

# Re-Imagining Industrial Systems

## HIGH SCHOOL READING

The Industrial Revolution in the late 18<sup>th</sup> and 19<sup>th</sup> centuries mechanized the production of goods and enabled production on a mass scale. The need for raw materials from all over the world fueled colonialism and imperialism, with rapidly industrializing countries exploiting foreign lands and people for natural resources and labor. As industrial systems increased food yields, population grew, and with it, the demand for more goods.

Today, industrial systems govern the production and management of resources that sustain the world, producing the cars we drive, clothes we wear and food we eat. There are many parts and steps in these systems, from the raw material inputs, workers who make the goods, energy that powers distribution and production, to waste management and disposal systems. We live in a globalized world, and many of these activities are interconnected with other countries. While this can create jobs and opportunities, it has also led to unequal development, inequality and environmental destruction. The COVID-19 pandemic has shown the need for more sustainable and inclusive industrial systems, from supply chains, to waste disposal, to insuring safety of essential workers

Re-imagining these big systems to make them environmentally sustainable and more equitable requires innovation and collaboration from many stakeholders -- the different individuals, groups of people, or organizations who have a concern or interest in an issue. This includes governments, corporations, entrepreneurs, students, activists, and voters. As you read through these topics, think about your own lifestyle and community. What issues do you see? Now, think globally. What needs to be done to create a sustainable and inclusive solution to one of these global challenges?

# Procurement of Raw Materials

Raw materials are the basic materials needed to make common goods and services, from clothes and food, to hand sanitizer. When procuring raw materials, companies must consider costs, availability, and efficiency. However, many raw materials are finite resources, meaning they can't be replenished. The world's **material footprint**, the amount of materials needed to meet consumer demands, has been rapidly increasing. With rising population and global consumption, by 2050, we would need the **equivalent of almost three planet Earths to provide the natural resources** needed to sustain current lifestyles. Wealthier nations consume more per capita (per individual), which leads to more extraction of raw materials from often lower and middle-income countries.

Unsustainable extraction of raw materials often harms local ecosystems, human health, and human rights. For instance, we see this with deforestation to plant palm oil plantations in Indonesia, **child labor used to mine cobalt in the Congo** to make smartphone batteries, and **mining conflict diamonds in Subs-Saharan Africa** to meet the demand for engagement rings. Promoting a “circular economy” and **“Sustainable Materials Management”** are some ways manufacturers and governments are trying to promote sustainable procurement of raw materials, but there are challenges in creating and enforcing practices. What would re-imagining this system look like in your community, nation, or world to protect human rights, ecosystems, and livelihoods?



Red palm fruits in a market in Abidjan, Côte d'Ivoire. Palm oil is a popular raw material used in many items around the world, from chocolate to shampoo. Photo by Eva Blue on Unsplash

# Waste Management

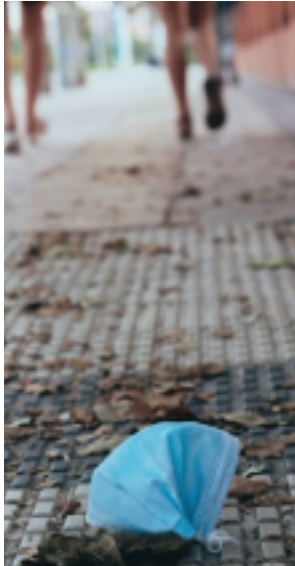


Municipal solid waste bins. Photo by Paweł Czerwinski on Unsplash

Waste management is the process of safely collecting, treating, and disposing of waste in ways that protect the environment and human health. Human activities **generate over 11 billion tons** of waste each year. When not managed properly, waste can pollute the soil, water, or air, and can harm human health. Not all states or countries have the same regulations to promote consistent

waste management, and some places in the world have very weak or no waste management systems.

The COVID-19 pandemic has shown the need to improve waste management in many parts of the world. In many cities, budget cuts during the pandemic disrupted local **recycling and composting services**. **At the same time, waste generation increased** from hospitals and households, as people used more single-use items, like paper masks, latex gloves and takeout containers. In other parts of the world, rapid urbanization and population growth have outpaced infrastructure development, leaving communities without waste management systems. Fragmented governments and poor leadership also contribute to a buildup of waste and, consequently, the degradation of environmental and human health. Finding ways to safely manage the many kinds of waste (solid, hazardous/toxic, and chemical) is a global challenge.



**Industrial waste**, often toxic, is any unwanted byproduct from industry operations, such as hospitals, factories, mines, food processing plants, and manufacturing facilities.

**E-waste** is any discarded tech and electronic device and is a big global problem. E-waste is rarely recycled properly, and is often shipped abroad to be sorted and processed by poorer local communities, often with little to no regulations. **Municipal solid waste**, or “trash”, is non-hazardous material that households or businesses throw away in their garbage cans, recycling, or compost bins. Cities then collect, treat, and dispose of this waste.

A single-use face mask litters the street during the COVID-19 pandemic.

Photo by Marta Ortigosa on Unsplash

# CAFOs/Brownfields



A lagoon of hog manure in North Carolina. Waste from CAFOs can pollute local water sources. Photo courtesy of USDA Natural Resources Conservation Service

Concentrated animal feeding operations (**CAFOs**) and **brownfields** are sites that pose threats to ecosystems and human health because they contain hazardous waste or pollutants.

CAFOs, also known as “factory farms”, confine many animals on large feedlots, without vegetation or grass. **CAFOs produce large amounts of manure and wastewater,** which can pollute the local water and air. Despite these dangers and animal welfare concerns,

CAFOs are popular because they are an inexpensive way to raise livestock and supply meat at a lower price to consumers. CAFOs are regulated under the U.S. Clean Water Act, but environmental advocacy groups claim that **data and transparency on CAFOs and enforcement of protections is lacking.** CAFOs are most **often located in poor communities and communities of color.**



An abandoned site on Treasure Island in San Francisco, California. Treasure Island has many brownfields, due to toxic materials leftover from U.S. Navy operations. The city is redeveloping the island with sustainability in mind. Photo by Joseph Barrientos on Unsplash.

**Brownfields** are properties that pose a threat if redeveloped or expanded because they contain a hazardous substance, pollutant, or contaminant. This can be asbestos, lead, heavy metals, petroleum, and others. Brownfields can be abandoned lots and/or former gas stations, factories, automobile shops, or warehouses. “Land recycling” is the process of safely redeveloping a brownfield, but it has many steps and hurdles. If not done properly, the contamination can seep into water, air, and soil, and harm the health of communities nearby and workers who are redeveloping or expanding the property. While states and the **federal government often fund brownfield cleanup and redevelopment projects in the U.S.,** finding long-term financing remains a challenge. In many countries, there are also political, legal, and technical barriers to safely addressing brownfields.<sup>1</sup> **Take a look at this EPA** map to find brownfield sites across the U.S.

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1. Ahmad, N., Zhu, Y., Shafait, Z., Sahibzada, U., & Waheed, A. (2019). Critical barriers to brownfield redevelopment in developing countries: The case of Pakistan. *Journal of Cleaner Production*, 212(1), 1193-1209.



# Energy Production



Wind turbines in Greece.

Photo by Jason Blackeye on Unsplash

Energy fuels economies and lifestyles. It powers factories, cars, and modern conveniences. **Energy production and use is also the largest contributor of greenhouse gas emissions,** comprising two-thirds of global emissions. While investment in clean energy is growing, the majority of the world's energy still comes from fossil fuels (coal, oil, and natural gas), used

for heating, electricity production, and transportation. In the U.S., **natural gas production has been the largest driver of global CO2 emissions since 2012.**



Oil drilling (fossil fuel extraction) in North Dakota.

Photo by Tim Evanson on Flickr **(CC BY-SA 2.0)**

There are many reasons why fossil fuels are still the most produced energy sources, even though they are non-renewable and not clean. Addressing those reasons and finding ways to **decarbonize our energy systems** will be key to ensuring sustainability of the planet and meeting the international climate goals outlined in the Paris Agreement. However, just like

unsustainable energy sources, green energy sources are not always available in every region. What must happen so we can produce sustainable, clean energy at scale?



# Production/Distribution of Consumer Goods

Consumer goods are the products that people can buy from the store shelves or online. They can be common items, like toothbrushes, or luxurious items, like jewelry. In our globalized world, making these products often involves many interconnected activities, which often happen in stages in different parts of the world. This is called the **global value chain** (GVC). The COVID-19 pandemic **disrupted global value chains** and hit manufacturing industries hard, as economies slowed. With less demand for certain consumer goods, many factories closed and laid off workers. In Bangladesh, where many big-name fashion brands have factories, **millions of garment workers lost their jobs or were furloughed.**

**Surging demand for other items** also impacted global value chains, making it harder for people to obtain essential goods, from food to disinfectant wipes. In many countries, food distribution during the pandemic remains a dire problem, **especially in poorer communities, conflict zones, or refugee camps.** Even before the pandemic, there were many challenges to ensuring the **sustainable production and distribution** of goods. Reducing food loss (which is different from food waste) is an important goal, since **the world loses one third of the food it produces.** Food loss happens before the food even gets to the market. This could be because of improper storage, poor transportation or the way the food is processed.



Bread in a market in Riga, Latvia.

Photo by Jacques Bopp on Unsplash

Reducing carbon footprints during the production and transport of goods is also crucial. This includes everything from the energy it takes to make product packaging, to the ships, trucks, and planes that distribute goods locally and internationally.

# Occupational Health and Safety



Farmworkers in California. Extreme heat and pesticides can harm farmworkers. Photo by Linnaea Mallette on Flickr (CCO Public Domain)

Occupational health and safety is all about promoting safe and decent working conditions, and preventing workplace hazards and injuries.

**During the COVID-19 pandemic,** essential workers, from EMTs to grocery store clerks, have been a major focus of this topic, along with staff at schools, nursing homes, and hospitals. However, even before the pandemic, workplace health and safety was not equitable.

In the U.S., **agriculture** is one of the most dangerous occupations. Along with toxic pesticide exposure, which can lead to serious health conditions,<sup>1</sup> **exposure to extreme heat fueled by climate change threatens many farmworkers,** who plant, pick, and package the country's food. Yet many migrant **farmworkers in the U.S. lack protections and benefits.** As climate change causes more intense and frequent wildfires,<sup>2</sup> firefighters face **exposure to dangerous toxins from burning homes,** as seen in California. One of the UN's **"Global Goals"** is to "promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment." Solving these issues will require bold work from many stakeholders to change systems and mindsets and ensure everyone has safe and decent working conditions.

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1 Union of Concerned Scientists. (Updated 2020, March 11). The connection between climate change and wildfires.

2 Damalas, C. & Koutroubas, S. (2016). Farmers' exposure to pesticides: Toxicity types and ways of prevention. Toxicity,4(1),1.