

ARTICLE

Integrated Environmental Management: Achieving Sustainable Development through the Lens of Water, Air and Waste

Changkui LI,^{1,2} Sophia LI,^{*,3} and Emily SONG^{*,4}

¹Kaiyuan E-commerce (Shenzhen) Co.,ltd.lichangkui@gmail.com, <https://orcid.org/0000-0001-7446-0198>

²Hong Kong Metropolitan University

³Pui Ching Middle School, Hong Kong

⁴Stamford American School Hong Kong

*Corresponding author. Email: lisophiahk@gmail.com, <https://orcid.org/0009-0007-4866-7815>; emilysongus@gmail.com, <https://orcid.org/0009-0008-3326-6397>

(Received 26 March 2024; revised 15 April 2024; accepted 20 April 2024; first published online 30 June 2024)

Abstract

This paper explores the global status, primary issues, challenges, and implications of water, air, and waste management for sustainable development. Water management is crucial to achieving sustainable development goals. Currently, half of the global population faces severe water shortages annually, and a quarter faces "extremely high" water stress. Air management is closely tied to energy consumption, urbanization, and industrialization, with air pollution causing millions of premature deaths each year, especially in low- and middle-income countries. Waste management faces challenges from plastic pollution, electronic waste, and food waste, urgently requiring global improvements in infrastructure and regulations. The paper emphasizes the importance of an integrated approach to water, air, and waste management, as they are interconnected and impact the environment, health, and the economy. It calls for policy innovation, technological advancements, and societal behavior change, and emphasizes global cooperation and local action to achieve sustainable development goals.

Keywords: Water management, air pollution, waste management, sustainable development, integrated environmental management

1. Introduction

Water, air and waste management are important life support systems for the Earth, important factors in environmental management, frontier issues in environmental management, and

key to achieving sustainable development. These elements are closely related to human survival, economic growth and ecological balance, and are intertwined with each other, and are the cornerstones of achieving sustainable development.

On Earth, water resources are limited. Innovative solutions are needed to achieve clean and equitable distribution of water. Air, like water, is the basis for human survival. We must protect the cleanliness of the air and be wary of pollutants. Waste is a by-product of human work and life. Humans are required to follow the concept of circular economy, reduce waste generation, and achieve sustainable development. Human life and economic and social development require the management of water, air and waste in an integrated and sustainable manner to protect the environment and achieve sustainable development.

This article aims to explore the global status, main issues, challenges and implications for sustainable development of water, air and waste management.

2. Discussion

2.1 *Water resources management: the cornerstone of sustainable development*

Water is the source of life. Without water, human beings cannot survive. Water has a significant impact on the environment, economic development and human health. It is necessary to meet the needs of human beings at present while also meeting the needs of future generations. Effective water management not only meets the immediate needs of human beings, but also ensures the sustainable development of this precious resource. The global population explosion and the continuous change of climate require effective management of water resources.

2.1.1 *Global Status*

Global freshwater use is growing at a rate of just under 1% per year due to the combined effects of population growth, urbanization and agricultural intensification. Although agricultural water accounts for about 70% of freshwater use, industrial (about 20%) and domestic water (about 10%) are the main areas of increased demand for freshwater [1], and water resources are facing unprecedented pressure. Industrial activities, agricultural production and wastewater treatment facilities are expensive, resulting in serious water pollution and deteriorating water quality around the world, causing serious damage to human health and aquatic ecosystems.

2.1.2 *Main issues*

Currently, about half of the world's population faces severe water shortages at least part of the year. A quarter of the world's population faces "extremely high" water shortage pressure, and the annual renewable water resource utilization rate in these regions exceeds 80%. When water is scarce, contaminated or difficult to access, food security can be undermined and livelihoods lost, threatening world peace and prosperity. [1]

2.1.3 *Challenges faced*

At present, water resource problems are largely caused by climate change, such as changes in precipitation patterns, reduced snow cover, and intensified droughts and floods. Climate

change has exacerbated water shortages and requires innovative water resource management models and reforms in agricultural irrigation technology and management methods. Solving water resource management challenges requires addressing the problems of aging and insufficient water infrastructure, effective transportation and treatment, and avoiding major losses and pollution. Integrated water resources management (IWRM) is required.

2.1.4 Impact on sustainable development

Water management issues are critical to achieving Sustainable Development Goal 6 (SDG6). As of 2022, 2.2 billion people worldwide will still lack access to safe drinking water. [1] Four out of five people without basic drinking water services live in rural areas. Sanitation insecurity remains dire, with 3.5 billion people still without access to such services. Water management is intrinsically linked to multiple Sustainable Development Goals (SDGs), including those related to poverty alleviation, health, and environmental sustainability. Unsustainable water use and pollution are causing severe damage to biodiversity and ecosystem services, threatening human survival and well-being.

2.2 Air management: Energizing a sustainable future

Industrialization, urbanization and vehicle emissions are major environmental factors affecting health. By reducing air pollution levels, global diseases caused by respiratory infections, heart disease and lung cancer can be mitigated.

2.2.1 Global Current Situation

Currently, various compounds released by humans into the atmosphere have caused many environmental and health problems. Some compounds, such as chlorofluorocarbon gases (CFCs), are produced indiscriminately and ultimately emitted into the atmosphere through various equipment and products. Air pollution causes millions of premature deaths every year, mostly in low- and middle-income countries. Particulate matter (PM2.5 and PM10), nitrogen dioxide, sulfur dioxide and ozone are the main pollutants affecting air quality and originate from industrial activity, traffic, agriculture and residential heating and cooking.

2.2.2 Main issues

Air pollution poses serious threats to human health and ecosystems. Air pollution can damage the respiratory system and lead to cardiovascular disease, stroke and lung cancer. Vulnerable groups such as children, the elderly and people with pre-existing health conditions are especially at risk. Certain air pollutants, especially black carbon (a component of particulate matter), directly contribute to climate change by absorbing sunlight and warming the atmosphere, exacerbating global warming, damaging crops, and disrupting ecosystems.

2.2.3 Challenges faced

The main challenges facing air problems are urbanization and industrialization as well as excessive energy consumption. Urbanization and industrialization lead to increased emissions from vehicles, factories and buildings, which pollute the air. Energy consumption is an important source of air pollution. Innovative technologies are needed to use clean energy.

2.2.4 *Impact on sustainable development*

Air pollution affects multiple Sustainable Development Goals, including health (SDG 3), sustainable cities (SDG 11) and climate action (SDG 13). Air pollution harms health and quality of life, affects production and economic growth, and widens disparities between countries.

2.3 *Global waste management: towards sustainable development*

Waste management includes the collection, transportation, processing, recycling and disposal of waste materials. Proper waste management practices are essential to protect human health, conserve natural resources and minimize environmental impact. However, the volume and complexity of waste, driven by economic growth and consumer lifestyles, continues to increase, posing major challenges worldwide.

2.3.1 *Global Status*

Humanity's unsustainable production and consumption behaviors are pushing the planet toward destruction. Households, small businesses, and public service providers generate 2.1 billion to 2.3 billion tons of municipal solid waste each year, including packaging materials, electronics, plastics, food, electronic waste, and hazardous waste. [3] Developing countries face even more severe waste challenges due to urbanization and inadequate waste management infrastructure.

2.3.2 *Main issues*

Currently, the main problems facing waste management are plastic pollution, e-waste and food waste.

Plastic pollution: Plastics, due to their durability and widespread use, constitute a large portion of waste and are a major environmental problem, particularly in the oceans, where they threaten marine life and ecosystems.

E-waste: The rapid renewal of electronic devices has led to a surge in e-waste, which contains hazardous substances such as lead and mercury, which can cause health risks and environmental harm if not handled properly.

Food waste: A large portion of food produced globally is wasted, resulting in greenhouse gas emissions from decomposition and loss of resources used in food production.

2.3.3 *Challenges*

At present, the main problems facing waste management are the serious lack of waste recycling infrastructure, low recycling rates, and imperfect laws and regulations. The equipment of global waste management service agencies is still not perfect, 2.7 billion people lack access to solid waste collection services, and only 61–62% of urban solid waste is managed in controlled facilities. In particular, developing countries lack effective waste collection, recycling and disposal infrastructure, leading to open dumping and burning of waste. The waste recycling rate is low and the circular economy cannot be achieved. Many countries and regions lack effective waste management laws, policies and enforcement mechanisms, which affects waste recycling.

2.3.4 *Impact on sustainable development*

Improper waste management causes air, water and soil pollution and greenhouse gas emissions, threatening Sustainable Development Goals such as human health and well-being (SDG 3), sustainable cities (SDG 11), responsible consumption and production (SDG 12) and life on land (SDG 15). Therefore, effective waste management is essential for environmental protection, resource conservation and economic efficiency, supporting the transition to a more sustainable circular economy.

3. Conclusion

This article's exploration of water, air and waste management highlights the complex relationships between human activities, environmental health and the pursuit of sustainability. Although each field faces different challenges and solutions, they share a common necessity and urgency in solving the environmental crisis facing the planet. The global status of water, air and waste management reveals not only the scope of the challenge, but also the interconnectedness of these issues and their cumulative impact on the environment, health and the economy.

Water management focuses on ensuring availability and quality for all, emphasizing the critical balance required between human consumption and ecological protection. Air stewardship aims to address widespread pollution problems, calling for cleaner production methods and stricter emissions standards to protect public health and slow climate change. Waste management requires us to rethink our consumption patterns and embrace circular economy principles to reduce the environmental footprint of our lifestyles.

From water scarcity and contamination to the health hazards of air pollution and the growing tide of waste, the major problems found in these areas are not insurmountable. However, they require coordinated, comprehensive strategies that include policy innovations, technological advances, and societal behavior changes. Implementing such strategies is a huge challenge, involving complex socioeconomic dynamics and requiring global cooperation and local action.

Sustainable development as a unifying goal depends on our ability to manage these environmental resources wisely and equitably. The impacts of poor management are far-reaching, affecting not only the environment but also economic stability and social equity. The path to sustainable development requires a shift to integrated management practices that recognize the value of our natural resources and the urgent need to protect them.

In short, water, air and waste management are integral to achieving sustainable development. Lessons learned in each area point to a path forward: one marked by innovation, integration and collective action. As we move towards the 2030 Agenda for Sustainable Development, stewardship of these vital resources demonstrates our commitment to the planet and future generations. The time to act is now; by working together and with a shared vision, we can achieve a sustainable, resilient and equitable world.

REFERENCES

[1]United Nations (2024).The United Nations World Water Development Report 2024: water for prosperity and peace, Retrieved from<https://www.unwater.org/publications/>

un-world-water-development-report-2024

[2] United Nations (2024), About air pollution. <https://www.un.org/zh/sustainability/airpollution/>

[3] United Nations (2023), Addressing the waste crisis (2023), Retrieved from <https://www.un.org/zh/observances/zero-waste-day>

[4] United Nations and the International Solid Waste Association (ISWA)(2024), Global Waste Management Outlook 2024, Retrieved from <https://www.unep.org/resources/global-waste-management-outlook-2024>

Cite This Article

Changkui LI, Sophia LI, Emily SONG.(2024).Integrated Environmental Management: Achieving Sustainable Development through the Lens of Water, Air and Waste. *Integration of Industry and Education Journal*, 3(2):1-6, DOI:<https://doi.org/10.6914/iej.030201>

© 2024 The Author(s).

Integration of Industry and Education Journal, ISSN 2791-2671 (print), ISSN 2791-268X (online), DOI 10.6914/iej, Volume 3 Issue 2, was published by Creative Publishing Co., Limited on 30 June 2024, ISBN 978-988-79866, <http://www.iej.cc>, <http://ssci.cc/>, <https://cpcl.cc/>, Email:wtocom@gmail.com,kycbshk@gmail.com.