargaining position and arriving at a group decision, cost incurred to collect water fee, cost incurred to enforce the decision made were also considered. Time spent by farmer in attending the group meeting, annual meetings, guarding activity has been calculated by considering the opportunity cost of the labour under prevailing wage rate (Kolla and Chandrakanth, 2013).

## RESULTS

### Operation and maintenance cost of tanks

The total operation and maintenance cost incurred in farmers managed and MID managed tanks are presented in Table 1. The operation and maintenance cost included the expenditure on reconstruction of bunds, repair of sluice gate and spillways, cement

lining of irrigation channels and de-silting of tanks. Since the operation and maintenance expenditure is not incurred in a single year, the expenditure from 2000 till 2018 was considered.

In both the tanks, the expenditure was higher on lining of irrigation channels (₹ 30 lakh and ₹ 640 lakh in farmers managed and MID managed tanks, respectively) which was followed by reconstruction of bunds (₹ 25 lakh and ₹ 180 lakh in farmers managed and MID managed tanks, respectively). Total operation and maintenance cost per ha of command area was ₹ 0.97 lakh and ₹ 0.60 lakh in farmers managed and MID managed tank areas, respectively. In addition to this the salary for neerkatti was ₹ 40,000 per year in farmers managed tank, whereas it was ₹ 1,50,000 per year in MID managed tank. Neerkatti is a person appointed and paid by the water users association during the time of water release from tank to ensure equity in distribution of tank water among all the users. Neerkatti will inform the farmers one or two days in advance regarding the time and date of release of water to the field. It is the duty of Neerkatti to inform the members of water users association if any farmer is drawing the water illegally.

The Total operation and maintenance cost per ha of command area per year (including salary of neerkatti) was lower in farmers managed (₹ 7,611) than MID managed tank (₹ 11,667). The operation and maintenance cost incurred was directly related to the performance of tanks. On the contrary, Palanisami (2006) reported that the operation and maintenance cost incurred and the level of tank performance were not directly related.

### Transaction costs of governance of tank management institutions

#### Farmers managed tank area

The Transaction Cost (TC) of governance of tank management institutions in farmers managed and MID managed tanks comprised of information cost, contractual cost and enforcement cost. These costs in turn are subdivided into One Time Expenditure (OTE) and Annual Expenditure (AE). One time expenditure is the expenditure made during the establishment of water users association. Annual expenditure is incurred every year to sustain its operation.

**Table 1:** Operation and maintenance cost of tanks from 2000-2018

Sl. No.	Particulars	Farmers Managed Tank area (₹ in lakh)	MID Managed Tank area (₹ in lakh)
1	Reconstruction of Bunds	25	180
2	Repair of Sluice gate/spillways	1.50	43
3	Lining of irrigation channels	30	640
4	De-silting of tanks	17.50	85.5
<b>Total operation and maintenance cost</b>		<b>74</b>	<b>948.50</b>
<b>Total operation and maintenance cost per ha of command area</b>		<b>0.97</b>	<b>0.60</b>
5	Salary for Neerkatti (₹ in lakh per year)	0.40	1.5
<b>Total operation and maintenance cost per ha of command area per year (including salary of Neerkatti)</b>		<b>7,611</b>	<b>11,667</b>

Source: Minor Irrigation and Groundwater Development Board, Chikkamagaluru.

Note: MID- Minor Irrigation Department.

**Table 2:** Transaction cost involved in establishment and sustenance of tank WUA managed by the farmers' (Active WUA)

(a) Information cost		₹	Per cent
OTE	1 Cost incurred by the President		
	a. To attend the meeting in Chikkamagaluru (3)	75	0.12
	b. Opportunity cost of time (2 hours per meeting)	750	1.22
	2 Cost incurred to inform all the farmers about formal registration of WUA	250	0.41
	3 Opportunity cost of service of Government agency	1,500	2.44
4 Expenditure on telephonic calls to inform farmers regarding the meeting	130	0.21	
<b>Total OTE of information cost</b>		<b>2,705</b>	<b>4.40</b>
(b) Contractual Cost			
OTE	1 Opportunity cost of farmers (70 No.) in attending the meetings (2 meetings, 0.5 hour)	1,094	1.78
	2 Opportunity cost of President and members in conducting meeting (2 meetings, 1 hour)	313	0.51
	3 Snacks and tea served in the meetings	1,100	1.79
	4 Documents and Registration of the Society	2,500	4.07
	5 Cost incurred to open a bank account	900	1.46
<b>Total OTE of contractual cost</b>		<b>5,906</b>	<b>9.61</b>
AE	6 Expenditure in general meetings (Breakfast/Snacks)	5,500	8.95
	7 Opportunity cost of time spent by the farmers (45 No.) in attending the meeting (3 meetings, 0.45 hour)	5,906	9.61
<b>Total AE of contractual cost</b>		<b>11,406</b>	<b>18.55</b>
(c) Enforcement Cost			
OTE	1 Opportunity cost of labour for collecting the records of members	150	0.24
AE	2 Opportunity cost of president and members in attending meeting at Sakarayapattana	1,313	2.13
	3 Salary to neerkatti (₹ 400 * 100 days)	40,000	65.06
<b>Total AE of Enforcement cost</b>		<b>41,313</b>	<b>67.20</b>
<b>Total transaction cost</b>		<b>61,480</b>	<b>100.00</b>

Note: OTE: One Time Expenditure and AE: Annual Expenditure.

Since there was equity in the distribution of water the transaction cost remains same for head as well as tail reach farmers. The estimated transaction cost in farmers managed tank was ₹ 61,480 per year (Table 2). Of which, major cost was incurred on enforcement cost (67.44 %) followed by contractual cost (28.16 %) and information cost (4.40 %). The results are in

consonance with study conducted by Sripadmini (2000) where she reported that the enforcement cost (71 %) which was higher than information cost and contractual cost in Government watershed. Total OTE was ₹ 5,906 which mainly comprised of cost incurred on documents and registration of society (₹ 2,500), snacks and tea served during the meeting

(₹ 1,100) and opportunity cost of farmers in attending the meetings (₹ 1,094).

Annual expenditure on enforcement cost consisted of opportunity cost of president and members in attending the meeting at Minor Irrigation Department office located at Sakarayapattana (2.13% of TC) to arrange the supply of water to the tank from Madaga tank (BBukkarayanakere tank receives water from largest tank in Kadur taluk called Madaga tank) and salary to Neerkatti (65.06% of TC).

**MID managed tank area**

Since there was no equity in the distribution of tank water between head and tail reach farms, the transaction cost of governance is different for head and tail reach farmers and the results of the same are presented in Table 3.

The total transaction cost was ₹ 20,566 and ₹ 1,91,604 per year for the farmers in head and tail reach, respectively. OTE on information cost and contractual cost remains same for both head and tail reach farmers since they both were the members of water users association during establishment. The information cost accounted for 16.09 per cent and 1.73 per cent of the transaction cost for head and tail reach farmers, respectively and was lower than contractual and enforcement costs. The results of the study are contradictory to the findings of study by Durga *et al.* (2015) where search and information cost was higher than contractual cost. The one time expenditure on contractual cost was ₹ 3,781 per year (18.39% and 1.97% of TC in head and tail reach areas, respectively). Annual expenditure of contractual cost was zero for head reach farmers because the water users association was defunct and no meetings were held. But the farmers in tail

**Table 3:** Transaction cost involved in establishment and sustenance of tank WUA managed by the MID (Passive WUA)

Transaction cost		Head Reach		Tail Reach	
(a) Information cost		₹	%	₹	%
OTE	1 Cost incurred by the President to attend the meeting in Chikkamagaluru				
	a. To attend the meeting in Chikkamagaluru (3)	60	0.29	60	0.03
	b. Opportunity cost of time (2 hours per meeting)	750	3.65	750	0.39
	2 Cost incurred to inform all the farmers about formation of WUA	500	2.43	500	0.26
	3 Opportunity cost of service of Government agency	1,500	7.29	1,500	0.78
4 Expenditure on telephonic calls and fuel charges to inform farmers regarding the meeting	500	2.43	500	0.26	
<b>Total OTE of information cost</b>		<b>3,310</b>	<b>16.09</b>	<b>3,310</b>	<b>1.73</b>
<b>(b) Contractual Cost</b>					
OTE	1 Opportunity cost of farmers (60 No.) in attending the meetings (2 meetings, 0.5 hour)	938	4.56	938	0.49
	2 Opportunity cost of President and members in conducting meeting (2 meetings, 1 hour)	344	1.67	344	0.18
	3 Snacks and tea served in the meetings	500	2.43	500	0.26
	4 Documents cost for registration of the society	1,500	7.29	1,500	0.78
	5 Cost incurred to open a bank account	500	2.43	500	0.26
	<b>Total OTE of contractual cost</b>		<b>3,781</b>	<b>18.39</b>	<b>3,781</b>
AE	7 Opportunity cost of time spent by the farmers (38No.) in attending the meeting (2 meetings, 0.5 hours)	0	0.00	1663	0.87
<b>Total AE of contractual cost</b>		<b>0</b>	<b>0.00</b>	<b>1663</b>	<b>0.87</b>
<b>(c) Enforcement Cost</b>					
OTE	1 Opportunity cost of labour for collecting the records of members	350	1.70	350	0.18
AE	2 Opportunity cost of farmers in ensuring water supply to their fields	13,125	63.82	1,57,500	82.20
	3 Expenditure incurred by farmers on food in ensuring water supply to their fields	0	0.00	25,000	13.05
<b>Total AE of Enforcement cost</b>		<b>13,125</b>	<b>63.82</b>	<b>1,82,500</b>	<b>95.25</b>
<b>Total transaction cost</b>		<b>20,566</b>	<b>100.00</b>	<b>1,91,604</b>	<b>100.00</b>

**Note:** OTE: One Time Expenditure and AE: Annual Expenditure.



**Table 4:** Transaction cost involved in establishment and sustenance of tank water users association per ha and per member

Sl. No	Particulars	Information cost		Contractual cost		Enforcement cost		Total cost (₹)	Transaction cost per ha (₹)	Transaction cost per member (₹)
		Total cost (₹)	Cost per ha (₹)	Total cost (₹)	Cost per ha (₹)	Total cost (₹)	Cost per ha (₹)			
<b>Farmers Managed Tank</b>										
1	OTE	2,705	22	5,906	47	150	1	8,761	70	110
2	AE	0	0	11,406	91	41,313	330	52,719	421	659
3	Total TC	2,705	22	17,313	125	41,463	331	61,480	491	769
<b>MID Managed Tank</b>										
4	OTE	3,310	79	3,781	90	350	8	7,441	177	186
5	AE	0	0	831	23	97,813	2,583	98,644	2,605	2,466
6	Total TC	3,310	79	4,613	112	98,163	2,591	1,06,085	2,782	2,652

**Note:** OTE: One Time Expenditure; AE: Annual Expenditure and MID: Minor Irrigation Department.

reach incurred a cost of ₹ 1,663 per year because of opportunity cost of labour. The farmers of tail end area met together and discussed on the next steps to be taken to ensure the water supply to their fields. The annual expenditure on enforcement cost accounted for 64 per cent and 95 per cent of the total transaction cost for head and tail reach farmers, respectively. The farmers in the head reach had to ensure that no one draws water illegally when it was their turn to use the water. Hence, the opportunity cost of labour in ensuring amounted to ₹ 13,125 per year.

The farmers in the tail end reach had to guard whole day and night to make sure that the farmers in head reach will not use water illegally. Nearly 5 farmers each at three main points had to guard the channels for nearly 10 days. Each farmer on an average spent about six hours a day in guarding. Hence, the opportunity cost of labour in guarding the channel amounted to ₹ 1,57,500 per year. The total transaction time spent by the farmers in tail reach was higher than the farmers in head reach and was because of free riding and illegal use of irrigation water by the head reach farmers. Bhattari (2010) reported that, total transaction time was more for the farmers at downstream (32 man days) as against 20 man days for the farmers in upstream of the canal.

It is clear from the analysis that, farmers in the head reach of MID managed tank incurred lower transaction cost than tail end farmers. This calls

for the rejuvenation of the defunct institution and ensure the equitable distribution of water between head and tail end. This helps in reduction of transaction cost incurred by tail reach farmers in MID managed tank area.

Total transaction cost incurred was high in MID managed tank or defunct water users association (₹ 1,06,085 per year) than farmers managed tank or active water users association (₹ 61,480 per year). This is because of free riding problem that prevailed in the MID managed tank command. Bhattarai and Bhusal (2015) reported that, transaction cost was high in the area with free riding than the area where they control free riding. Senaratne and Karunanayake (2006) revealed that, lowest average transaction cost was reported in farmers managed village tanks (₹ 25,088 per year) than the one managed by sub-group (₹ 35,717 per year) and third party (₹ 54,535 per year). The results are in line with the study conducted by Gururaj (2018) where it was noticed that, transaction cost was high in moderately performing water users cooperative society than better performing water users cooperative society.

Transaction cost per ha per year was ₹ 491 and ₹ 2,782 in farmers managed and MID managed tanks, respectively (Table 4). Hence, the hypothesis that transaction costs of governance are less in the tank managed by farmers than by MID was accepted. Increase in enforcement cost per member (₹ 2,591 and ₹ 331 in MID managed tank and farmers managed tank, respectively) due to defunct water

users association in MID managed tank was ₹ 2,260. Transaction cost per member was ₹ 769 and ₹ 2,652 in farmers managed tank and MID managed tank, respectively (Table 4). The results of the study thus emphasize the need for active water users association to reduce the transaction cost.

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## CONCLUSION

Transaction cost was more in the tank managed by the farmers through collective action than the tank managed by MID. Institutions are transaction cost reducing mechanism. Transaction cost in MID managed tank was more for the farmers in the tail end reach compared to head reach farmers. Free riding and illegal extraction of water enhanced the guarding time of the tail reach farmers resulting in higher transaction cost. Hence, such institutions which result in lowering the transaction cost must be adopted wherever transaction costs are high. Educating the farmers regarding the benefits of collective action is necessary to reduce the transaction cost. There is a need to rejuvenate the defunct institution to ensure collective action and achieve equity in distribution of water between head and tail end users in the tank managed by Minor Irrigation Department (Ayyanakere).

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