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TRENDS IN E-WASTE AND ENVIRONMENTAL IMPACTS OF TECHNOLOGY

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Environmental degradation, sustainable technology, E waste

ABSTRACT

The research topic focuses on the rapid growth of e-waste, driven by frequent device replacements and improper disposal, which causes severe environmental and health hazards. Resource depletion, pollution, and high energy consumption highlight the need for improved recycling, stricter regulations, and sustainable technology practices to mitigate these impacts. This topic holds significance in the present context as we live in the digital revolution era. It is of utmost importance to analyze and regulate technological advancement and focus on the sustainable way forward. This research paper highlights the causes and current scenario, its impact on the environment as the adoption of EVs increases the lithium waste which is not decomposable. Technology usually leads to environmental degradation by reducing forest covers, causing loss of biodiversity, and disrupting the balance of ecosystems, consequently leading to the acceleration of climate change. The resultant effect of technological advancement is e-waste, which can contaminate soil and groundwater if not well disposed of. One of the dividing opinions among speciesism advocates is that the interests of human beings should be considered first due to their perceived superiority rating. In view of these negative impacts of technology, some of the mitigative measures would be to have stringent environmental impact assessments for upcoming technologies with a focus on promoting sustainable development, holding producers accountable for the collection and disposal of e-waste through Extended Producer Responsibility, while incorporating e-waste management into Corporate Social Responsibility for a more comprehensive strategy, investing in research and development for sustainable technologies, and building collaboration between sectors. Finally, use international platforms for standard definition, technology transfer, and spreading awareness about e-waste recycling.

Introduction

In the era of digitalization, the use of electronic devices has significantly increased. These devices contain semiconductor chips and other components that are not easily decomposable. The unorganized collection and poor handling of e-waste present a major obstacle to sustainability. The United Nations Environment Program (UNEP) estimates that the world generated a record 76 million metric tons (Mt) of e-waste in 2021, with only around 17.4% being collected and recycled responsibly[1]. This underscores the pressing need for improved e-

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waste management practices to safeguard environmental sustainability.

Research Methodology

This research employs a qualitative methodology, utilizing a comprehensive review of secondary data sources. The primary sources of data include editorials, expert opinions, and information from credible websites. Research involves systematically searching and analyzing data available from these authentic sources to understand the trends in e-waste and its environmental impacts. Editorials provide insights into current issues and public discourse, while expert opinions offer authoritative perspectives on the consequences of e-waste. Data from reputable websites, such as environmental organizations and scientific journals, are analyzed to support the findings. This methodology ensures a well-rounded understanding of the subject, grounded in credible and diverse sources of information, to emphasize the critical need for sustainable e-waste management and policy intervention.

The Purpose of research

The primary purpose of this research is to analyze the detrimental consequences of e-waste on environmental degradation, human health, biodiversity loss, and ecosystem deterioration. By investigating how improper disposal and recycling of e-waste lead to pollution and pose health risks, the study aims to provide a comprehensive understanding of these issues. Specifically, it will assess the impact of toxic substances from e-waste on soil, water, and air quality, examine the health risks posed to workers and nearby communities, and explore the effects on wildlife and ecosystem functions. This research seeks to raise public awareness and serve as an urgent call for policymakers to develop and enforce robust e-waste management policies. Ultimately, the goal is to advocate for sustainable practices and legislative measures that protect the environment and public health from the increasing threat of e-waste. By presenting evidence-based recommendations, this study aims to drive efforts toward effective e-waste recycling and disposal systems, ensuring a safer and healthier future.

Causes of the E waste

E-waste comes from a wide range of sources and includes practically all of the electronic devices that we use on a regular basis. Here's a breakdown of the main categories:

- **Discarded Consumer Electronics:** The more modern gadgets that are being made, the more electronic devices are being discarded. This comprises items such as mobiles, tablets, laptops, TV monitors, printers, as well as old gaming consoles, and so on.
- **Outdated Appliances:** House machines that have been relentlessly worn and used will eventually lose their life. An increased number of refrigerators, washing machines, microwaves, and vacuum cleaners can be seen as the key drivers that collectively cause the depletion of e-Waste.
- **Medical and Laboratory Equipment:** The sectors of healthcare and research rely heavily on electronic equipment for diagnosing, treating, as well as for experimentation. At the time when this

equipment becomes old or inefficient in technological terms than, it is one of the total e-waste problems.

- **Manufacturing Scrap:** In the process of creating electronics, some materials or components become unusable, generating electronic waste in manufacturing sites themselves.
- **Entertainments and Leisure Devices:** Playlisted devices like digital cameras, and drones for photography as well as tyre other fun toys for kids, also, generate electronic waste after being discarded.
- **Network Infrastructure Upgrades:** During the periods in which the technology is getting advanced, the network infrastructure also needs an update. The unused routers, servers, and other networking equipment become the kind of e-waste.
- **Battery Disposal:** The batteries are an essential part of many electronic devices and their disposal is responsible. Faulty battery disposal multiplies e-waste problems.

Impacts of E waste and the negative effect of technology on environment

Exploitation of Natural Resources- E-waste significantly contributes to the exploitation of natural resources. The production of electronic devices demands large quantities of raw materials, including precious metals like gold, silver, and palladium, along with rare earth elements. Extracting these resources is highly resource-intensive and harmful to the environment. For instance, it is estimated that producing a single smartphone consumes over 30 different elements and compounds. The extraction processes not only deplete natural resources but also cause habitat destruction, loss of biodiversity, and soil erosion. Additionally, the Global E-waste Monitor 2020 reveals that in 2019 alone, 53.6 million metric tons of e-waste were produced worldwide, with this number expected to climb to 74.7 million tons[2] by 2030, further intensifying the pressure on natural resources.

Biodiversity Loss - Improper disposal and recycling of e-waste result in significant biodiversity loss. Toxic elements like lead, mercury, and cadmium in e-waste can seep into the environment, contaminating soil and water sources. These contaminants harm wildlife, disrupt ecosystems, and lead to the death of numerous species. For example, studies have shown that e-waste recycling activities in informal sectors, particularly in developing countries, release hazardous chemicals into the environment, adversely affecting local flora and fauna. As these toxic substances enter the food chain, they endanger the survival of various species and contribute to the degradation of ecosystems.

Human Health Deterioration - E-waste presents a serious risk to human health. The toxic chemicals and heavy metals it contains can lead to numerous health issues if not properly managed. Exposure to these substances can lead to respiratory issues, neurological damage, and even cancer. In regions where informal e-waste recycling is prevalent, workers, including children, are often exposed to harmful chemicals without any protective

measures. For instance, the use of acids to extract precious metals from circuit boards releases toxic fumes, which can lead to chronic health conditions. The Basel Action Network highlights that improper e-waste management results in significant health risks, particularly in low-income communities where e-waste is often processed.

Air Pollution - The disposal and informal recycling of e-waste contribute to air pollution. When e-waste is burned to recover valuable metals, it releases toxic substances into the air, including dioxins, furans, and other harmful compounds. These emissions contribute to air quality degradation and pose severe health risks to nearby populations. According to the Global E-waste Monitor 2020, only 17.4% of e-waste is properly recycled[3], with the majority being discarded in ways that lead to the release of hazardous pollutants into the atmosphere. This not only impacts human health but also contributes to global warming and climate change through the release of greenhouse gases.

Trends in India

India is the third-largest producer of e-waste globally, generating approximately 2 million tons annually. The rapid growth in electronic device usage and shorter life cycles of electronic products have significantly increased e-waste generation in the country. A staggering 95% of this waste is either burned or dumped in landfills, leading to severe environmental and health issues.

Environmental Consequences:

1. **Soil and Water Contamination:**
   - Improper recycling methods release toxic chemicals such as lead, mercury, and cadmium into the soil and water. Studies have shown significantly higher concentrations of these heavy metals in areas surrounding e-waste recycling sites in New Delhi .
   - Pollution from e-waste contributes to the contamination of major rivers like the Ganges and Yamuna, with large quantities of industrial waste, including e-waste, being dumped daily.
2. **Air Pollution:**
   - The burning e-waste releases toxic fumes and particulate matter into the air, worsening air pollution. Informal recycling methods, such as open burning of cables, result in the emission of harmful substances that pose health risks to the local population[4].
3. **Greenhouse Gas Emissions:**
   - E-waste disposed of in landfills produces methane, a powerful greenhouse gas that intensifies climate change. Recycling e-waste properly can help reduce these emissions and conserve natural resources by recovering valuable materials.

Health Impacts:

- Exposure to toxic substances from e-waste has been associated with health problems such as respiratory issues, skin conditions, and impaired cognitive function., particularly affecting informal waste pickers who handle e-waste without proper safety measures.

Conclusion and Suggestion

Technology comes with certain impacts, sometimes harmful impact on the environment in the form of environmental loss like forest cover reduction, biodiversity loss and disruption in the ecosystem led to the climate change. Technology brings luxury to the human at the cost of the environment. E waste is also the consequence of the advancement of the technology which is not easily decomposable and contaminate soil and ground water if mistreated. By analyzing this we can see that technology come for human comforts, human is given first priority over other species and environment known as speciesism, and proponents of this concept argue that human superiority, natural order, human welfare, moral differences, and religious or cultural beliefs justify prioritizing human interests over those of other species.

Here is certain suggestion to regulate the negative impact of technology and innovative ideas to collect the total e waste also its treatment.

- **Environmental Impact Assessment-** Introducing assessment report for the upcoming technology. Forming strict laws for the assessment and its implementation by the authorities. Technology EIA will help to reduce the negative impacts of it focus on the more sustainable technological advancement.
- **Extended Producer Responsibility-** this focuses on the collection of e-waste by the respective producers. This can be a game changer move as this will ensure proper collection and formal treatment of e-waste. This will not only save the environment but also saves the life of people who are indulged in the informal treatment of the e waste, which can be fatal.
- **Corporate Social Responsibility-** Interlinking management of E waste and industrialist through the introduction of e waste in the realm of the CSR, this will help in the formalization of E waste sector. It will be a wholistic approach rather than the efforts made from one direction for the sustainable environment.
- **Research and Development-** Increase R&D in the field of sustainable technological environment. this can create innovative solutions that reduce our ecological footprint, conserve resources, and promote renewable energy. This includes developing cleaner energy sources, improving energy efficiency, and finding sustainable materials. Expanding this effort involves collaboration between governments, industries, and academic institutions to ensure that new technologies are both effective and accessible. Ultimately, a strong focus on sustainable technology R&D can lead to a healthier planet and a more sustainable future for all.

International Collaborations- Using Global platforms for the deliberative and wholistic approach to tackle the environmental impact of technology. Insights of the developed nations and inclusion of the MNCs and other stakeholders to cover every dimension of the issue. Framing International standards and laws, technology transfer initiatives related to sustainable e waste treatment, etc. Also initiating people awareness

program on recycling of e waste and customer responsibilities.

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