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## Sources and Consequences of Environmental Pollution and Institution's Role, in Pakistan

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**Abstract:** The objective of the study was to highlight the major sources of pollution, economic damages due to different pollutants and to suggest their possible remedies through sustainable economic growth. It is observed that automobiles, industrial sector and solid wastes are the major sources of environmental pollution. According to (Brandon and Ramankutty, 1993), the environmental cost to Pakistan economy was estimated as \$1.8 billion. Pakistan currently spends about \$17 million per year on pollution-related cleanup activities but it requires \$84 million to resolve the country's environmental problems to save \$1.8 billion per year from environmental damages. Finally comprehensive, research and administrative based solution to tackle the environmental issues without affecting the development process is suggested.

**Key words:** Environmental pollution, health damages, economics of pollution, institution's role

### INTRODUCTION

The per capita income in Pakistan has increased from US\$335 in 1980 to 652 in 2004. Different sectors like agriculture, textile, services, water, power infrastructure and telecommunication remarkably contributed to achieve this significantly higher level of income. Despite the higher population growth rate other social indicators of development such as life expectancy, infant mortality and nutrition all has significantly improved during the same period. Substantial inflows of foreign assistance have aided these accomplishments. With the implementation of WTO rules rate of transfer of technology from developed nations to developing countries is expected to increase significantly. This will further help to multiply per capita income because of availability of higher number of jobs in private sector with higher wage rates. The share of industrial sector in GDP is gradually increasing and most productive land is shifting from agriculture sector to non-agricultural sector (industries and construction) and agriculture is shifting towards marginal lands with higher population pressure. This will compel scientists to introduce another green revolution and first experience is an evident that yields can be increased only with higher level of input use, fertilizer, pesticide and water etc.

The higher rate of transfer of technology and greater level of input use in agriculture sector together with elevated level of income will exaggerate environmental problems which are already touching to the hazardous limits but it does not mean that we should not adopt these innovations. Rather we need to make the role of our institutes more effective and practical in development process to tackle these issues. The past trends of increasing pollution level with development process are

clearly demonstrating that our institutes could not perform their imperative role to control pollution level.

The major sources of environmental pollution are industrial and transportation sectors because both sectors are emitting toxic effluents directly into the environment. Increasing per capita income will further elevate the pressure on these sectors of the economy because of having positive income-demand elasticity of these sectors. The increasing population pressure with high per capita income will generate additional demand of cars, air conditions, refrigerators, medicines, shoes and for better clothes etc. In order to match the demand and supply situation, industrial and transportation sector has to be expanded. The objective of the present study is to highlight the sources and causes of environmental pollution in Pakistan and suggest policy directions in order to minimize pollution to a level that can sustain our economic growth.

### SOURCES OF POLLUTION

During the last few years, traffic in urban areas has increased tremendously due to increase in purchasing power and car loan facility provided by different banks. The number of vehicles in Pakistan has swelled in recent years-from 680,000 in 1980 to 5.2 million in 2004 showing an overall increase of 635% (Government of Pakistan 2005). Since 1980, the maximum growth has been seen in 2-stroke vehicles i.e., delivery vans which is 1751%, followed by Motor cycles 541% and Rickshaws 159%. Diesel trucks and buses have also increased at an alarming rate of 200-300% since 1980. Diesel vehicles due to overloading, faulty injection nozzles and weak engine emit excessive graphitic carbon (visible smoke). Diesel

Particulate Filter (DPF), which is a device used in many countries to control emission in diesel vehicles, cannot be used in Pakistan as it requires low sulphur diesel i.e., 0.05-0.5% sulphur (available diesel in market contains 1% sulphur). The major cause of suspended particulate matters was due to 2-stroke vehicles using straight mineral oil (instead of 2T oil) as lubricant and use of excessive quantity of lubricant (12%) instead of 2% for motor cycles and 3% for three wheelers (Brandon and Ramankutty, 1993).

Generally, the level of air pollution in our cities is as high as three times of the acceptable limits. It has been estimated that on an average each vehicle in Pakistan emits 15-20 times more pollutants than the average vehicle in developed country. The 1992 National Conservation Strategy Report (NCSR) claims that the average Pakistani vehicle emits 25 times as much carbon dioxide as the average U.S. vehicle, as well as 20 times as many hydrocarbons and more than 3.5 times as many nitrous oxides in grams per kilometer. Pakistan's per capita carbon emissions in 2001 were 0.2 metric tons per person and it is almost double compared to Bangladesh who emitted 0.1 metric tons of carbon per person. Most of Pakistan's carbon dioxide emissions were from oil (54.6%) while emissions from natural gas were 38.1% and emissions from coal (7.3%) accounted for the rest.

Recently, Pakistan Environmental Protection Agency (EPA) with the assistance of Japan International Cooperation Agency (JICA) carried out ambient air quality study in three major cities namely Lahore; Rawalpindi; and Islamabad to assess pollution levels in traffic congested areas. The study revealed that the average suspended particulate matters in our cities were 6.4 times higher than WHO guidelines and 3.8 times higher than Japanese standards. The levels of sulphur dioxide, oxides of nitrogen and carbon monoxide were found in excess than acceptable standards in some areas but the average levels were found below than WHO guidelines. Presence of such a high levels of suspended particulate matters in the air is certainly an issue of concern due to its serious health implications for public.

Another serious issue is of high content of lead in gasoline, which presently is  $0.35 \text{ g L}^{-1}$ . Different studies carried out by Pakistan Medical and Dental Association and Aga Khan Medical Hospital have confirmed presence of high concentration of lead levels in blood of school children, traffic police and adults. Road side air samples also showed high lead in air. Many countries of the region including Bangladesh, China, India, Japan, Philippines, Thailand and almost all Europeans countries have banned lead in gasoline.

Some environmentalists say that poor fuel quality is also to blame for the country's serious air pollution problems. Fuel consumption increased by 65% in Pakistan from 1990 to 2004 (Govt. of Pakistan 2005) and gasoline continues to contain high levels of lead and sulfur. Unleaded gasoline was introduced in 2001, but many vehicles in Pakistan's major cities still use leaded gasoline. Various grades of gasoline sold in Pakistan contain about  $350 \text{ mg L}^{-1}$  of lead while leaded gasoline in other countries usually contains no more than  $150 \text{ mg L}^{-1}$ . The leading researchers working on environmental issues agreed that the problem of air pollution largely could be solved if the government were to tighten its lax fuel quality standards.

The most important air pollutant is particulate matter as it affects more people on a regular basis than any other pollutant. It is made up of coarse particles such as soil, ash and engine exhausts. These particles, especially those with diameters of less than  $10 \mu$  deposit on the pulmonary region of the respiratory tract and cause irritation and increase the rate of respiratory tract infections. They also aggravate cases of asthma and bronchitis. Infants and children are particularly susceptible (Pope *et al.*, 2002).

The solid waste is another source of environmental pollution. Pakistan generates over 50,000 tons of solid waste per day; out of which only 20 to 25% is collected but not disposed off in the proper manner, causing serious air, water and land pollution and health hazards. This implies that pollution level will further increase in coming years if strict measures are not put in place.

Now the question is why we are so cautious about air pollution? Simply, because it damages human health abruptly which lead to affect the labor productivity of a nation and finally it will affect the economic growth rate of a nation. The estimated burden of disease from air pollution cited above, 150,000 deaths annually in South Asia, provide a useful benchmark for comparing the relative magnitude of different health risk factors. However, they are not an appropriate basis for comparing different air pollution reduction strategies. Burden-of-disease estimates are based on reducing air pollution to theoretically minimum levels (for example,  $\text{PM}^{10}$  "particles smaller than  $10 \mu$ " concentration of  $15 \mu\text{g m}^{-3}$  (Cohen *et al.*, 2003)). Pollution reductions to such low levels have not been achieved in many US and European cities and it would be unrealistic to assume that developing country like Pakistan would achieve such levels in the near future. Instead, health gain estimates should be determined for each pollution reduction strategy based on the expected population exposure reductions. The cost of different health related damages can be estimated as explained below.

## EFFECTS ON HUMAN HEALTH

Pollutants are known to be causative for many diseases, including cancer, lupus, immune diseases and asthma. Higher levels of background radiation have led to an increased incidence of cancer and mortality associated with it worldwide. Some illnesses are named after the sites of human tragedy where specific pollutants were first formally implicated as the culprit. One example is Minamata diseases, which is caused by mercury compounds.

Persistent adverse air quality above certain thresholds impacts mortality rates. Ozone pollution can cause sore throats, inflammation, chest pain and congestion. Skin irritations and rashes may arise when oil is spread in the local environment. While the general public has become more aware of the harm posed by air and water pollution, awareness of the consequences of noise pollution is less pervasive. Hence, present study is concentrating only on environmental pollution

**Valuing reductions in illness:** Improving air quality should reduce the number of episodes of acute illness (such as asthma attacks) experienced each year, as well as the number of cases of chronic respiratory illness that occur. To economists the value of avoiding an illness episode, such as an asthma attack, consists of four components: (1) the value of the work time lost due to the attack (by the asthmatic or an unpaid caregiver or both); (2) the medical costs of treating the attack; (3) the amount an asthmatic (or, in the case of a child, the child's parents) would pay to avoid the pain and suffering associated with the attack and (4) the value of the leisure time lost due to the attack (by the asthmatic or a caregiver).

If the asthmatic were to bear all costs of the attack (including lost work time and medical costs) his or her stated willingness to pay should reflect all four components of value. If, in contrast, the asthmatic has health insurance and paid sick leave, he or she will not bear all medical costs and productivity losses. These are, however, legitimate economic costs and must be included in the value of an illness episode.

**Calculating the value of avoided illness:** Medical costs and productivity losses are often estimated by asking about the type of treatment sought during an illness episode and by asking how long the episode lasted and for how many days the patient (or a family caregiver or both) were unable to perform their usual duties. Lost work time is then valued at the wage rate and medical costs are imputed based on the full social costs of providing the care, not just the costs to the patient (Pandey *et al.*, 2003).

Economists usually estimate the value of pain and suffering avoided and the value of leisure time gained by direct questioning: that is, people are asked what they would pay to avoid the discomfort and inconvenience of an illness of a specific type and duration. This approach is referred to as the Contingent Valuation Method (CVM) or the stated preference method.

When estimates of the value of pain and suffering and lost leisure time are unavailable, medical costs and productivity losses are often used to provide a lower bound to the value of avoiding illness. This is referred to as the Cost-of-illness (COI) approach to valuing morbidity. Medical costs are referred to as the direct costs of illness and productivity losses as the indirect costs of illness. In the case of a serious but infrequent illness, such as a stroke, reducing air pollution reduces the risk of a person having a stroke. Thus what should be estimated is what a person would pay to reduce his or her risk of having a stroke. In practice, the COI approach is often used to value serious illnesses, such as a heart attack or stroke. However, empirical estimates of what people are willing to pay to avoid the pain and discomfort of these conditions tend to be lacking.

**Valuing reductions in premature mortality:** Cropper *et al.* (1997) predicted the impact of air pollution on premature mortality and studied that how many fewer people are likely to die if air pollution is reduced. For example, a 10% reduction in PM<sup>10</sup> (particles smaller than 10  $\mu$ ) in Delhi, India, might result in 1,000 fewer deaths each year. It refers to the 1,000 fewer deaths as the number of statistical lives saved by improving air quality. What this means is that the risk of dying is reduced by a small amount for all people living in Delhi and that these risk reductions add up to 1,000 fewer deaths. To illustrate, if reducing air pollution in Delhi results in 1,000 fewer deaths in a population of 10 million, this is equivalent, on average, to reducing risk of death annually by 1 in 10,000 (0.0001) for each person in the population (calculated from dividing 1,000 deaths by 10 million people, or 0.0001)<sup>1</sup>.

Since reducing air pollution reduces risk of death by a small amount for each person in an exposed population, what economists wish to estimate is what each person in the population would pay for this small risk reduction. When this willingness to pay (WTP) were added across all 10 million residents of Delhi, it represented the value of saving 1,000 statistical lives. Dividing the total willingness to pay by the number of statistical lives saved yields the average Value of a Statistical Life (VSL). People's willingness's to pay (WTPs) for small risk reductions are usually stated in terms of the VSL-the sum of WTPs for risk reductions that save one statistical life<sup>2</sup>.

<sup>1</sup> For simplicity, this example assumes that all people in Delhi benefit equally from the air pollution reduction. In reality, people with heart and lung disease are likely to benefit more than others.

<sup>2</sup> The goal of calculating the VSL is to estimate what people themselves would pay for risk reductions. The VSL is not intended to estimate the intrinsic value of human life.

When WTP estimates are not available, the human capital (human capital refers to knowledge and skills found in the labor force) approach can be used to obtain a lower bound to WTP. This approach values loss of life based on the foregone earnings associated with premature mortality. The notion is that people should be willing to pay at least as much as the value of the income they would lose by dying prematurely. This is not the theoretically correct approach to valuing a program that reduces the risk of dying, but does provide a useful lower bound to WTP (Freeman, 2003).

#### **Calculating the value of a reduction in risk of death:**

Economists realize that people trade money for safety every day. Workers are willing to work in riskier jobs if they are compensated for it and people are willing to pay for safer vehicles or for helmets to protect themselves when riding two-wheelers. WTP for a reduction in risk of dying is usually estimated from studies on compensating wage differentials in the labor market, or expenditures to reduce risk of death. These studies are usually referred to as revealed preference studies because they are based on actual behavior. A second source of estimates are stated preference studies in which people are asked directly what they would pay for a reduction in their risk of dying (also called CVM, referred to above in the context of valuing morbidity).

Studies of compensating wage differentials or expenditures on safety must determine what portion of the wage or what portion of the vehicle price represents payment for safety. This payment is then associated with the size of the risk differential to infer what people are willing to pay for it. For example, compensating wage studies empirically explain variations in the wage received by workers as a function of worker characteristics (age, education, skills) and job characteristics, including risk of fatal and nonfatal injury, in order to determine what portion of wage represents compensation for risk of death. In theory, the impact of small changes in the risk of dying on wages should equal to the amount a worker would have to be compensated to accept this risk.

#### **ECONOMICS OF POLLUTION IN PAKISTAN**

Vehicles are the leading source of air pollution that adversely affects Pakistan's economy and living standards of people of Pakistan. According to an estimate, the country is losing 25% of its potential crop production. According to (Brandon and Ramankutty, 1993), the environmental cost to Pakistan economy was estimated as US\$1.8 billion. Economic damages from urban air pollution are estimated at about \$370 million,

with 6.4 million people hospitalized annually for air-pollution-related illnesses. This cost was associated with expenditures on health, economic and production loss due to absentees in factories, offices and schools. A report released in January 2000 by the Ministry of Environment showed that Pakistan currently spends about \$17 million per year on pollution-related cleanup activities but it requires \$84 million to resolve the country's environmental problems in order to save \$1.8 billion per year which we are losing due to environmental damages. The cost-benefit situation clearly depicts that it is economical to invest in pollution control strategies. Beside profitability it will also help to improve the sustainability of the existing natural resources. The additional benefits that are expected to generate by sustaining the resources are not included in the estimates. The difference between cost-benefit situations will further broaden with the implication of WTO rules which stipulate that members can face higher tariff barriers for their exports if certain basic environmental criteria are not met. It is clear that Pakistan need to place greater emphasis on environmental protection in order to stem the country's environmental degradation and safeguard citizens' health because, under provisions of World Trade Organization (WTO) agreement, Pakistan will have difficulty in exporting products from industries without adequate environmental safeguards.

After having very clear understanding of huge economic losses of environmental degradation it is easy to conclude that the productivity of different resources cannot be sustained unless the trends of environmental degradation will not be reversed. It has serious implication for present as well as for future generation's welfare. Now the most important question is how to tackle the issue?

#### **INSTITUTION'S ROLE**

- Presently a number of environment related laws such as pesticide control, motor vehicles emission's regulation and control of industrial pollution through Pakistan Environment Protection Ordinance 1983 exist. However, these laws are not being implemented fully and effectively. Society need to attack this serious problem from different angles. Without any doubt, development of laws along the lines of objective has a key role to resolve the issue, implying that it is necessary but not sufficient condition.
- Another major area that has been totally ignored is a development of series of institutes to implement the existing and complicated laws and to refine them further according to local needs. A work force consist of different cells at the district level responsible to

implement the environment protection laws should be established. The force should be well equipped with modern tools of investigation such as computer with all related software, remote senses technology etc. In order to deal with complex and diverse industrial sector specialists from each field should be employed in each regional office. The operational cost can be minimized by employing specialist on consultancy basis or through public-private partnership. These specialists should be responsible to identify different damages from different economic activities.

- The research laboratories in all big universities of the country should be established or laboratories already exist can be enhanced according to changing demands of the market oriented system. These laboratories should be responsible to estimate the environmental damages from different sources of pollution identified by specialists. The damages done by each source of pollution will help to penalize the economic activities accordingly. These laboratories should be well equipped with all the latest technology together with good scientists having capabilities to operate all the available complicated technology and to conduct in-depth analysis. These laboratories should be responsible to conduct all necessary test proposed by work force to impose tax on some specific firm or industry. The objective to impose tax on different industries is not to generate revenue rather to encourage the industrialists to install modern equipment to control pollution.
- These laboratories should also be responsible to generate weekly data on all variables (such as amount of sulphur oxide, carbon monoxide, nitrogen oxide and hydrocarbons etc.) accountable to environmental degradation so that future scientist can analyze interaction among different variables and based on their conclusion future policy parameters could be formulated. The weekly or monthly data on different environmental pollutants from all big cities of Pakistan generated by these laboratories should be published in national statistic so that it could be easily available to all future researchers. Presently no time series data exist for any city of Pakistan and it is creating a big gap to develop any solid environmental related policy at the national level.
- Another necessary component that needs to be pointed out is the availability of operational budget that should be reserved in sufficient amount for the work force and laboratories. Most of the public sector institutes are operating with high level of inefficiency just because of not having sufficient operational budget. These institutes should operate under the umbrella of ministry of environment.
- In order to control the biggest source of pollution (automobile sector), we need to adopt the European pattern where the owner of each vehicle is responsible to get the annual permit from local environment protection office. The vehicles which are not fulfilling minimum required standard are not allowed to operate and those who are above the minimum required standard but below the maximum required standard are allowed to operate but they have to pay some certain amount of tax depending on how much they are polluting. Different amount of taxes corresponding to different level of pollution can be developed. In order to implement such system Ministry of environment also need to establish a very strong workshop at each district level and the workshop should be responsible to issue permit with or without tax to each vehicle according to the class in which it lays.
- To minimize the burden of expenditure on Government or to save the public resources collected through taxes, the cost of different tests applied to determine the level of pollution by each vehicle will be shouldered by the owner.
- In order to control the pollution from waste garbage, the local bodies should take very strict measures and again we should try to follow the European pattern. Presently local authorities have no modern vehicle to collect and recycle the waste material (garbage). This should be arranged at priority basis and people should be trained to operate the new technology. In order to collect the garbage big and closed drums (according to standard sanitary rules) can be placed in each street and people should be forced to put their garbage in these drums. The local authorities should replace these filled drums with empty ones on weekly basis. Those who are not following the instructions should be penalized by the local authorities. The cost of purchasing equipment (vehicles and drums) and implementation of such system is too low compared to expected benefit in terms of public health improvement and reduction on medical expenditures. The improvement in health will definitely expand the productivity of economy overall and the benefit in terms of productivity from such improvement will be enormous.
- Now if any industrialist for his new project wants to get clearance from environmental institute then the department should be liable to clear the file with or without objection within a minimum possible time and the maximum time required to get clearance should be elaborated clearly in their by laws so that development process should not be slumped. The process of accountability should be two ways i.e., If

the Governmental laws allow the environmental protection agency to arrest the person who is violating the environmental protection laws then the person who is paying tax and is the member of this society should have a right to claim some penalty from the agency if he proved in the court that agency failed to protect him from the environmental degradation because the amount of certain elements in the environment has permanently increased from the prescribed standards and these elements have badly affected his health. This kind of two ways accountability will keep the agency efficient and will make the nation proud that their tax money is being efficiently used to provide clean environment. The absence of such two ways accountability will generate high level of inefficiency and will lead towards wastage of public resources collected through taxes.

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