Foreign Aid and Its Environmental Implication in India

Kalpana Sahoo [1]

Narayan Sethi [2]

The present study empirically investigates the impact of foreign aid on environmental quality in India with the presence of some linkage factors i.e. gross domestic product, trade liberalization, net forest depletion and total value added by the industrial sector. This study is based on the annual time series data covering the period from 1970-71 to 2010-11. By using the OLS technique, the study finds that impact of foreign aid on environment degradation is negative and statistically significant. However, aid helps in reduction of environment pollution in India. It concludes that deforestation, industrialization and economic growth are the major factors which responsible for environment degradation in India. This study suggests that, it is the responsibility of the government to make appropriate plans and programs to maintain a balance between growth challenges and environment challenges. Careful planning and systematic policies should be implemented to ensure that the green growth strategies do not result in a slow growth strategy.

[1]**Kalpana Sahoo ,**Doctoral Research Fellow (JRF),Department of Humanities and Social Science,National Institute of Technology (NIT),Rourkela-769008, Odisha, India, e-mail: kalpana.sahoo8@gmail.com.

[2] **Narayan Sethi** ,Assistant Professor, Department of Humanities and Social Sciences, National Institute of Technology (NIT),Rourkela-769008, Odisha, India, e-mail: nsethinarayan@gmail.com

I.   Introduction

Environment is the basic ingredient necessary for the survival of the mankind to live a healthy life with dignity. It brings good health, wealth and social prosperity for the existence of the human being on the earth. Conservation of environment quality has its own importance from both national and international perspectives. The perception that foreign aid inflows influence the environment quality in developing countries is not a new line of investigation. The debate on how foreign aid influences the environment quality of the aid-recipient country remains inconclusive (Castro and Hammond, 2009). The aid literature has given more attention on the growth impact of foreign aid inflows i.e. higher economic growth, poverty eradication, employment opportunities, infrastructure development, accelerated development process etc. (Arvin et al., 2006). There are very few studies exist relating to the environmental implication of the foreign aid program. The impact of foreign aid on environmental quality depends upon the methods by which the recipient government spends aid money which in turn is a function of government's survival strategies (Bueno et al., 2003).

Foreign aid is considered as an important financial tool to finance the initial development process of a developing country. Since after World War II, huge amount of foreign aid has been sanctioned by the developed nations to both developing and underdeveloped nations for developmental purposes. Foreign aid can be defined as the international transfer of public funds in the forms of loans and grants directly from one government or an international financial institution to another government at the time of need. It takes two forms such as

loans at concessional term (contains grant element of at least 25%) and grants which is nonrefundable (OECD, 2009). The purpose of the foreign aid programs is to accelerate the process of economic development up to a point where a satisfactory rate of growth can be achieved on a self-sustaining basis. The traditional approach of determining aid effectiveness through growth dimension is no longer considered as a sufficient criterion. Currently the effectiveness of aid programs is calculated by considering its impact on conservation of environmental quality, maintenance of stable political system and sustainable development. Foreign aid programs positively contribute to the environmental clean-up only when it becomes tied with the environment protection (Chao and Yu, 1999). Supporting this view, Hatzipanayotou et al. (2002) have found that higher amount of foreign aid inflows lead to reductions in the total amount of cross-border emissions. This study has suggested that performance-driven aid inflows should be included in the pollution policy by the polluting country to protect environment quality.

Presently, environmental degradation has become one of the greatest challenges for the mankind. In the dynamic world, most of the developing countries have been struggling hard to accelerate the process of both economic growth and development to sustain in the competition. Overemphasized on achieving fast economic progress, however, it puts severe threat on the achievement of sustainable development goal. Over utilization of natural resources creates threat for environment quality and its availability for the future generations. India is the second largest growing economies of the world. In India, rapid economic growth has taken place over the last two decades by the adoption of new economic reforms in 1990's which involves heavy industrialization and acceptance of many developmental projects. These developmental projects have caused degradation of the dense forest areas and massive loss of biodiversity. Adding to this, weak implementation of environment protection laws has responsible for

environmental damages in the form of air, water and soil pollutions. The degradation of environment in terms of environment pollution, depletion of natural resources and loss of bi-diversity are responsible for the reduction of income generation capacity of the present and future generations by affecting adversely their health status (Smith, 1999).

In the era of globalization and economic integration, economies are so interdependent that economic activity of one economy quickly affects the economic activity of other economy. Environment pollution does not respect national boundaries and affecting both the polluters as well as its neighboring countries. Environment pollution is a matter of concern for both the polluters and its neighboring countries as the productivity of an individual country is adversely affected by the worldwide aggregate emission of harmful materials (Branden & Bromley 1981; Hoel 1991 and Dockner and Long 1993). The impact of foreign aid on improving the global environmental quality depends on the marginal rate of substitution between the environmental qualities of the trading partners and the relative efficiency in the technology of reducing pollution in the recipient country (Niho, 1996). In recent years, most of the developing countries have experienced lower rate of growth in terms of reduction of poverty and pollution if the amount of foreign aid had been reduced (Addison et al. 2004). According to the 'trading up' (Vogel 1995 and Greenhill et al., 2009) and 'investing up' (Prakash and Potoski, 2007) criterion, high levels of globalization flows raises the environment quality as the preferences of the investors are pro-environmental.

Shortage of domestic capital for environmental clean-up and conservation is one of the major factors responsible for environmental degradation in many developing countries. Foreign capital in terms of aid is the other alternative available with the poor countries to supplement its scarce domestic capital and it acts as an important financial tool to finance the developmental projects (Morrissey, 2001).

There are two major sources which help an economy to generate capital i.e., internal sources and external sources. Lack of adequate amount of domestic capital in the developing countries, compel them to depend upon foreign capital. The two major forms of external capital inflows are official flows and private flows. The major difference between these two types of flows is that the former is guided by the welfare motive whereas the latter is guided by the profit motive. So private capital flows has nothing to do with the developmental programs like infrastructural development, education, health, environment preservation etc. of the recipient countries. Following the low level of development and a small tax base, developing countries has to depend upon external sources to finance their economic growth (Haber and Menaldo, 2011).

There is relatively few empirical literature available related to the question that how foreign aid influences the environment quality of the recipient countries. Among them, some have examined the effects of environmental aid on specific country (Gutner, 2002) and some have done related to specific donor agency (Dauvergne, 2001). The Environmental Kuznets Curve (EKC) argues that pollution level rises in the early stages of development but after a certain point it starts to decline. Asafu-Adjaye (1999) has supported the main thrust of Environmental Kuznets curve and found that turning points of the curve vary by both country and pollutant type. Arvin et al. (2006) examines the relationship between foreign aid and ecological conditions in developing countries using a Granger causality test. They have found that there exist an empirical causal link between foreign aid and the environment level. Some theoretical studies find that foreign aid inflows may not only reduce poverty but also encourage conservation of natural resources in the aid-recipient countries. Supporting to this, Arvin and Lew (2009) examine the same nexus in a broader model by considering some other determinants that affect environmental conditions and found that foreign aid has shown

favorable effect on environment. Perkins and Neumayer (2012) have found that trade can be used as an important financial tool for transforming the environment preference of the importing countries to the exporting countries. In a recent study carried out by Rivera and Oh (2013) state that European MNCs are more interested to invest in those countries where the environment regulations are more stringent than home country. A similar study by Lim et al. (2014) have found that at lower level of export receipts and Foreign Direct Investment (FDI) inflows, foreign aid act as an environment friendly tool but the result becomes reversed with the increase in FDI inflows and export earnings.

Both higher economic growth and good environment quality are two important criteria for the survival of the mankind, so both should be given equal importance in the national plans. One should not be ignored or compromised with other. With a growing inequality and given the fact that both environmental degradation and higher economic growth goes side by side, it is essential to examine whether foreign aid accelerate, deteriorate or have no impact on the environment quality of the aid-recipient country. By using the Ordinary Least Squares (OLS) technique, the present study attempts to investigate the impact of foreign aid on environment quality in India for the period 1970-71 to 2010-11. The remaining part of this paper is organized as follows: Section II describes the contemporary environment situation in India. Section III presents methodology and model specification of the study. Section IV provides the empirical results and discussion. Section V presents the conclusion, policy implication and limitation of the study.

## II.   Contemporary Environmental Situation in India

Since the Industrial Revolution, human activities have had a significant impact on environmental quality. Most significantly, the burning of fossil fuels, heavy industrialization, use of harmful products,

machineries and equipment's, use of heavy chemicals in agriculture, extraction of contaminated water supply, desertification, urbanization and deforestation are some of the major factors responsible for environment degradation. These factors raise the amount of greenhouse gases which causes climate change, global warming and ozone layer depletion. In the globalized era, India is emerged as one of the most economic power in the world. Its economy was not much affected by the recent global financial meltdown of 2007-08. If we compare GDP growth rate of India in the post crisis period then it was quite higher i.e. 8 % in comparison to many developed nations such as USA (0.8%), UK (1.7%), Germany (1.0) and Japan (1.5%) (IMF, 2009). On the other side, if we compare the other developmental indicators like HDI value, unemployment rate, pollution level etc. then it is quite unsatisfactory. In the year 2010, HDI value of India was 0.57 whereas USA, UK, Germany, Japan have experienced 0.908, 0.904, 0.895 and 0.884 respectively (World Bank, 2012).

The Indian industrial sector underwent significant changes as a result of the adoption of new economic reforms in 1991. India ranks in the top ten in terms of Green House Gas (GHG) emissions. This high level of CO_2 emissions is contributed by its large population, heavy industrialization, urbanization, deforestation and geographical size. The Indian Network for Climate Change Assessment (INCCA, 2010) has found that the total net GHG emissions from India in 2007 were 1727.71 million tons in comparison to 1228.54 million tons in 1994. This represents a compounded annual growth rate of 2.9 per cent during the period 1994 to 2007. GHG emissions from the energy, industry, agriculture and waste sectors in 2007 constituted 58 per cent, 22 per cent, 17 per cent and 3 per cent of the net CO_2 emissions respectively (Economic Survey, 2011). According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2007), over the century, atmospheric concentrations of

carbon dioxide increased from a pre-industrial value of 278 parts per million to 379 parts per million in 2005, and the average global temperature rose by 0.740C (Economic Survey, 2011). The following diagram-1 shows CO_2 gas emissions in million tons (as an indicator of environment pollution level) by the top 10 richest countries in the world which is classified on the basis of the GDP (nominal), 2011. The following figure-1 shows that USA is the richest country in the world in terms of nominal GDP. At the same time, it occupies first position in polluting the environment in terms of releasing highest amount of CO_2 emissions i.e. 2530 MT which is followed by China, Russia and India. India occupies 10th position in terms of nominal GDP, but it ranks 4th position in releasing carbon dioxide emission which is the one of the major factor contributes to the environment pollution, global warming and Ozone layer depletion.

Figure-1

CO_2 Emissions by Top 10 Richest Countries in the World
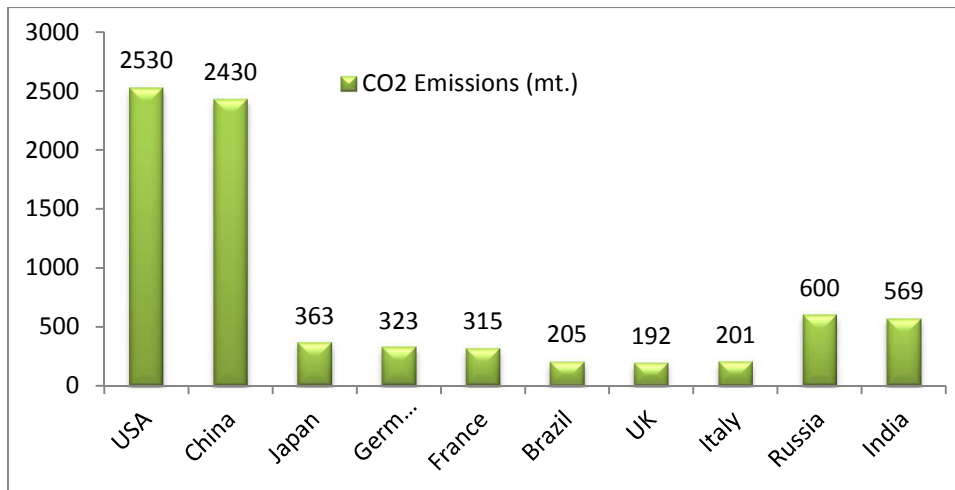
Source: CIA World Fact book

The following figure 2 shows Environment Vulnerability Index (EVI) of the top ten richest countries in the world which is classified in terms of their nominal GDP. Environment Vulnerability Index (EVI) is a measurement devised by the South Pacific Applied Geoscience Commission (SOPAC) and the United Nations Environment Programs to characterize the relative severity of various types of Environment issues. From the figure 2, it is clear that Japan occupies the first position in terms of Environment Vulnerability Index which is followed by India and UK.

Figure 2

Environment Vulnerability Index (EVI) by Top 10 Richest Countries
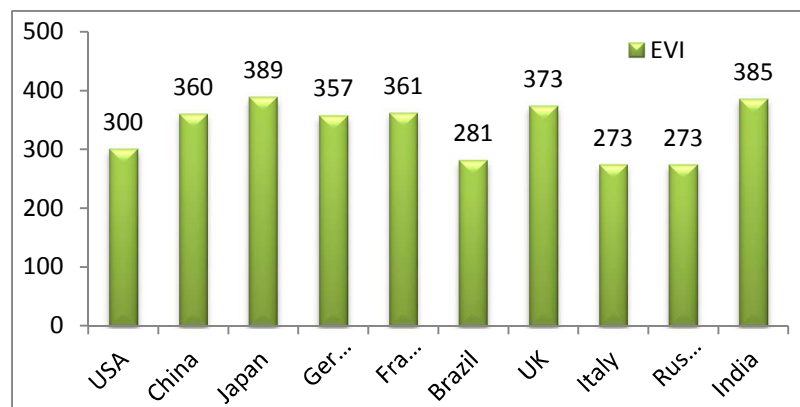
Source: CIA World Fact book,

Economic development without considerations of environmental quality will be meaningless for an economy like India. Overemphasis on higher economic growth without considering the environment quality will cause serious environmental damage by affecting the quality of life of both present and future generations. This challenges needs to be addressed in the economic planning, with necessary remedial measures. Recognizing the importance of environment,

government of India, through its various policies, has been adopting some ecological concerns into the development process so that economic development can be achieved without damaging the environment (Economic Survey, 2011). The following table-1 shows some recent initiative measures adopted by government of India with an aim to protect the environment quality:

Table-1
Recent Initiative Measures for Environment Protection, by Govt.of India

Measures	Objective
The Wetlands (Conservation and Management) Rules 2010	Ensure the degradation of wetlands from industrialization, construction, dumping of untreated waste
The National Green Tribunal (NGT) Act, 2010	relating to environmental protection and conservation of forests and other natural resources
The Coastal Regulation Zone Notification, 6th Jan, 2011	To protect Coastal ecosystems which protect biodiversity and also saves from natural disasters such as floods and tsunamis
Integrated Coastal Zone Management Project, 1156 cr. (with World Bank)	This project is for a period of five years. It is estimated that it will benefit 3.56 crore people directly 6.30 crore indirectly.
National Action Plan on Climate Change (NAPCC) in June, 2008	Sustainable Development

Source: Economic Survey, 2011

III. Methodology and Model Specification

This study considers some major determinants of environment quality like Carbon Dioxide emissions (CO_2) as an indicator of environment pollution, Gross Domestic Product (GDP) as the indicator of economic growth, Official Development Assistance (ODA) as an indicator of foreign aid, Trade liberalization (TrO) as an indicator of trade openness, Net forest Depletion (DEF) as the indicator of deforestation and total value added by the industrial sector (INDU) as the indicator of Industrialization for its empirical analysis. The study is based on the annual time series data which is collected from the World Development Indicators (WDI, 2012) published by the World Bank and Economic Survey of India. For the uniformity among the variables, all the variables are taken in terms of their real values i.e. US $ in constant price. There are some other indicators of environment pollution like land degradation, water pollution level, greenhouse gas emissions and organic pollution etc. Here, we have considered CO_2 as the proxy of environment pollution due to unavailability of time series data on other indicators of environment pollutants.

We have used annual time series data of 41 years for this study. It is very important to check stationarity in case time series data. Unit root test is one of major econometric tool commonly uses to test the stationarity property of the time series data. If the variables of a time series data do not satisfy the unit root test or becomes non-stationary random processes, then the modelling of the dependent and explanatory variables will generate spurious regression result due to the effect of the common trend. This study has used Augmented Dickey-Fuller (ADF) test (Dicky and Fuller, 1979) and Phillips-Perron (PP) test (Phillips and Perron, 1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test to test the stationary property of the variables. Among all unit root tests only the KPSS test without trend shows that all the variables are satisfies the stationary property (table-2).

The following functional relationship is framed to examine the impact of foreign aid on environment quality in India along with the presence of some linkage factors i.e. trade liberalization, deforestation, industrialization and economic growth. We have employed the Ordinary Least Squares (OLS) technique to empirically investigate the impact of foreign aid on environment quality in India. This model is framed by hypothesize CO_2 (Carbon Dioxide) as the dependent variable while ODA, TrO, DEF, INDU and GDP as the explanatory variables.

$$CO_2 = f \{ODA, TrO, DEF, INDU, GDP\} \ldots\ldots\ldots\ldots(1)$$

We have estimated the effects of foreign aid on environment quality by employing the ordinary least squares (OLS) techniques which can be written as:

$$(E)_t = \alpha_0 + \alpha_1 ODA_t + \alpha_2 TrO_t + \alpha_3 DEF_t + \alpha_4 INDU_t + \alpha_5 GDP_t + u_t \quad \text{-------- (2)}$$

Here,

$(E)_t$ = Environment pollution during the time period t

ODA_t = Net Official Development Assistance during the time period t

TrO_t = Trade Liberalization during the time period t

DEF_t = Total Deforestation during the time period t

$INDU_t$ = Total value added by the industrial sector during the time period t

GDP_t = Economic growth during the time period t

u_t = Disturbance term/White noise error term

III. Empirical Results and Discussion

This section presents the empirical results and its discussion. Unit root test is a pre-requisite of testing long run relationship between two or more time series data (Granger, 1981). We have conducted three unit

root tests i.e. ADF, PP and KPSS. The criterion of selection for unit test is that the absolute value of the test statistics should be higher than the critical value of the variables. The result of unit root test has presented in table-2. All the variables are stationary in in KPSS test.

Table 2

Unit Root Tests Result

Variables	ADF Test Without Trend	ADF Test With Trend	PP Test Without Trend	PP Test With Trend	KPSS Test Without Trend	KPSS Test With Trend
CO_2	0.98	-2.41	1.26	-2.36	0.77*	0.16**
ODA	-2.65***	-3.81**	-2.5	-3.64**	0.66**	0.1
TrO	2.16	-0.39	2.58	-0.39	0.68**	0.19**
GDP	12.76*	4.9*	07.47*	7.99*	0.73**	0.2**
DEF	-1.65	-4.71**	-1.48	-3.35**	0.7**	0.06
INDU	9.59*	3.01	9.51*	2.91	0.72**	0.19**

Source: Author's Calculation by using E-views 5.0 Software,
Notes: **, ** and *** indicate significance at 1%, 5% and 10% level respectively.*

The following table-3 presents the result of the simple regression test. In this table, CO_2 is considered as the dependent variables while other five variables are considered as explanatory variables.

Table 3

Impact of Foreign Aid on Environment Quality in India

Variable	Coefficient	t-Statistic
Dependent Variable: CO$_2$ **Method: OLS test** **Timer Period: 1970-71 to 2010-11**		
C	1.97	0.14
ODA	-0.632	-4.55*
GDP	0.058	3.49*
INDU	0.196	2.84*
DEF	0.449	2.17*
TrO	3.89	0.5
R-squared-0.94, Adjusted R-squared-0.93, Durbin Watson stat-1.84, Prob (F-Statistics)= 0.00		

Source: Author's Calculation,

From the above table 3 it is clear that the result satisfies all the criteria of a good model. The values of both R^2 and adjusted R^2 are nearer to 1 is defined as a goodness of fit of the model however; the value of Durbin-Watson (DW) statistic is 1.84. The ideal value of the DW statistics should be nearer to 2 (Gujarati, 2004), which indicate lower chances of the presence of auto-correlations in the error term. R^2 and adjusted R^2 values shows the variability present in the dependent variable that can be explained by the independent variables used in this model. Therefore, we consider the regression results of table 3 for the analysis of equation 2, as the estimated OLS test results satisfy all the criteria of a good model.

$$(E)_t = \alpha_0 + \alpha_1 ODA_t + \alpha_2 TrO_t + \alpha_3 DEF_t + \alpha_4 INDU_t + \alpha_5 GDP_t + u_t \quad \text{-------- (2)}$$

After putting the values of both coefficients and t-statistics (table 3) in the equation-2, we have framed the equation as follows:

$$(E)_t = 1.97 - 0.632\,ODA_t + 3.89\,TrO_t + 0.449\,DEF_t + 0.196\,INDU_t + 0.058\,GDP_t + u_t\ ..(3)$$

t- Statistics (0.14) (-4.55*) (0.5) (2.17*) (2.84*) (3.49*)

From the above regression results it is clear that, the coefficients of foreign aid, deforestation, industrial growth and economic growth have shown significant impact on the dependent variable i.e. CO_2, as the indicator of environmental pollution level in India during the study period. The coefficient of trade liberalization has shown statistically insignificant impact on the dependent variable, so no exact inference can be drawn about the impact of this variable on environment pollution level in India during this study period. On the other hand, the estimated coefficient of deforestation, industrial growth and economic growth rate have shown positive and statistically significant impact on the dependent variable i.e. CO_2 which indicate that these three variables are contributing to the release of higher amount of CO_2 emissions in India. Rise in industrialization, deforestation and economic growth lead to higher amount of environment pollution (in terms of more extraction of CO_2 emissions) in India. Among the three variables, economic growth has shown highest significant and positive impact on environment degradation of India than other two variables, which may be the reason that major determinants of growth i.e. heavy industries set up, commercialization of agriculture, and use of luxurious machineries for saving time and energy causes higher amount of environment pollution. Official capital inflows (ODA) has shown significant but negative impact on environment pollution of India which indicates that among all the five independent variables, foreign aid is the only variables which helps in the reduction of environmental pollution and indirectly helps in the preservation of environmental quality in India. This study confirm to

the findings given by Arvin and Lew (2006) that foreign aid helps in the reduction of CO_2 gas emissions in the recipient country.

V. Conclusion

The empirical result reveals that foreign aid positively contributes toward the improvement of environment quality via reduction of the pollution level in India. The study finds that higher rate of economic growth; deforestation and industrial growth are some of the major factors responsible for the degradation of the environment quality in terms of releasing more CO_2 gas emissions in India. Among all the five independent variables foreign aid is the only variable which has shown significant and negative impact on pollution level in India which indicates that foreign aid helps in improving environmental quality in India particularly in the study period. The finding of this study supports the statement that foreign aid inflows positively contribute for the conservation of environment quality (Hatzipanayotou et al., 2002). The study concludes that foreign aid inflows can be used as an important financial tool to reduce the environmental pollution in future.

In the light of the above empirical findings, it proposes that reward in terms of higher amount of foreign aid should be sanctioned those are performing well in terms of maintaining good environment quality and the polluter countries will be punished in terms of reduction of foreign aid inflows and in extreme cases aid should be completely stopped. It also suggests that careful planning and systematic policies should be implemented to ensure that the economic growth strategy should be followed by green growth strategies. However, the study is not without its limitations. The study is constrained due to the unavailability of time series data of certain variables like environment aid, polluted water quality, land degradation, deforestation.

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