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Rapid Environmental Impact Assessment (REIA): the Perception and Impact of Thermal Power on the Social Ecology of Kolaghat, West Bengal

Amitava Biswas[*], Sankar Kr Acharya[*], Sourav Burman[**] and Anannya Chakraborty[***]

[*]*Professor, Department of Agricultural Extension, BCKV, Mohanpur, Nadia, West Bengal*
[**]*M. Sc. Student, Department of Agricultural Extension, BCKV, Mohanpur, Nadia, West Bengal*
[***]*Ph D scholar, Department of Agricultural Extension, BCKV, Mohanpur, Nadia, West Bengal*

Abstract—*Environmental Impact Assessment (EIA) can broadly be defined as a study of the effects of a proposed project, plan or program on the environment. The legal, methodological and procedural foundations of EIA were established in 1970 by the enactment of the National Environmental Policy Act (NEPA) in the USA.. The paper highlights the evolution to current status, the legal framework, concepts, processes and principles of EIA and associated studies. It has been realized that thermal power plant has several primary as well as secondary environmental impacts on Kolaghat and surrounding areas for which assessment studies are necessary for mitigating the possible future impacts that have adverse impact on the environment. The study was conducted in Kolaghat block of Purba Medinipur district and in Bhogpur, Bordabar, Chitra and Dariwala villages. It also shows how they react on the socio-economic and socio-cultural condition of the following areas. The study includes detailed to prepare Environmental Management Plan (EMP) outlining additional control technologies to be adopted for mitigation of adverse impacts.*

Keywords*: Environmental pollution and stewardship, water resource and stewardship, soil resource and stewardship, Thermal power pollution on Human, Live stock, Water, Soil, Air.*

1. INTRODUCTION

There has been a remarkable and refreshing interest in environmental issues over the past few decades. A major impetus was provided by the 1987 report of the World Commission on the Environment and Development; stressing need for sustainable environmental management followed by the Rio Summit in 1992 sought to accelerate the impetus through developing global consensus on sustainability and biodiversity conservation (World Business Council for Sustainable Development, 2005) .Much of the discussion on environmental issues centre around sustainable development (*Imperiale, A.J. & Vanclay, F. 2016*) is about the on sustainability and biodiversity conservation (*Agarwal, V.C. Ghosh, P.K.1991*). Much of the discussion on environmental issues centre around sustainable development is about the batter management of the current activity in harmony with the environment. However, keeping place with development the thrust question is how much better it would be to avoid or mitigate the harmful effects of future development on the environment at the planning stage (Flyberg, B. 2003). Rapid Environmental Impact Assessment (REIA) asses the impacts of planned activity on the environment in advance, thereby allowing avoidance measures to be taken respecting age old idea: prevention is better than cure. Agarwal,V.C., P.k. and Ghosh (1991) indentified that India is very rich in terms of not only species diversity but is blessed with an enormous variety and variability (genetic diversity) within species along with the presence o majority of which are expected to be micro-organisms and invertebrates a large number of endemic species. The Ministry of Environment & Forests, Government of India, has set up an Environmental Information System (ENVIS) Centre on Faunal Biodiversity in the Zoological Survey of India at Calcutta to collect, computerized and disseminate all available information on the enormous animal diversity of the country. Franks, D. & Vanclay, F.(2013) The social impacts of the planned wind farm Wind park No or door spooler‘ on the village of Urk are considered. Generating 190 megawatts (MW) when operational, the wind farm will be the largest in the Netherlands. Urk residents will experience a variety of negative impacts including a reduction in the aesthetic quality of their landscape, and their community identification and place attachment will be affected. The wind farm will also reduce leisure and recreation opportunities. Hanna, P. Vanclay, F. Langdon, J. & Arts, J.(2014) The number of environmental licence applications for projects affecting Indigenous peoples in Brazil has increased since the implementation of a major infrastructure program in 2007. This increase has caused problems for Brazilian agencies involved in environmental licensing procedures. We analyze the Brazilian environmental licensing procedure for situations involving Indigenous peoples, Maroons or other traditional communities in order to identify potential improvements for Brazil and potentially other countries. Although Brazilian procedures are consistent with international best practice in environmental licensing, in practice social impacts are

inadequately addressed, mitigation measures are poorly implemented, and there is a lack of enforcement and compliance. World Business Council for Sustainable Development, (2005) The CSI has examined all the major issues and offers in this document a set of guidelines for cement companies and local communities considering an ESIA. These guidelines build on existing excellent work in this field by others in which many of the concepts offered here for the cement sector are discussed at greater length and with broader application. These guidelines are not intended to be comprehensive or prescriptive. Local circumstances vary greatly depending on geography, culture, economic development, etc, so an exhaustive list of hard and fast rules is not appropriate. These guidelines therefore provide a basic framework for taking environmental and social concerns into account throughout the life of any quarry and cement plant from initial planning to construction.

Research locale:

In the above context, Kolaghat Thermal Power Station was setup in 1984. It is located at Mechada, approx.55 km from Kolkata in the Purba Medinipur district. The power plant is operated by West Bangal Power Development Corporation Limited.

Objectives of Environmental Impact Assessment

i. To understand general a base line on the present status of pollution and social ecology of Kolaghat.

ii. To identify and estimate different factors /variables casting adverse environment impact on the social ecology of Kolaghat.

iii. The level and direction and efficacy of interrelationship among and between the set of variables (Cartesian variables Vs predictor variables).

iv. To conduct some participatory exercises on the facts and perceive impact of the thermal power.

Coefficient of correlation (r): Impact on Human Health (y) vs. 13 independent variables (x_1.....x_{13})

Sl. No.	Variables	r value	Remarks
1.	Age(x_1)	0.224	
2.	Education(x_2)	0.009	
3.	Family Size(x_3)	0.082	
4.	Occupation(x_4)	-0.035	
5.	Homestead Land(x_5)	0.239	
6.	Land under cultivation(x_6)	0.262	*
7.	Land under irrigation(x_7)	0.248	
8.	Land under rain fed(x_8)	-0.008	
9.	Cropping intensity(x_9)	0.012	
10	Cost of production(x_{10})	-0.126	
11.	Income from field crops(x_{11})	-0.133	
12.	Income from cash crops(x_{12})	0.245	
13.	Income from live stocks(x_{13})	0.271	*

It presents the coefficient of correlation between y (Impact on Human Health) and 13 independent variables. It has been found that following variables viz. Land under cultivation(x_6) and Income from live stocks (x_{13}) have recorded significant correlation with the dependent variable that is y

Revelation: The results have indicated that Land under Cultivation got a propensity for impact on Human Health. As size of land holding is increased the adverse effect on Human health is also increased as because of more amounts of contaminants connected with the cultivars. If more numbers of live stocks are there more no of contaminated products transfer from livestock to human. So the result will be vice-versa.

Step down Regression Analysis

Step down Regression Analysis, Impact on Human Health (y) vs. 13 independent variables ($x_{1...}x_{13}$)

Sl. No.	Variables	Beta	Beta × R	Reg. coef. B	S.E. of B	t value
1.	Age(x_1)	0.123	0.075	0.013	0.015	0.872
2.	Education(x_2)	0.111	0.067	0.065	0.130	0.501
3.	Family Size(x_3)	0.085	0.052	0.039	0.135	0.287
4.	Occupation(x_4)	-0.050	-0.030	-0.130	0.647	-0.201
5.	Homestead Land(x_5)	-2.124	-1.299	-0.094	0.055	-1.718
6.	Land under cultivation(x_6)	1.999	1.217	0.092	0.056	1.623
7.	Land under irrigation(x_7)	0.283	0.173	0.087	0.098	0.880
8.	Land under rain fed(x_8)	0.057	0.034	0.170	0.485	0.350
9.	Cropping intensity(x_9)	0.026	0.015	0.111	0.613	0.181
10.	Cost of production(x_{10})	-0.175	-0.107	0.000	0.000	-1.338
11.	Income from field crops(x_{11})	-0.106	-0.065	0.000	0.000	-0.825
12.	Income from cash crops(x_{12})	0.300	0.183	0.000	0.000	2.063
13.	Income from live stocks(x_{13})	0.111	0.067	0.000	0.000	0.782

MULTIPLE R-SQ=37.50%

S.E= 0.761

Regression Analysis, Impact on Human Health (y) VS 13 independent variables (x_{12}, x_{10}, x_7)

Variables	Beta	Beta x R	S.E. of B	t value
Income from cash crops(X_{12})	0.427	0.220	0.000	3.638
Cost of production(X_{10})	-0.257	-0.132	0.000	-2.174
Land under irrigation(X_7)	0.246	0.127	0.075	2.134

MULTIPLE R-SQ=26.80%

S.E= 0.746

The multiple regression analyses between criterions Impact on Human Health vs. 13 causal variables. It has been found that the variables Land under irrigation(X_7), Cost of production(x_{10}), Income from cash crops(x_{12}) have contributed substantially to the variance embedded with the consequent variable y.

The R2 value being 0.375, it is to infer that 37.50 per cent of variance in the consequent variable has been explained by the combination of these 13causal variables.

Presents full model of Multiple Regression Analysis, followed by Step down Regression to retain the most important and critical causal variables that are Land under irrigation(x_7),Cost of production(x_{10}) ,Income from cash crops(x_{12}) have been Retained at the last step.

The R2 value being 0.268, it is to infer that 26.80% of variants in the consequent variable has been explained by the combination of these 3 causal variables.

Revelation:

It has been found that variables Income from cash crops, Cost of production, Land under irrigation have contributed substantially to the impact on human health.

So, the reasons are well discernible income from cash crops consists of betel vine, Rose, Jasmine, Tube rose have also been vulnerable to pollution created by fly ash. So, all these need more intensive programming, cleaning or marketing ,as it useable also influences cost of production. Land under irrigation implies Cropping intensity in its substance. Higher cropping intensity, the more crops on stands, the higher has been the impacts.

Factor Analysis

Factor Analysis: Conglomeration of 13 explanatory variables into 7 factors.

Factors	variables	Factor Loading	% of variance	Cumulative %	Factor renamed
Factor 1	Homestead Land(X_5), Land under cultivation (x_6), Land under irrigation (x_7)	0.921 0.730 0.325	14.77	14.773	Resource back-up
Factor 2	Education(x_2), Occupation (x_4)	0.808 0.872	11.991	26.764	Capacity
Factor 3	Impact on commercial crops(y_5), Impact on Human Health(y_1), Income from cash crops(x_{12}), Income from live stocks(x_{13})	0.688 0.782 0.586 0.427	10.634	37.399	Performance
Factor 4	Impact on cultivation crops(y_2), Land under rain fed(x_8), Impact on livestock(y_3)	0.836 0.628 0.716	9.514	46.913	Agro-ecology
Factor 5	Education(x_2), Age(x_1)	0.808 0.653	8.015	55.598	Acquisition factor
Factor 6	Intensity of Human Health Hazards(y_6), Impact on Fishes(y_4), Cropping intensity(x_9)	0.730 -0.653 0.520	8.015	63.614	Health factor
Factor 7	Cost of production(x_{10}), Income from field crops(x_{11})	0.814 0.383	6.934	70.547	System economy

Presents the factor analysis, wherein 13 numbers of independent variables have been

conglomerated into 7 dominant factors.

Factor1 is consists of 3 variables viz. Homestead Land(x_5), Land under cultivation (x_6), Land under irrigation (X_7). These variables contribute about 14.773 per cent of variance, and the factor renamed as Resource back-up .

Factor2 consists of 2 variables education(x_2), occupation(x_4). These variables contribute about 11.99% per cent of variance and is renamed as Capacity.

Factor3 consists of 4 variables Impact on commercial crops (y_6), impact on Human Health(y_1) Income from cash crops(x_{12}), Income from live stocks(x_{13}). Which contributes about 10.63% per cent of variance and, is renamed as performance.

Factor 4 consists of 3 variables viz. Impact on cultivation crops(y_2), Land under rain fed(x_8), Impact on livestock(y_3).These 3 variables contribute 9.514 per cent variance and is renamed as Agro-ecology.

Factor 5 consists of 2 variables viz. Education(x_2) and Age(x_1). These 2 variables contribute 8.68 per cent of variance and is renamed as acquisition factor.

Factor 6 consists of 3 variables viz. Intensity of Human Health Hazards (Y_6), Impact on Fishes (y_4), Cropping intensity(x_9). These 3 variables contribute 8.01 per cent of variance and is renamed as Health ecology.

Factor 7 consists of 2 variables viz. Cost of production(x_{10}), Income from field crops(x_{11}). These 2 variables contribute 6.93 per cent of variance and are renamed as Health ecology.

Path Analysis: Direct, Indirect and Residual effects

Impact on Human Health (y) vs. 13 exogenous variables.

Variables	TE	DE	TID	HIDF
x_1	0.213	0.118	0.095	X6(0.540)
x_2	0.015	0.107	-0.092	X5(0.839)
x_3	0.006	0.099	-0.093	X5(-1.129)
x_4	-0.015	-0.039	0.024	X5(0.851)
x_5	0.125	-2.244	2.369	X5(-2.244)
x_6	0.184	2.110	-1.926	X5(-2.224)
x_7	0.261	0.290	-0.029	X5(-1.576)
x_8	-0.225	0.066	-0.291	X5(-0.364)
x_9	0.134	0.027	0.107	X5(0.236)
x_{10}	-0.194	-0.173	-0.021	X6(-0.251)
x_{11}	-0.126	-0.103	-0.023	X6(-0.230)
x_{12}	0.360	0.295	0.065	X12(0.295)
x_{13}	0.217	0.115	0.102	X5(-0.233)

Residual effect: 62.50%

Represent the path analysis for decomposing the total effect (r) into direct, indirect and residual effect.

Revelation: It has found that x_{12} has retained the highest total effect on impact on human health. Human health and live stocks resources have co-genital effect on each other. It has also been found that the variable x_6(Land under Cultivation) has excreted the highest direct effect to justify the over-helming role in perceiving the impact on human health (y_1). Science the size of lands under cultivation is directly hit by fly ash of Thermal Power Station. Its impact has been so decisive and discernible as well. The size of homestead land helps to elicit the intense association effect on human health effect. The variable x_5 has routed the highest indirect effect as many as 8 variables to characterize the dependent variable y_1 (Impact on Human Health). So, this variable can create a better networking with other variables under study.

The residual effect 62.50 per cent (Even with the combination of 13 exogenous variables 62.50 percent of variables in y_1 (Impact on Human Health) can't be explained.

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