

IMPACT OF INDUSTRIALISATION ON SUSTAINABILITY OF NATURAL ENVIRONMENT AND TRIBAL COMMUNITIES IN ODISHA, INDIA

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Abstract

Based on an empirical exploration, the dominant objective of the paper is to understand the impact of industrial projects, for example, National Aluminium Company Limited (NALCO) on the sustainability of tribal communities as well as the surrounding natural environment. The contemporary industrial project has devastated the natural capital through its industrial practices, such as over-extraction of natural resources, over-passage of decomposed wastes, contamination of water bodies, inordinate drilling out of groundwater, etc., without any concern for the existence of nature as well as the rich culture developed by the tribal communities. In this context, the study unearths an empirical understanding of NALCO in Koraput, Odisha, and its impact on the sustainability of the tribal village communities as well as their symbiotic relationship with the natural environment. The empirical investigation has been conducted in selected tribal villages located in and around the NALCO.

Keywords: Industrialisation, Nature, Sustainability, Sustainable Development, Tribal Health, Livelihood.

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Introduction

The modern industrial civilisation – that reached its apogee in the cutting-edge techno-economic breakthrough, especially during the 20th/21st century – has jeopardised the vital natural resource with its celebration of LPG (liberalization-privatization-globalization) as the engine of development. This paradigm of development has produced devastating influence over the natural capital through a plethora of industrial practices – over-extraction of natural resources, over-passage of decomposed wastes, contamination of water bodies, inordinate drilling out of groundwater, etc., without any socio-cultural and eco-cultural concerns for the existence of the nature. Their ramifications prevail particularly in the tribal landscapes because these areas are located in and around the nature. The tribals and their association with nature are profoundly sacred. According to Burman Roy (1982), ‘the tribal communities are not only forest-dwellers but also for centuries they have evolved a way of life, which on the one hand is woven around the forest ecology and forest resources, and on the other ensures that the forest is protected against depredation by men and nature’.

As a significant component of (nature) ecosystem, the tribals are in a multiplex relationship among the population of other organisms for their means of livelihood. Their livelihood is structured around the properties of the nature. As the literature suggests, nature not only provides the tribals with food, construction materials, fodder, and employment opportunities in various forest-based occupations but it also serves as a source of their deep-rooted sentiments. The forest occupies a central position in tribal culture and economy. It provides long-persisting diets for their dining, supplies several substances for their shelter, fuel for preparing their food, fulfilling fodder for their cattle so on and so forth. Nonetheless, the very economy of the tribals, i.e. the so-called ‘shifting cultivation’ depends on nature/forests. Traditionally, the shifting cultivation of the forestland and the collection of forest products, especially non-timber products, are the most

important economic activities of the tribals (Banerjee, Dasgupta & Roy, 1992). Thus, the economy of tribals is ecologically inseparable. According to Punam Kumari and A. K. Sinha (1992), “tribals are economically and ecologically inseparable from forests. Forests are, in the first place, storehouses of food plants such as cereals, roots, tubers, vegetables, fruits, and nuts. Apart from being sources of food, forests also provide the tribals with medicinal plants. The tribals obtained their numerous requirements from the forest with the help of simple implements and without any technological aid from outside... As the tribals depend on the forest flora for their livelihood and collect various herbs, roots, rhizomes, tubers, flowers, fruits, and seeds of many wild and cultivated plants that grow in and around the forest, forests occupy an important position in the tribal economy.”

That apart, the tribals satisfy their deep-rooted religious sentiments in close association with the properties of nature. The folksongs and dances of tribals revolve around nature. A good number of clan names are also associated with the names of plants and animals that are available in the forests (Debashish, 1998). Many of the roots, tubers, and leaves are required for them for their magico-religious rites. Nature has a direct impact on the physical, mental, spiritual, social, and health conditions of the tribals. Several properties of nature often influence the health of individuals as well as tribal societies. The long-persisting tribal healthcare system, especially ethnomedicine, is based on their deep observation as well as understanding of nature.

However, this long-persisting historic nexus between tribals’ culture and nature has collapsed with the introduction of different development projects in the name of establishment and expansion of the industrialisation process. As a result, the symbiotic relationship has been diluted. One such experiment happened in Koraput, one of the tribal-dominated and natural resource pool districts of the state of Odisha, India. The devastation of the nature-culture nexus happened due to the establishment of NALCO in Damanjodi,

Koraput. Established in 1981 as a central public sector enterprise (CPSE) under the Ministry of Mines, Government of India, NALCO is considered as Asia's largest integrated Bauxite-Alumina-Aluminium-Power complex. The NALCO has acquired 7263 acres at Damanjodi in Koraput, one of the most backward districts of Odisha for its mines and refinery complex. As per official statistics, 600 families were displaced during the time of the inception of this plant at Damanjodi. The establishment of this mega-industrial development project has greatly influenced the tribal communities on the one hand, and the natural environment on the other.

With the establishment of NALCO, the local tribal communities as well as the natural environment have been severely impacted. The impact of industrialisation and its concomitant contaminants have devastated the symbiotic relationship between the natural environment and the tribal communities (Mishra & Mishra, 2021). As a result, the emergence and gradual expansion of NALCO has raised the issue of the 'sustainability' of both the natural environment and the tribal communities in the study area. The idea of sustainability has been prominent since the publication of the world-famous report titled *Our Common Future* by the World Commission on Environment and Development, which anchored the idea of sustainable development, which notes that 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987). According to the literature, sustainability deeply rooted in the idea of sustainable development is a philosophy, approach, or practice that leads to the efficient use of today's resources to ensure that resources are available and sufficient to fulfil today's requirements as well as the needs of future generations (Greenland, 1997; Grant, 2010; Ruggerio, 2021). It is viewed as the ability to make responsible decisions in the use and allocation of resources for economic and non-economic activities to achieve certain desired social, economic, and environmental outcomes (Grant, 2010; Mishra & Mishra, 2021). Thus, the

idea of sustainability is based on a three-pillar conception – social, economic, and environmental – and their mutual interactions.

In this context, the central focus of the current study revolves around the following research questions: What are the perceptions of tribals towards the establishment of NALCO and its influence on the surrounding properties of the natural environment and natural cultural patterns of the human communities? How do the tribal communities view their worldviews on the establishment of NALCO and its impact on the nature-culture nexus? What are the changing 'ways of life' or 'changing-cultural or socioeconomic or socio-environmental patterns' – housing, occupation, health, and natural environment – of tribal communities after the introduction of NALCO?

Methodology

Based on the above research questions, the present study operates in a socio-cultural context. Based on purposive sampling, the study has selected three revenue villages, namely Bhitara Bhejaput, Karidiguda, and Kandhaputraghati, and two hamlet villages, namely Bhaluguda and Jhodiguda. These five tribal villages come under Litiguda Gram Panchayat of Koraput Block in Koraput district, Odisha. These five tribal villages were selected as (1) they are tribal-dominated, and (2) they are very adjacent to both the refinery plant as well as the bauxite mining. Twenty tribal households from each village have been selected for empirical investigation because the study intends to gain a wider understanding as well as the worldviews of the tribals located around both the plant as well as the mining. Thus, the study has been conducted by taking into account 100 households from these five villages. However, the study has purposively covered those households whose age group ranges from 50 to 65 years since these households have experienced both pre and post-establishment of NALCO and its relation to the adjacent tribal communities and their surrounding biotic environment. The study is based on two tribal communities: Paraja and Kandha. The rationale

behind the selection are firstly, both communities are considered as dominant tribal communities in the study area, and secondly while reviewing the literature for the study, the researchers have found that very few or no empirical investigation has been conducted on these tribal communities. An interview guide has been used for the collection of data. Data has been collected both from primary and secondary sources by adopting interview, observation, and focused group discussion methods. The study is both qualitative as well as quantitative in nature.

Industrialisation and the Habitat of Tribals' Habitation

Human habitation, or more appropriately housing pattern, has been considered a significant indicator of the socioeconomic well-being of people. The case of social groups like tribes, who

have traditionally been reckoned with living traditional housing conditions, have changed with the change of the pace of development; that's why it is imperative to have an in-depth inquiry into the housing pattern of the tribals. Thus, the present study attempts to understand human habitation by taking into consideration the traditional human habitation and changing human habitation among the tribals after the introduction of NALCO. Traditionally, the tribal population has been living in and around nature, i.e. on the hills and mountains, in the forests and valleys. Every tribe has developed culture-specific ways and means to design their settlements and housing patterns; the tribes under study, i.e. Paraja and Kandha are no exception. They have evolved their habitation in and around Panchpatmali Hill having dense forest, whizzing springs, and rich bauxite. The traditional structure of housing patterns among Parajas and Kandhas are as follows:

Table 1

Traditional Housing Patterns among Paraja and Kandha

Tribe Name and Village		Type of House Pattern		
		Clay Tiled Hut	Wood-Stick Thatched Hut	Total
Paraja	Bhaluguda	5	15	20
	Village Name Bhitara Bhejaput	15	5	20
	Jhodiguda	8	12	20
	Total	28	32	60
Kandha	Kandhaputraghati	5	15	20
	Village Name Karidiguda	7	13	20
	Total	12	28	40
	Grand total	40	60	100

Table 1 explains the traditional housing patterns among Parajas and Kandhas, of which clay tiled hut comprises 40 per cent and wood-stick thatched hut consists 60 per cent. Out of a total of 60 Paraja houses, 28 are clay tiled, and 32 are wood-stick thatched huts. Similarly, out of a total of 40 Kandha houses, 12 are clay tiled, and 28 are wood-stick thatched huts. Depending on the resources of nature such as timber, sticks, bamboo, leaves, etc.,

available within the ecosystem, the Parajas and Kandhas have evolved their traditional housing patterns. However, the process of establishment of NALCO has changed the nature-based habitation of human habitation. It has changed both the elements as well as the structure of housing. The changing structure of housing patterns among Parajas and Kandhas is as follows:

Table 2*Changing Housing Patterns among Parajas and Kandhas*

Tribe Name and Villages			Type of Housing Pattern			Total
			Kachha	Semi-pucca	Pucca	
Paraja	Village Name	Bhaluguda	14	3	3	20
		Bhitara Bhejaput	11	6	3	20
		Jhodiguda	5	11	4	20
	Total		30	20	10	60
Kandha	Village Name	Kandhaputraghati	10	6	4	20
		Karidiguda	7	8	5	20
	Total		17	14	9	40
	Grand total		47	34	19	100

Table 2 shows the changing housing structure among Parajas and Kandhas after the emergence of NALCO. The study has found three categories of changing houses, namely, kuchaa houses, semi-pucca houses, and pucca houses - kuchaa comprises 47 per cent, semi-pucca comprises 34 per cent and pucca comprises 19 per cent. Out of the total 60 Paraja changing housing patterns, 30 are kuchaa, 20 are semi-pucca and only 10 are pucca houses. Similarly, out of a total of 40 Kandha changing housing patterns, 17 are kuchha, 14 are semi-pucca and only 09 are pucca houses.

The study has marked an interesting explanation of the changing nature of human habitation. The opinion of one of the Kandha tribals of Karidiguda village is self-explanatory. According to the poor Kandha tribal of Karidiguda, they were forced to change the housing pattern because of the establishment of NALCO and its selfish agenda of industrial development. The establishment as well as the expansion of NALCO has mercilessly ceased and destroyed enormous properties of nature. As a result, they are unable to access and avail the raw materials they traditionally collect from nature itself. Therefore, out of any alternative, the tribals are compelled to leave their traditional housing pattern and accept the changing housing pattern, he says.

An interesting aspect of the study is to observe major influences towards the changing nature of housing patterns among tribals. While interrogating the factors towards the changing housing pattern, the tribals provide a threefold classification: Indira Awaas Yojana (IAY), Mo Kudia Scheme (MKS), and Self-Generated Income (SGI) (see Table 3). The IAY which was implemented from the year 1985-86 assists in the construction or upgradation of dwelling units to the below-poverty line rural/tribal households belonging to the scheduled castes, scheduled tribes, and freed bonded labourer categories. The MKS is being implemented from the year 2008-09 by the Government of Odisha to provide financial assistance for the construction of houses belonging to the most vulnerable households. The SGI comprises the income generated by the poor tribals through their occupations.

Table 3 shows the factors relating to the changing housing patterns among Parajas and Kandhas in the study area. Nineteen per cent of total changing housing patterns are influenced by the financial assistance provided under IAY followed by 10 per cent from MKS and 71 per cent from SGI. As shown in the table, there are more numbers of changing houses under the category of SGI. According to one of the Paraja tribals from Bhitara Bhejaput village, they depend upon SGI for

Table 3*Factors of Changing Housing Patter among Parajas and Kandhas*

Government-Assisted House		Tribe Name		Total	
		Paraja	Kandha		
Indira Awas Yojana (IAY)	Village Name	Bhaluguda	4	0	4
		Bhitara Bhejaput	3	0	3
		Jhodiguda	5	0	5
		Kandhaputraghati	0	4	4
		Karidiguda	0	3	3
	Total	12	7	19	
Mo Kudia Scheme (MKS)	Village Name	Bhaluguda	2	0	2
		Bhitara Bhejaput	2	0	2
		Jhodiguda	2	0	2
		Kandhaputraghati	0	2	2
		Karidiguda	0	2	2
	Total	6	4	10	
Self-generated income (SGI)	Village Name	Bhaluguda	14	0	14
		Bhitara Bhejaput	15	0	15
		Jhodiguda	13	0	13
		Kandhaputraghati	0	14	14
		Karidiguda	0	15	15
	Total	42	29	71	
Grand total		60	40	100	

two reasons: first, it is too difficult to get the government-provided financial assistance for the construction of houses; being poor tribals, it is very difficult on their part to follow up the official procedures. Secondly, the government-assisted assistance is not regular; it is sanctioned in a phased manner, which is also time-taking in nature.

Although the tribals are compelled to construct the changing housing pattern, almost all houses are still devoid of basic necessities like proper toilets and bathrooms, drainage systems,

electrification, and road connectivity for easy transportation. Although the government makes certain efforts to change the habitat of human habitation, their initiatives have gone in vain as the tribals are still fighting for these minimum housing necessities. Registering their frustration against NALCO, the Paraja and Kandha tribals say that the firm has not provided any financial assistance towards the construction of houses except for certain displaced households. "It has destroyed our long-persisting nature and its symbiotic relationship with our communities, says a villager of Karidiguda.

Industrialisation and the Structure of Tribals' Occupation

In this section, the study intends to unearth the traditional as well as the changing occupational structures of Paraja and Kandha tribal households. This is considered to be an important exercise because it will determine the extent of economic independence or economic exclusion of the poor tribals. It is often presumed that occupation shapes and influences life as well as the living standards of the individual in society. The level of occupation is

also considered as an index of social stratification in the society. Traditionally, the category of occupation among tribals is significantly different from the non-tribals. It is gained from the study that traditionally, the tribal occupation is more appropriately nature-induced whereas the occupation among non-tribals is non-nature-induced. Shifting agriculture or hilly agriculture is a characteristic feature of tribal occupation apart from certain direct nature-based occupations. Table 4 indicates the landholding structure of Paraja and Kandha tribals in the study area.

Table 4

Landholding Structure among Paraja and Kandha

Village Name	Landholding Structure				Total
	Landless [No land]	Marginal [below 2 acres]	Middle [2-4 acres]	Rich [above 4 acres]	
Bhaluguda	10	7	3	0	20
Bhitara Bhejaput	11	9	0	0	20
Jhodiguda	7	9	4	0	20
Kandhaputraghati	11	9	0	0	20
Karidiguda	5	9	3	3	20
Grand total	44	43	10	3	100

Table 4 shows four types of farming households in the study area: landless, marginal, middle, and rich. By taking into account the total landholding structure of the respondents, the study has categorised four forms of farming households in the study villages: landless (no land), marginal (below two acres), middle (two to four acres), and rich (above four acres). The landless (44) and marginal (43) households constitute the major farming households in the study villages. Apart from agriculture, the Paraja and Kandha tribal households also traditionally engage in other forms of occupations, which are mentioned in Table 5.

As shown in Table 5, the study finds that the Parajas and Kandhas traditionally engage in seven major forms of occupations in the study area: (i) hilly agriculture, (ii) collection of forest-products, (iii)

clay artistry, (iv) bamboo weaving, (v) herbal medicine, (vi) priesthood, and (vii) hilly-agriculture and forest-products collection. The category of hilly agriculture (37 per cent), forest-products collection (20 per cent), and hilly-agriculture and forest-products collection (20 per cent) constitute 77 per cent of the total occupation among Paraja and Kandha tribal households in the study area. The table also confirms that the other forms of traditional occupation among tribals are primarily induced by nature.

These traditional forms of occupations are hardly performed among the poor Paraja and Kandha tribals in the study area. While examining the reason behind the reluctance to engage in traditional occupation, a Kandha tribal from Kandhaputraghati opines that the tribal

Table 5*The Traditional Occupational Structure among Paraja and Kandha*

Traditional Occupations	Name of the Villages					Total
	Bhaluguda	Bhitara Bhe-japut	Jhodiguda	Kandha-putraghati	Karidiguda	
Hilly Agriculture	8	10	10	3	6	37
Forest-Products Collection	4	4	5	4	3	20
Clay Artisan	2	0	0	2	0	4
Bamboo Weaving	2	2	0	2	0	6
Herbal Medicine	2	1	1	2	1	7
Sacred Priest	2	1	1	1	1	6
Hilly Agriculture and Forest Products Collection	0	2	3	6	9	20
Grand total	20	20	20	20	20	100

communities traditionally depend upon the forest and hilly area for their occupational support system. Hence, we consider forest and land as important elements in tribal occupational structure. However, the introduction of NALCO has disturbed this structure. The occupation among the tribals in this region before NALCO was forest/land-based. NALCO has ruthlessly destroyed the natural forest base and fertility of the agricultural land to gratify its desired industrial targets. Thus, the emergence of

NALCO has not only disturbed the traditional occupational support system but has also forced them to opt for alternative occupational strategies for our support system, he adds.

As a result, the poor tribals in this region are mostly forced to opt for certain alternative occupational strategies for their survival. The changing occupational structure among the Paraja and Kandha tribals is mentioned in Table 6.

Table 6*Changing Occupation among Parajas and Kandhas*

Changing Occupations	Name of the Villages					Total
	Bhaluguda	Bhitara Bhe-japut	Jhodiguda	Kandha-putraghati	Karidiguda	
Hilly-agriculture	0	0	3	0	3	6
Herbal Practice	1	1	1	1	1	5
Sacred Priest	1	1	1	1	1	5
Clay Artisan	0	0	0	1	0	1
Agriculture and Casual Labour	3	2	2	5	4	16
Agriculture and Business	4	3	5	3	5	20
Agriculture and Industrial Contract Labour	4	4	3	1	3	15
Business	1	4	2	3	0	10
Daily Labour	6	5	1	5	1	18
Government Service	0	0	2	0	2	4
Grand total	20	20	20	20	20	100

As mentioned in Table 6, the study finds that the Parajas and Kandhas have started engaging in 10 major forms of changing occupations in the study area: (i) hilly agriculture, (ii) herbal practice, (iii) priesthood, (iv) clay artistry, (v) agriculture and casual labour, (vi) agriculture and business, (vii) agriculture and industrial contract labour, (viii) business, (ix) daily wage labour, and (x) government service. The category of hilly agriculture (06 per cent), agriculture and casual labour (16 per cent), agriculture and business (20 per cent), and agriculture and industrial contract labour (15 per cent) constitute 57 per cent of the total changing occupation among Paraja and

Kandha tribal households in the study area. It is seen that the tribals are still engaging in agriculture. However, they are also practising other allied occupations since agriculture fails to provide them sufficient economic benefits for their survival due to the impact of NALCO on the soil fertility of agricultural land.

Having mentioned the landholding and occupational structures (traditional and changing), the study also attempts to examine the income status of the Paraja and Kandha tribals in the study area. It is axiomatic that the central criterion of the tribals' occupation can be examined based on their level of income.

Table 7

Monthly Income among Parajas and Kandhas

Village Name	Monthly Income			Total
	Minor-income households [Below Rs. 1500]	Medium-income households [Rs. 1,500-3,000]	Major-income households [Rs. Above 3000]	
Bhaluguda	13	7	0	20
Bhitara Bhejaput	9	8	3	20
Jhodiguda	5	9	6	20
Kandhaputraghati	13	6	1	20
Karidiguda	9	6	5	20
Grand total	49	36	15	100

As mentioned in Table 7, the study has classified the income level of these Paraja and Kandha tribals into three categories: (i) minor-income households, (ii) medium-income households, and (iii) major-income households. The minor-income households are those households whose monthly income is below Rs.1500. The medium-income households have a monthly income between Rs.1500–Rs.3000, whereas the major-income households earn above Rs.3000 per month. The study finds that 49 per cent of households belong to minor income followed by medium (36 per cent) and major (15

per cent). While inquiring about the reason for the low income, a Paraja tribal from Bhaluguda viewed that one's income is rightly derived from one's occupation. "I am engaged in hilly agriculture and business, which is home-based in nature. Due to the establishment of NALCO, which is directly responsible for soil erosion, I am not getting target production from agriculture, which has compelled me to open a home-based shop to feed my family. The NALCO should introduce certain employment-raising and income-raising opportunities by which the level of income can be increased over time," he demanded.

Industrialisation and the Tribals' Health Practices

The health status of the tribal groups is poor. Their health and sickness are influenced by a combination of biological, cultural, and environmental factors. The Paraja and Kandha tribals have their own concept of health, and they understand health only in relation to diseases. Health, for Paraja and Kandha, indicates sound body and mind, and the surrounding environment. They view ill health when the body does not permit them to do routine work. According to the Parajas and Kandhas, diseases are attributed to natural causes, such as contamination of water, air, and

food as well as high temperature. They believe that diseases could also be caused due to infection, wrath of the gods and goddesses, weather, congenital reasons, mosquito bites, etc. Their health problems can be grouped into four main categories: (i) high rate of infectious and water-borne diseases, (ii) poor environmental sanitation and hygiene-related diseases, (iii) malnutrition-related diseases, and (iv) poor healthcare delivery related diseases. The Parajas and Kandhas have their traditional worldviews in treating their diseases. They have priests, magicians, and medicine men/ethnomedicine men who traditionally provide treatment to the diseased in their societies.

Table 8

Traditional Medicine Practices among Paraja and Kandha

Traditional Medicine Practices	Village Name					Total
	Bhaluguda	Bhitara Bhejaput	Jhodiguda	Kandha-putraghati	Karidiguda	
Socio-religious Practice	6	7	4	6	3	26
Ethno-medicine Practice	2	1	3	4	5	15
Socio-religious and Ethno-medicine Practice	12	12	13	10	12	59
Grand total	20	20	20	20	20	100

As shown in Table 8, the traditional medicine practice among Parajas and Kandhas is broadly grouped into three broad categories: (i) socio-religious practice where the village priest plays a pivotal role, (ii) ethnomedicine practice where the village medicine man occupies a central position, and (iii) socio-religious and ethnomedicine practice where both the priest as well as the village medicine man occupy a crucial role. As indicated in the table, the Paraja and Kandha tribals traditionally prefer socio-religious and ethnomedicine (59 per cent) followed by socio-religious practice (26 per cent) and ethnomedicine (15 per cent). As gained from the field, this is to argue that whatever the forms of practice, the Paraja and Kandha tribals attribute their treatment practices to the properties of nature. However, the health practice among the Parajas and Kandhas has changed after the introduction of the NALCO, which has been mentioned in Table 9.

As shown in Table 9, the changing medical practice among Parajas and Kandhas is broadly grouped under four broad categories: (i) socio-religious and herbal-medicine practice, (ii) homeopathy, (iii) allopathy, and (iv) homeopathy and allopathy. The tribals still prefer socio-religious and herbal-medicine practice (40 per cent) for their immediate recovery followed by homeopathy and allopathy (25 per cent), homeopathy (18 per cent), and allopathy (17 per cent). The tribals prefer homeopathy to socio-religious and herbal medicine because it is less expensive in comparison to allopathy. When enquired about their dependency on traditional medicine even in the presence of changing forms of medicine practices, a poor Kandha from Karidiguda village opines that they use traditional medicine for three reasons: (a) it is nature-based, which does not have any side effects; (b) it is inexpensive; and (c) it is directly available in the village community itself.

Table 9*Changing Medicine Practices among Paraja and Kandha*

Changing Medicine Practices	Village Name					Total
	Bhaluguda	Bhitara	Jhodiguda	Kandha-	Karidiguda	
Socio-religious and herbal medicine practice	13	9	4	7	7	40
Homeopathy	0	2	3	7	6	18
Allopathic	0	5	9	0	3	17
Homeopathy and Allopathic	7	4	4	6	4	25
Grand total	20	20	20	20	20	100

Since the government hospitals are located far away and there is no proper transport facility, we, without any alternative, depend upon the traditional forms of medicine practice practised by the priest and herbal medicine man for immediate treatment.

The Paraja and Kandha tribals have their arguments against the establishment of NALCO and allege that it has caused a series of diseases. The argument of a poor Paraja tribal from Bhaluguda is axiomatic. The health of the tribals is intimately linked to the well-being of the natural environment in this region. Traditionally, the unquestioned and unpolluted natural environment was contributing to the health conditions of the poor tribals in this region. Because of the presence of a healthy natural environment, there were no such critical health diseases among the tribals in this region. However, after the establishment of NALCO, we are suffering from several environment-borne diseases, which are caused by the pollutants released by the company. The NALCO is not only responsible for the destruction of nature but also for the diseases that regularly affect the tribals in this region nowadays.

Industrialisation and the Tribals' Natural Environment

Having discussed in detail the housing, occupation, and health structures among tribals in the light of the establishment of the NALCO, the

study also made an observation relating to the structure of environment in the study area. The relationship of the tribals with their physical environment is intimate and direct. This has been perhaps well defined by several ethnobotanical studies. The tribals depend heavily on forest for their livelihood, shelter, occupation, and employment. Because the tribals and their habitat constitute a system, the objective is not to destroy the natural environment but rather to preserve and perpetuate it, because it is a multifaceted resource for sustenance and survival of enumerable life forms, including the tribals. Traditionally, the Paraja and Kandha tribals from these five villages are heavily depending on the natural environment.

As mentioned in Table 10, the study has categorised the traditional dependence on the natural environment among Paraja and Kandha tribals into five categories: (i) tribal occupation, (ii) tribal-ethnomedicine, (iii) tribal religion, (iv) tribal domestic consumption, and (v) tribal women work-engagement. This is to be stated that tribals' way of life is dwelled upon the existence of nature only. Their occupation, medicine, religion, domestic consumption, etc., are largely based upon the existence of the natural environment. However, the study has made this classification for an analytical understanding of the tribals and their traditional dependence upon nature. As mentioned by the respondents, the tribals mostly depend on their surrounding natural environment for tribal occupation (38 per cent) followed by tribal domestic

Table 10*Traditional Dependence on the Natural Environment among Paraja and Kandha*

Traditional Dependence on Nature	Village Name					Total
	Bhaluguda	Bhitara Bhejaput	Jhodiguda	Kandha-putraghati	Karidiguda	
Tribal occupation	7	5	10	8	8	38
Tribal ethnomedicine	3	2	2	2	2	11
Tribal religion	3	4	2	2	2	13
Tribal domestic consumption	3	6	3	5	5	22
Tribal women work engagement	4	3	3	3	3	16
Grand total	20	20	20	20	20	100

consumption (22 per cent), tribal women's work-engagement (16 per cent), tribal religion (13 per cent), and finally tribal ethnomedicine (11 per cent). However, due to the establishment of NALCO, large-scale vegetation has been affected in and around its industrial belt. The development of NALCO's refinery, transport communication, mining, and township has affected the existing

natural vegetation in the study area, which eventually led to the destruction of harmonious relationship between the tribals and natural environment. The study has attempted to understand the major factors leading to the collision of the symbiotic relationship between the tribals and their surrounding natural environment.

Table 11*Factors Responsible for the Destruction of Symbiotic Relations between Tribals and Nature*

Factors responsible for the destruction of symbiotic relations	Village Name					Total
	Bhaluguda	Bhitara Bhejaput	Jhodiguda	Kandha-putraghati	Karidiguda	
Establishment of refinery	11	7	6	11	3	38
Expansion of mining activity	3	7	6	3	10	29
Development of township	2	2	4	2	2	12
Transport and communication	2	2	2	2	3	11
Immigration of non-tribals	2	2	2	2	2	10
Grand total	20	20	20	20	20	100

As shown in Table 11, the study has conceptualised five major factors responsible for the destruction of the symbiotic relationship between the Paraja and Kandha tribals and their surrounding natural environment: (i) establishment of refinery, (ii) expansion of mining activity, (iii) development of township, (iv) transport and

communication, and (v) immigration of non-tribals. As opined by the respondents, the reciprocal relation between tribals and their natural environment is affected mostly by the establishment of refinery (38 per cent) followed by the expansion of mining activity (29 per cent), development of township (12 per cent), transport

and communication (11 per cent) and finally immigration of non-tribals (10 per cent). The destruction of the natural convertible relationship between the tribals and their natural environment has severely influenced the tribals and their way of

life as well as the natural environment. Table 12 shows the major impacts of the breakdown of the symbiotic relationship between the tribals and nature, as explained by Paraja and the Kandha tribals.

Table 12

Impact of the Destruction of Symbiotic Relations between Tribals and Nature

Factors responsible for the destruction of symbiotic relations	Village Name					Total
	Bhaluguda	Bhitara Bhejaput	Jhodiguda	Kandha-putraghati	Karidiguda	
Tribal poverty	6	7	9	5	7	34
Tribal health problems	4	2	2	4	3	15
Environmental pollution	6	6	4	6	6	28
Tribal displacement	2	2	2	1	2	9
Devaluing tribal women's position	2	3	3	4	2	14
Grand total	20	20	20	20	20	100

Table 12 mentions the major impacts due to the collision of the nature-culture nexus, which has been conceptualised into five major categories: (i) tribal poverty, (ii) tribal health problems, (iii) environmental pollution, (iv) tribal displacement, and (v) devaluing tribal women's position. The table explains that the major impact of the destruction of reciprocal relations leads to tribal poverty (34 per cent) followed by environmental pollution (28 per cent), tribal health problems (15 per cent), devaluing tribal women's position (14 per cent), and tribal displacement (09 per cent). Thus, the establishment of NALCO has severely affected the tribals and their socio-cultural practices, the natural environment, and the nexus between the tribals as well as their natural environment.

Discussion and Conclusion

The aforesaid analysis clearly shows that the establishment as well as the expansion of NALCO at Damanjodi in Koraput, Odisha has influenced the sustainability of tribal communities and the natural environment. It has influenced the properties of the natural environment. No doubt, the NALCO industrial project has certainly brought about much

economic progress. The unprecedented economic development by NALCO by exploiting the natural bauxite is considered a symptomatic answer to the question of economic progress brought out by its industrial project. But here the question arises: whose progress is it? Is it necessary on the part of the community? Is it really necessary on the part of the environment? What is the cost of this progress? Who has provided this cost?

After analysing the above-mentioned aspects – the structure of housing pattern, occupation, health, and the environment – in the context of the construction of NALCO, it could be argued that the economic progress arising out of the industrial development, i.e. NALCO, has achieved at the cost of two significant factors: the natural environment and tribal village communities. These two categories are economically and ecologically inseparable. However, the development of NALCO has badly affected tribal communities and their way of life. At the same time, it has also brought a sea change on the part of the natural environment inhabited by the poor Paraja and Kandha tribals for a long time. In other words, the industrial progress has been achieved at the cost of natural environment and tribal village communities. As a

result, it has certainly disturbed the long-persisting nature-culture nexus. Thus, the project of industrial development questions the sustainability of the long-persisting nature-dwelling tribal communities, and poses serious concerns over the sustenance of various properties of the natural environment. Thus, based on the empirical understanding, the study finds certain appropriate policy implications, which have been mentioned below.

The government as well as the industries should enact and enforce stringent environmental regulations, which should address issues such as water and air pollution, hazardous waste management, and sustainable resource extraction. Regular monitoring and strict penalties for non-compliance should be implemented to ensure adherence.

The policies should be designed to promote meaningful participation of tribal communities in decision-making processes regarding industrial projects. Their rights to land, resources, and local knowledge should be recognised and protected. This can be achieved through inclusive governance mechanisms like tribal councils or local committees, where the interests of both stakeholders and tribal communities are considered.

Encouraging the adoption of environment-friendly practices by industries can be achieved through regulations and financial incentives. The government should provide incentives for industries that prioritise sustainable practices, such as renewable energy adoption, waste reduction, and resource efficiency.

Policy interventions should focus on providing skill development and alternative livelihood

opportunities for tribal communities affected by industrialisation. This can empower them with diversified skills and income sources, reducing their dependence on traditional practices that often lead to environmental degradation.

The government should establish an effective monitoring and enforcement system to ensure compliance with sustainable development policies. Regular inspections, strict penalties for non-compliance, and grievance redressal mechanisms should be put in place. This can help industries hold accountable for any environmental or social harm caused due to their operations.

The study has certain limitations. It is confined to only five revenue and hamlet villages of Odisha. It has been visualised by taking into account limited dimensions of the larger issue of sustainability of the natural environment and tribal communities. It is also limited to a particular period. However, the rich and robust empirical database of the current study will be a vantage point for the scope of further research. The study can be an immensely useful resource base for future research that intends to understand the dynamic interplay between industrialisation and the nature-culture nexus. In addition, it will be useful while exploring policy options and research on industrialisation, the environment, tribal communities, and sustainability.

Acknowledgement: The authors are extremely thankful to Odisha University Research and Innovation Incentivization Plan (OURIIP), Odisha State Higher Education Council (OSHEC), Department of Higher Education (DHE), Government of Odisha for the financial assistance.

Author's Contribution:

Aditya Keshari Mishra: Review of literature, Selection of methodology and preparation of the first draft of article.

Sagarika Mishra: Field study, data analysis, and finalisation of the article.

References

- Aitken, H. G.(2003). Industrialisation in W. Outhwaite (ed.) The Blackwell Dictionary of Modern Social Thought. USA: Blackwell Publishing.
- Banerjee, A., M. Dasgupta and O. P. Roy. (1992). The Importance of Forests in the Economic Life of the Jhumias of Tripura in B. Chaudhuri (ed.) Tribal Transformation in India. New Delhi: Inter-India Publications.
- Beck, U. (1992). Risk Society: Towards a New Modernity. London: Sage Publication.
- Bodley, J.H. (1990). Victims of Progress. California: Mayfield Publishing Company.
- Boyd, W. W. S. Prudham and R. A. Schurman. (2001). Industrial Dynamics and the Problem of Nature, *Society and Natural Resources*, 14 (7).
- Burman Roy, B. K. (1982). *Report of the Committee on Forest and Tribals*. Ministry of Home Affairs, Government of India, New Delhi.
- Cahill, M. (2007). The Environment and Green Social Polity in J. Baldock, N. Manning and S. Vickerstaff (eds.) Social Policy. New York: Oxford University Press.
- Debashish, D. (1998). Tribal-Forest Relationship in V. Joshi (ed.) Tribal Situation in India: Issues in Development. New Delhi: Rawat Publication.
- Giddens, A. (1991). Modernity and Self Identity: Self and Society in the Late Modern Age. Cambridge: Polity Press.
- Grant, L. K. (2010). Sustainability: From Excess to Aesthetics. *Behavior and Social Issues*, 19. <https://doi.org/10.5210/bsi.v19i0.2789>
- Greenland, D. J. (1997). The Sustainability of Rice Farming. New York: CAB International.
- Josephson, P. (2012). Technology and the Environment in J R McNeill and E S Mauldin (eds) A Companion to Global Environmental History. West Sussex, UK: Wiley-Blackwell.
- Joshi, V. (1998). Genesis of Tribal Problems in V. Joshi (ed.) Tribal Situation in India: Issues in Development. New Delhi: Rawat Publication.
- Jules, P.et al. (2008). Introduction to Environment and Society in J Pretty (et al.) The Sage Handbook of Environment and Society, London: Sage Publications Ltd.
- Kumari, P. and A. K. Sinha. (1992). Role of Minor Forest Produce in Tribal Economy in B. Chaudhuri (ed.) Tribal Transformation in India. New Delhi: Inter-India Publications.
- Magdoff, H. (1982). Imperialism in H Alavi and T Shanin (ed.) Introduction to the Sociology of Developing Societies. New York: Monthly Review Press.
- Mishra, S. and A. K. Mishra, A.K. (2021). Industrialisation and Environmental Sustainability: Setting the Context in S. Mishra and A.K. Mishra (eds.) Industrialisation and Environmental Sustainability. New Delhi: Mittal Publications.
- Marshall, G. (1998). Oxford Dictionary of Sociology. New York: Oxford University Press.
- Mohanti, K. K., P. C. Mohapatra and J. Samal. (2006). Tribes of Koraput. Koraput: Council of Analytical Tribal Studies.
- Neale, W. C.(1956). Social Effects of Industrialisation, *The Economic Weekly*, 08 (32).

- Pathy, J. (1998). Impact of Development Projects on Tribals in V. Joshi (ed.) Tribal Situation in India: Issues in Development. New Delhi: Rawat Publication.
- Pearce, D.W. and Turner, R.K.(1990). The Economics of Natural Resources and the Environment. Hemel Hempstead: Harvester Wheatsheaf.
- Robins, N and A. Trisoglio. (1995). Restructuring Industry for Sustainable Development in J. Kirkby, P. O'Keefe and L. Timberlake (eds.) The Earthscan Reader in Sustainable Development, London: Earthscan Publications Ltd.
- Ruggerio, C. A. (2021). Sustainability and Sustainable Development: A Review of Principles and Definitions. *The Science of the Total Environment*, 786, 147481. <https://doi.org/10.1016/j.scitotenv.2021.147481>
- WCED.(1987). Our Common Future: Brundtland Report, Oxford: Oxford University Press.