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RECYCLING CULTURES IN INDIA: STUDYING ELECTRONIC AND TEXTILE WASTE

Anwesha Borthakur

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At our home in Delhi's National Capital Region (NCR) in India, I often wake up in the morning to the calls of street vendors. Many of them are experts in fixing small household items—be it a pressure cooker that needs a quick repair or a kitchen knife that requires a swift sharpening. Their calls are one of the few things in Delhi that remind me of my childhood in Assam, a state in the foothills of the Indian Himalayas. The cries of the scrap dealers, locally known as *kawadiwalas*, in the mornings in an otherwise quiet neighbourhood of the small town of Tinsukia are still distinct in my memory: "Tina, loha, plastic," they were shouting, asking for recyclable waste such as old newspapers, plastic, or metals.

Clothes are sorted by colour before being spun into yarn, a step that makes the bleaching process easier, at a recycling factory in Panipat, India. © Anuj Behal. All rights reserved.

Today, I encounter these vendors and scrap dealers, who have been integral to India's urban and semiurban landscapes for decades, as a researcher interested in waste management while conducting fieldwork in India. Their cries now hold more extensive meaning to me. Reading up on them, I find that they have been playing a pivotal role in diverting large volumes of waste from the country's landfills. Reusing, repairing, recycling—both upcycling and downcycling—a wide range of products has been common practice in the country for ages, without being particularly informed about the local or global environmental state of affairs. What has been introduced as a way to combat environmental degradation elsewhere has simply been a way of life here. Having observed and experienced the socioeconomic changes in the country—a rising upper- and middle-class population with disposable incomes and an ever-growing consumer market—I have been assuming that such traditional waste management systems in India are gradually shifting or disappearing. But the places I have visited over the past few years as part of my research tell a different story: People in the country are largely still holding on to these practices, which are often not only financially viable but also environmentally sustainable.

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Assam. Photo by Anwesha Borthakur. CC BY-NC-ND 4.0.

Waste is widely considered "unsightly," and hence, there is always an attempt to hide the mountains of refuse humans produce.[1] This is particularly true in the Global North where extremely high waste generation often remains unnoticed as excesses are transported to neat little logistical units in the forms of boxes, containers, and bags, signifying modernism and cleanliness.[2] In most countries in the Global South, however, waste is omnipresent and fully visible—in open bins, clogged drains, landfills, and on roadsides. What you get to see is mostly municipal solid waste, such as food and kitchen waste or plastic and packaging waste. Yet there are voluminous streams of waste that remain out of sight even in places where waste is constantly visible. In India, e-waste and textile waste represent two major types of such hidden waste. They remain somewhat unnoticed and absent from public debate despite being inherently toxic, having detrimental impacts on human health and the environment.

Today, electronics and textiles represent two major industries globally. With more than a 44 percent share of total global e-commerce sales in 2023, existing statistics show both their immense size and unprecedented growth. Such surges are not unproblematic, however, due to the short life cycles of the products and their constant waste creation. According to the United Nations (UN), a record 62 million tonnes of e-waste were generated worldwide in 2022, expected to reach a minimum of 82 million tonnes by 2030.[3] This makes e-waste one of the fastest-growing domestic waste streams in the world. The same report postulates that only 22 percent of the e-waste generated in 2022 was collected and recycled, while the remaining 78 percent has remained entirely undocumented. The latter was likely landfilled, incinerated, or traded across countries—mostly from the Global North to the Global South.

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E-waste in Nayandahalli, Bangalore, 2015. © S. Shreyas. All rights reserved.

Likewise, the UN notes that 92 million tonnes of textile waste are produced worldwide every year.[4] In 2023 only 8 percent of textile fibres were made from recycled sources, and 11 percent of plastic waste essentially comes from clothing and textiles. Textile waste is expected to reach a 148 formidable million tonnes in 2030.[5] These figures show the intensity of the global e- and textile-waste crisis, as both constitute a significant portion of the formidable 2.1 billion tonnes of global solid waste generated in 2023, and the need for urgent policy action.[6]

My study region, India, the most populous country in the world, is a major producer, consumer, and exporter of electronics and textiles as well as a key contributor to the global e- and textile-waste crisis. In December 2024, the Union Ministry of Housing and Urban Affairs observed that India's e-waste generation has experienced a surge of 73 percent in only five years, since 2019–20.[7] Likewise, a report by the same ministry in 2021 concludes that textile amounts to a substantial 15 percent of the total dry waste generated from municipal sources in the country every day.[8]

The Global North–Global South trade of e- and textile waste further aggravates the situation in India. It is indisputable that significant volumes of disposed electronic and textile products are sent to India in the name of "donation" or "working equipment."[9] Unfortunately, there is no exact quantification of imported waste. The majority of waste ends up on informal recycling sites. Prominent think tanks like Toxic Links estimate that 70 percent of the e-waste processed on informal recycling sites in India is imported.[10] At these recycling sites labour is carried out by marginalised and economically weaker members of society, such as Dalits and Adivasis, as the global phenomenon of waste work considered dirty and inferior is ubiquitous in India.[11] Workers often operate in toxic environments without health and safety measures. Unlike the formal recycling sites, the informal ones are laden with major pollution concerns. The engagement of women and children

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in recycling activities additionally makes the existing management scenario both critical and alarming. Thus, e-waste and textile waste in India is not only contributing extensively to environmental pollution but also poses a pressing environmental justice issue.

Women in a village named Behta Hajipur, near New Delhi, India, are scraping the PVC off of copper wire. They are paid less than 2 US dollars a day for the labour. © Peter Essick on Alamy. All rights reserved. Courtesy of Cavan Images.

In a waste management sector valued at an estimated 14 billion US dollars in 2025, there are between 1.5 and 4 million informal waste pickers, or *kawadiwalas*, in India.[12] The country's overall waste management landscape is thus dominated by informal recycling, which is performed by these *kawadiwalas*—essential stakeholders of this sector. They often pick up recyclable waste from individual households or even bulk consumers through a system of door-to-door collection, gathering paper, plastic, glass, or metals—among them many e-waste and textile waste items. The *kawadiwalas* operate through an excellent local network, which covers almost every household in most major Indian cities and towns. Subsequently, they direct items to recyclers, who extract "value" from the collected "waste."

E-waste in the informal sector is often processed using effective yet rudimentary techniques including open burning or acid baths. While recycling sites are places of uncontrolled pollution—of the air, water, soil, or by noise—the activities as such remain a major source of income for the urban poor, including migrant labourers from rural India coming to the cities or towns in search of livelihood opportunities. From collection, transportation, sorting, segregation, and dismantling of waste, most activities involved in the recycling process are done manually, providing employment opportunities for a large number of people. Seelampur, for example, a locality in North East Delhi and arguably the largest e-waste dumping site in India, handles over thirty thousand tonnes of e-waste every day,[13] and employs fifty thousand men, women, and children.[14]

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Nehru Place in Delhi, India. Photo by Thousandways. Wikimedia Commons. CC BY-SA 2.5.

But Seelampur is only one of the many informal e-waste recycling sites in India. In Greater Delhi I encountered larger and smaller sites. Small recycling shops located between other shops engage in activities such as dismantling e-waste to recover precious or valuable metals. Nehru Place in the country's capital, New Delhi, considered one of Asia's largest electronics markets, boasts both high-end electronics shops and a large number of repair stores that are also selling locally made nonbrand electronic products. The fact that the two types of stores exist next to each other shows the significance of India's urban repair and recycling culture. When I went to Nehru Place to buy a new charger for my laptop, the shopkeeper insisted that I purchase their "local" product because, as he argued, while being remarkably cheaper, it is as good as its "branded" counterpart. My money, as he reasoned, "should not be wasted unnecessarily buying an expensive yet functionally equivalent product."[15] He also enquired about my broken charger and asked if I brought it along as he could fix it, which could pay off financially. People like this shopkeeper are contributing to an environmentally responsible culture of reuse—without active consideration of the environment in everyday life. Nonetheless, with an attractive consumer market fuelled by the emergence of e-commerce, the waste-generation and -management scenario in India is at risk of evolving towards a throwaway culture, and acknowledging the role of sites like Nehru Place thus becomes increasingly important.

The case of textile waste is similar in many ways. During my visit to the city of Ludhiana, a prominent textile hub in the country often called the heart of India's garment industry, I was once again reminded of the irrefutable role the informal recycling sector plays. Ludhiana has a textile industry worth a billion dollars and accounts for substantial production of apparel for the Indian and foreign markets. I took a tour of Ludhiana's cloth markets, which are spectacles in themselves with unending lanes lined by apparel stores. Many of the shop owners have their own factories for producing garments. It was, however, interesting to learn that they do not have a good sense of the fate of the textile waste produced in their factories. When asked about preconsumer textile waste, all of them said that they sell the scrap clothes to the *kawadiwalas* for a small price.[16]

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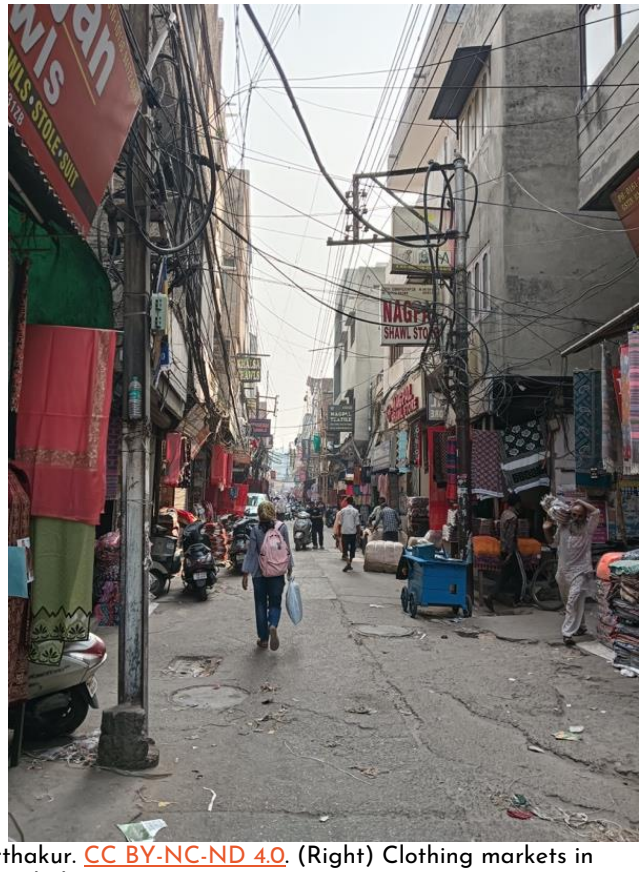

(Left) Tailoring shops at Tinsukia. Photo by Anwesha Borthakur. CC BY-NC-ND 4.0. (Right) Clothing markets in Ludhiana. Photo by Anwesha Borthakur. CC BY-NC-ND 4.0.

Similar tendencies surfaced when I visited the tailoring shops in my hometown, Tinsukia, in another corner of India. Unlike Ludhiana, Tinsukia hardly has any textile factories except for some small-scale traditional handloom establishments, and its cloth markets source their products mostly from outside. But you can find an impressive tailoring market to cater to the needs of local residents as is common in many small Indian towns. I interviewed a few tailors to find out where the waste produced from their activities goes. As was the case in Ludhiana, the generators of preconsumer textile waste in Tinsukia replied that stakeholders in the informal waste sector are equipped enough to deal with the textile waste produced in their facilities.

The excellent rapport the informal waste workers have built with their customers, both pre- and postconsumer textile waste generators, over the years result in highly localised (and efficient) waste-collection and -management mechanisms in India. The sector is constantly expanding and creates massive competition with the formal waste sector as the latter has limitations, especially in terms of its capacities and efficacy in collecting waste.

India's waste management system has always been centred around the informal sector. Echoing its importance, an expert I interviewed during my research said, "Formalisation of the informal sector is not required. Instead, the informal sector should remain 'informal.' Converting it into a formal setup will reduce its efficiency."[17] It is nonetheless crucial to ensure an environment where workers are safe and pollution is minimal. There should be awareness creation efforts to convey the role of the informal workers in managing India's waste so that their work is not stigmatised. Here lies the significance of an active role of the government at three major levels—national, state, and local. Mandatory health- and liability-insurance coverage for informal waste workers needs to be introduced. Regulations need to be initiated by the national or state governments, and local governments should help implement them.

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Discarded clothes at a recycling factory in Panipat, India. © Anuj Behal. All rights reserved.

Further tracking textile waste led me to Panipat. This small district in northern India is known as the world's "castoff capital." Although in Ludhiana I was told that Panipat is indeed one of the prime destinations of their waste textiles, it is evident that the bulk of the textile waste in this small town essentially comes from abroad. The port of Kandla on India's western coast is the hub of imported postconsumer textile waste, where containers full of textiles from the Global North arrive.[18] Travelling over one thousand kilometres, these items find their way to Panipat. The NGO Closed Loop Fashion calculates that Panipat receives 250 tonnes of textile waste every day.[19] This volume arrives in addition to the textile waste directed to Panipat locally. In Panipat's recycling centres, the first task is to remove the zippers, buttons, and labels from the clothes, followed by sorting them by colour. They are subsequently broken down into yarn before they are rewoven again to make blankets and woollens, for which a huge market exists in Africa, while some of these products are also sold at local Indian markets. Similar activities can be observed on smaller scales in many small Indian towns and villages.

The trade of waste, as I found, is convenient due to some major lacunas in the existing policies. The lack of a uniform definition of "textile waste" or "e-waste" worldwide makes its transboundary movement favourable. For instance, different interpretations and usage of the term across different countries contribute to a system where one country's e-waste may not be categorised as "waste" in another country. In India, until very recently, the definition of e-waste was rather narrow. Only 21 types of electrical and electronic equipment used to come under the purview of India's e-waste rules. In 2022, new e-waste rules were introduced. They include a wide range of electrical and electronic equipment, hopefully resulting in better management practices and policy interventions.

While prevailing management challenges such as the massive volume, pollution burden, and unhealthy working environment in the informal recycling sector remain incontestable, there is an opportunity to learn from India's traditional waste management practices, which are in alignment with a circular economy system—a "buzzword" in current waste-related policymaking.[20] Eager to take my research beyond urban India, I travelled to a small Himalayan town called Bhaderwah in Jammu and Kashmir, situated 1,700 metres above the mean sea level. This mountain settlement situated approximately 800 kilometres north of New Delhi exemplifies textile circularity. Throughout the year, the inhabitants in and around Bhaderwah store their worn-out clothes and wait for the

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"mattress makers" to arrive in spring. These mattress makers convert garments—be it woollens, cottons, or any other material—back to yarn, often using a basic yet effective diesel-operated machine, a frugal grassroots innovation. They make new mattresses, cushions, and pillows using the newly made yarn or refill old ones. They usually move from one village to another carrying their machines, staying at each place for a couple of days until they run out of work. Without any acknowledgement, commendation, and perhaps without realising its significance, the populace of this area sets examples for responsible and sustainable textile waste management. Unfortunately, textile waste management policies hardly acknowledge such practices or take initiatives to promote them in emerging economies like India. Similar to the items they work with, these recyclers remain "invisible" in India's waste management scenario.

Mattress makers in Bhaderwah. Still from a video by Anwesha Borthakur. CC BY-NC-ND 4.0.

In the context of both e-waste and textile waste, policies in India take inspiration from the Global North. However, we must acknowledge that India has very different socioeconomic and cultural-environmental conditions. A policy that is successful in one country may not be effective in another. Waste management initiatives and policies should therefore be "location specific." For that, we must take hints from India's traditional waste management practices. Similar to the textile management interventions in a remote Himalayan village, out-of-use clothes often find other applications in households—they are downcycled as dusters, cleaning cloths, floor mats, or upcycled as tote bags or quilts, as young adults I interviewed in New Delhi report.

To date, as I saw in the various places I visited across the country, India is reasonably holding onto its traditional recyclable waste management practices. And yet, the question remains: For how long in the foreseeable future will these practices remain relevant and gainful while India is experiencing major socioeconomic change? Will they cease to exist in the aftermath of a competitive and promising consumer market that discourages those household recycling practices? As put forth by India Brand Equity Foundation under India's Department of Commerce, Ministry of Commerce and Industry, "India's consumer market is set to grow by 46 % by 2030, driven by rising incomes, a young workforce, and rapid urbanization. Projections indicate that consumer spending will reach Rs. 3,72,33,700 crore (US$ 4.3 trillion) by 2030, up from Rs. 2,07,81,600 crore (US$ 2.4 trillion) in 2024."[21] This will make India the second-largest consumer market in the world. The same report highlights a

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shift from "unorganized to organized retail" and "unbranded to branded products" in the country.[22] All of this will challenge the traditional waste recycling practices that centre around informality and a brand-agnostic psyche.

My fieldtrips to India have left me with mixed feelings. Waking up to the cries of the *kawadiwalas* or the sound of the vendors repairing small equipment in the morning makes me happy. It ascertains that they still have "customers" in a rapidly emerging economy with an aspiring populace. Living in a relatively well-off neighbourhood in Delhi NCR, I can confirm that many of their clients do not necessarily "need" to opt for their services as they are affluent enough to purchase a replacement product in no time. The fact that they still seek support from the vendors is reassuring. But then again, the stigmatisation and working conditions of the informal waste workers are disturbing. I'm torn, realising that if issues of social injustice were addressed, people like the mattress makers in the small Himalayan settlement could act as a model for sustainable waste management in the Global North.

Notes

[1] Christof Mauch, ed., "Out of Sight, Out of Mind: The Politics and Culture of Waste," *RCC Perspectives: Transformations in Environment and Society*, no. 1 (2016), https://doi.org/10.5282/rcc/7388.

[2] Liz Ricketts and Charlie Engman, "The Messy Truth: Where Your Clothes Go to 'Die'," *Atmos*, 1 August 2025, https://atmos.earth/the-messy-truth/.

3 Cornelis P. Baldé, Ruediger Kuehr, Tales Yamamoto, Rosie McDonald, Elena DÀngelo, Shahana Althaf, et al., *Global E-Waste Monitor 2024* (International Telecommunication Union and United Nations Institute for Training and Research, 2024), https://www.itu.int/en/ITU-D/Environment/Documents/Publications/2025/d-gen-e_waste.01-2024-pdf-e.pdf.

[4] "Unsustainable Fashion and Textiles in Focus for International Day of Zero Waste 2025," United Nations Environment Programme, 27 March 2025, https://www.unep.org/news-and-stories/press-release/unsustainable-fashion-and-textiles-focus-international-day-zero.

[5] Xiaotong Li, Ming Zhang, Jiewen Luo, Shicheng Zhang, Xiao Yang, Avanthi Deshani Igalavithana, et al., "Efficient Succinic Acid Production Using a Biochar-Treated Textile Waste Hydrolysate in an *in situ* Fibrous Bed Bioreactor," *Biochemical Engineering Journal* 149 (2019): 107249, https://doi.org/10.1016/j.bej.2019.107249.

[6] *Global Waste Management Outlook 2024: Beyond an Age of Waste—Turning Rubbish into a Resource* (United Nations Environment Programme, 2024), https://www.unep.org/resources/global-waste-management-outlook-2024.

[7] Kiran Pandey, "India's E-Waste Surges by 73% in 5 Years," *Down to Earth*, 17 December 2024, https://www.downtoearth.org.in/waste/indias-e-waste-surges-by-73-in-5-years.

[8] Minakshi Solanki, "Tripartite MoU to Reduce Textile Waste in India Gives Hope, but Cautious Steps Needed," *Down to Earth*, 6 March 2024, https://www.downtoearth.org.in/waste/tripartite-mou-to-reduce-textile-waste-in-india-gives-hope-but-cautious-steps-needed-94843.

[9] Anwesha Borthakur, "Generation and Management of Electronic Waste in India: An Assessment from Stakeholders' Perspective," *Journal of Developing Societies* 31, no. 2 (2015): 220–48, https://doi.org/10.1177/0169796X14545574; and Shilpa Kannan, "Where Many of the Clothes You Throw Away End Up," *BBC News Business*, 12 July 2017, https://www.bbc.com/news/business-40352910.

[10] Kishore Wankhade, "Is India Becoming Dumping Ground for British E-Waste?," Toxics Link, 24 September 2004, https://icpe.in/pdf/Is_India_becoming_dumping.pdf.

[11] Barbara Harriss-White and Gilbert Rodrigo, "Discrimination in the Waste Economy: Narratives from the Waste Workers of a Small Town," *Journal of Social Inclusion Studies* 2, no. 2 (2018): 3–27, https://doi.org/10.1177/2394481120160201.

[12] Orchie Bandyopadhyay, "India's Waste Pickers: Indispensable but Invisible," British Safety Council, 7 February 2025, https://www.britsafe.in/safety-management-news/2025/india-s-waste-pickers-indispensable-but-invisible.

[13] Osama Manzar and Udita Chaturvedi, *Seelampur: Life in India's Digital Trashcan* (Inomy Media, 2017), https://www.defindia.org/wp-content/uploads/2021/10/Seelampur-Indias-Digital-Trashcan.pdf.

[14] Orchie Bandyopadhyay, "E-Waste: A Toxic Legacy," British Safety Council, 12 October 2022, https://www.britsafe.in/safety-management-news/2022/e-waste-a-toxic-legacy.

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[15] Author in conversation with the shopkeeper, April 2024.

[16] Author in conversation with several shopkeepers in Ludhiana, April 2025.

[17] Anwesha Borthakur, "Design, Adoption and Implementation of Electronic Waste Policies in India," *Environmental Science and Pollution Research* 30, no. 4 (2023): 8672–81, p. 8679, https://doi.org/10.1007/s11356-022-18836-5.

[18] Ojas Malpani, Mansha Balecha, Anushka Sureka, Vyoma Uchil, and Deepanshu Kansal, *Unveiling India's Textile Waste Landscape: A Cost Analysis* (IDH and Sattva Consulting, 2023), https://www.idhsustainabletrade.com/uploaded/2023/09/IDH_textile-waste-cost-analysis_2023.pdf; Kannan, "Clothes You Throw Away."

[19] "Panipat: A Visit to Asia's Largest Textile Recycling Hub," Closed Loop Fashion, 17 April 2024, https://closedloopfashion.com/news-at-clf/panipat-a-visit-to-asias-largest-textile-recycling-hub/.

[20] The European Parliament defines circular economy as "a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible." See Didier Bourguignon, "Closing the Loop: New Circular Economy Package," European Parliament Briefing, January 2016, https://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573899/EPRS_BRI%282016%29573899_EN.pdf; and "Circular Economy: Definition, Importance and Benefits," European Parliament, 24 May 2023, https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits.

[21] "India's Consumer Market to Become World's Second Largest by 2030: Report," *The Economic Times*, 30 January 2025, https://economictimes.indiatimes.com/news/india/indias-consumer-market-to-become-worlds-second-largest-by-2030-report/articleshow/117721641.cms.

[22] Ibid.

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Anwesha Borthakur is a Humboldt fellow at the Rachel Carson Center engaged in interdisciplinary research focusing on e-waste and textile waste governance in India, South Africa, and the European Union. She holds a PhD in science policy from Jawaharlal Nehru University (JNU), New Delhi, and recently was a Marie Skłodowska-Curie fellow at KU Leuven, Belgium. She currently analyzes the design of textile waste policies in India and South Africa and researches why local practices centered around reuse and recycling are absent from the countries' policymaking.

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