

An Economic Impact of Dyeing and Bleaching Industrial Pollution in Erode District of Tamil Nadu

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Abstract:

Pollution continues to be a major global concern and the need for a clean environment has become more pressing than ever. While economic growth and industrialization have brought prosperity, they have also transformed clean air, water, and land from free resources into scarce commodities. The basic need for a human life is water that had been polluting because of industrialisation especially dyeing industries as a result it had consequences for human health. Thus, the study examines the socio-economic conditions and health impacts of industrial pollution caused by textile dyeing and bleaching industries in Erode district of Tamil Nadu. Primary data were collected from 100 households through well-structured interview schedule using random sampling method. The study found that contaminated water sources have led to skin diseases, respiratory problems, and gastrointestinal disorders. The result shows that the respondents suffer from higher financial burden due to increased healthcare costs and income loss due to sickness. There is common effluent treatment plants have been established, but, inefficiencies and poor maintenance lessen the effectiveness of the plants. The study suggests that the government could make some strict pollution regulation, and the industries should monitor Common Effluent Treatment Plants (CETPs) to safeguard livelihoods and ensure environmental sustainability in the region.

Keywords: Industrial Pollution, Health Impacts, Financial Burden, Water Quality, Income Loss

1. Introduction:

Water is a fundamental natural resource that covers major portion of the Earth's surface and plays a vital role in sustaining life, maintaining ecological balance and supporting agriculture, industry and human health. Despite its abundance, availability of usable fresh water remains limited, underlining the urgency of its conservation and sustainable management (United Nations Educational Scientific and Cultural Organisation, 2022). Freshwater systems not only sustain biodiversity but also ensure food security, industrial productivity and public health. However, rapid population growth, urban expansion, industrialization and climate change have intensified stress on water resources, leading to scarcity, irregular availability, and declining quality (Food and Agricultural Organisation, 2021). Industrial and agricultural activities have become major contributors to water pollution, with untreated effluents, fertilizer runoff, and improper waste disposal introducing harmful pollutants into rivers, lakes, and

groundwater. Such contamination undermines agricultural productivity, disrupts ecosystems, and creates severe public health risks (World Bank, 2020). In particular, water-intensive industries such as textile dyeing release large volumes of chemically laden wastewater containing dyes, salts, and heavy metals, which degrade both soil and water resources. The textile sector, concentrated in regions such as Tamil Nadu, has been reported to cause significant ecological damage and livelihood disruption through water and soil contamination, as well as increased incidence of health hazards among nearby populations (Central Pollution Control Board, 2021). Evidence shows that nearly 72% of India's industrial wastewater is discharged into surface water bodies without adequate treatment, exacerbating water pollution and reducing its usability for domestic or agricultural purposes (Central Pollution Control Board, 2021). Small and medium-scale industries, which often lack advanced treatment facilities, are responsible for nearly 45% of this pollution burden (National Institution for Transforming India Aayog, 2023). This results in severe consequences like India alone records more than 2.3 million premature deaths annually due to pollution-related illnesses, ranking among the highest globally (Global Alliance on Health and Pollution, 2023). These challenges highlight the urgent need for integrated water management strategies, stricter regulatory enforcement, technological upgrades in wastewater treatment, and enhanced community awareness to mitigate pollution and safeguard long-term ecological and socio-economic stability.

2. Review of Literature:

Tariq and Mushtaq (2023) discussed the major causes, sources and impacts of untreated wastewater in most affected areas and cities. The study systematically analyses the various studies to find out the primary causes of untreated wastewater and used the quantitative review. The study highlighted that the surface and ground water was highly polluted due to rapid industrialization, urbanization, population growth, improper waste water treatment plants and agricultural runoff. The study found that the untreated water contamination causing problem severe in South Asia, East Asia, Sub-Saharan Africa and Latin America and also high-income countries treat 70 percent of wastewater whereas low-income countries treat only 8 percent of waste water. The study concluded that improper waste treatment causes ecological damages, economic losses and serious health hazards and also recommends improvement in water quality, strict legislative measures and awareness among public.

Alam et.al., (2023) analysed the negative impact of textile industrial pollution on environment and socio-economic conditions due to untreated industrial effluents and improper treatment of waste in Bank town and Baraigram areas of Bangladesh. The study revealed that the discharge of untreated industrial effluents and solid waste from textile industries into Karnatali River affected the quality of water, air, soil created diseases among people, reduce the features of agricultural land, and also makes socio-economic stress. The study highlights the need to conduct an EIA and proper feasibility study of the industries to address the impact on agricultural land, human health and the socio-economic condition. The study suggests to improve the policy measures to safeguard the environment, people and economy of the country.

Govindarjalu (2003) examined the impact of industrial effluents make changes in micro environment, damage to crops, animal husbandry, health status of people and even sanitation in rural communities around the Noyyal River Basin. The study attempts to identify the nature and impact of water pollution, and to evaluate the impact of industrial effluent on human health. The primary data were collected through random sampling method and correlation was used to find out the relationship between industrial pollution and health hazards. The study found out that the river was severely contaminated due to industrial waste water disposal and 25 percent of people were affected by water borne diseases and also the contaminated

water has negative impacts on agriculture and livestock. The study highlights the urgent need for implementation of effective pollution control measures and proper waste water treatment plants.

3. Objectives:

- To evaluate the demand side of household domestic water consumption.
- To examine the average consumption of water (LPCD) and status of water quality in the study area.
- To analyse factors influencing the treatment cost due to dyeing and bleaching industrial pollution.

4. Methodology

The study examines the impact of dyeing industry among households in Erode district of Tamil Nadu. Erode district consists of 14 blocks among them, Bhavani Block has the majority of dyeing industries. In Bhavani Block, Kadayampatti village and Periyapuliur village were randomly selected which highly affected areas due to dyeing and bleaching industrial pollution. A total of 100 sample households has been undertaken for this study. 50 households in Kadayampatti and 50 households in Periyapuliur were taken. The study was based on primary data. Primary data was obtained through a well-structured questionnaire. The collected data has been analyzed and interpreted using the average and percentage methods.

5. Hypothesis

The influencing factors of treatment cost of the household were age, family members, years of living, family income and distance from the industry.

6. Data Analysis:

Table 1: Industrial Wastewater mix in water bodies

Name of the Area	Industrial water Mix in water bodies		Total
	Aware	Unaware	
Kadayampatti	40 (80.00) [85.10]	10 (20.00) [18.90]	50 (100.00) [50.00]
Periyapuliur	7 (14.00) [14.90]	43 (86.00) [81.10]	50 (100.00) [50.00]
Total	47 (47.00) [100.00]	53 (53.00) [100.00]	100 (100.00) [100.00]

Source: Primary data (2025); () – Row wise Percentage; [] – Column wise Percentage

Table 1 shows the analysis of industrial water mixing in local water bodies in Kadayampatti and Periyapuliur. In Kadayampatti, 80 percentage of respondents were aware about the industrial wastewater mixes into the water bodies, only 14 percent of the respondents were not aware about contamination in waterbodies. In contrast, Periyapuliur only 14 percent of the respondents were aware about industrial wastewater mixing, maximum respondents were not aware about the contamination of industrial waste water into water bodies.

Table 2: Consumption of contaminated water

Name of the Area	Consumption of contaminated water		Total
	Yes	No	
Kadayampatti	31 (62.00) [60.80]	19 (38.00) [38.80]	50 (100.00) [50.00]
Periyapuliur	20 (40.00) [39.20]	30 (60.00) [61.20]	50 (100.00) [50.00]
Total	51 (51.00) [100.00]	49 (49.00) [100.00]	100 (100.00) [100.00]

Source: Primary data (2025); () – Row wise percentage; [] – Column wise percentage

Table 2 shows the consumption of contaminated water in Kadayampatti and Periyapuliur. In Kadayampatti, 62 percentage of respondents consumed contaminated water, while 38 percentage of respondents were not consuming contaminated water. In Periyapuliur, only 40 percentage of families consuming contaminated water, while 60 percentage of respondents using clean water for consumption, contributing to 61.2 percentage of the total families with clean water usage. The table reveals that Kadayampatti has a higher rate of contaminated water consumption compared to Periyapuliur.

Table 3: Frequency and quantity of water collected

Name of the Area	Water collection Frequency			No of litters collected	
	Daily	Twice a week	Total	Statistics	Water Collected
Kadayampatti	50 (100.00) [53.20]	0 (0.00) [0.00]	50 (100.00) [50.00]	Sum Mean N	3316 66.32 50
Periyapuliur	44 (88.00) [46.80]	6 (12.00) [100.00]	50 (100.00) [50.00]	Sum Mean N	7539 150.78 50
Total	94 (94.00) [100.00]	6 (6.00) [100.00]	100 (100.00) [100.00]	Sum Mean N	10855 108.55 100

Source: Primary data (2025); () – Row wise percentage; [] – Column wise percentage

Table 3 depicts that the water collection frequency and the quantity collected for cooking and drinking of Kadayampatti and Periyapuliur. In Kadayampatti village all the respondents used to collect water daily with the average of 66.32 liters per family. But in Periyapuliur village, 88 percentage of families collect water daily with the average of 150.78 liters per family, while 12 percent collect it twice a week. The table concludes that in both areas, 94 percentage of families collect water daily, while only 6 percentage collect it twice a week with an average of 108.55 litres.

Table 4: Consumption of water for Domestic Purpose (LPCD) (in litres)

Name of the Area	Statistics	Drinking	Cooking	Bathing	Cleaning House	Livestock	Gardening	Washing clothes	Washing vessels	Vehicle washing	Total water consumed	LP CD
Kadayampatti	Sum	619	974	2595	370	1620	1170	3025	2250	369	12992	2266.56
	Mean	12.36	19.48	51.90	7.40	32.40	23.40	60.50	45.00	7.38	259.84	45.33
	N	50	50	50	50	50	50	50	50	50	50	50
Periyapuliur	Sum	668	1335	3380	500	895	775	3080	2235	395	13263	2830.67
	Mean	13.36	26.70	67.60	10.00	17.90	15.50	61.60	44.70	7.90	265.26	56.61
	N	50	50	50	50	50	50	50	50	50	50	50
Total	Sum	1287	2309	5975	870	2515	1945	6105	4485	764	26255	5097.23
	Mean	12.87	23.09	59.75	8.70	25.15	19.45	61.05	44.85	7.64	262.55	50.97
	N	100	100	100	100	100	100	100	100	100	100	100

Source: Primary data (2025)

Table 4 shows the consumption of water for domestic purpose and liters per consumption per day. In the Kadayampatti, the total average water consumption in a family was 259.84 liters, for washing the clothes they spend an average of 60.50 liters, followed by 51.90 liters, for washing vessels they spend average of 45 liters, for livestock the spend average of 32.40 liters of water, for cooking they spend average by 19.48 liters and for drinking they spend an average of 12.36 liters, per person they spend an average of 45.33 liters. In Periyapuliur, the total water consumption was 265.26 liters, major portion of the water 67.60 liters of water spend on bathing purpose, 61.60 liters of water spend on washing clothes purpose, followed by 44.70 liters of water was spend on washing vessels, followed by 26.70 liters used for cooking purpose, and 56.61 liters was used as per person per day liters consumption. The table revealed that the total water consumed across both areas is 26,255 liters, with an average LPCD of 50.97 liters. Periyapuliur shows higher water consumption, especially for bathing and cooking, suggesting a relatively higher standard of living or larger family size compared to Kadayampatti. Kadayampatti families consume less water overall, possibly due to limited water availability or differences in domestic habits.

Table 5: Health issues due to Water Contamination

Name of the Area	Health issues		Total
	Yes	No	
Kadayampatti	33 (66.00) [51.60]	17 (34.00) [47.20]	50 (100.00) [50.00]
Periyapuliur	31 (62.00) [48.40]	19 (38.00) [52.80]	50 (100.00) [50.00]
Total	64 (64.00) [100.00]	36 (36.00) [100.00]	100 (100.00) [100.00]

Source: Primary data (2025); () – Row wise percentage; [] – Column wise percentage

Table 5 shows health issues caused by water contamination in both Kadayampatti and Periyapuliur. In Kadayampatti, 66 percentage of respondents have health issues due to water contamination, while 34 percentage reported no health issues. Similarly, in Periyapuliur, 62 percentage of families affected due to health-related problems, while 38 percentage did not experience any health-related effects. This table indicates that a majority of families in both areas are experiencing adverse health effects, highlighting the need for improved water quality, better treatment practices, and increased community awareness to prevent waterborne diseases.

Table 7: Health Impacts Due to Industrial Pollution

Name of the Area	Health Impacts						
	Skin diseases	Dysentery	Abdominal Cramps	Vomiting	Jaundice	Fever	Throat infection
Kadayampatti	19 (38.00) [52.80]	6 (12.00) [42.90]	28 (56.00) [100.00]	36 (72.00) [92.30]	6 (12.00) [100.00]	32 (64.00) [59.30]	24 (48.00) [47.10]
Periyapuliur	17 (34.00) [47.20]	8 (16.00) [57.10]	0 (0.00) [0.00]	2 (4.00) [7.70]	0 (0.00) [0.00]	22 (44.00) [40.70]	27 (54.00) [52.90]
Total	36 (36.00) [100.00]	14 (14.00) [100.00]	28 (28.00) [100.00]	39 (31.00) [100.00]	6 (6.00) [100.00]	54 (54.00) [100.00]	51 (51.00) [100.00]

Source: Primary data (2025); () – Row wise percentage; [] – Column wise percentage

Table 7 indicates type of health impacts by respondents from Kadayampatti and Periyapuliur due to the consumption of contaminated water. In Kadayampatti, 38 percent of respondents have skin diseases, 64 percent have fever, and 56 percent have Abdominal Cramps, 48 percent have throat infections, 12 percent of respondents have Dysentery and Jaundice and 72 percent of respondents have vomiting sensation. In Periyapuliur, majority of 54 percent have throat infections, 44 percent affected due to fever, 34 percent have skin diseases, and 16 percent of respondents have affected by Skin diseases. Notably, abdominal

cramps and jaundice were not reported in Periyapuliur. The most common health issues due to water contamination across both areas were fever, throat infection and fever.

Table 8: Highly affected age group by industrial pollution

Name of the Area	Highly Affected Age Group					Total
	Children	Old Age	Middle Age	All Age	None	
Kadayampatti	6 (12.00) [54.50]	7 (14.00) [58.30]	3 (6.00) [60.00]	21 (42.00) [46.70]	13 (26.00) [48.10]	50 (100.00) [50.00]
Periyapuliur	5 (10.00) [45.50]	5 (10.00) [41.70]	2 (4.00) [40.00]	24 (48.00) [53.30]	14 (28.00) [51.90]	50 (100.00) [50.00]
Total	11 (11.00) [100.00]	12 (12.00) [100.00]	5 (5.00) [100.00]	45 (45.00) [100.00]	27 (27.00) [100.00]	100 (100.00) [100.00]

Source: Primary data (2025); () – Row wise percentage; [] – Column wise percentage

Table 8 shows the most affected age groups by industrial pollution in Kadayampatti and Periyapuliur. In Kadayampatti, 42 percent of respondents reported that all age groups are highly affected by industrial pollution, followed by 26 percent indicating that none of the age groups are affected. There are 12 percent of respondents reported that children are the most affected, whereas 14 percentage said that the old age group and 6 percentage notified that middle age group is highly affected. Likewise in Periyapuliur with 48 percentage of respondents indicating that all age groups are affected, while 28 percentage reported that none of the age groups are affected. Among individual age groups, 10 percentage identified children and 10 percentage pointed to the old age group as being highly affected, while 4 percentage reported that the middle age group is affected. The table found that all age group people were affected by health issues caused by polluted water due to discharge of industrial waste into water bodies.

Table 9: Average Treatment Cost and Man days loss per month

Name of the Area	Statistics	Treatment cost	Loss of pay
Kadayampatti	Sum	85000	12000
	Mean	1847.83	1090.91
	N	46	11
Periyapuliur	Sum	78100	9500
	Mean	1562.00	1187.50
	N	50	8
Total	Sum	163100	21500
	Mean	1698.96	1131.58
	N	96	19

Source: Primary data (2025)

Table 9 shows the monthly treatment costs incurred by respondents from Kadayampatti and Periyapuliur. In Kadayampatti, average monthly treatment cost of ₹1,847.83 was spend per respondent and in Periyapuliur, average monthly treatment cost was ₹1,562 per respondent. The table depicts that the average treatment cost is higher in Kadayampatti compared to Periyapuliur, possibly indicating higher healthcare needs or more frequent medical visits in Kadayampatti. The average of 1090.91 and 1187.50 rupees were lost due to the inability of respondents to go for work at the time of illness in Kadaiyamapatti and Periyapuliur. The table concludes that the amount spent for treatment as a result of their illness and the loss of pay caused by their absence in work hours has created a socio-economic impact on the respondents.

Table 10: Regression Analysis

Age, Family members, years of living, family income and Distance from the Industry are the factors influencing the Treatment Cost

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2804.579	458.819		6.113	0.000
Age	6.249	10.293	0.084	0.607	0.042*
Family Size	2.334	78.449	0.031	0.285	0.025*
Years of Living	12.864	6.572	0.037	0.284	0.000**
Family Income	0.002	0.010	0.023	0.213	0.032*
Distance	-529.688	53.057	-0.729	-9.983	0.000**
R Square	0.575				
Adjusted R Square	0.543				

Source: Computed primary data ** 1% level of significant, * 5% level of significant

$$y = a + bx_1 + bx_2 + bx_3 + bx_4 + bx_5 + \mu$$

In table 10 Regression analysis, the R Square value of 0.575 depicts that the selected socio-economic and geographical variables jointly explain a significant amount of variation in treatment cost. The variables such as age, family size, years of residence and family income has a significant impact on treatment cost shows that the older people, long-term residence, larger households and higher income families spend large amount for treatment. There is a significantly negative correlation between treatment cost and distance from the industry. The households closer to the industry pay significantly pay more for treatment cost than the household lives father away. The socio-economic factors and distance from the industry majorly influence the treatment costs in the study area.

Conclusion:

The study clearly reveals that the discharge of effluents from dyeing and bleaching textile industries has led to water contamination, which in turn affects the health and economic conditions of the local

communities. The households living proximity to the textile industry facing health problems particularly waterborne diseases such as skin diseases, throat infection, and fever affecting all age groups especially children and old age groups severely which has led to increase in medical expenses and loss of income. The study suggests that the industrial pollution creates a significant impact on socio-economic conditions of affected families highlights the urgent need for improvement of effluent treatment plants and strict regulations in pollution control measures.

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