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In the 'Afterlife': *Reusability, Frugality, Tech-Capitalism and Disposable Technology Paradigm of e-Waste from India*

Sandeep Beniwal[1]*, Sanju Sunda[2]

A B S T R A C T

The abstract investigates the multifaceted dynamics surrounding the afterlife of electronic waste (e-waste) within the context of India, exploring themes of reusability, tech capitalism, and the disposable technology paradigm. It delves into the diverse perspectives and practices of different stakeholders, including large corporations, medium enterprises, and individual users, regarding the use, functionality, and disposal of electronic devices post their shelf life. Through a lens of planned technological obsolescence and the rapid pace of technological change, the abstract elucidates how large consumers navigate policies and strategies to manage their electronic infrastructures. It further examines the role of medium consumers, such as small and medium enterprises, in leasing electronic equipment and adhering to e-waste regulations. The abstract highlights the informal sector's significant involvement in e-waste management, with actors like "kabaddi-walas" and scrap dealers playing crucial roles in the collection and dismantling of discarded electronics. Moreover, it discusses the emergence of formal recyclers and their reliance on foreign technologies for advanced e-waste processing. Despite challenges, the abstract underscores the imperative of addressing reusability, circularity, and frugality in managing e-waste, emphasizing the need for comprehensive strategies and collaboration among stakeholders to mitigate the environmental and social impacts of electronic consumption and disposal in India.

KEYWORDS

Electronic waste, Reusability, Tech capitalism, Planned obsolescence, Informal sector, Formal recycling, Sustainability.

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[1] Ph.D. Scholar, Jawaharlal Nehru University, New Delhi (First Author)(* Corresponding author)
[2] Ph.D. Scholar, Sophia Girls College, Maharshi Dayanand Saraswati University, Ajmer(Rajasthan)(Second Author)

1. Introduction

The concept of afterlife often evokes diverse emotions, beliefs, and ideologies, particularly within an orientalist worldview. However, when applied to e-waste, it conjures imaginative visuals of electronic devices such as computers, laptops, and mobile phones continuing their existence beyond their shelf life and usability. These electronic artifacts hold different significance for various users, be they large corporations, medium enterprises, or individuals. The notions of functionality and non-functionality in this context also raise concerns about planned technological obsolescence and the fast-paced nature of technological advancement.

For large consumers like industries and corporations, the functional use of electronic items is often governed by shelf-life policies and the imperative to keep up with evolving technology. They may opt to discard non-functional electronic goods or engage in buy-back programs with big producers. Medium consumers, such as small and medium enterprises, often lease electronic infrastructures from larger consumers to reduce costs and comply with e-waste regulations.

Individuals typically use electronic goods until they are no longer operational, after which they may discard them through informal channels like "kabaddi-wala" or repurpose them for learning purposes, especially in households with school-going children engaging in tinkering activities.

The management of e-waste involves considerations of reusability, circularity, and frugality, with various actors, institutions, processes, and technologies coming into play. Actors range from big industries donating non-usable electronic goods to schools and NGOs for educational purposes to informal collectors like "kabaddi-walas" who sell discarded electronics to scrap dealers. These dealers then employ basic techniques to dismantle e-waste and extract valuable materials for resale to industries.

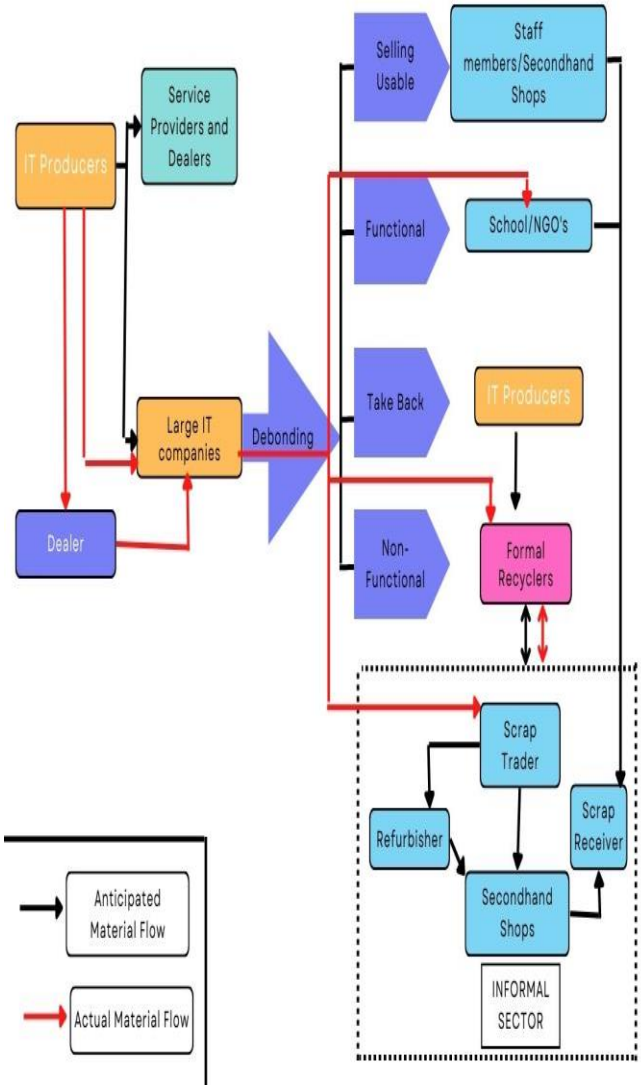

Fig. 1 Material Flow of E-waste

Formal recyclers also play a role, purchasing non-functional electronic goods from large consumers and employing more advanced techniques for dismantling and recycling.

However, their reliance on foreign countries for advanced technologies highlights the nascent state of formal recycling in the country. Despite this, large IT and electronics manufacturers primarily focus on purchasing precious metals and materials from both formal and informal recyclers for manufacturing new electronic equipment.

2. Exploring the Re-Circularity of Functional E-Waste in Educational Settings: Implications for Learning and Capabilities Building

In recent years, there has been a growing interest in understanding the dimension of reusability within the context of electronic waste (e-waste), particularly in educational settings. This subtopic delves into the intricacies of re-circularity, focusing on the utilization of usable electronic goods that exhibit both functional and non-functional attributes within specific user contexts.

One prominent aspect under examination is the practice of donating functional e-waste to schools and NGOs for educational and learning purposes. Specifically, this subtopic seeks to ascertain whether such donated electronic goods find their way into tinkering labs, where they can serve as valuable resources for hands-on learning experiences.

Tinkering labs, increasingly prevalent in educational institutions, offer students opportunities to engage in practical, experiential learning activities centered around technology, innovation, and problem-solving. By repurposing donated e-waste for tinkering labs, schools and NGOs can leverage these resources to foster creativity, critical thinking, and technical skills among students.

Furthermore, this subtopic aims to explore the broader implications of re-circularity in e-waste management within the context of the circular economy. By incorporating functional e-waste into educational initiatives, such as tinkering labs, schools contribute to the circularity of resources by extending the lifespan of electronic devices and reducing the need for new production.

Moreover, the study investigates the role of re-circularity in enhancing learning outcomes and capabilities building among students. By interacting with functional e-waste in tinkering labs, students not only gain technical skills but also develop an understanding of sustainability principles and responsible consumption practices.

In essence, this subtopic underscores the significance of re-circularity in transforming e-waste from a perceived liability into a valuable asset for educational institutions. By harnessing the potential of functional e-waste for learning and capabilities building, schools and NGOs can play a pivotal role in promoting a more sustainable and environmentally conscious approach to technology utilization and disposal.

3. Mapping Western Technological Capitalism in E-Waste Recycling: The Role of Processes, Techniques, and Government Policies

This subtopic delves into the intricate nexus between Western technological capitalism and the extraction of reusable precious metals and materials from electronic waste (e-waste). It seeks to unravel the conceptual mapping of how Western capitalist systems influence the availability and non-availability of technologies utilized in e-waste recycling processes.

Central to this exploration is an examination of the dimension of frugality inherent in the processes, techniques, and technologies employed by both informal and formal recyclers. These actors play a crucial role in dismantling, segregating, and supplying usable metals and materials extracted from e-waste to concerned clients.

The subtopic scrutinizes the influence of Western technological capitalism on the development and accessibility of advanced recycling technologies. It investigates how economic interests and market forces shape the investment in and deployment of technologies aimed at extracting valuable resources from e-waste.

Furthermore, the study explores government policy initiatives aimed at regulating e-waste recycling practices and promoting sustainable resource management. It examines the extent to which government policies facilitate or hinder the adoption of innovative recycling technologies and the integration of frugal techniques into e-waste recycling processes.

Moreover, this subtopic considers the broader implications of Western technological capitalism on global e-waste trade dynamics and environmental justice issues. It highlights the disparities in access to recycling technologies and resources between developed and developing countries, as well as the socio-economic implications for marginalized communities engaged in e-waste recycling activities.

In conclusion, this subtopic sheds light on the complex interplay between Western technological capitalism, e-waste recycling practices, and government policies. By critically examining these dynamics, the study aims to contribute to a deeper understanding of the challenges and opportunities in promoting sustainable e-waste management practices on a global scale.

4. Analyzing Technological Dependency and Capability Disparities: A Comparative Study of Western Countries and India

In examining the technological dependency and capability disparities between developing nations like India and developed Western countries, a nuanced understanding emerges of the intricate dynamics shaping global technological landscapes. This inquiry transcends mere geographical categorizations, delving into the broader conceptual framework of technology capitalism (tech-capitalism) and its implications for diverse socio-economic contexts.

The deliberate choice of framing this question "from" rather than "in" India underscores the interconnectedness of global technological ecosystems and the complex power dynamics inherent within them. By focusing on the advanced recycling technologies prevalent in Western nations, juxtaposed against the reliance of developing countries like India on these technologies, the study elucidates a vicious cycle of dependency perpetuated by unequal access to technological resources and capabilities.

At the heart of this analysis lies a critical examination of the asymmetrical distribution of technological expertise, infrastructure, and resources between the Global North and the Global South. Western countries often possess advanced recycling technologies and infrastructure, allowing them to extract maximum value from e-waste and minimize environmental impact. In contrast, developing nations like India frequently find

themselves in a position of dependence on these technologies, lacking the means to develop comparable capabilities independently.

This dependency not only reinforces existing power differentials but also perpetuates a cycle of technological underdevelopment and economic exploitation. Developing countries may become reliant on Western technologies and expertise, limiting their ability to innovate and develop sustainable solutions tailored to their unique contexts. Furthermore, the unequal distribution of technological capabilities exacerbates environmental degradation and social inequalities, as marginalized communities bear the brunt of e-waste pollution and exploitation.

Addressing these disparities requires a multifaceted approach that acknowledges the intersecting dimensions of technology, capitalism, and global inequality. By fostering knowledge exchange, capacity-building initiatives, and collaborative partnerships, stakeholders can work towards dismantling the structures of dependency and empowering developing nations to harness technology for sustainable development. Additionally, policymakers must prioritize equitable access to technology and invest in local innovation ecosystems to ensure that all communities can participate in and benefit from the digital revolution.

In conclusion, the examination of technological dependency and capability disparities between Western countries and India unveils the intricate interplay of power, privilege, and progress shaping our global technological landscape. By interrogating these dynamics through a critical lens, scholars and practitioners can pave the way for more inclusive and sustainable approaches to technology development and utilization on a global scale.

5. Exploring Waste Capitalism in the Electronic Goods Industry: A Multi-Actor Perspective

The concept of waste capitalism within the electronic goods industry encapsulates the intricate network of actors involved in the production, consumption, and disposal of electronic devices. At its core, waste capitalism embodies the commodification of waste materials and the extraction of value from discarded products. This phenomenon extends beyond mere economic transactions, encompassing socio-political and environmental dimensions as well.

Central to the understanding of waste capitalism are the diverse actors operating within the electronic goods supply chain. Producers, including large corporations and manufacturers, play a pivotal role in driving consumption through product innovation and marketing strategies. Their pursuit of profit often fuels planned obsolescence, wherein products are intentionally designed with limited lifespans to stimulate demand and perpetuate consumption cycles.

Consumers, both individual and institutional, become enmeshed in this cycle as they purchase and eventually discard electronic devices. The disposal phase marks a crucial juncture where waste capitalism manifests most prominently. Actors such as informal collectors, scrap dealers, and "kabaddi-walas" participate in the informal economy, salvaging valuable materials from discarded electronics for resale to downstream actors.

Formal recyclers, on the other hand, represent a burgeoning sector seeking to formalize e-waste management practices. These entities employ advanced technologies and processes to extract precious metals and recover reusable components from electronic waste. However, their operations are often constrained by regulatory frameworks, technological limitations, and market dynamics.

The dynamics of waste capitalism also intersect with broader socio-economic issues, including labor exploitation, environmental degradation, and inequitable distribution of resources. Informal workers engaged in e-waste recycling often endure hazardous working conditions and receive meager compensation for their labor. Moreover, the environmental ramifications of improper e-waste disposal, such as soil and water contamination, pose significant challenges to sustainability and public health.

Addressing the complexities of waste capitalism in the electronic goods industry necessitates a holistic approach that considers the interests and responsibilities of all stakeholders involved. Policy interventions aimed at promoting extended producer responsibility (EPR), incentivizing sustainable design practices, and fostering collaboration between formal and informal sectors are crucial steps toward mitigating the adverse impacts of waste capitalism. Furthermore, raising awareness among consumers about the environmental and social consequences of electronic consumption and disposal is imperative for fostering a culture of responsible consumption and waste management.

In conclusion, the study of waste capitalism in the electronic goods industry offers valuable insights into the intricate web of economic, social, and environmental dynamics shaping contemporary consumption patterns. By examining the roles and interactions of various actors within this ecosystem, scholars and policymakers can devise strategies to promote sustainable and equitable practices that mitigate the negative externalities associated with electronic waste.

6. Informal Disposal of E-Waste in India: Environmental and Health Implications and Government Policy Framework

The informal disposal of electronic waste (e-waste) in India represents a significant challenge with far-reaching environmental and health consequences. Informal methods of e-waste disposal often involve practices such as burning, dismantling, and dumping in landfills or open areas, leading to the release of hazardous substances into the environment. These substances include heavy metals like lead, mercury, and cadmium, as well as toxic chemicals such as brominated flame retardants and polychlorinated biphenyls (PCBs).

The environmental impact of informal e-waste disposal is profound, contributing to soil and water pollution, air contamination, and ecosystem degradation. Heavy metals and toxic chemicals leach into soil and groundwater, posing risks to human health and biodiversity. Additionally, burning e-waste releases toxic fumes into the air, exacerbating air pollution and respiratory ailments among nearby communities.

The health implications of informal e-waste disposal are alarming, particularly for individuals involved in dismantling and recycling activities. Workers in informal recycling facilities are exposed to harmful substances without adequate protective

measures, leading to a range of health issues such as respiratory problems, skin disorders, neurological disorders, and cancer.

In response to these challenges, the Indian government has developed a policy framework to address the informal disposal of e-waste and mitigate its environmental and health impacts. The E-Waste (Management) Rules, 2016, mandated by the Ministry of Environment, Forest, and Climate Change, provide guidelines for the proper handling, collection, transportation, and disposal of e-waste. These rules aim to promote environmentally sound management practices, encourage recycling and resource recovery, and regulate the informal sector's activities.

Furthermore, the government has implemented initiatives such as the Extended Producer Responsibility (EPR) program, which holds producers responsible for managing the e-waste generated from their products throughout their lifecycle. EPR encourages producers to establish collection centers, recycling facilities, and awareness campaigns to facilitate proper e-waste management.

Despite these efforts, challenges persist in effectively regulating the informal sector and ensuring compliance with e-waste management regulations. Enforcement mechanisms need strengthening, and greater awareness and capacity-building initiatives are required to educate stakeholders about the importance of responsible e-waste management.

In conclusion, the informal disposal of e-waste in India poses significant environmental and health risks, necessitating urgent action from policymakers, industry stakeholders, and civil society. By strengthening regulatory frameworks, promoting sustainable practices, and fostering collaboration among stakeholders, India can address the informal e-waste disposal problem and transition towards a more sustainable and circular economy.

7. Conclusion

The management of electronic waste (e-waste) in India presents a complex challenge with multifaceted environmental, social, and economic dimensions. Throughout this exploration, we have delved into the intricate dynamics of e-waste disposal, highlighting the informal sector's significant role, the environmental and health consequences of informal practices, and the existing government policy framework aimed at addressing these issues.

It is evident that the informal disposal of e-waste poses grave threats to the environment, with toxic substances contaminating soil, water, and air, and endangering ecosystems and human health. Moreover, the health risks faced by individuals engaged in informal recycling activities underscore the urgent need for comprehensive interventions to safeguard the well-being of vulnerable communities.

In response to these challenges, the Indian government has taken steps to regulate e-waste management through the E-Waste (Management) Rules, 2016, and initiatives such as Extended Producer Responsibility (EPR). These efforts signal a commitment to promoting responsible e-waste management practices and transitioning towards a more sustainable and circular economy.

However, despite these regulatory measures, significant gaps remain in enforcement, awareness, and capacity-building, particularly within the informal sector. Addressing these gaps requires concerted

efforts from government agencies, industry stakeholders, civil society organizations, and the broader community.

Moving forward, it is imperative to strengthen enforcement mechanisms, enhance public awareness, and promote collaboration among stakeholders to ensure the effective implementation of e-waste management policies. By fostering a culture of sustainability, innovation, and responsibility, India can mitigate the environmental and health impacts of e-waste disposal and pave the way for a more sustainable future.

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