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Insights on Air Pollution Using a System Dynamics Approach

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Introduction

Air is essential for the survival of all living things on Earth, including humans. No one could ever survive without air for more than a few minutes. Air is composed of various gases such as nitrogen, oxygen, carbon dioxide, and others. A minor change in its composition may result in unpleasant atmospheric conditions for humans and their surroundings. This is referred to as air pollution. Air pollution is a major environmental concern, especially in developing countries. The path of air pollution in the city involves the emission and spread of air pollutants caused by a variety of factors. Air pollutants are dispersed throughout the path via various dispersion pathways (air, water, soil, living organisms), thinning and undergoing chemical reactions [1,2].

Furthermore, air pollution is a major health concern in developing countries. Despite improvements in air quality over the last 50 years, air pollution continues to shorten people's lives and send a large number of people to the hospital. It also causes significant harm to the natural environment, as evidenced by frequent studies indicating that people are constantly aware of air pollution, particularly in urban and industrial areas. In addition, epidemiological studies conducted over the last two decades have revealed that air pollution is one of the leading causes of death.

Air pollution, on the other hand, is primarily caused by industrialization and population growth. An increase in the concentration of greenhouse gases is blamed for air pollution (air pollutants). There are different types of air pollutants. As a result, it is critical to continuously monitor the level of pollutants in the air and ensure that air quality meets standards. Air quality in cities is the result of a complex interaction between environmental and human factors. Furthermore, various factors contribute to the unreliability of calculation risks, which can lead to changes in weather conditions as well as fluctuations in emission sources and activities in the long run. Furthermore, despite advances in mechanical understanding of ecological processes, the complication of ecology in the real world continues to limit our ability to predict ecological dynamics, especially when ongoing environmental pressures are applied.

About the study

System dynamics is a tool that allows us to focus on complex issues like delays, feedback, and nonlinearity. A field of study that includes science, education, engineering, and medicine is system dynamics with its own development. Dynamic modelling is divided into four stages, which are summarised as follows: (A) conceptualization: defines the model's purpose and boundaries, identifies the model's key variables, describes the behaviour or draws reference modes of the key variables [3,4], and graphs the basic mechanisms, feedback loops, and system; (B) formulation entails converting feedback diagrams into level and rate equations, as well as estimating and selecting parameter values. (C) Testing entails simulating the model and testing the dynamic hypothesis, as well as testing the model's assumptions and model behavior [5].

Conclusion

The application of system dynamics to the study of environmental systems has grown in popularity in recent years. A study on Suzhou water resources in China was conducted in 2010 that addressed modelling of water carrying capacity of water resources from 2001 to 2030, and optimization plans for three water resources were examined. Another survey, conducted in 2012, addressed the interactions between water resources and environmental flow, as well as economic and social status, with the goal of evaluating the socioeconomic effects of various levels of environmental flow allocation in China's Vihe River Delta.

To optimise the system dynamics parameters, the genetic algorithm was used. Furthermore, in 2013, research was conducted in Spain that used system dynamics to create a model to study the fate of persistent organic pollutants in soil. The simulation results showed that the amount of linden in the soil had decreased over a 10-year period. Bastan et al. demonstrated how a system dynamics simulation approach can provide deep insights into the field of sustainable development and present efficient agricultural sustainability policies.

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