

AN ENVIRON-ECONOMICAL MATHEMATICAL MODELING OF WATER POLLUTION IMPACT ASSESSMENT IN REFERENCE TO INDIAN SCENARIO

Hemant PATHAK*

Indira Gandhi Govt. Engineering College, Department of Chemistry, Sagar, (M.P.), India
E-mail: hemantp1981@yahoo.co.in

Abstract: This paper presents the application of the mathematical modeling to such a specific area as environ-economical interaction in prospect of big countries like India. A model of mutual interaction of dirty drinking water resulting water borne diseases, badly affected economy is proposed. For the description of some of these models illustrates drinking water resources, incapable municipal water treatment consequently expansion of diseases, World Bank loan, affected biggest labour forces (mankind) and ultimate results in the form of decrease in GDP. These mathematical models may be used in the solving of similar type problems exist in south and eastern Asian economies.

Keywords: mathematical models, environ-economical interaction

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INTRODUCTION

Water is life, but sadly more than a billion people in india do not have access to safe water.

Lack of safe water results in untold suffering, diseases, infant mortality, stunted growth and economic loss. Out of a list of 122 countries rated on the quality of potable water, India stands second last at 120 million.

- 37.7 million people – over 75% of whom are children, are afflicted with water borne diseases every year;

- diarrhea itself claims over 450,000 lives in India with over 200 deaths per hour;
- lack of drinkable water also results in stunted development of 60 million children annually;
- by 2020 more people would have died of unsafe drinking water than of AIDS;
- two-thirds of the hospital beds are filled with people with waterborne diseases;
- over 1600 children die every year due to waterborne disease;
- rs. 6400 crore are spent on rural medical expenses every year.

The statistics are staggering. It is unfortunate that this does not have to be this way and these are avoidable by simple solutions of providing safe water. Water life aims to bring in change by providing long lasting sustainable solutions to make a difference explained the effect of water quality on economics of a country explained the Sanitation Status of India (Akhilesh, 2006; DWSSI, 2005; Kleiner, 1999; Saroj, 2012; Times of India - Special Report April 13th, 2008).

* Corresponding Author

HEALTH BURDEN OF POOR WATER QUALITY

Water is a basic nutrient of the human body and is critical to human life. It supports the digestion of food, adsorption, transportation and use of nutrients and the elimination of toxins and wastes from the body (Kleiner, 1999). It is estimated that around 37.7 million Indians are affected by waterborne diseases annually; 1.5 million children are estimated to die of diarrhea alone and 73 million working days are lost due to waterborne disease each year. The resulting economic burden is estimated at \$600 million a year. The problem of chemical contamination is also prevalent in India with 1, 95,813 habitations in the country are affected by poor water quality. As of 2000 it was estimated that one-sixth of humanity (1.1 billion people) lacked access to any form of improved water supply within 1 kilometer of their home (WHO and UNICEF, 2000). Without water, life cannot be sustained beyond a few days and the lack of access to adequate water supplies leads to the spread of disease. Children bear the greatest health burden associated with poor water and sanitation. Diarrheal diseases attributed to poor water supply, sanitation and hygiene account for 1.73 million deaths each year and contribute over 54 million Disability Adjusted Life Years, a total equivalent to 3.7% of the global burden of disease (WHO, 2002).

WATER POLLUTION AND POVERTY

Lack of access to safe and adequate water supplies contributes to ongoing poverty both through the economic costs of poor health and in the high proportion of household expenditure on water supplies in many poor communities, arising from the need to purchase water and/or time and energy expended in collection. In rural areas of developing countries, the great majority of health-related water quality problems are the result of bacteriological or other biological contamination. A significant number of very serious problems may occur as a result of the chemical contamination of water resources. Some potentially chronic effects may occur in rural areas where overuse of agrochemicals leads to significant levels of pesticides in water sources. The presence of nitrate and nitrite in water may result from the excessive application of fertilizers or from leaching of wastewater or other organic wastes into surface water and groundwater. Although effects may be difficult to detect in human populations, such contaminants may pose a risk to health. There are other poverty-related factors behind inequalities in child mortality, including poor nutrition and access to affordable healthcare. But increased exposure to the risk of waterborne infections is a major causal link. Children who are malnourished are more likely to suffer from diarrhoea and sickness episodes last longer. Repeated incidences of diarrhoea result in weight loss, stunted growth and vitamin deficiency, with greater chances of dropping out from school, leading to reduced earning power and poverty.

ECONOMY-ENVIRONMENT MATHEMATICAL MODELING

It is an important method for determining the economical growth may also elaborate the effect on GDP of that country. Although there has been substantial efforts to improve human health quality but less emphasis has been placed on the relevance of clean environment, particularly in developing countries like India. In India most public health policies and human development index have failed due to contaminated water supply. Clean healthy water will not only promote economic development but also ensure a healthy labour force. The economic growth and water quality interaction model make basis GDP of any nation. This model also expressed poverty in society; the optimal strategy for promoting economic growth would be healthy humankind. Diverse infectious and non-infectious water-related diseases have direct impact on economy.

HEALTH EXPENDITURE; TOTAL (% OF GDP) IN INDIA

The Health expenditure; total (% of GDP) in India was last reported at 4.05 in 2010, according to a World Bank report published in 2012. Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation.

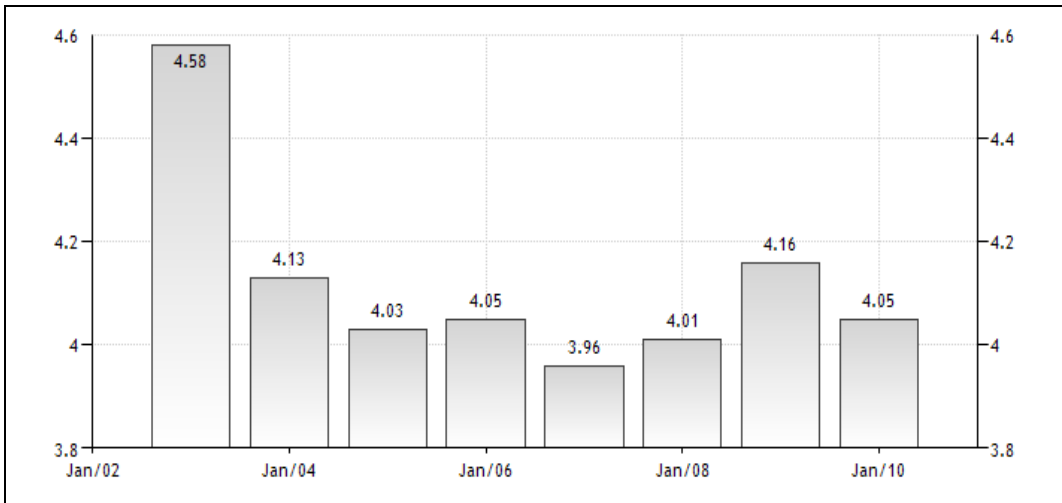


Figure 1. Health expenditure of India (in percentage)

RESULTS AND CONCLUSION

The Research Area on Economy-Environment Interactions will therefore focus on the new dangers and opportunities brought about by the new aspects of water pollution problems in order to conciliate the health of the biosphere with sustainable world development. Dirty drinking water produced water borne diseases can expressed by environ-economical interaction model described economic growth of India dependence on water quality. In general, there is a deep analogy between biological and economic processes that is useful for the development of mathematical techniques in both these areas of modeling.

The provision of clean drinking water has been given priority in the Constitution of India, with Article 47 conferring the duty of providing clean drinking water and improving public health standards to the State. The government has undertaken various programmes since independence to provide safe drinking water to the rural masses. Till the 10th plan, an estimated total of Rs.1,105 billion spent on providing safe drinking water. One would argue that the expenditure is huge but it is also true that despite such expenditure lack of safe and secure drinking water continues to be a major hurdle and a national economic burden.

Poor water quality spreads disease, causes death and hampers socio-economic progress. Around five million people die due to waterborne diseases. In addition, these diseases affect education and result in loss of work days, estimated at 180 million person days annually. The annual economic loss is estimated at Rs.112 crores.

Water-related diseases put an economic burden on both the household and the nation's economy. At household levels, the economic loss includes cost of treatment and wage loss during sickness. Loss of working days affects national productivity. On the other hand, the government spends a lot of money and time on treatment of the sick and providing other supportive services.

According to Government of India estimates, expenditure on health adds up to Rs.6,700 crore annually (approximately Rs.60 per head per year). The WHO recommends that 5 per cent of a nation's GDP be earmarked for investments in the health sector. However, public health expenditure in India has declined from 1.3 per cent of its GDP in 1990 to 0.9 per cent of its GDP in 1999. The National Rural Health Mission of the Government of India has set the target of rising public spending on health from 0.9 per cent of its GDP to 2-3 per cent of its GDP.

In India, 60-80 per cent of the resources in the health system is spent on hospital care, leaving a much lower proportion for basic services. In addition, the focus is on urban-curative services, leaving rural areas more vulnerable.

As per estimates, the average expenditure of rural households on health services amounts to 5.28 per cent of their average annual income¹⁷ this percentage can vary with population in different income groups but the important message that can be derived from these facts is that our rural households are forced to spend a significant amount of their earnings on health.

According to Down to Earth, rural people in India spend at least Rs.100 each year for the treatment of water/sanitation-related diseases. According to the Government of India, this adds up to Rs.6,700 crore annually, which is just Rs.52 crore less than the annual budget of the Union Health Ministry and more than the allocation for education.

However supplying clean water alone would not solve health-related problems. Only an integrated approach of water quality improvement with improvement in water availability combined with sanitation and hygiene education will help address this issue.

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