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A Detailed Review of Environmental Pollution and Its Ramifications from an Indian Context

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ABSTRACT:

The commercial sector of the most industrialized economy accounts for a significant percentage of the total environmental pollution (EP) that we experience today. Recent advancements in EP research have therefore provided environmental regulators and health scientists with a wide array of solution techniques. Unfortunately, the EP literature has lagged in providing an up-to-date integrated stream of research that could be useful for new entrants and experienced researchers. The paper's objective is to present a comprehensive review of EP research. The principal motivating factor is the deficiency of informative articles that reveal the length, breadth, and depth of scientific investigations in the area. The study extends to a general survey, models, empirical studies, and cases that have developed the frontier of knowledge in EP research. We aim to stimulate further practical and theoretical developments in the EP area. A second intent is to argue that research into EP provides excellent potential for increasing our knowledge regarding environmental management. The future holds promising results for researchers and practitioners engaged in EP research. Future studies are expected to save billions of dollars by developing novel, cost-effective methods.

Keywords:

Environmental pollution, water, air, soil.

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INTRODUCTION

The environmental pollution literature has a long and distinguished history. The primary incentive for the high interest in environmental pollution problems is the need for improvement and realization of sustainable development in the environment. Recently, research on environmental pollution has been gaining the increasing attention of professionals, scholars, and governments. The notable stakeholders in environmental pollution research are engineers, chemists, physicists, meteorologists, environmental pollution epidemiologists, lawyers, economists, sociologists, agronomists, and toxicologists, among others. Today, environmental pollution presents a big problem, a challenge, and a matter of environmental pollution interest and concern to citizens, governments, and professionals. Consequently, governments in many countries worldwide have in- creased their devotion and currently making efforts to strengthen the prevention of environmental pollution. Environmental pollution threatens the safety of people's lives and wealth and brings interrelated social problems. Thus, this has led to a huge investment of human intelligence and capital resources in the management and control of environmental pollution problems.

Environmental pollution problems evolved in the 20th century as a result of rapid economic development that was generated by the production activity in the manufacturing sector, causing damage to the productivity of other sectors, including the agricultural sector. The literature defines environmental pollution as an unfavorable alteration of our surroundings through direct or indirect effects, resulting in changes in energy patterns, radiation levels, chemical and physical constitution of our environment, and abundance of organisms. These changes may affect humans directly or through their supplies of water, agricultural, and other biological products.

Most countries of the world that previously had wonderful and untouched nature are now occupied with motorways, sky scrapers, nuclear power stations, and smoking industrial plants. A number of responsible humans also destroy the natural ecosystem for their own profit. Unfortunately, today, this irreversible destruction of the base of existence is still being carried on at a fast speed. Another concern is the greenhouse effect caused by the release of co2 into the environment. In China, for example, the signing of the un climate change framework treaty indicates recognition of the need to control the exhaust of greenhouse gases, such as carbon dioxide. The world is also committing itself to action to reduce pollution associated with energy use, including the reduction of carbon dioxide.

LITERATURE REVIEW

The English language literature on environmental pollution classifies pollutants into two major groups: natural and artificial (antonescu and Mateescu (2001)); Takahashi et al. (2000); Milton and Rahman (1999). Artificial pollutants result from human activity Takahashi et al. (2000). Natu- ral pollutants are non-human induced Milton and Rahman (1999). Even in the artificial pollutants group, we have two categories: completely artificial and substantially artificial. Examples of the first category are chlorinated hydrocarbons (such as DDT) and lead

aerosols (from the use of leaded gasoline). The second category includes oil in the oceans and phosphate in running water. There is also a substantial contribution of natural sources to pollution. Substances involved are hydrocarbons and sulfur oxides in the atmosphere and radiation. Clearly, even if natural sources exceed artificial ones, the ad- verse effects might result largely from artificial sources in populated industrial areas.

AIR, WATER, AND SOIL POLLUTION

Three broads theoretical and empirical research streams (air, water, and soil) and environmental pollution resent the environmental pollution literature. These major areas contain several hundreds of research papers with contributions from research institutions, universities, and government agencies.

AIR POLLUTION

Air pollution research is an important public health area. Many environmental pollution epidemiological studies show that air pollution in developing countries accounts for tens of thousands of deaths and billions of dollars in losses in medical costs and productivity every year Milton and Rahman (1999). A great many published papers have therefore appeared, varying from reviews to rigorous analyses of specific problems, suitable for both the specialist and the arcade- musician. Forest decline and decreasing crop yield are generally thought to be caused by a combination of air Pollutants such as acid environmental pollution positions, O3, SOx, NOx, and other oxidants. Air pollutants such as o3 dramatically reduce the primary production of forests since leaves exposed to large Doses of O3 display the typical symptoms of mottling with decreasing photosynthesis and increasing dark respiration.

To stimulate the change of the primary production by the air pollutants, various models have been developed for trees in which the dynamics or the cumulative frequency of short-term and/or long-term exposure to air pollutants has been considered (Lavrov et al. (2002)).

Some notable documentation on air pollution in- includes those by Takahashi et al. (2000), Abdel and Metwally, and Sabir et al. (2003). These studies have an international dimension in collaborative research efforts between countries of the world on the subject. Air pollution research also extends to cover the iron and steel industries, livestock, and agriculture. Takahashi studied air pollution in two countries (China and Japan) based on the iron and steel industry (coal and coke industries are contained). The preventive measures for environmental protection in China were environmental pollution sorted. Co-generation system of clean energy and pig iron was proposed as a new process.

The investigation by Abdel and Metwally focused on cement production factories in Egypt. They assessed the air quality from the environmental and health point of view based on traces of dust particulate from cement industrial areas. The multi-elemental analysis has re- revealed that the cement factories are potential sources of danger and toxic pollutants with serious impacts on human health in the study area. Principally, the identified pollutants are suspended particulate and lead.

Sabir et al. (2003) studied the daily contamination of the meat sold in the open market and on roadsides that are consumed by people. The samples were analyzed for the estimation of trace metals such as Pb, cu, ni, and zn, along with ca, mg, and fe. The overall concentration of pu, ni, zn, and mn was found (0–4 ppm). Among major elements, fe was found to be quite high (600– 700 mm). The ca (600–2000 pm) and mg (800– 1300 ppm) levels were also higher. Fe was recorded higher in beef and mutton. Ca in fish and mutton and mg in mutton chicken and fish were comparatively high.

WATER POLLUTION

Research on water pollution has emphasized the risk of surface oil and other contaminants. A strong cry of this body of research has been the protection of water from pollution by contaminants. Prominent studies in the area of water pollution include Ahmed (1998), Lasut and colleagues, and Ganjidoust (1998).

Ahmed focused on pure water pollution used for drinking and different other industrial purposes. He sought for pollution due to cadmium, lead, and heavy and toxic metals in the water. Cadmium and lead were expected to be not more than 10 and 50 ng/ml levels in the water. An automatic voltammetric method was used to measure the pollution levels of these metals in the sample area. Last and colleagues studied the marine and coastal zone environmental pollution and found a rapid increase in the quantity of pollution in marine and coastal waters.

Pollutants diminished the number of survivors, in- influenced metabolism and breeding efficiency, altered behavioral patterns, and effective structures and forms of the ecosystem. Clearly, pollutants can degrade the quality of the environment and influence resources. The work is a challenge to planners and designers of marine environmental management to avoid the degradation of marine resources due primarily to the activities of exploitation of resources, which were not well managed.

Gankidoust (1998) advocated that the daily extract- tons of crude oil and gas and their transportation are the main pollution sources of the Caspian Sea, which contains about 100 000 million barrels of oil and over 35 000 million cubic meters of flue gas. Many ships that navigate in the sea emit pollution into the sea, which is surrounded by many cities and industries. Pollution from these cities and industries enters the Caspian Sea either directly or through rivers.

SOIL POLLUTION

Different directions have been used to investigate soil pollution research. A direction is indicated in the principal study carried out by Ulukanligil et al. On soil-transmitted helminth (STH) infection in developing countries. They studied sewage farms, streams, and vegetables to determine the sources and routes of stomach infection in Turkey. One hundred and eight-seven (59,5 %) of a total of 314 samples, including 88,4 % of the stool samples, 60,8 % of the water samples, 84,4 % of the soil samples, and 14 % of the vegetable samples, were found to

be positive for sth eggs. These results indicate that the soil and vegetables are heavily contaminated and suggest a vicious circle between humans and the environment.

OTHER DIMENSIONS OF ENVIRONMENTAL POLLUTION RESEARCH

Apart from the traditional respective of viewing environmental pollution research in terms of air, water, and soil, there are other numerous studies that did not fall directly into these classifications (see Jost and Quas (2001); Milton and Rahman (1999)). An example of this is the study of the relationship between urban population density and ur- ban environmental problems. Jost and Quas (2001) in- vestigated various types of environmental pollution in Mumbai, classified into problems related to air pollution and, secondly, problems due to the lack of an adequate provision of local public goods such as sewage and refuse collection. It has been shown that this kind of environmental problem is closely related to the high growth and density of the population in Mumbai. Finally, the facts of Mumbai's population growth and environmental pollution were related to each other. Interre- relations between population, development, and environmental damage were identified.

Another study investigated the influence of environmental pollution in Evaluating the health condition of animal species as well as the risk factors affecting them. Specifically, Antoneseu and Mateescu (2001) studied the honey industry and the new exigencies faced due to the high sensitivity of the raw material to a wide array of aggression factors.

Yet, in another study, naa was investigated for precision analysis of metallic elements in a pine needle. It was found that about twenty elements in a pine needle could be simply analyzed by naa, and a pine needle could be suitable as a bio-monitor for the monitoring of environmental pollution in Horea.

Still on other aspects of environmental pollution research, Vavrova et al. (2002) carried out a related work on contamination of ration components and roughage fed to dairy cows and finishing bulls in two different agricultural ecosystems. Materials used for analyses included irrigation water, grass growth, roughage, preserved feeds, and trough samples of feed.

The mobile laboratory of regional hygienic ser- vices measured emissions by high-resolution gas chromatography with electron capture detection. The concentrations of indicator polychlorinated biphenyl (PCB) congeners did not exceed the safety limit in any of the sampling areas (mean concentrations of PCB in feed between 1–2 mg·kg–1). Calculation of the transfer co-efficient q proved to be a suitable tool for the assessment of resi- due transfer (dairy cows 0,2–1,0 bulls 0,3–1,0). Feed was identified as an important contamination source for animal tissues and milk.

Yet, in another study, sugary treats a comprehensive analysis of welfare in an open economy where there are two countries, two goods, one factor, and the transboundary. It has been found that the transboundary rate of pollution from an agricultural goods exporting country is

sufficiently large, and the non-transboundary rate of pollution in a manufacturing goods exporting country is sufficiently small.

Rao (1996) adds to the empirical evidence supporting a significant connection between ethics and profitability by examining the connection between published re- ports of unethical behavior – in terms of environmental pollution by publicly traded us and multinational firms and the performance of their stock. The analysis has shown that the actual stock performance for those companies was lower than the expected market-adjusted returns. Unethical conduct by firms that were discovered and publicized does impact the shareholders by lowering the value of their stock for an appreciable period of time.

COMPUTERS AND ENVIRONMENTAL POLLUTION

The advent of the computer has brought tremendous progress in the study of environmental pollution. Today the environmental pollution researcher is in the midst of a dramatic revolution in scientific and environmental investigations. Computers, in general, and the use of a decision support system (DSS) with a reference database appear destined to dominate soon the whole area of environmental pollution research. The computer has emerged as one of the most revolutionary inventions of our time. This revolution has come about so abruptly that researchers and practitioners recognize a very real technological gap in their background and the need to overcome it.

The impact of the computer on environmental pollution research is complex and many-sided. On the surface, an appraisal of the impact of the computer on environmental pollution research bears some similarity to an appraisal of the audience in a movie theatre. A theatre can be judged to be half-full or half-empty, environmental pollution ending upon the perspective of the perceiver. By the same token, the impact of the computer on environmental pollution research can be judged to be considered if one takes into account the multiple manipulations of data that make electronic data processing possible and per- formable.

Today data analysis in environmental pollution research would be impossible without computers. Practitioners rely on the computer as an important and powerful tool for collecting, recording, retrieving, and analyzing simple and complex problems, as well as distributing tremendous masses of information in environmental pollution research. It saves countless years of tedious work for environmental pollution researchers and practitioners. The computer removes the necessity to monitor and control tedious and environmental pollution-sensitive processes. Despite the importance of computers, their potential is so little explored that their full impact is yet to be realized.

Having discussed the impacts of computers on environmental pollution research, it is worthwhile reviewing a number of related computer documentation in environmental pollution research. A prime paper that comes to mind is the work by v. De Oliveira et al. (2001), who developed an intelligent decision support system (DSS) applied to environmental pollution caused by swine manure. The DSS allows the identification of high-pollution risk

producers and pollution sources. It has useful information to restrict the issue of new swine production licenses in high-risk areas and to identify current producers that must improve their waste management system, thus reducing pollution. The system may also be used to simulate the consequences of changes in animal density and management techniques on the severity of pollution (what-if analysis). The system gives support to technicians, researchers, and environmental organizations for making decisions on pollution issues involving swine production.

Another useful study carried out by Diaman- takes on the application of computer simulation to the estimation of the environmental pollution costs of an inactive hazardous waste site. The models of the pollution costs simulation model (pcs) were described, which trace the flow of costs from remedial action at environmental pollution and state-administered sites through to insureds in the form of potentially responsible parties and finally to the application of coverage defenses. Results were presented, including the characterization of variability and comparisons to the published insurance industry estimates of ultimate loss and expenses.

In attempts to solve the ever-increasing complexity and uncertainty involved in real-world environmental pollution problems, researchers have sought to apply different soft computing techniques in environmental pollution control. Soft computing environmental pollution presents a collection of emerging problem-solving technologies, including fuzzy logic, probabilistic reasoning, neural networks, and evolutionary algorithms. Much progress has been recorded in this area since soft computing technologies allow us to use prior empirical knowledge and unprecise data to build approximate environmental pollution models. Soft computing also provides it with a set of flexible computing tools to perform approximate reasoning.

Primarily, the area of fuzzy logic control systems has been explored in the literature. In one case, the adaptive fuzzy proportional-integral-derivative (PID) control, as an effective method of alternative control for environmental pollution in chemical reactions and for temperature control in process control industries, was developed. The research was divided into two tasks (i) the design and analysis of the adaptive fuzzy logic pid controller and (ii) the design of both simulated and real-pro- cess data. The first involves the development of a design method implemented on a pc-based algorithm. The controllers' gains are self-tuned during the control process following the fuzzy logic if-then rules, which are designed according to the classical adaptive control principles under the fuzzy logic environment.

For the second task, the method was first tested with computer-simulated data in comparison with both the conventional PID controller and the non-adaptive fuzzy PID controller. Simulation results have shown that the new design was overall better in the sense that it can handle highly nonlinear models and trade relatively rapidly changing set points also been tested using other- mal temperature control of an aluminum heat sink provided by the chemical company test sought to control the isothermal temperature better or close to ± 0,02 0c the fuzzy PID controller has less overshoot and steady-state error. The next environmental

pollution in the research was to test and improve the design for chemical reaction data, which had more rapid changes in processing and, hence is much more difficult to control.

CONCLUSIONS

We presented a review of the literature on environmental pollution research based on the key works of notable experts in the field. Our work incorporated four major parts: air, water, soil, and another aspect of the environmental pollution research. The conclusions drawn from this work may be summarised as follows. First, it seems that there is a significant in- interest of researchers and practitioners in the experimental analysis of air, water, and soil samples. The focus of this body of research has been the determination of the concentration of pollutants. All these were measured in 3 states – solids, liquids, and gases. In gases, for example, measurement is done on a fraction by volume basis (e, g Nine ppm) co2. It could otherwise be done in mass per volume (e g 15 microgrammes per m lead in the air). The Measurement of the concentration of liquids and solids is the same. Two main measures may be mentioned. The first is the fraction by weight (e g 5 ppm lead), while the second may be mass per volume (e g 23 mg/l phenol in water).

There is a global trend seen in recent research on environmental pollution. Studies seem to relate environmental pollution with other variables. One common area of increasing interest is the sources of in- creased pollution. Three main sources are highlighted in the literature. Population growth is the first. The second one is the increase in capital production and composition of goods. The third one relates to changes in goods and production methods.

From the literature, scholars have directly or indirectly pointed out the important characteristics of pollution. However, the following points are distilled out. First, pollutants have long-distance movement. An example of this is the transport of DDT to Antarctica. The second is persistence in the environment. For example, pesticides take months to years to degrade. Also, radioactivity continues to gradually decrease for long periods. The third is synergism. This explains that the combined effects of two or more pollutants are more severe than or even qualitatively different from the individual effects of environmental pollution are pollutants. Another characteristic of pollutants is their effects on the environment. This is perceived from different angles. We can consider its ef- effects on plants, animals, materials, humans, and climates. For example, its effect on man could be viewed from (i) clinical effects by many pollutants; (ii) long latency period for some pollutants; and (iii) cancer mortality data in different countries.

Arsenic is an emerging issue that challenges our way of experiment action in environmental pollution research. The increasing occurrence of these pollutants is at an alarming rate. While this paper shows where scholarship is and has been, we hope that the work makes a preliminary environmental pollution in the creation of a new, more integrated theory, modeling, and analysis of environmental pollution research. Future progress might arrive in a variety of ways. Perhaps, new theories, modeling, and analysis of environmental pollution problems are best conceived by a few scholars via thoughtful discussions over fine wine in

front of a roaring fire. In that context, a key to intellectual progress is to capture the sustaining desire of the intellect for inquiry. A second approach is to see a collective focus among a group of interconnected scholars from different disciplines paying attention to major environmental pollution issues. We can envision scholars working on networks and alliances to converge on a number of environmental pollution issues.

Research documentation, professional experience, environmental pollution orts, and intellectual discussions all suggest that the information explosion in the current decade will pro- fondly influence environmental pollution research. Currently, computing is increasingly gaining the attention of researchers in the environmental pollution domain.

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