Economic Impact of Industrial Water Pollution on Agriculture and Rural Households in Bhavani River basin of Tamil Nadu

Abstract

Aim: To study the impact of industrial water pollution on Agriculture and rural households in Bhavani River basin of Tamil Nadu.

Study Design: Multistage random sampling

Place and Duration of the study: The study was conducted in the Sathyamangalam block of Erode district of Tamil Nadu during September 2021 to December 2021.

Methodology: Erode district of Tamil Nadu has been purposively selected due to high intensity of industrial units. In the second stage, Sathyamangalam block of Erode district, was selected based on the extent of external effects on land and water. In total, 360 respondents are selected as a sample, constituting ten persons in each affected and unaffected village. Both primary and secondary data were collected for the present study.

Results and Conclusion: The industrial water pollution in Bhavani River basin of Tamil Nadu leads to changes in agricultural pattern, reduction in farm income, decline in agricultural activities and most of the rural households were shifted to non-farming activities in this study area. In order to overcome these issues, it is suggested to develop alternative sources of water for irrigation.

Keywords: Economic impact, Industrial water pollution, agriculture, land value.

1. Introduction

Water, a priceless gift from nature to humans, is becoming more and more polluted due to growing urbanisation. Although water surrounds three-fourths of the world, just a small amount of it may be used for drinking. (Jonnalagada and Mhere, 2001) [1]. The ground water and surface water are the two major sources of water that are utilised for household, agricultural, and industrial uses. However, the water supply is becoming increasingly contaminated and depleted due to agricultural and industrial activity. (Behera, et al, 2002)[2]. Urbanization and economic development have a two-way effect on water resources, increasing demand as economic activity increases and resulting in pollution. The unregulated discharge of sewage and industrial effluents into surface water bodies has often been identified as a major cause of water quality degradation in urban India. (Srikanth, 2009)[3].

The primary cause of water pollution is the discharge of untreated industrial effluent into water sources. As a result of increasing industrialization and urbanisation, the water requirement for energy and industrial use is estimated to increase to around 18 percent of the total requirement in 2025. Poor environmental management systems, particularly in industries such as thermal power plants, leather processing, sugar mills, chemicals, metals and minerals, have resulted in the discharge of highly toxic and organic wastewater. This has led to the contamination of surface and groundwater sources, from which water is also obtained for irrigation and domestic consumption (CPCB 2012)[4].

While industries are essential for development, it is also crucial to be aware of the environmental effects of industries. Groundwater pollution is caused by the release of industrial effluents onto land and the dumping of sludge in and around the industry. Studies on their effect on groundwater quality indicate the presence of chromium in a polluted area's groundwater in excess of

the permissible limits for drinkable water standards (Sastry, et al, 2003)[5]. An estimated 55,000 million m3 of wastewater is produced by these industries per day, of which 68.5 million m3 is untreated and dumped directly into adjacent rivers and streams (Ministry of Water Resources 2002)[6]. The development of Common Effluent Treatment Plants (CETP) in industrial regions has been mandated by the government, but implementation has lagged and the majority of enterprises are either not connected to CETPs or only partially treat their effluent before disposal. Although practically all enterprises in India do not meet emission regulations, the Central and State Pollution Control Boards have recognised 1,532 as "grossly polluting" industries (World Bank, 1999)[7].

In India, several enterprises discharge their effluent into rivers. From 2016 to 2017, it is estimated that industries released 7,17 million tonnes of hazardous waste. (CPCB, 2017). There are around 17,000 polluting industries in Tamil Nadu, of which 700 are large, 2200 are medium, and 14,000 are small. It is disheartening to note that 6,500 small units, 450 large units, and 1,000 medium units are all classified as highly polluting enterprises (Appasamy, 2007)[8]. These industries discharge pollutants include heavy metals, organic compounds, and other toxic materials, which can have negative impacts on both human health and the environment. (TNPCB, 2021)[9]. The water bodies like the Cauvery, Bhavani, Noyyal, Cooum and Adyar rivers and the Bay of Bengal are highly affected by the industrial pollution (Gandhimathi, 2017)[10]. In light of these facts, an attempt was made to examine economic impact of Industrial water pollution on Agriculture and rural households in Bhavani River basin.

2.Review of Literature:

Reddy and Behera (2002) [2] analysed the impact of water pollution in terms of loss of agricultural production and income from livestock. The study was based on primary data collected from polluted and non-polluted areas in Andhra Pradesh. The estimated average wage loss due to illness, based on current wage rates, was Rs. 3,695 per household. In the past six years, it was stated that 338 cattle have died after drinking contaminated water. Over the years, the majority of the cattle have fallen sick. Reportedly, the reproductive ability of the cows has diminished. Reductions in the milk yield of buffaloes and cows were also observed. It revealed that the cost due to pollution was higher. Passing of laws alone would not reduce the industrial pollution.

Indu *et al.* (2010) [11] conducted a study to assess the impact of Groundwater Contamination with Fluoride and Arsenic in the semiarid to arid western states of Rajasthan and Gujarat, also in the southern states of Tamil Nadu, Karnataka and Andhra Pradesh. Fresh drinking water in these areas is contaminated with fluoride, which indicates that only those with high incomes can afford to drink water that is safer to consume. The cost of medicines and loss of wages represented a significant portion of the earnings afflicted households and had a higher impact on their income. More than fifty-three percent of the total sample population from all the locations suffer from at least one symptom of 1–6 in the age group of 16 and 40, irrespective of gender, and incurring high medical expenses on account of fluorosis, ranging from 6 to 25 percent of the annual income of the affected families.

Sarathamani *et al.* (2014) [12] examined the economic impacts of water pollution on agricultural and rural households in five villages located in close proximity to the industrial estate in Pollachi, Tamil Nadu. The study revealed that the water bodies around the industrial area were extremely polluted. The income wise analysis revealed that 66.9292 percent of respondents in the income group of Rs.5000-8000/- and 44.92 percent of respondents in the income group of Rs.8000-12000 are affected by drinking water pollution, and that more than 60 percent of respondents in the

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wage labour category (62.3 percent) suffer frequently from dysentery and diarrhoea. More over one-third of industrial workers (36.92%) suffer from both vomiting and diarrhoea. Due to drinking polluted water, the majority of government employees suffer occasionally from water-borne diseases. Consequently, respondents will incur additional medical expenses. In addition, the quantity of soil is diminished, which leads to a decrease in crop production.

3. Methodology:

Both primary and secondary data were collected for the present study. The multistage random sampling method has been adopted. For the present study, Erode district of Tamil Nadu has been purposively selected due to high intensity of industrial units. In the second stage, Sathyamangalam block of Erode district, was selected based on the extent of external effects on land and water. Based on the discussions held with the government departments like Tamil Nadu Pollution Control Board and Agricultural departments, the sample villages were classified as affected and unaffected. For the present study, eighteen affected villages which are very near to the industrial area of Sathyamangalam were selected. The eighteen unaffected study villages selected were located near the affected study villages to ensure otherwise similarity in agro-climatic conditions. In total, 360 respondents are selected as a sample, constituting ten persons in each affected and unaffected village. Interview schedules were used to collect information on the socioeconomic profile of the farmers, farm assets, farm income, farm expenditure, details regarding cropping patterns, types of industrial pollution, causes and effects of industrial pollution on agriculture, etc. The secondary data collected from the report of the Tamil Nadu Pollution Control Board, Village administrative office, District statistical office and other relevant data were collected and analysed.

4. Results and Discussion:

The occupational distribution of the household members is reported in the Table 1. In the affected villages none of the households depended on farm activities alone. The employment of the respondents in on-farm activities was reported to be higher (28.89 per cent) in the unaffected villages where as it was only about two 4.44 per cent in the affected villages. Employment through the combination of both on-farm and non-farm activities was observed to be much higher (79.44 per cent) in the affected villages, whereas it was 62.22 per cent in unaffected villages.

Table 1: Occupational distribution of the households

S.No	Particulars	Affected villages		Unaffected villages	
		Number	Per cent	Number	Per cent
1.	Crop alone	-	-	13	7.22
2.	Crop + Dairy activities	8	4.44	52	28.89
Total households engaged in on farm activities alone		**8**	**4.44**	**65**	**36.11**
3.	On farm + Non farm activity	143	79.44	112	62.22
4.	On farm + Off farm + Non farm activity	14	7.79	3	1.67
5.	Non farm activity	15	8.33	-	-
	Total	**180**	**100**	**180**	**100**

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The details of the generated by the households are presented in Table 2. In the affected villages, none of the farm households depended on non-farm activities alone. The average annual income earned through the combination of on-farm and non-farm activities was found to be higher

(84.96 per cent) in the affected villages compared to 67.9 per cent in the unaffected villages. In the affected villages, the income from the on-farm activities alone was higher (25.21 per cent) when compared to the affected area (0.83 per cent). The combination of all the three activities (on-farm, off-farm and non-farm) was observed to be much higher (3.48 per cent) in the affected villages than in the unaffected villages (0.68 per cent). The average income of households were Rs. 2,37,486 in affected villages and marginally higher at Rs. 2,85,542 in unaffected villages.

Table 2: Pattern of income of the households (in Rs.)

S.No	Particulars	Affected villages		Unaffected villages	
		Number	Per cent	Number	Per cent
1.	Crop alone	-	-	17715	6.20
2.	Crop + Dairy activities	1984	0.83	71997	25.21
Total households engaged in on farm activities alone		**1984**	**0.83**	**89712**	**31.41**
3.	On farm + Non farm activity	201784	84.96	193887	67.91
4.	On farm + Off farm + Non farm activity	8236	3.48	1943	0.68
5.	Non farm activity	25482	10.73	-	-
	Average annual income per household	**237486**	**100.00**	**285542**	**100.00**

The location and average month of operation of the industrial unit are presented in Table 3. The distance between the sample farm holdings and the industries was less than a kilometre (0.89 km). Out of 180 respondents interviewed, 112 were of the view that dyeing was their main activity in their villages. The period of operation of factories ranged from 9 months to12 months.

Table 3: Location of industries and average month of operation of industries

S.No	Particulars	Polluted villages
1.	Proximity (in km)	0.89
2.	Average month in operation/year	9-12

The farmer's perceptions about the decline in agricultural activities are reported in Table 4. Out of 180 respondents from the affected study area, 79.44 per cent expressed that decline in agricultural activities due to poor water quality followed by water scarcity (67.78) and labour scarcity (60 per cent). The other reasons for failure of agricultural activities were poor crop stand (37.77 per cent), decline in agricultural income (32.22 per cent) and decline in water table (18.33 per cent).

Table 4: Farmers' opinion on decline of agricultural activities (per cent)

S.No	Particulars	Affected category
1.	Poor water quality	79.44
2.	Water scarcity	67.78
3.	Labour scarcity	60
4.	Poor crop stand	37.77
5.	Decline in agricultural income	32.22

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6.	Decline in water table	18.88

The change in the value of agricultural lands were reported in Table 5. In the affected villages, the demand for the land increased, because of the increasing levels of industrial activities and the farmers sold their crop lands for house sites and industrial activities. Due to shortage of lands, the value of the crop lands increased five to seven times in the affected areas whereas in unaffected areas, it was only two to four times only.

Table 5: Changes in value of agricultural lands (Rs/ha)

S.No	Particulars	Affected villages	Unaffected villages
1.	2014-15	38,32,618	13,07,143
2.	2020-21	87,27,066	35,96,367

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Conclusion:

~~It is concluded from the present study that the~~ The industrial units in Bhavani River basin of Sathyamangalam block causes water pollution and impacts the agriculture as well. In the unaffected villages, the employment of the respondents in on-farm activities was reported to be higher than the affected villages. The average income of households in affected villages were significantly lesser than in unaffected villages. The affected study area faced significant level of decline in agricultural activities due to poor water quality followed by water scarcity and labour scarcity. In the affected villages, the demand for the land increased, because of the increasing levels of industrial activities and the farmers sold their crop lands for house sites and industrial activities. The shortage of lands, the value of the lands increased five to seven times in the affected areas whereas in unaffected areas, it was only two to four times only. These above-mentioned reasons lead to changes in agricultural pattern, reduction in farm income and causes decline in agricultural activities and most of the rural households were shifted to non-farming activities in this study area. Hence, it is suggested to develop alternative sources of water for irrigation and the government should take the appropriate measures to ensure the industrial water pollution has been treated before discharge into the river.

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