

How To Solve Fashion's Shoe Waste Problem

A White Paper

Kriti Sharma and Tanita S. Gray

Problem

Introduction

Global footwear production reached 23.9 billion pairs in 2022, showing a growth of around 7.6% over the last year (World Footwear Yearbook, 2023). Asia hosts the majority of shoe production units, with every 9 out of 10 pairs of shoes being manufactured there. Subsequently, it holds the first position in the consumption of footwear with a growth of 5% as compared to 2010. On the contrary, dictating the socio-demographic and economic dynamics, per capita consumption in North America stands at 5.9 pairs of footwear as compared to 1.4 pairs per person in Africa (World Footwear Yearbook, 2023; FDRA, 2023).

The environmental impact of the footwear industry is a growing concern, encompassing the entire lifecycle of shoes from design and manufacturing to disposal. Change in fashion preferences boosts rapid demand fluctuations triggering a habit of throwing away what is no longer in fashion or on trend. This behavior contributes to a vicious cycle of a newer variety of shoes being produced and thrown away for the next collection. Symbolism in the form of labels and models takes value over the utility of the footwear thus, giving a boost to both production and solid waste. The terms, 'Sneakerheads' and 'Shoe Addict' can be considered the birth-child of mass consumerism and the attached symbolism.

The complexity of modern shoe design, as pointed out in the Business Insider, with a typical running shoe consisting of 40 different parts and numerous materials, poses a significant challenge for recycling efforts. The intricate composition makes it difficult to separate and recycle these components effectively. Out of the 22 billion pairs of shoes discarded annually, a pair of shoes takes around 30-40 years to decompose (Dennis, 2022).

Carbon Emissions in Manufacturing

The environmental impact of shoes precedes their disposal. According to Unsustainable Magazine, a substantial portion of this impact stems from the manufacturing process and the acquisition of raw materials. Shoe manufacturers often rely on fossil fuels and coal to power their factories, leading to the release of carbon dioxide and other greenhouse gases into the atmosphere. Similarly, a study conducted by MIT revealed that a typical pair of running shoes generates 30 pounds of carbon dioxide emissions, with more than two-thirds of this impact arising from manufacturing processes (Chu, 2013).

The MIT lifecycle assessment, led by Randolph Kirchain and Elsa Olivetti, identified key hotspots of greenhouse gas emissions in the manufacturing process of running shoes. Manufacturing plants, particularly those in regions like China, where a significant portion of the world's shoe production occurs, heavily rely on coal for electricity. The use of coal in both

electricity generation and internal plant processes significantly contributes to the carbon footprint associated with the production of running shoes.

Energy-Intensive Production Processes

Further analysis by Olivetti, Kirchain, and their colleagues highlighted the energy-intensive nature of the production processes for the many components in a pair of running shoes. With 65 discrete parts requiring over 360 processing steps, activities such as sewing, cutting, injection molding, foaming, and heating are particularly energy-intensive. The small and light components used in shoes, such as polyester and polyurethane, contribute to the overall carbon intensity of the manufacturing process (Kirchain et al., 2013).

Environmental Impact Beyond Manufacturing

Extending beyond the manufacturing phase, the environmental impact of shoes is experienced in the distribution as well as post-disposal stage. An alarming revelation comes from the coast of Ireland, where discarded trainers, flip-flops, and other footwear, washup with alarming regularity on shores. These items, including around 60 Nike trainers, are often unworn and bear the same production dates, raising concerns about the global journey of shoes and their contribution to ocean pollution (BBC, 2019). For instance, the material called ethylene vinyl acetate (EVA), a major component in the development of running shoes, gives the shoe its shock absorbent property, can stay in the landfill for about 1000 years.

The Landing in the Western World: The Trash No One Wants

A report published by the Reuters revealed how US Petrochemical giant Dow Inc, as well the Government of Singapore, left the commitment of recycling the donated shoes unfulfilled. The study was part of a test by the Reuters team where 11 pairs of shoes donated by the team were fitted with trackers to trace the journey of these donations. In the name of a promising deconstruction of the shoe to separate the rubber soles for building playgrounds and running tracks, the tracker-attached pair of shoes found their way from Singapore to Indonesia over various land and sea routes. Some of these shoes also found their way to secondhand textile exporters in developing nations as cast-offs, causing various risks to public health, and the domestic textile industry, thus contributing to the mounting landfills, and polluting rivers of the importing nation.

It is known that shoes that are thrown away or donated to charity shops in countries like US or the EU are collected by recycling agents who further sort them into bales to be sent to Africa and Asia as supply for wholesale and retail secondhand markets situated in these locations. There are increased instances where the receiving countries report that these donations contain over 40% of waste.

Shoe Waste and Public Health: What Harm Can Shoes Do?

Focusing on the impact of shoes on the artisans; prolonged exposure to dust particles and glue fumes in footwear manufacturing units in Indonesia was found to cause respiratory disorders among workers in the age group of 20-30 years. Additionally, exposure to a chemical called Toluene irritates the mucous membranes of the eye and the respiratory tracts, causing cough, cough with phlegm, shortness of breath, etc.

Dangerous levels of toxic chemicals like Perfluoroalkyl and Polyfluoroalkyl (or PFAS)¹, being used to waterproof shoe leather, polluted dozens of residential drinking water wells in Michigan USA. Exposure to these chemicals can create decreased odds of women becoming pregnant and high blood pressure or pre-eclampsia during pregnancy.

Similarly, improper disposal of these footwear which are rich in carcinogenic chemicals expose both human and plant life to various respiratory conditions while contributing to the pollution of groundwater and river systems. Thus, the multi-faceted impact of shoe waste on the ecological and economic health of the globe calls for an alternate solution to the problem.

Solution

Responsibility: The Change Of Hands

A sustainable solution to the matter demands the distribution of responsibility, and acknowledging the shift in perspective and accountability across the entire supply chain. All the stakeholders including local government, the manufacturers, retailers, and consumers play crucial roles in ensuring a more sustainable future for the industry. Beginning with a choice to recycle against disposing of the used pair of shoes, the deemed shoe waste becomes a potential resource for future use.

The motivation to choose to recycle among consumers (indicating the change of hands) depends on a strong, accessible, and incentive-oriented channel of collection by the organizations involved in processing the used shoes. Ensuring that the shoes manufactured under their brand name are diverted from landfills, downcycled, or recycled, requires the producers to take 'extended producer responsibility'(EPR).

Collection: Gathering The Waste

Waste collection efficiency is foundational to the success of a circular economy. Widespread engagement of both industry partners and consumers in waste collection and processing requires incentivizing these stakeholders to actively participate in the process. From dedicated drop-off points to innovative collection programs, a seamless and widespread gathering of shoe waste is fundamental to its effective management.

To effectively raise awareness within the footwear industry and local communities about the environmental impact of discarded shoes ending up in oceans and landfills, it is essential to conduct workshops and programs. However, beyond community engagement, forming alliances with footwear manufacturers and retailers is crucial to align and streamline our objectives. By forming partnerships with these stakeholders, we can strategically position specialized collection bins in retail locations. This initiative aims to provide consumers with convenient drop-off points for their old shoes, fostering responsible disposal and contributing to our environmental goals.

Additionally, manufacturers can contribute by integrating collection efforts into their supply chains, ensuring a continuous flow of discarded shoes for sustainable disposal. Innovative approaches such as reverse logistics and mail-in programs play a pivotal role in waste collection. This approach targets the consumers directly. Mail-in programs can be incentivized, encouraging individuals to send their old shoes to designated recycling centers

in return for offers like redeemable points or credit scores, reducing the burden on traditional waste disposal channels.

Deconstruction, Breakdown: How Shoes Become Something New

After collection, the next critical step is the deconstruction and breakdown of these used shoes. Traditional methods of breaking down shoes often involve the use of harsh chemicals that contribute to environmental degradation, thus there is a need for the shift towards eco-friendly solvents and processes that prioritize the health of both the environment and the workers involved in the deconstruction process.

Emphasizing these sustainable practices highlights the industry's commitment to reducing its ecological footprint. Efficient deconstruction extends beyond breaking down materials; it involves identifying and sorting various components such as shoe soles, insoles, laces, fabric, metal pieces, and eyelets for further use. This meticulous sorting ensures that each component can be repurposed appropriately, contributing to a more resource-efficient system.

Shoes become Something New by identifying the ten plus waste stream characteristics and readying those materials for the circular economy.

Extended Life Re-Distribution: Reduction of Virgin Material Use

One of the primary objectives in combating shoe waste is the reduction in the use of virgin material. It focuses on the reintroduction of repurposed materials from discarded shoes into the manufacturing process. By giving shoes an extended life through redistribution of their components, the industry can significantly decrease its reliance on new resources, thereby minimizing its environmental footprint.

Ongoing research and development to determine what products can be derived from shoe waste will promote future innovation.

Shoe Waste Has A Solution

Shoe Waste LLC's California based recycling and recovery service is a landfill divergent. The goal is to turn footwear waste into new recycled materials that can be distributed to industries looking to reduce virgin material use; participate in the circular economy and create new green occupations. The processing effort entails the following steps:

1. Shoes (feedstock) is sourced from local and regional manufacturers and brands. Typically, these are shoes that have been kept in storage units or distribution centers as returns, damages, sales samples, awaiting a time they can be offloaded.
2. Shoe Waste's recycling intake subscription service innovation will assist in reducing the impact footwear waste has on our environment and local communities by collecting the unwanted and unusable shoes from local footwear manufacturers. Thus, in compliance to the Nation's EPR bill, "producers will be financially responsible for funding recycling of their products".
3. After collection, the discarded shoes would be sorted, cleaned, and deconstructed into usable materials like rubber, foam, textile, and fluff to enter the supply chain of industries requiring these materials, fuelling a circular economy.

4. A waste audit is then produced with the collection data, and a waste reduction plan is then offered to the client.

For example: A total of 102 components have been calculated for recovery from the deconstruction of a lace up boot. Of which, 90% of the components are recyclable including textiles, metals, organics, plastics, etc., Our unique approach to shoe deconstruction features two methods; a.) Total pallet deconstruction and b.) White-glove deconstruction, a method that is much like the reverse of handmade shoes. This meticulous process reduces or eliminates the use of chemical breakdown and salvages shoe components in a way that recovers the materials with little to no contaminants. These salvaged materials are then sorted, categorized and prepared for the next destination thus extending the life cycle of the shoe.

Manufacturers can participate in “Shoe Waste Day”- an educational awareness PSA - with community initiatives like drop-offs, take back programs, and curbside bins in the future. This engagement will supply the data research needed to implement collection service for post-consumer waste.

A Pivot in the Industry: Creating High Pay Green Jobs

The need for skilled, semi-skilled, and unskilled professionals in the collection, sorting, and recycling processes, as well as in the development and marketing of sustainable products, opens up avenues for job growth in the emerging green economy. Shoe Waste's innovative practices thus foster a sustainable and lucrative future for the shoe recycling industry, simultaneously addressing environmental concerns and promoting economic development through green job creation.

1. Collection and Sorting:

- *Collectors*: Individuals responsible for collecting used shoes from designated locations, ensuring a steady supply of materials for processing.
- *Sorters*: Professionals who categorize collected shoes based on material types and conditions, facilitating efficient recycling.

2. Deconstruction and Recycling:

- *Deconstruction Technicians*: Skilled workers trained in disassembling shoes into their constituent materials, such as rubber, leather, metal, and fabric, for recycling.
- *Recycling Plant Operators*: Individuals managing and overseeing the machinery and processes involved in breaking down materials into reusable components.

3. Material Innovation and Research:

- *Material Experts*: Experts focused on researching and developing innovative ways to repurpose recovered shoe materials for various industries.
- *Product Designers*: Professionals creating sustainable and eco-friendly products using the recycled materials, contributing to the circular economy.

4. Logistics and Supply Chain:

- *Logistics Coordinators*: Individuals managing the transportation and distribution of recycled materials to different industries.
- *Supply Chain Analysts*: Experts optimizing the supply chain to enhance efficiency and reduce environmental impact.

5. **Marketing and Sales:**

- *Sustainability Marketers:* Professionals promoting Shoe Waste's eco-friendly practices and products to consumers and businesses.
- *Sales Representatives:* Individuals responsible for securing partnerships with industries interested in using recycled materials.

6. **Environmental Compliance and Regulation:**

- *Environmental Compliance Officers:* Experts ensuring that Shoe Waste's operations adhere to environmental regulations and sustainability standards.
- *Policy Advocates:* Professionals involved in advocating for policies that support sustainable practices in the shoe industry.

7. **Education and Outreach:**

- *Environmental Educators:* Individuals responsible for raising awareness about sustainable practices, including the importance of recycling shoes, among communities and schools.
- *Community Outreach Coordinators:* Professionals engaging with local communities to promote eco-friendly behavior and the benefits of sustainable initiatives.

By encompassing these diverse roles, Shoe Waste not only contributes to environmental sustainability but also fosters the creation of high-paying green jobs, addressing both ecological and economic concerns in the shoe industry.

Conclusion

The escalating concern over the shoe waste problem, exacerbated by the relentless demand created through social media influence and aggressive advertising, underscores the urgent need for a sustainable solution. Recognizing this imperative, Shoe Waste LLC emerges as a trailblazer in reshaping attitudes within the entire supply and demand chain of the footwear industry. The company's unique model, encompassing green job development and training, comprehensive shoe collection, meticulous deconstruction, and material recovery, stands as a beacon of hope. By actively addressing the environmental impact of discarded shoes, Shoe Waste LLC not only pioneers a solution to the problem but also sets the stage for a paradigm shift in the industry towards a more sustainable and responsible future.

This innovative model not only serves as a solution for the footwear industry, but also fosters a mindset that prioritizes ecological harmony over the transient allure of fast fashion.

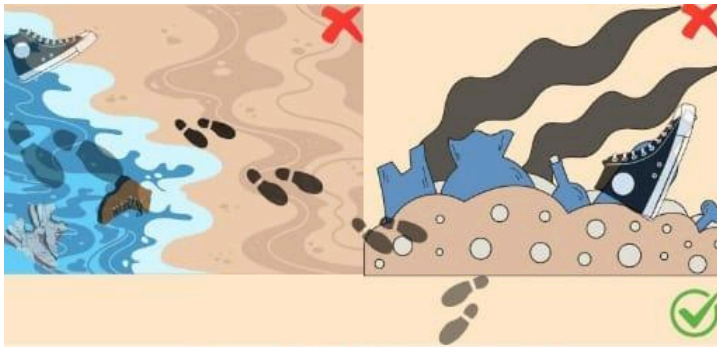
About Shoe Waste

Our mission is to reduce and divert shoes from local landfills, both globally and domestically. We do this by offering quarterly intake and off load services to the footwear industry. We educate manufacturers and consumers about the impacts shoes have on our environment. We conduct deconstruction demos that highlight the value chain of shoe waste to promote green jobs. We help people deal with their shoe waste.

How to contact us

To learn more about how to properly discard your shoe waste, contact:

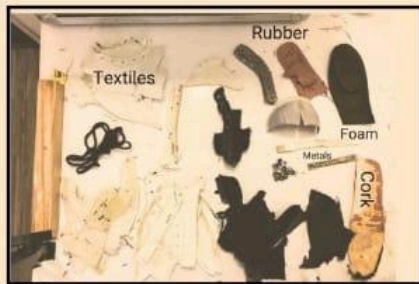
Tanita Gray: hello@shoewaste.com Learn more: www.shoewaste.com



Landfill Divergent



Shoe waste '2-lane' process will sort, clean, deconstruct, and ready shoes for new raw materials that will enter the circular economy.



Recovered Raw Materials



Recovered Material Product

For more information contact: Tanita Gray (hello@shoewaste.com)

(Kriti Sharma)

ELEMENTS OF SHOE WASTE

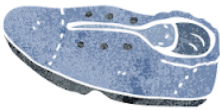
What is considered Shoe Waste?
These are the basic elements of shoe waste. They are the building blocks to understanding what shoe waste is.



MATERIAL SCRAPS
Any materials left over from production or sample making that include swatches, die cuts, trims, cast-offs, damaged materials and findings like zippers, buttons, eyelets, laces, etc.



SAMPLE PAIRS
After-selling-season pairs, with or without holes, odd side samples, mistake samples, old sales samples, unsellable, un-givable, unwanted, and unwearable samples.



PROTOTYPES
Testing shoes, first take uppers, pattern pieces, non-lasted, etc. Prototypes that are considered garbage.
Can also be considered material scraps.



ILL-FITTING
Shoes that do not fit or have fitting problems. From consumers; shoes that just don't fit anyone or shoes that are simply...made wrong.



RETURNS
Retail returns, customer returns, production order drops, damaged orders returned, shoes returned to manufacturer for any reason and they cannot be donated for good.



DAMAGED
Shoes that are damaged beyond repair and are considered garbage. Shoes that cannot be worn, sold or donated due to damage. The creative "worn look" aesthetics do not apply unless they are truly damaged beyond wear.



ALL SHOES
Prototypes, samples, damaged shoes, customer returns, unwanted shoes, half pairs, ill-fitting, good for the garbage. All shoes that is considered garbage - is SHOE WASTE.

(Tanita Gray)



References:

World Footwear. (2023). *10 countries were responsible for 88% of total footwear production, World Footwear*. Available at: <https://www.worldfootwear.com/news/10-countries-were-responsible-for-88-of-total-footwear-production/9148.html>

World Footwear. (2019). *World Footwear Yearbook*. Available at: <https://www.worldfootwear.com/yearbook/the-world-footwear-2019-Yearbook/213.html>

Dennis, P. (2022). *Shoe waste: How consumption became culture, Circular Online*. Available at: <https://www.circularonline.co.uk/features/circular-trainers-how-consumption-became-culture/>

Chu, J. (2013). *Footwear's (carbon) footprint, MIT News | Massachusetts Institute of Technology*. Available at: <https://news.mit.edu/2013/footwear-carbon-footprint-0522#:~:text=The%20researchers%20divided%20the%20shoes,to%20the%20product's%20carbon%20footprint>

DiNapoli, T. (2022). *Global shoe waste: The environmental impact of Footwear, unsustainable*. Available at: <https://www.unsustainablemagazine.com/global-shoe-waste/>

Cheah, L., Ciceri, N. D., Olivetti, E., Matsumura, S., Forterre, D., Roth, R., & Kirchain, R. (2013). Manufacturing-focused emissions reductions in footwear production. *Journal of cleaner production*, 44, 18-29.

Mackay, H. (2019). *Why are Nike trainers washing up on beaches?, BBC News*. Available at: <https://www.bbc.com/news/uk-48464664>

How adidas, Asics, and other shoemakers deal with waste | world wide waste | insider business (2023) *YouTube*. Available at: <https://www.youtube.com/watch?v=C032oem5eaY> (Accessed: 04 February 2024).

Brock, J., Budiman, Y.C. and Campbell, J. (2023). *Dow said it was recycling our shoes. we found them in Indonesia*. Available at: <https://www.reuters.com/investigates/special-report/global-plastic-dow-shoes/>

Hoskins, T.E. (2020). *'Some soles last 1,000 years in landfill': The truth about the Sneaker Mountain, The Guardian*. Available at: <https://www.theguardian.com/fashion/2020/mar/21/some-soles-last-1000-years-in-landfill-the-truth-about-the-sneaker-mountain>

Roelofs, T. (2017). *Michigan maker of Hush Puppies called on its toxic past | bridge ... , Bridge Mi*. Available at: <https://www.bridgemi.com/michigan-government/michigan-maker-hush-puppies-called-its-toxic-past>

Spasić, V. (2023) *EU's used clothing, footwear exports ending up in landfills in Africa, Asia, Balkan Green Energy News*. Available at: <https://balkangreenenergynews.com/eus-used-clothing-footwear-exports-ending-up-in-landfills-in-africa-asia/>