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Comparative Analysis on Impact of Industrial Pollution on Commodity Value in Erode District

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ABSTRACT:
This research examines how agricultural production is affected by industrial water pollution, namely from dyeing and bleaching facilities, in Tamil Nadu's Noyyal River Basin, with a focus on the Chennimalai block in the Erode district. Data from 246 people chosen by systematic random sampling, or 20% of the local population, were analyzed using a mixed-methods approach using a paired sample test design. A thorough grasp of the impacts of pollution on the area's agriculture was the goal of this meticulous sampling. Within a five-kilometer radius, the study divided sample houses into contaminated and non-polluted villages. These villages were selected because of the high concentration of industrial facilities and the regular reports of water pollution impacting nearby populations. By contrasting circumstances prior to and following industrial pollution (BIP vs. AIP), the investigation tested a number of variables, such as yield variations, commodity price, and agricultural productivity. Important government programs to reduce pollution, particularly Individual Effluent Treatment Plants (IETPs) and Common Effluent Treatment Plants (CETPs), were a major focus of the study. Critical evaluation was done on how well these measures worked to lower pollution levels and how they affected the environment later on. In addition to harming locals' health, the study discovered that industrial water contamination in the Noyyal River watershed significantly reduced agricultural production. Higher cultivation costs, lower commodity prices, and poorer total yields were the results of this drop. As a solution to these urgent problems, the report highlights the necessity of stringent regulations and suggests creating alternate water sources for agricultural usage. It encourages businesses to use cutting-edge pollution-reduction techniques prior to releasing wastewater into the river in an effort to improve agricultural sustainability and protect local public health. Through the implementation of these solutions, the research aims to assist the livelihoods of farmers impacted by pollution and promote a healthier ecosystem.

***Keywords**: Dying and bleaching industry in Erode district: Agriculture Productivity: BIPs &AIP: Polluted and Non-polluted villages: Economic consequences.*

I. INTRODUCTION:

An important element of India's export economy, the Erode region in Tamil Nadu is renowned for its superior food, textile, and turmeric goods. Known as the "Turmeric City," Erode is growing sugarcane and bananas and is one of India's biggest producers of turmeric. Crops that thrive in the area's arid environment and little rainfall are preferred. Particularly at Bhavani, where in-demand cotton and silk textiles are made, Erode has a thriving handloom sector that has established a significant wholesale and retail center. The district's dairy industry, which is vital to the production and processing of milk, is also robust and is headed by the Aavin cooperative. Erode exports to a number of nations, including those in Southeast Asia, the United States, the United Arab Emirates, Japan, and Saudi Arabia.

The Palar River flows through the district's northern regions, while the Cauvery and Noyyal rivers are vital to its agricultural economy. Although Erode concentrates on exporting textiles and agricultural products, it also strategically imports raw materials and machinery, which helps Tamil Nadu and India's economies flourish. But in recent decades, Erode's environment has been greatly damaged by industrialization, especially in the agricultural sector. Agricultural productivity has been impacted by industrial pollution, particularly in the Noyyal River, making it difficult to maintain the district's traditional crop-based economy in the face of industrial expansion demands.

1.1 Agricultural Landscape Before Industrial Impact:

- **Bountiful Soil and Agricultural Prosperity:** The Kaveri River runs through Erode, which is well known for its rich soil that has allowed for the production of a wide range of products, including rice, sugarcane, bananas, coconuts, turmeric, and more.
- **Pristine Water Resources:** High crop yields and superior produce for regional agriculture were guaranteed by Erode's clean lakes, rivers, and groundwater supplies, which offered copious amounts of uncontaminated irrigation.
- **Sustainable Agricultural Practices:** Traditionally, farmers have maintained the fertility and health of their land by using organic manure and artificial fertilizers sparingly. This practice has been sustainable for millennia.
- **Synergistic Effects of Climate on Crops**: Semi-arid environments and monsoon rains improved soil fertility, allowing many areas to support two crop cycles per year.

1.2 Post-Industrial Pollution Impact:

- **Water Quality Degradation**: The Kaveri River and other water bodies are now more polluted as a result of the expansion of the paper milling, leather processing, and textile dyeing industries.
- **Erosion of Soil Vitality**: Polluted by chemicals and heavy metals, industrial runoff has degraded soil, reduced fertility, and raised acidity, all of which have an impact on crop quality and yield.
- **Consequences for Yield and Crop Quality**: The quality of crops, especially turmeric, was adversely affected by industrial pollutants in irrigation water, which resulted in slower growth rates and poorer yields, which ultimately affected farmers' profits.
- **Transition to Chemical-Heavy Agriculture**: Due to the decrease in soil fertility, farmers began using chemical pesticides and fertilizers to increase crop yields, which degraded the soil and reduced the land's suitability for organic farming.
- **Impact on Health and Economic Stability**: As soil fertility decreased, farmers turned to chemical pesticides and fertilizers to boost crop yields, degrading the soil and reducing the land's suitability for organic farming.

- **1.3 Agricultural Status in Erode: Challenges and Opportunities:**

- **Actions for Enhanced Regulation**: Even though dyeing facilities and other companies have effluent treatment plants installed, the government has imposed more stringent rules for the discharge of industrial effluent, yet irregular adherence to these rules results in sporadic pollution events.
- **Strengthening Awareness for Sustainable Development**: Farmers and businesses are becoming more conscious of sustainable farming methods and the significance of lowering chemical dependency. In order to reduce soil pollution, some farms are switching back to organic practices and using cleaned water sources.
- **Integration of Alternative Crop Varieties**: By concentrating on crops that are less affected by problems with soil and water quality, some farmers are progressively diversifying their agricultural output.
- **Support from Government and Non-Governmental Organizations**: Through financial aid, subsidies, and training for drip irrigation systems, several groups are advancing sustainable agriculture with the goal of lowering pollution and water consumption through organic farming.
- **Enduring Issues in Agricultural Practices**: Despite advancements, problems including soil pollution, fluctuating water quality, and the need on chemical inputs continue to exist, impacting farmers' crop yields and placing financial strain on smaller landholdings.

Industrial pollution has affected Erode's agricultural sector, leading to both adaptation and deterioration. Erode's agricultural heritage must be preserved, sustainable methods must be encouraged, and health must be restored despite advancements in environmental regulations. Restoring and desilting contaminated water bodies and working with neighborhood organizations to lower pollution and enhance water quality are important projects.

Recharge wells and rainfall collection systems are installed as part of groundwater recharge projects to increase the quality and availability of groundwater. In order to restore natural groundwater supplies, the government supports community-driven water conservation measures. In order to offer clean drinking water and lower health hazards for locals, public water purification units and RO plants are installed in impacted regions.

II. OBJECTIVE:

➢ To explore the relationship between industrial pollution and its effects on agricultural output and sustainability.

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➢ To examine government strategies for minimizing environmental harm through CETPs and IETPs.

III. RESEARCH METHODOLOGY:

This study uses a quantitative research technique to examine the effects of the dyeing and bleaching business in Erode District on human and environmental health. Two villages, Chennimalai (non-polluted) and Orathapalayam (polluted), five kilometers apart, provided data using a methodical questionnaire. Twenty percent of the 1,231 people living in these communities, or 246 respondents, made up the sample. Demographic characteristics were evaluated using percentage analysis, and the associations between changes in agricultural production prior to and following industrial contamination were evaluated using sample t-test procedures. The purpose of the study is to provide light on how industrial pollution affects local communities and agricultural output.

IV. REVIEW OF LITERATURE:

Paul P. Appasamy and N. Jayakukar Etl., (2015): Due to deregulation, India's cotton textile and apparel industries have grown significantly, driven by cheap labor and abundant materials. However, contamination from bleaching and dyeing facilities has led to environmental problems, especially in Tiruppur, Tamil Nadu. The budgetary limitations of small-scale facilities present enforcement issues for the State Pollution Control Board. Common Effluent Treatment Plants (CETPs) have harmed local fisheries, agriculture, and water quality while failing to reduce pollution. In addition to legislative incentives and enhanced monitoring, cleaner manufacturing technologies and collective management solutions are proposed.

Jayanth Sarathi N and Karthik R Etl., (2011): In Tiruppur, South India, the cotton knitwear sector is responsible for 80% of India's exports. A good environment, a wealth of raw materials, and cheap labor costs all contribute to its success by creating jobs locally and generating foreign exchange. However, local agriculture has suffered due to the industry's high water usage, which has resulted in acute shortages. The Noyyal River and Orathupalayam dam have been contaminated by untreated dyeing and bleaching effluents, resulting in poor soil and water quality that impacts fisheries and agriculture.

V. RESULTS & DISCUSSION:

In food grain farming, the study finds notable disparities in economic metrics between Before Industrial Pollution (BIP) and After Industrial Pollution (AIP).

Table: 5.1 BIP & AIP *Food Grains* – Paired Sample Test:

BIP & AIP		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Food Grains	Cultivation Expenditure	.34700	1.06824	.23311	-.13926	.83326	1.489	20	.152
	Cultivation Expenditure Acre	2.34040	1.27986	.27929	1.75781	2.92299	8.380	20	.000
	Commodity Value (A)	.86501	1.07178	.23388	.37714	1.35288	3.698	20	.001
	Price Per KG	.63328	1.48618	.32431	-.04322	1.30978	1.953	20	.065
	Commodity Final Price (B)	.25230	.96857	.21136	-.18859	.69319	1.194	20	.247
	Total Commodity Final Price	.86501	1.07178	.23388	.37714	1.35288	3.698	20	.001
	Cost of Yield (A) - Loss (B)	.20539	.94397	.20599	-.22430	.63507	.997	20	.331
	Total Cost of Yield (A) - Loss (B)	.84069	1.03381	.22560	.37010	1.31128	3.727	20	.001

Source: Primary Data

Significant differences between Before Industrial Pollution (BIP) and After Industrial Pollution (AIP) are found by analyzing paired differences for a number of economic indicators in food grain farming. Higher BIP levels are often indicated by positive mean differences. A mean difference of 2.34040 for "Cultivation Expenditure Acre" for example indicates that BIP has higher costs per acre, which may have an impact on profitability.

The standard deviation and standard error mean values in the findings show how different pairs might be from one another; higher standard deviations indicate more disparities. If it excludes zero, the 95% Confidence Interval of the Difference aids in confirming substantial differences. Higher absolute values indicate more evidence against the null hypothesis. The t-value measures the distance between the mean difference and zero.

With a p-value of 0.001, the main results show that BIP obtains higher commodity values and prices, which is probably due to improved market positioning. The mean difference for Commodity Value (A) and Total Commodity Final Price is 0.86501. Although the Cultivation Expenditure mean difference is 0.34700 (p-value of 0.152), it is not statistically significant. A tendency toward better pricing for BIP is shown by the Price Per KG's mean difference of 0.63328 (p-value of 0.065), albeit this trend is not statistically significant. Cost of Yield (A) - Loss (B) and Commodity Final Price (B) did not differ significantly.

In terms of expenses per acre, commodity values, and final prices, BIP exhibits notable benefits, indicating the possibility of increased profitability and indicating that AIP requires tactics to improve cultivation methods and market participation.

Table: 5.2 BIP & AIP *Commercial Crops* – Paired Sample Test:

BIP & AIP		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Commercial	Cultivation Expenditure	2.31485	1.28370	.25674	1.78497	2.84474	9.016	24	.000
	Cultivation Expenditure Acre	2.98820	1.32498	.26500	2.44127	3.53513	11.276	24	.000
	Commodity Value (A)	2.58094	1.32354	.26471	2.03461	3.12727	9.750	24	.000
	Price Per KG	1.24362	.64267	.12853	.97833	1.50890	9.675	24	.000
	Commodity Final Price (B)	1.90759	1.25583	.25117	1.38921	2.42597	7.595	24	.000
	Total Commodity Final Price	2.58094	1.32354	.26471	2.03461	3.12727	9.750	24	.000
	Cost of Yield (A) - Loss (B)	1.39246	1.28085	.25617	.86375	1.92117	5.436	24	.000
	Total Cost of Yield (A) - Loss (B)	2.17872	1.41176	.28235	1.59597	2.76146	7.716	24	.000

Source: Primary Data

The paired samples test indicates that Before Industrial Pollution (BIP) outperforms After Industrial Pollution (AIP) in commercial settings across all analyzed metrics.

Before Industrial Pollution (BIP) spends a lot more than After Industrial Pollution (AIP) in a number of important sectors, according to the cultivation expenditure study. A mean difference of 2.31485 (p = 0.000) indicates that BIP may be able to produce greater yields due to its increased investment in agricultural resources. Furthermore, higher expenses per acre for BIP are indicated by the mean difference of 2.98820 (p = 0.000), which suggests more intensive farming methods that boost production.

A mean difference of 2.58094 (p = 0.000) in commodity value and a mean difference of 1.24362 (p = 0.000) in price per kilogram show that BIP also delivers stronger market placement, which increases revenue. With a mean difference of 1.90759 (p = 0.000), BIP's final commodity prices are noticeably higher, enhancing its competitiveness in the market.

A mean difference of 2.17872 (p = 0.000) for total cost of yield and 1.39246 (p = 0.000) for cost of yield demonstrate how well BIP reduces losses and demonstrates improved cost management. All things considered, the steady and statistically significant variations demonstrate BIP's benefits in terms of investment, output, and profitability, establishing it as a pioneer in commercial farming.

Table: 5.3 BIP & AIP *Vegetable Items* – Paired Sample Test:

BIP & AIP		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Vegetables	Cultivation Expenditure	.769	1.145	.306	.107	1.430	2.511	13	.026
	Cultivation Expenditure Acre	1.535	1.312	.351	.778	2.292	4.378	13	.001
	Commodity Value (A)	1.739	1.298	.347	.989	2.488	5.013	13	.000
	Price Per KG	-.568	1.062	.284	-1.182	.045	-2.002	13	.067
	Commodity Final Price (B)	.972	1.202	.321	.278	1.667	3.027	13	.010
	Total Commodity Final Price	1.739	1.298	.347	.989	2.488	5.013	13	.000
	Cost of Yield (A) - Loss (B)	.351	1.822	.487	-.701	1.403	.721	13	.484
	Total Cost of Yield (A) - Loss (B)	1.773	1.337	.357	1.000	2.545	4.960	13	.000

Source: Primary Data

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According to the paired samples test, financial indicators pertaining to vegetable production show that Before Industrial Pollution (BIP) performs noticeably better than After Industrial Pollution (AIP).

When comparing Before Industrial Pollution (BIP) to After Industrial Pollution (AIP), the examination of vegetable cultivation shows notable benefits on a number of financial parameters. With a mean difference of 0.769 (p = 0.026), BIP results in increased cultivation expenses, indicating a larger investment in farming inputs and techniques that might improve overall production. Additionally, BIP displays much higher expenses per acre (mean difference of 1.535, p = 0.001), which is indicative of a more intense and perhaps successful method of growing vegetables.

BIP's competitive advantage and effectiveness in the market are shown by its much higher commodity values (mean difference of 1.739, p = 0.000) in terms of market performance. BIP's strong market position is further supported by the fact that its final prices are likewise much higher (mean difference of 0.972, p = 0.010). It is important to note, nonetheless, that BIP seems to get somewhat lower pricing per kilogram (mean difference of -0.568, p = 0.067), suggesting a topic that needs more research.

There are no discernible variations in net losses between BIP and AIP (mean difference of 0.351, p = 0.484), according to the research, indicating that both groups manage losses with comparable effectiveness. A mean difference of 1.773 (p = 0.000) suggests that BIP controls its overall expenses in relation to losses successfully. A more efficient and perhaps lucrative method of producing vegetables is suggested by these results, which also emphasize BIP's advantages in market participation and agricultural methods.

Table: 5.4 BIP & AIP *Fruits Items* – Paired Sample Test:

Paired Samples Test										
BIP & AIP		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Fruits	Cultivation Expenditure	-.10125	.49236	.28426	-1.32434	1.12184	-.356	2	.756
	Cultivation Expenditure Acre	.49600	.43278	.24986	-.57908	1.57108	1.985	2	.186
	Commodity Value (A)	.22796	.40853	.23586	-.78688	1.24279	.966	2	.436
	Price Per KG	.92420	.80038	.46210	-1.06405	2.91244	2.000	2	.184
	Commodity Final Price (B)	-.36930	.48435	.27964	-1.57249	.83389	-1.321	2	.317
	Total Commodity Final Price	.22796	.40853	.23586	-.78688	1.24279	.966	2	.436
	Cost of Yield (A) - Loss (B)	-.72392	.43191	.24936	-1.79684	.34900	-2.903	2	.101
	Total Cost of Yield (A) - Loss (B)	.06584	.40997	.23669	-.95258	1.08425	.278	2	.807

Source: Primary Data

According to the paired samples test, there are no appreciable economic differences between fruit cultivation before and after industrial pollution, suggesting that both groups performed similarly.

Cultivation Expenditure The mean difference of -0.10125 (p = 0.756) indicates that there is no significant difference between BIP and AIP's overall cultivation expenditures, indicating similar levels of investment in fruit production. With a mean difference of 0.49600 (p = 0.186) for cultivation expense acres, there is no discernible difference in spending per acre, suggesting that the expenditures of the two approaches are comparable. Commodity Value (A): The mean difference of 0.22796 (p = 0.436) indicates that neither BIP nor AIP has a substantial advantage in terms of commodity value, highlighting their similar market performance. BIP may fetch higher prices per kilogram, according to a mean difference of 0.92420 (p = 0.184). This discovery is not statistically significant, though, and implies that more research may be necessary.

Since there are no discernible variations in final prices, the commodity final price (B) mean difference of -0.36930 (p = 0.317) suggests that both strategies are equally competitive in the market. The metric's total commodity final price, which shows a mean difference of 0.22796 (p = 0.436), confirms earlier results that BIP and AIP attain similar total prices. Although it falls short of statistical significance, the mean difference between Cost of Yield (A) and Loss (B) of -0.72392 (p = 0.101) indicates a tendency toward reduced losses for BIP. Total Cost of Yield (A) - Loss (B): The mean difference of 0.06584 (p = 0.807) suggests that both systems are equally efficient despite the lack of a significant difference in total costs compared to losses.

According to the data, BIP and AIP produce comparable economic results in fruit

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production; nevertheless, they do not significantly differ in terms of cost, commodity value, or price, suggesting that more research is necessary.

VI. GOVERNMENT MONITORING REGULATIONS:

Industries must have a "Consent to Operate" and follow environmental standards in order to comply with the stringent pollution control laws enforced by the Tamil Nadu Pollution Control Board (TNPCB). To keep untreated wastewater from harming water bodies, textile dyeing enterprises must either establish Effluent Treatment Plants (ETPs) or link to Common Effluent Treatment Plants (CETPs). To ensure that no liquid waste enters rivers or streams, the TNPCB requires many enterprises to use Zero Liquid Discharge (ZLD) technology. For continued supervision, real-time effluent quality monitoring systems and routine inspections are also necessary.

VII. CONCLUSION:

Crop yields and the livelihoods of farmers are being impacted by Tamil Nadu's Erode district's economic shift from agriculture to industry. Nonetheless, initiatives by the government and local community, like as wastewater treatment regulations and sustainable farming practices, offer promise in minimizing environmental impact while also preserving Erode's agricultural heritage and fostering economic development.

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