



INDUSTRIALIZATION AND RURAL LIVELIHOODS: A COMPARATIVE ANALYSIS OF INDUSTRIAL AND NON-INDUSTRIAL VILLAGES

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ABSTRACT

Industrialization is an important part of economic development because it creates employment, increases income and changes the occupational structure of local communities. However, industrial activities may also create social, health and environmental concerns for people living in and around industrial areas. The present study examines the socio-economic impact of the steel industry (Aarti Steel Plant, Ghantikhal, Kataka) by comparing an industrial village (Ghantikhal) with a non-industrial village (Balarampur). The study is based on primary data collected from 100 respondents, consisting of 50 respondents from an industrial village and 50 respondents from a non-industrial village. The social impact of industrialization is examined through four factors: education, occupation, health and perceived environmental conditions. Household income is considered as the main economic indicator. Frequencies and percentages are used for the analysis of social factors, while an independent-samples t-test assuming unequal variances is used to compare mean household income between the two groups. The findings show that plant-related employment is considerably higher in the industrial village, while agricultural labour is more common in the non-industrial village. The education pattern differs between the two villages but does not show a clear overall advantage for either group. Reported health problems are generally higher in the industrial village, particularly skin problems and joint pain. A very high proportion of respondents in the industrial village also perceive deterioration in air, water, agricultural land and overall environmental quality. The mean household income is higher in the industrial village, and the t-test indicates a statistically significant difference in income between the two villages. The study therefore highlights that industrialization is associated with economic opportunities as well as important social, health and environmental concerns.

KEYWORDS: Steel Industry, Industrialization, Local Communities, Socio-Economic Impact, Education, Occupation, Health, Environment, Household Income

1. INTRODUCTION

Industrialization plays an important role in economic development by creating employment opportunities, increasing household income and changing the occupational structure of local communities. The establishment of industries can provide direct employment in factories and indirect employment through contract work, transport, trade and other services. At the same time, industrialization may influence traditional occupations, land use, community life and environmental conditions. Previous research has shown that industrialization can bring economic opportunities while also producing social and ecological changes among local communities. (Meher, 2003) In the case of the Rourkela Steel Plant, industrialization was associated with changes in the social and ecological conditions of the surrounding tribal region. (Meher, 2003) Similarly, research on the NALCO industrial area of Koraput examined the effects of industrialization and mining on local income, employment, education, health, livelihood and environmental conditions. (Behera, 2015)

The steel industry is particularly important because steel plants require a large workforce and generate associated economic activities in surrounding areas. Therefore, industrial development may provide new employment opportunities to local people. However, industrial production can also create environmental and occupational concerns. For example, a study of work-zone noise at Aarti Steel Plant in Odisha found considerable noise levels in the plant area, demonstrating the importance of occupational and environmental health around industrial establishments. (Kerketta, Dash, & Narayan, 2009) Industrialization may also require changes in land use and may affect communities dependent on agriculture and other traditional livelihoods. CSR activities can partly address community-development needs, and the role of CSR in community development and sustainability has been examined in the context of Rourkela Steel Plant. (Acharya & Patnaik, 2018)

Against this background, the present study compares an industrial village and a non-industrial village using selected social and economic indicators. The social analysis focuses on education, occupation, health and perceived environmental conditions, while household income is used as the main economic indicator. The purpose is not only to examine the economic difference between the



two villages but also to understand the social and environmental conditions associated with industrial development at the village level.

2. REVIEW OF LITERATURE

Khan et al. (1994) found that industrialization brought significant socio-economic and behavioral changes in the way of life of the local population. At the same time, industrial development created new employment opportunities and contributed to an increase in household earnings.

Kerketta et al. (2009) investigated occupational noise levels at the Aarti Steel Plant in Odisha and found that noise levels ranged from 59 to 84 dBA, while the combined plant noise reached approximately 90–92 dBA. The study highlighted the contribution of industrial activities to noise pollution, particularly in surrounding industrial villages.

Meher (2003) explained that although industrialization was intended to promote economic development, it also resulted in the widespread displacement of tribal communities and contributed to severe environmental degradation in the Rourkela region.

Acharya and Patnaik (2018), in their study Corporate Social Responsibility in Community Development and Sustainability: Rourkela Steel Plant, a Unit of SAIL, India, examined the corporate social responsibility (CSR) practices of the Rourkela Steel Plant in Odisha. The study focused on the role of CSR in promoting community development and sustainability, particularly in the context of Section 135 of the Companies Act, 2013.

Behera (2015) investigated the significance of industrialization and its impact on local economic development through a case study of three peripheral villages surrounding the National Aluminum Company (NALCO) at Damanjodi, located in Odisha's major bauxite-mining region. The study highlighted the economic opportunities generated by industrialization while also pointing to its adverse effects, including displacement of tribal communities and pollution of air, water, and the surrounding environment.

Research Gap

Existing studies have examined the employment, income, environmental, health, displacement and CSR-related effects of industrialization in different industrial regions of Odisha. (Meher, 2003; Behera, 2015; Acharya & Patnaik, 2018) However, there is comparatively limited village-level comparative research that examines an industrial and a non-industrial village using the same set of social and economic indicators

In particular, there is scope to examine education, occupation, health and perceived environmental conditions together with household income. The present study attempts to address this gap by making a comparative analysis of an industrial village and a non-industrial village.

3. OBJECTIVE OF THE STUDY

To assess the socio-economic and Environmental impact of “Aarti Steel Plant” on Local community.

4. HYPOTHESIS

The hypothesis is formulated for household income:

H₀: There is no significant difference in the mean household income between industrial and non-industrial villages.

H₁: There is a significant difference in the mean household income between industrial and non-industrial villages.

5. METHODOLOGY

The study uses a comparative research design to understand the socio-economic impact of “Aarti Steel” Plant on households living in an industrial village (Ghantikhal) and a non-industrial village (Balarampur). A total of 100 respondents were selected for the study, with 50 respondents from each village. The study focuses on education, occupation, health, environmental conditions, and household income as the main indicators. Education, occupation, health, and environmental conditions are examined using frequencies and percentages, while household income is analyzed using the mean, variance, and an independent-samples t-test assuming unequal variances. The t-test is two-tailed because the purpose is to find out whether there is a significant difference in the average income of the two villages, without assuming beforehand which village has a higher income. Gender and age are treated only as demographic characteristics and are therefore not included in the analysis of social impact.

6. RESULTS AND ANALYSIS

6.1 Social Factor I: Education

Education is an important indicator of the social condition of households. It reflects the level of educational attainment and provides an indication of the human-capital characteristics of the two communities.



Table 1: Educational Qualification of Respondents

Educational Qualification	Industrial Village n	Industrial Village %	Non-Industrial Village n	Non-Industrial Village %
Illiterate	2	4	3	6
Primary	11	22	6	12
Upper Primary	9	18	5	10
Secondary	13	26	20	40
Higher Secondary	6	12	5	10
Graduate & above	9	18	11	22
Total	50	100	50	100

Source: Primary survey data.

The table shows differences in the educational structure of the two villages. In the industrial village, 4% of respondents are illiterate, compared with 6% in the non-industrial village. Primary education accounts for 22% in the industrial village compared with 12% in the non-industrial village, while upper-primary education accounts for 18% and 10%, respectively.

Secondary education is the largest category in the non-industrial village, where it accounts for 40% of respondents, compared with 26% in the industrial village. Higher-secondary education accounts for 12% in the industrial village and 10% in the non-industrial village. The proportion of graduates and above is 18% in the industrial village and 22% in the non-industrial village.

Therefore, the educational pattern is mixed. The industrial village has a higher proportion at the primary and upper-primary levels, while the non-industrial village has a higher proportion at the secondary and graduate-and-above levels. Thus, the data do not show a clear overall educational advantage for either village.

Since no statistical test has been conducted for education, these findings are interpreted only descriptively.

6.2 Social Factor II: Occupation

Occupation is an important indicator for understanding the livelihood structure of the two villages. Industrialization can change the importance of agriculture by creating employment in industrial plants and related activities.

Table 2: Occupational Structure of Respondents

Occupation	Industrial Village n	Industrial Village %	Non-Industrial Village n	Non-Industrial Village %
Plant Worker	31	62	16	32
Agricultural Labour	7	14	20	40
Plant Contractor	7	14	2	4
Other	5	10	12	24
Total	50	100	50	100

Source: Primary survey data.

The occupational structure shows a substantial difference between the two villages. In the industrial village, 62% of respondents are plant workers and another 14% are plant contractors. Thus, a total of 76% of respondents are engaged in plant-related occupations. In comparison, the non-industrial village has 32% plant workers and 4% plant contractors, giving a combined plant-related employment share of 36%.

Agricultural labour is more common in the non-industrial village. It accounts for 40% of respondents there, compared with only 14% in the industrial village. Other occupations account for 10% in the industrial village and 24% in the non-industrial village.

Table 3: Broad Comparison of Plant-Related and Other Occupations

Occupational Group	Industrial Village	Non-Industrial Village
Plant-related employment	76%	36%
Agricultural labour	14%	40%
Other occupations	10%	24%

Source: Calculated from Table 2.

Interpretation

The occupational pattern clearly shows a greater concentration of plant-related employment in the industrial village. The share of plant-related employment is 40 percentage points higher in the industrial village than in the non-industrial village.



At the same time, agriculture-related employment is much more prominent in the non-industrial village. This suggests that industrial development is associated with a different livelihood structure in the industrial village, where industrial employment has a greater role.

This finding is consistent with previous research showing that industrialization can influence traditional livelihood structures and employment patterns. (Meher, 2003; Behera, 2015)

6.3 Social Factor III: Health

Health is considered an important social factor because industrial workers and communities located close to industrial activities may experience different occupational and environmental conditions.

Table 4: Occupationally Related Health Status

Health Condition	Industrial Village n	Industrial Village %	Non-Industrial Village n	Non-Industrial Village %
Skin Problem	15	30	4	8
Eye Problem	4	8	3	6
Headache	7	14	5	10
Joint Pain	10	20	6	12
Blood Pressure	4	8	5	10
Others	3	6	6	12
Negative Response	7	14	21	42
Total	50	100	50	100

Source: Primary survey data.

The health table shows that reported health conditions differ between the two villages. The most notable difference is in skin problems. Skin problems were reported by 30% of respondents in the industrial village compared with 8% in the non-industrial village.

Joint pain was reported by 20% of industrial-village respondents compared with 12% of non-industrial-village respondents. Headaches were reported by 14% and 10%, respectively. Eye problems were reported by 8% in the industrial village and 6% in the non-industrial village.

Blood pressure was reported by 8% of industrial-village respondents and 10% of non-industrial-village respondents. Other health problems account for 6% and 12%, respectively.

An important difference is found in the negative response category. Only 14% of respondents in the industrial village were recorded under this category, compared with 42% in the non-industrial village.

Table 5: Difference in Selected Reported Health Problems

Health Indicator	Industrial Village	Non-Industrial Village	Difference
Skin problem	30%	8%	+22 percentage points
Eye problem	8%	6%	+2 percentage points
Headache	14%	10%	+4 percentage points
Joint pain	20%	12%	+8 percentage points
Blood pressure	8%	10%	-2 percentage points

Source: Calculated from Table 4.

Interpretation

The descriptive results indicate that several reported health problems are more common among respondents in the industrial village, particularly skin problems and joint pain. The finding is relevant in light of previous research on occupational and environmental conditions in industrial areas. Kerketta et al. (2009), for example, examined noise exposure at an Odisha steel plant and highlighted the importance of controlling industrial noise. (Kerketta, Dash, & Narayan, 2009)

However, the present study should not be interpreted as proving that the steel industry directly caused these health conditions. The data are based on respondents' reported conditions, and the study does not include medical examination or a separate statistical test of health outcomes.

6.4 Social Factor IV: Perceived Environmental Conditions

Environmental conditions are another important social concern because the quality of air, water and agricultural land directly affects the living and livelihood conditions of local communities.



Table 6: Perceived Environmental Deterioration

Environmental Indicator	Industrial Village n	Industrial Village %	Non-Industrial Village n	Non-Industrial Village %
Perceived deterioration in air quality	48	96	31	62
Perceived deterioration in water quality	47	94	19	38
Perceived deterioration in agricultural land quality	34	68	17	34
Perceived overall deterioration in environmental quality	49	98	20	40

Source: Primary survey data.

The environmental results show the largest differences among the social indicators considered in the study.

In the industrial village, 96% of respondents perceived deterioration in air quality, compared with 62% in the non-industrial village. Similarly, 94% of respondents in the industrial village perceived deterioration in water quality, compared with only 38% in the non-industrial village.

Perceived deterioration in agricultural land quality was reported by 68% of respondents in the industrial village and 34% in the non-industrial village.

The strongest difference is observed in overall environmental quality. 98% of respondents in the industrial village perceived overall deterioration in environmental quality, compared with 40% in the non-industrial village.

Table 7: Comparison of Perceived Environmental Deterioration

Environmental Indicator	Industrial Village	Non-Industrial Village	Difference
Air quality		62%	+34 percentage points
Water quality	94%	38%	+56 percentage points
Agricultural land quality	68%	34%	+34 percentage points
Overall environmental quality	98%	40%	+58 percentage points

Source: Calculated from Table 6.

Interpretation

The findings show that perceived environmental deterioration is substantially higher in the industrial village. The difference is particularly large for water quality and overall environmental quality, where the industrial village exceeds the non-industrial village by 56 and 58 percentage points, respectively.

These findings are broadly consistent with previous studies that have discussed environmental and ecological concerns associated with industrialization in Odisha. (Meher, 2003; Behera, 2015)

However, an important limitation should be noted: these results measure respondents' perceptions. They do not represent laboratory measurements of air pollution, water pollution or soil quality. Therefore, the results demonstrate a difference in perceived environmental conditions rather than proving a specific level of industrial pollution.

6.5 Overall Social-Factor Comparison

The four social factors provide a broad picture of the differences between the two villages.

Table 8: Summary of Social Factors

Social Factor	Major Finding in Industrial Village	Major Finding in Non-Industrial Village
Education	Higher share in primary and upper-primary categories	Higher share in secondary and graduate-and-above categories
Occupation	76% plant-related employment	40% agricultural labour
Health	Higher reporting of skin problems and joint pain	Higher negative-response category
Environment	Very high perceived deterioration in air, water, land and overall environment	Lower perceived deterioration

Source: Based on Tables 1, 2, 4 and 6.

Overall Social Analysis

The social analysis shows that the two villages differ considerably in occupation, health reporting and perceived environmental conditions. The industrial village is more strongly connected with plant-related employment, while agricultural labour is more common in the non-industrial village.



Education shows a mixed pattern and does not provide evidence of a clear overall advantage for either village. Health results show higher reporting of selected health problems in the industrial village, while environmental perceptions show a particularly large difference between the two villages.

Therefore, the social impact of industrialization cannot be described as purely positive or negative. The results indicate a combination of changes in employment opportunities and continuing concerns related to health and environmental conditions.

6.6 Economic Factor: Household Income

Household income is considered the main economic indicator in the present study.

Table 9: Mean Household Income

Income Statistic	Industrial Village	Non-Industrial Village
Mean household income	₹237,840	₹155,400
Variance	12,593,769,796	2,000,367,347
Number of observations	50	50

Source: Primary survey data and author calculation.

The mean household income of the industrial village is ₹237,840, while the mean household income of the non-industrial village is ₹155,400.

Therefore, the difference between the two mean incomes is:

$$₹237,840 - ₹155,400 = ₹82,440$$

The industrial village has a higher sample mean household income by ₹82,440.

One possible factor associated with this difference is the occupational structure. The industrial village has 76% plant-related employment, compared with 36% in the non-industrial village. However, the present study does not establish that industrial employment alone caused the income difference.

6.7 Hypothesis Testing: Independent-Samples t-Test

To examine whether the difference in mean household income is statistically significant, an independent-samples t-test assuming unequal variances were conducted.

Table 10: Independent-Samples t-Test Assuming Unequal Variances

Test Statistic	Value
Industrial village mean	₹237,840
Non-industrial village mean	₹155,400
Mean difference	₹82,440
Observations	50 and 50
Degrees of freedom	64
t-statistic	4.825405043
One-tailed p-value	0.000004511
Two-tailed p-value	0.000009022
One-tailed critical t	1.669013025
Two-tailed critical t	1.997729654

Source: Author's calculation from primary survey data.

Interpretation of the t-Test

The calculated t-statistic is 4.8254, whereas the two-tailed critical t-value is approximately 1.9977.

The two-tailed p-value is:

$$p = 0.000009022$$

Since the p-value is less than 0.05, the null hypothesis is rejected at the 5% level of significance.

Therefore:

There is a statistically significant difference in mean household income between the industrial and non-industrial villages.

The industrial village has the higher sample mean income.

However, the result should be interpreted carefully. The t-test establishes that the two-sample means are statistically different; it does not by itself prove that the steel industry caused the ₹82,440 difference. Other factors may also contribute to differences in household income.

7. DISCUSSION

The findings of the study show that industrialization is associated with considerable differences in the socio-economic conditions of the two villages. The strongest difference in the social analysis is found in occupation. Plant-related employment accounts for 76% of respondents in the industrial village but only 36% in the non-industrial village. In contrast, agricultural labour accounts for



40% of respondents in the non-industrial village but only 14% in the industrial village. This indicates a substantial difference in the livelihood structure of the two communities.

The income analysis also shows a substantial difference. Mean household income is ₹237,840 in the industrial village compared with ₹155,400 in the non-industrial village. The t-test confirms that this difference is statistically significant. This finding is consistent with the general argument in earlier industrialization studies that industrial development can create new employment and income opportunities. (Behera, 2015)

However, the social analysis also identifies concerns. Skin problems were reported by 30% of industrial-village respondents compared with 8% of non-industrial-village respondents, while joint pain was reported by 20% and 12%, respectively. Previous research on industrial environments has also highlighted occupational and environmental health concerns. (Kerketta, Dash, & Narayan, 2009)

Environmental perceptions show an even larger difference. Almost all respondents in the industrial village 98% reported overall deterioration in environmental quality, compared with 40% in the non-industrial village. Air-quality deterioration was reported by 96% and water-quality deterioration by 94% of industrial-village respondents. These findings are in line with the broader literature concerning the ecological effects of industrialization. (Meher, 2003; Behera, 2015)

Education, however, presents a mixed picture. The industrial village has higher proportions in primary and upper-primary education, while the non-industrial village has higher proportions in secondary and graduate-and-above categories. Therefore, the present data do not support a simple conclusion that industrialization has improved or reduced educational attainment.

Overall, the results suggest that industrial development is accompanied by both economic opportunities and social and environmental concerns. The comparison therefore supports the need for a broader approach to industrial development in which income and employment are considered together with health, education and environmental quality.

8. POLICY SUGGESTIONS

1 Increase Local Employment Opportunities

Industries should provide greater employment opportunities to eligible local residents through transparent recruitment, skill development and vocational training programs.

2 Strengthen Skill Development

Technical and vocational training can help local youth obtain skilled industrial employment rather than depending mainly on low-skilled or temporary work.

3 Improve Health Facilities

Regular health camps, medical check-ups and occupational-health programs should be provided for workers and nearby communities, particularly where repeated health concerns are reported.

4 Strengthen Environmental Monitoring

Air, water, soil and noise quality around industrial villages should be regularly monitored. Environmental information should also be made accessible to local communities.

5 Protect Water and Agricultural Land

Because a substantial proportion of industrial-village respondents perceive deterioration in water and agricultural land quality, measures should be taken to protect local water resources and agricultural land.

6 Strengthen Need-Based CSR

CSR activities should focus on the actual requirements of local communities, particularly in health, education, livelihood development, environmental protection and skill development. Research on Rourkela Steel Plant has examined the role of CSR in community development and sustainability. (Acharya & Patnaik, 2018)

7 Increase Community Participation

Local people should be involved in discussions concerning industrial development, environmental management, CSR programs and community health. Greater participation can help align industrial development with local needs.

9. CONCLUSION

The present study examined the socio-economic impact of the steel industry by comparing an industrial village with a non-industrial village. The analysis covered four social factors education, occupation, health and perceived environmental conditions and one economic factor, household income.

The occupational structure shows a strong difference between the two villages. Plant-related employment is considerably higher in the industrial village, while agricultural labour is more common in the non-industrial village. Education shows differences in distribution, but the data do not indicate a clear overall educational advantage for either village.



The health findings show higher reporting of several health problems in the industrial village, particularly skin problems and joint pain. The environmental findings show an even stronger difference, with very high proportions of industrial-village respondents reporting deterioration in air quality, water quality, agricultural land and overall environmental quality.

The economic analysis shows that mean household income is ₹237,840 in the industrial village compared with ₹155,400 in the non-industrial village. The independent-samples t-test gives a two-tailed p-value of approximately 0.000009, indicating a statistically significant difference between the two groups.

Overall, the study indicates that industrial development is associated with both economic opportunities and social and environmental concerns. The findings suggest that industrial development should not be assessed only on the basis of employment and income. Health protection, environmental management, education, local participation and need-based CSR are also important for achieving more balanced community development.

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