CIRCUIT CITY

From Wasteland to iLand

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Circuit City: From Wasteland to iLand
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TABLE OF CONTENTS

CONTENTION

"..many have become enamored with the same idea: What if the people who build circuits and social networks could build cities, too? Wholly new places, designed from scratch and freed from broken policies."

-*Emily Badger,* Tech Envisions the Ultimate Start-Up: An Entire City

The advent of hyper consumerist culture has led to the proliferation of electronic waste, or e-waste- our constant cycle of demand, production, and disposal has created detrimental local impacts on developing countries. Every year, consumers generate tens of millions of tons of this e-waste. Simulated by the rise of big tech, our digital age has conditioned us to be indifferent towards a lack of transparency in our digital lives. The value of the array of devices and products at our disposal has preceded the conditions of those dealing with the aftermath. These big tech corporations have now become fixtures of underdeveloped cities and towns worldwide, funneling out resources for their own gain with nothing in return. This unforgiving process has created the physical embodiment of environmental misconduct and a new type of landscape - an electronic dumping ground now known as "the e-wasteland." This e-waste is typically "recycled" though informal, unregulated, and dangerous conditions that threaten the health and safety of not only people but the environment. Efforts to properly recycle this e-wasteland as of late have mostly been experimental, uncharted, and contentious. As the main perpetrators of this problem, large corporations have attempted to address these concerns through meticulously constructed media productions and exposés, but have not treated the root of the problem itself- their endless cycle of products. By exposing the absurdity of net-zero pledges from big tech companies such as Apple, we can begin to construct a narrative of our futures, if they should remain unchecked. Through investigating the ways in which company towns have historically monopolized upon land, people and power to ensure productivity, a future in which contemporary corporations attempt to circumvent claims made against them through a proposed reclamation of the e-wasteland can be fabricated.

Fig. 1: Top view of an Apple Store

THE MACHINES OF THE CITY

DEMAND OF THE CENTURY

Throughout millennia, humans have mined the earth's surface for metals and minerals to fulfill production demands. The foraging of bronze allowed humans to weaponize; the use of gold facilitated trade on local, then global, levels. Now, a variety of these metals and minerals are utilized in a variety of everyday products to satiate humanity's demand for electronic devices. E-waste is now the fastest-growing waste stream in the world, with it estimated to surpass 56 millions tons in 2021. From our miniature smart devices to our washing machines, the rapid innovation and lowering costs of electric and electronic products (EEE) has dramatically increased access to these products as well as digital technology. This has led to an increase in the usage of electronics and consequently an increase in E-waste. Globally, only 20% of e-waste is appropriately dealt with, the rest ending up in landfills or disposed of by informal workers in poor and toxic conditions. There are many concerns about the availability and supply of new materials for electronics and electrical devices in the future. The improper handling of such e-waste results in the significant loss of valuable raw materials, such as neodymium (vital for magnets in motors), indium (used in flat panel TVs), and cobalt (in batteries). Almost none of these rare earth minerals get extracted from informal recycling, and pollute the environment it's dumped in. The creation and release of hazardous byproducts in the processes undertaken in these e-waste-yards, often using rudimentary industrial processes without proper protection. Unprotected exposure to such e-waste is not advisable for any , let alone children, who make up some percentage of workers working in e-wasteyards.

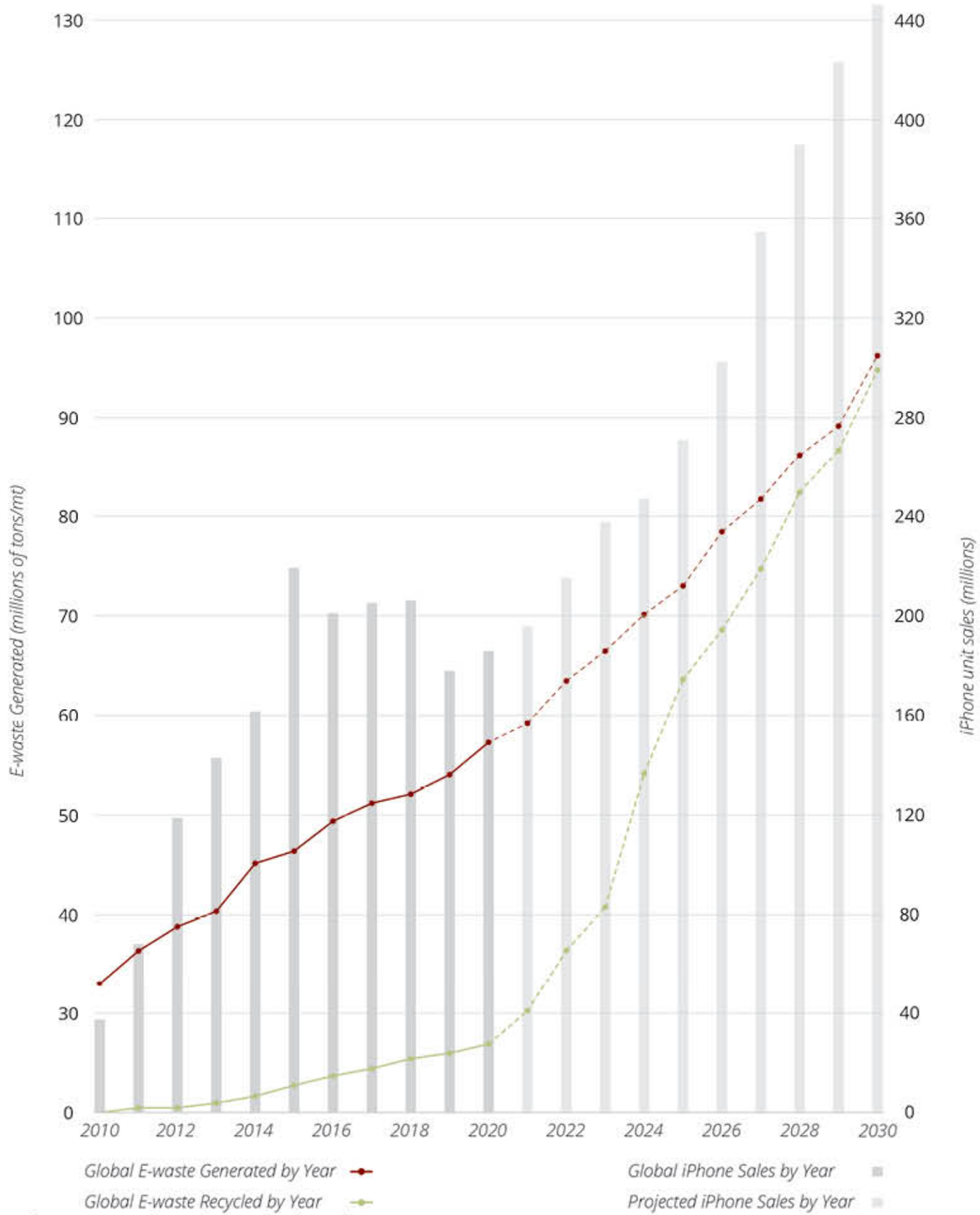


Fig. 1.1: E-waste in correlation with demand

ANATOMY OF E-WASTE

E-waste is a blanket term used to describe any household or business item containing circuitry or electrical components. They essentially are used electronics that have neared the end of their useful life and are discarded, donated, or given to a recycler. They are categorized into six waste categories: temperature exchange equipment (ex. refrigerators, air conditioners, heat pumps), screens and monitors (ex. televisions, monitors, laptops, tablets), lamps (ex. fluorescent lamps, high intensity discharge lamps, and LED lamps), large equipment (ex. washing machines, electric stoves, large printing machines, photo-voltaic panels), small equipment (ex. vacuum cleaners, video cameras, electrical and electronic toys, small medical devices), and small IT and telecommunication equipment (ex. mobile phones, global positioning systems (GPS), personal computers, routers). These categories were determined by the weight, size, material composition, and life-span of the aforementioned items. E-waste itself is the subset of used electronics that has ended up in landfills or has been improperly disposed of in dump sites in the United States or abroad. It has grown to 57 million metric tons annually, but only 20% of it is documented to be properly collected and recycled. The fate of the remaining 80% is unknown, but 4% of that is thrown into household trash while the remaining 76% is most likely dumped, traded and/or recycled under inferior conditions. Large volumes end up in places where proper recycling are yet to be established, and rudimentary methods are used to recover valuable components. Hazardous components are disposed of in uncontrolled landfills. Because of this, there are major concerns about resource efficiency as well as human health and environmental effects.

Fig. 1.2: Burning e-waste

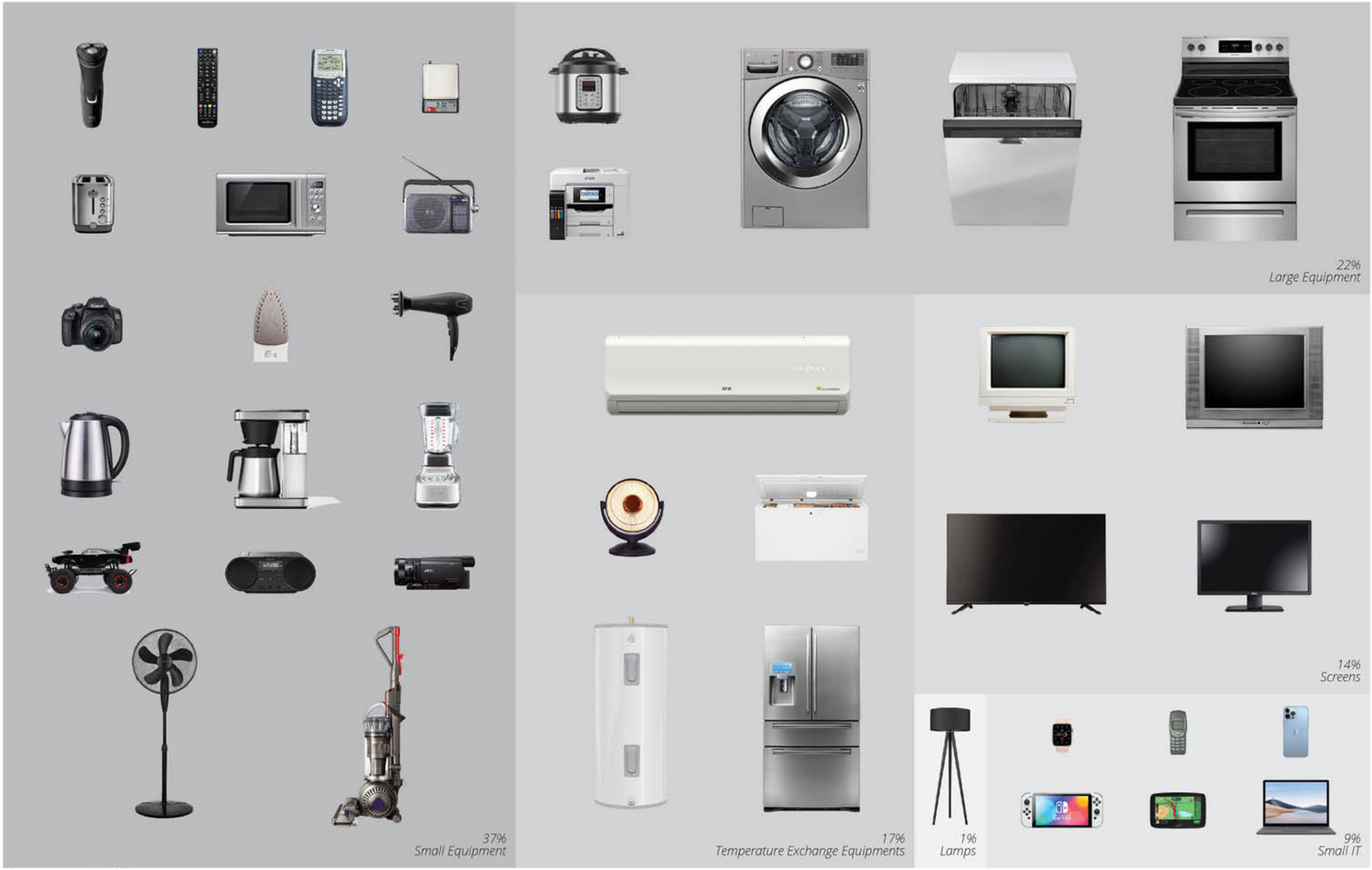


Fig. 1.2.1: Examples of e-waste

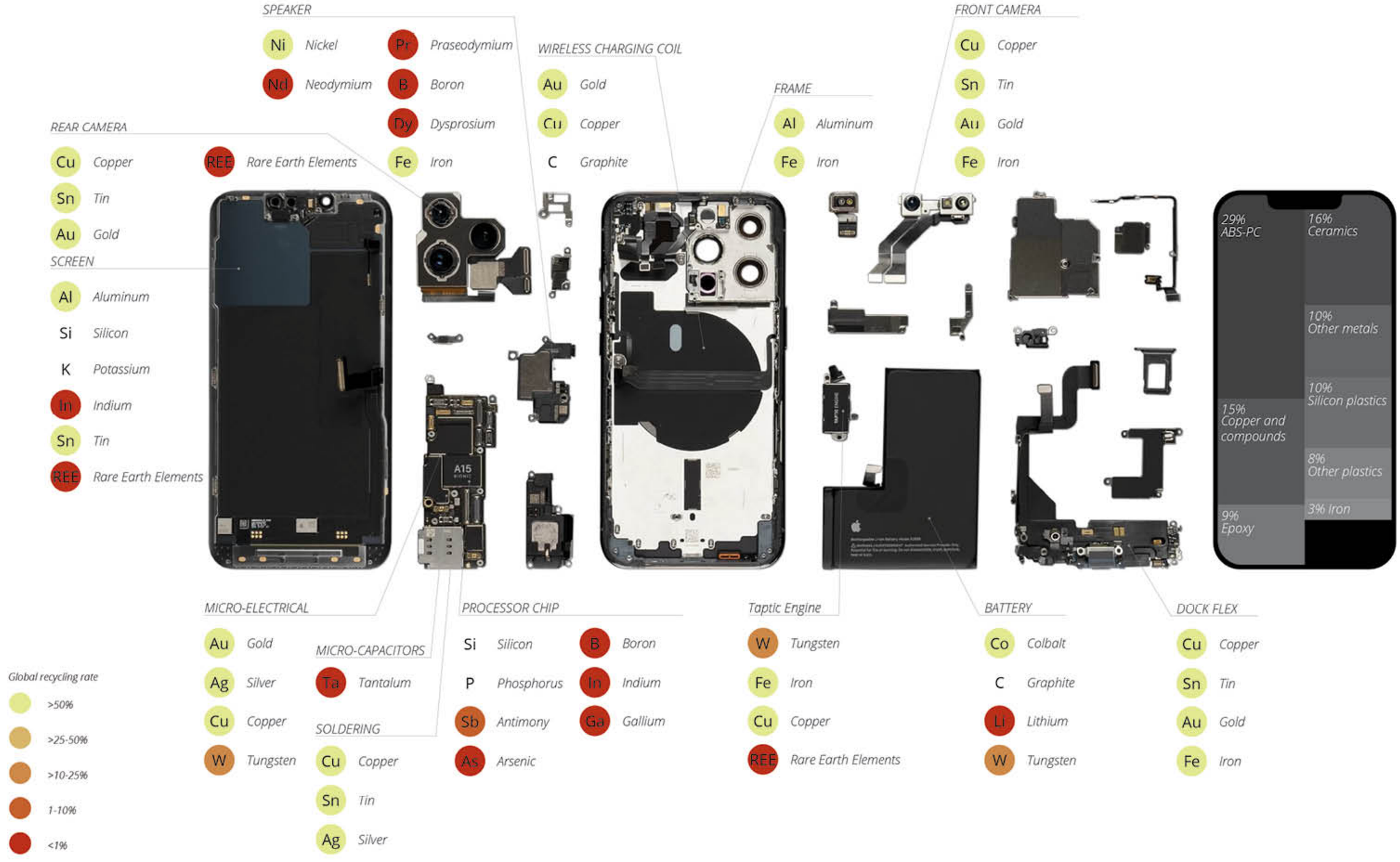


Fig. 1.2.2: iPhone tear-down

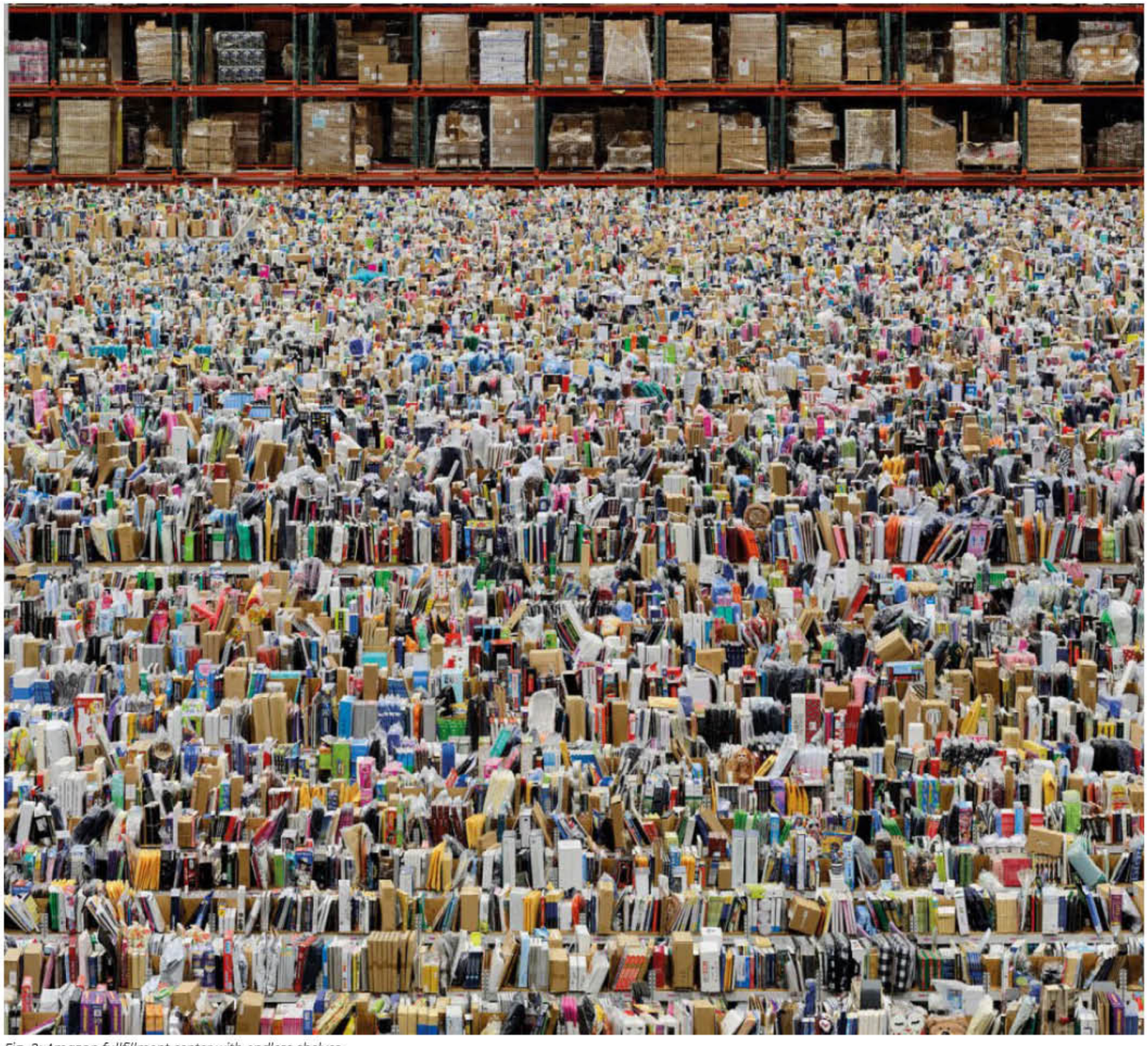


Fig. 2: Amazon fullfillment center with endless shelves

THE GLOBALIZED CITIES

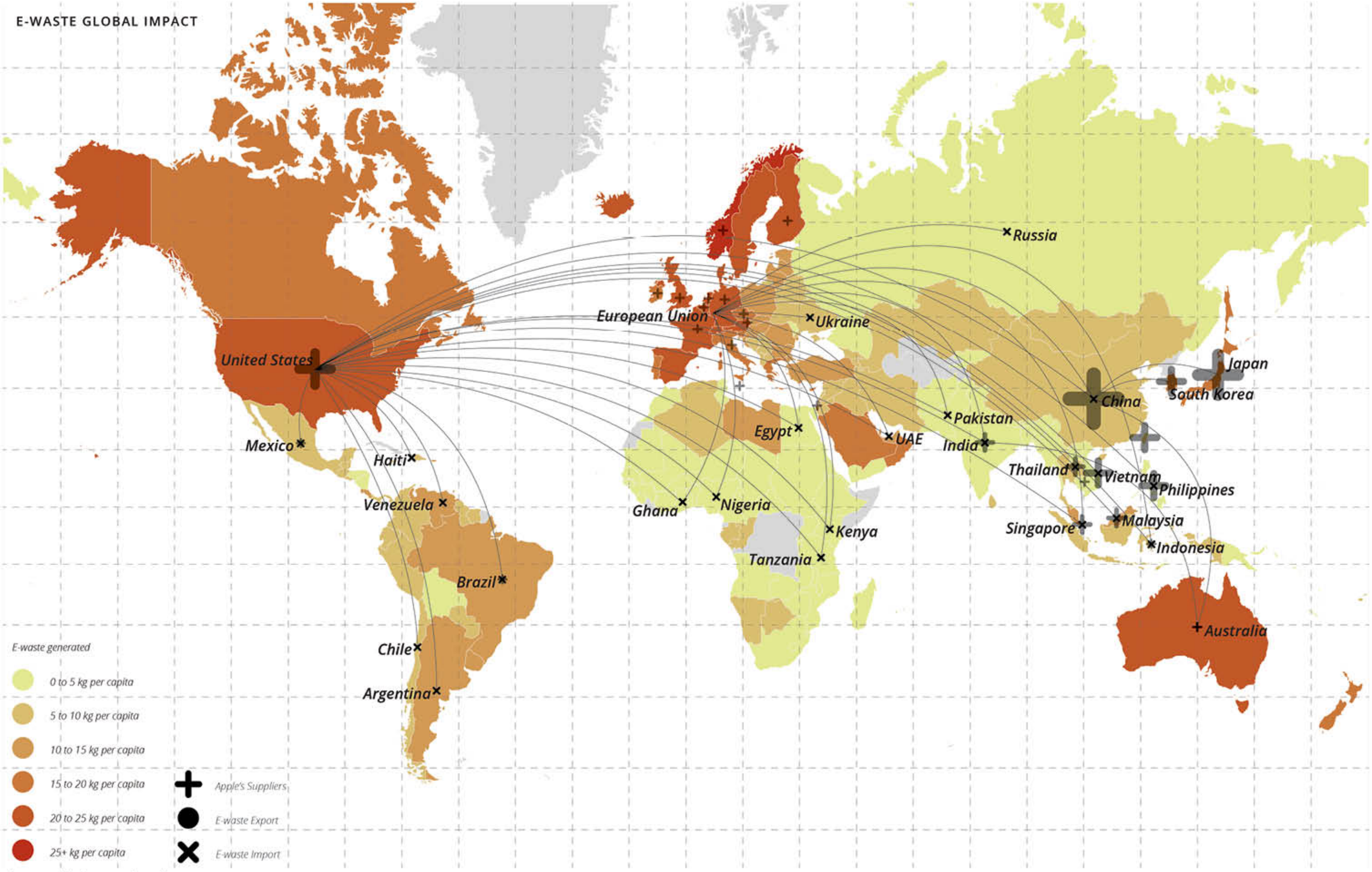


Fig. 2.1: Global e-waste flow diagram

CITY OF PRODUCTION

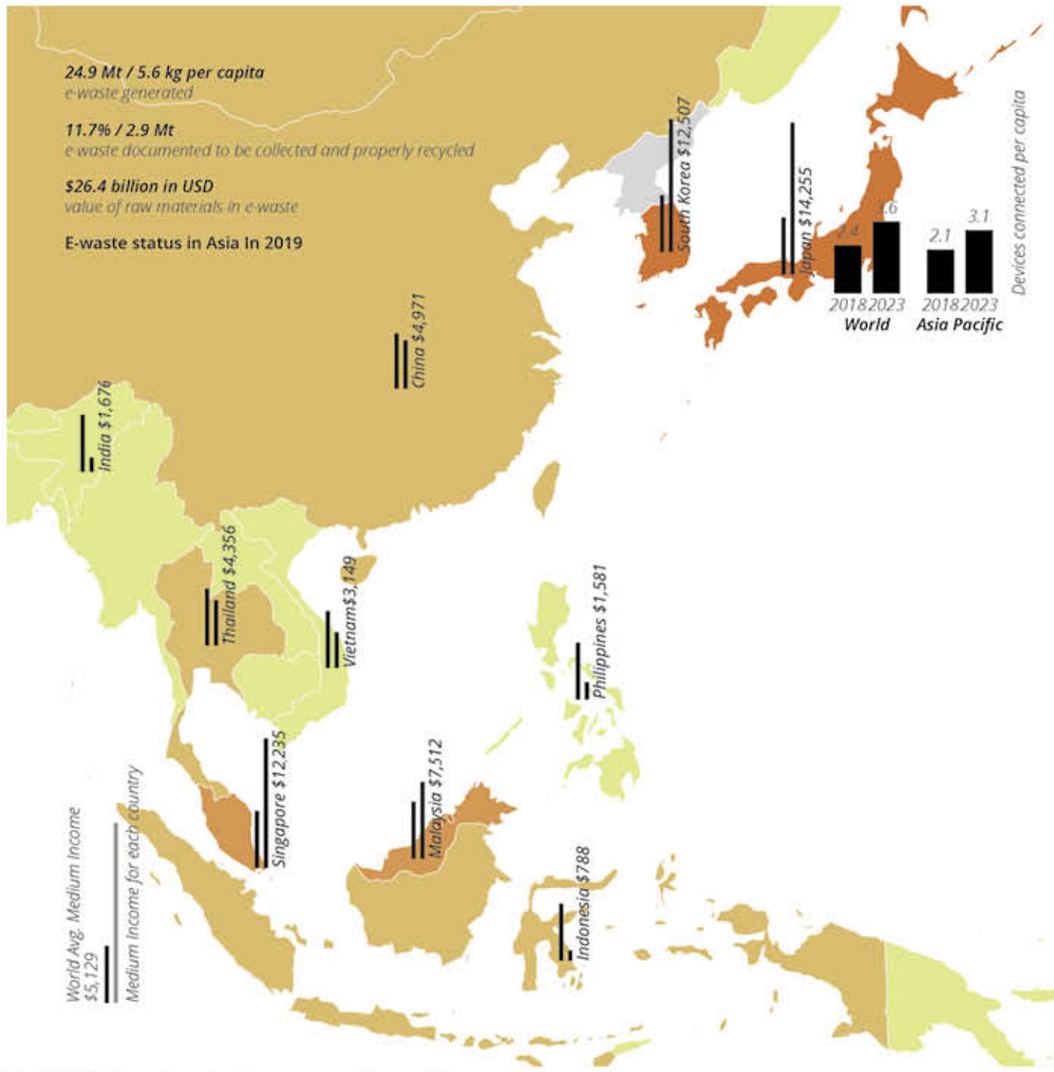


Fig. 2.2: Region of production compared to world average

Out of the 118 elements on the periodic table, the iPhone contains about 75 of them. From familiar elements like aluminum to seemingly foreign ones like gallium, the iPhone we know wouldn't exist without them. But the existence of devices like the iPhone and other EEE comes at a price- the metals are often derived from rocks excavated from below the surface of the earth using environmentally-destructive and ethically-questionable mining methods. These methods usually include manual labor (sometimes child labor), heavy machinery, and explosives. Tungsten and Cobalt are commonly mined in the Democratic Republic of the Congo (DRC). In 2016, the Washington Post found that laborers were working around the clock in the DRC's unregulated cobalt mines with hand-tools and lacking protective gear. Tantalum also used to largely sourced from DRC's mines, where children and slaves were forced to work. Rare earth metals, many of which exist in the iPhone, are primarily sourced from a single area: inner Mongolia, a semi-autonomous zone in northern China. In 2009, China produced 95% of the world's supply of these elements, and it's been estimated that the Bayan Obo mines, just north of Baotou (the largest industrial city in inner Mongolia), contain 70% of the world's reserve. Rare earth minerals have played a key role in the transformation and growth of China's economy over the last few decades, but not without severe environmental impacts. It's abundantly clear in the industrial landscape that is present Baotou, where sulfur fills the air and sludge fills the horizon. There is much to say about China's willingness to take the environmental impacts that rare-earth mining has that other nations won't- but China's dominance and control over the market, as well their economic success is the answer.

While Apple's robots are reliable at taking apart the Apple products precisely, the actual recovery rate stays unknown for the public. With the changing design and demand for sustainable materials, certain amount of materials from older devices become outdated and lost in the recycling process.

In Apple's material recovery labs, old devices collected through the Apple trade-in program are being precisely disassembled by Liam, Daisy or Dave, Apple's recycling robots.

Finished iPhones are shipped to the US by wide-body Boeing 747, which can each carry 150,000 iPhones.

A trailer truck that transports iPhones in China can carry up to 36,000 each, and takes almost as long to arrive Shanghai as it does to San Francisco.

Lost Material ← Material Recovery Lab ←

Raw Material Excavation → Parts Production → Assembly → Packaging → Customs → Shipping

The 2021 rare earth mine output quota by China has once again reached a historical high of 168,000 T, which is 20% up from the year before.

While the rising demand for renewable energies on top of preexisting tech productions are expected to increase rare earth demand at least twelve times by 2050.

Over 200 suppliers around the world provide components for small personal devices like iPhone.

The global production means the need for transportation at longer distances, invokes large carbon footprints and produces toxic waste.

About 350 iPhones can be assembled per minute in the Foxconn Zhengzhou factory, which can employ over 350,000 workers.

Excessive packaging has become a trend for personal devices for the "unboxing experience."

Packages made of multi-materials create durability but makes it harder to sort.

The Zhengzhou iPhone factory is located inside a bonded zone, few hundred yards away from the customs facility. Selling there are done electronically between affiliates around the world to support Apple's global tax strategy.

Fig. 2.2.1: Production flow chart

CITY OF CONSUMPTION

Rapid innovation and the lowering of costs have dramatically increased access to electronic products and digital technology. But, with the rise in use of electronic products have come with an unintended consequence-e-waste. The rise of hyper-consumerism, planned obsolescence, and few repair options for our personal devices and products have only further exacerbated this issue- the more we are encouraged to replace our products, the more we contribute to the e-waste dilemma. Our throwaway culture that has emerged with the rise of consumerism only adds on to this phenomenon. Consumer demand and the frequent releases of "upgraded" products" has lead to the constant and unnecessary purchases of EEE. Short innovation cycles coupled with the low recycling rates of old products have only continued to escalate this issue. The average life of a computer, for example has dropped from 4 years to 2 years in recent years. The symbol of status that comes with owning the newest product has also contributed to programs such as the iPhone upgrade program, in which users can pay a subscription and be able to upgrade every year. Being a consumer is a social identity and a new fundamental way of life, where permanent dissatisfaction correlates to the mass expenditure in goods to fill the void. But when items are only meant to be used once and displayed in disposable packaging, they have to be discarded somewhere. Waste is typically shipped at a low cost from richer nations to poorer nations, producing environmental, health and social problems for these developing countries. There's been a devastating toll on Earth's water supplies, natural resources, and ecosystems that has been encouraged by the advent of consumerism- all for cheaply-made products with a short life-span.

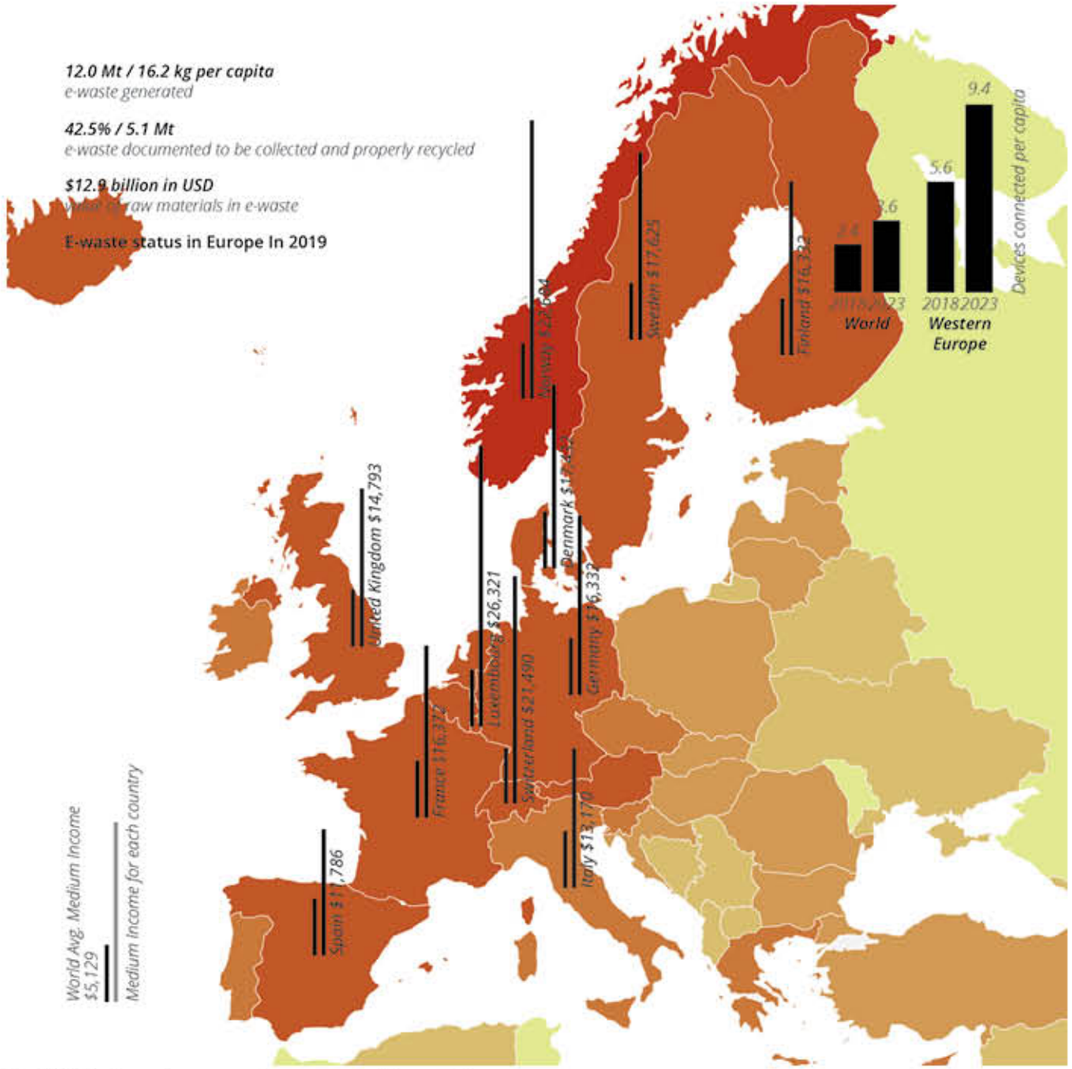


Fig. 2.3: Region of consumption compared to world average

There are very little repairing options when it comes to Apple products. Without the AppleCare service, any internal damages to the iPhone can cost up to $600, almost as much as the cost of an entry-level iPhone.

Out of 57.4 million tones of electronic waste that were produced in 2019, only 20% of them were properly documented, collected and recycled through a waste management system.

About 4% of the undocumented e-waste are thrown into home waste.

While the rest 76% are either dumped, traded or recycled under inferior conditions.

Formal Recycling

Trash Bins

Repair

Retail → Consumer → Usage → End of Life → Improper Treatments

Designed to resemble town squares in concept, there are now over 516 Apple Stores worldwide.

IPhone sales, as one of the biggest revenue producers for Apple, has been increasing steadily - reaching almost 200 million in 2020. The total active iPhone user has also gone up 10%, from the year before, to 1042 million in 2020.

An average American adult spends around 11 hours a day on digital devices, and smartphone usage takes up 20% of that time.

Planned obsolescence has been baked into the DNA of electronic devices. On top of releasing each a new model of their products, Apple has been found actively throttling older devices which cause them to slow down drastically.

80% of the EEE waste produced each year has been treated improperly. The total e-waste composite as followed:

38%	*Small Equipment*
20%	*Large Equipment*
17%	*Temperature Exchange Equipment*
15%	*Screens*
9%	*Small IT*
1%	*Lamps*

Fig. 2.3.1: Consumption flow chart

CITY OF DISPOSAL

In general, the role a region plays is greatly reflected through the social status of its residents - the city of production and the city of disposal are in-line with developing countries, whereas developed countries mainly fulfilled the role of consumption. Of the 20 million to 50 million tons of e-waste generated yearly, it is estimated that 75%-80% is shipping to countries in Asia and Africa for "recycling" and disposal. The amount of e-waste being generated is still increasing rapidly, and is escalated by the illegal exportation and inappropriate donation of EEE from developed to developing countries. Loopholes in current e-waste regulations allow for the export of e-waste from nation to nation, where as little as 25% of e-waste is formally recycled in recycling centers with adequate worker protection. There are many concerns about the availability and supply of new materials for electronics and electrical devices in the future. The improper handling of such e-waste results in the significant loss of valuable raw materials, such as neodymium (vital for magnets in motors), indium (used in flat panel TVs), and cobalt (in batteries). Almost none of these rare earth minerals get extracted from informal recycling, and pollute the environment it's dumped in. This can lead to indirect exposure of hazardous substances through the soil, air, and water surrounding e-waste recycling sites. Water contamination, for example, has been documented in areas surrounding such sites in China, with metal-contaminated sediments and elevated levels of dissolved metals being reported in rivers around Guiyu. The continuous release of hazardous chemicals into the environment can lead to bio-accumulation, food contamination, and widespread ecological exposure. For vulnerable populations, this condition is less than ideal for working, let alone living.

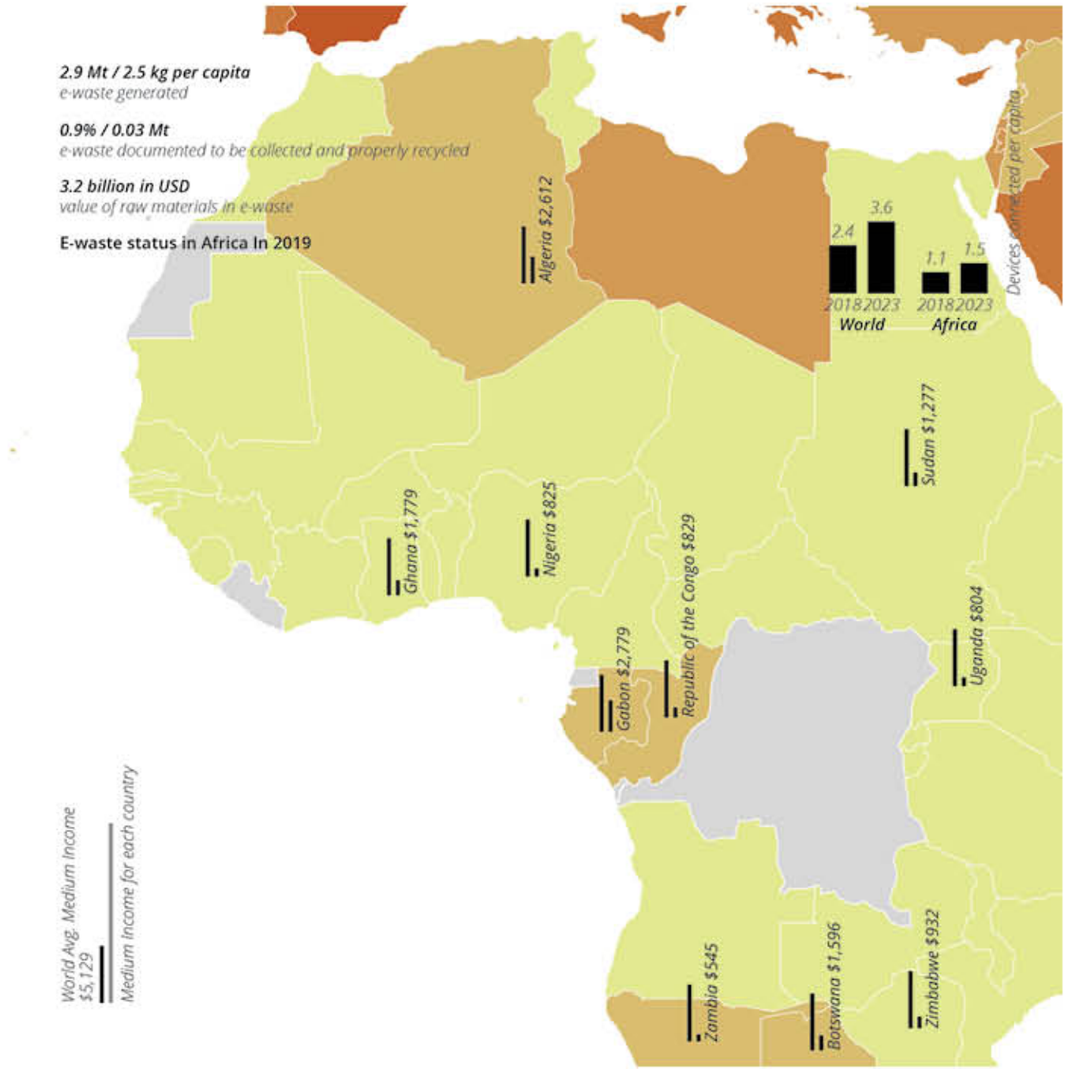
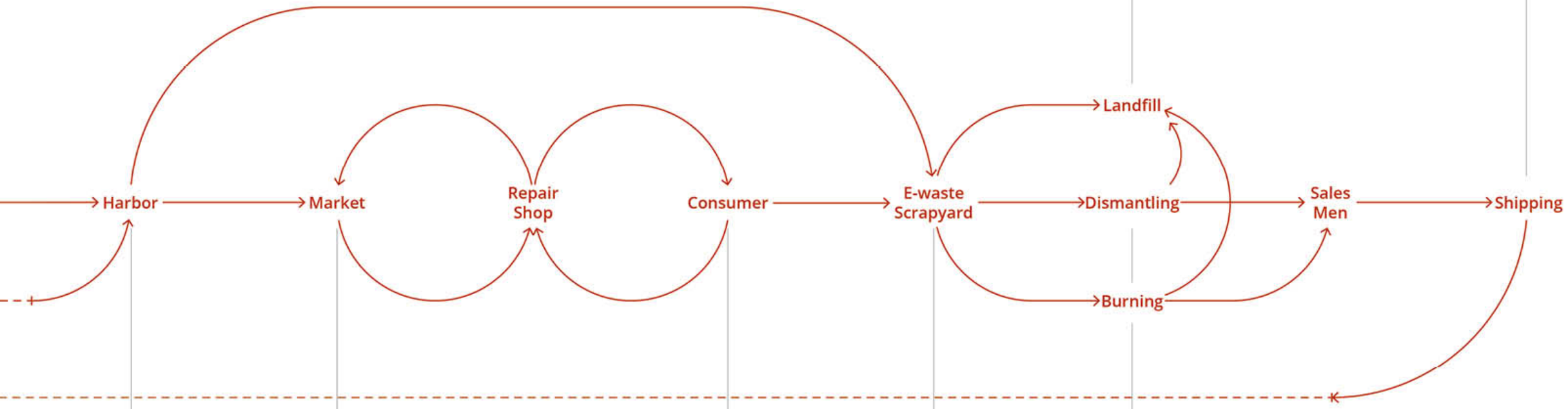


Fig. 2.4: Region of consumption compared to world average

Scraps like plastics and materials with little recovery profit stays at the dumpsite or flows through the river into the sea.

Materials and parts that are recovered from the e-waste dump are gathered and shipped to factories in production countries.



New and used electronics devices collected around the world arrives the harbors of developing countries thorough cargo ships. Every year, Ghana imports 40,000 tonnes of electronic waste and operates the largest recycle industry on the African Continent.

Second hand computers, TVs, phones and electric appliances are distributed to various markets and shops.

Second hand electronic devices are sold to families, schools and companies. The local repair shops then try to fix anything that breaks down until it's no longer repairable.

Agbogbloshie has one of the largest e-waste scrapyard in the world, collecting, sorting and trading externally generated automobile and electronic scraps from all over the world.

Young kids are sent to Agbogbloshie to extract valuable metals like copper by burning scrap cables, which causes a huge amount of toxic fumes that are both hazardous for the worker and toxic for the air and soil.

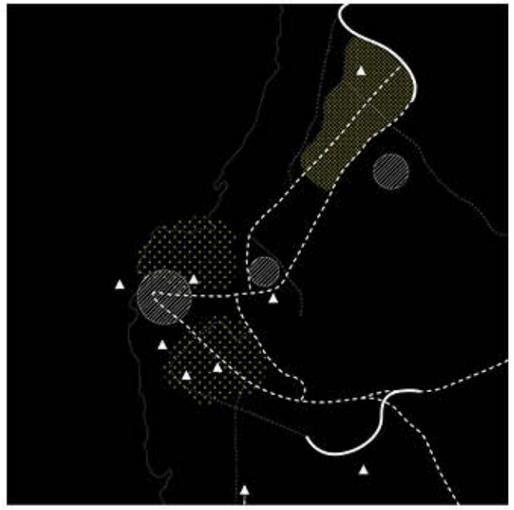
Fig. 2.4.1: Disposal flow chart

Fig. 3: Scene from movie, Playtime (Jacques Tati, 1967)

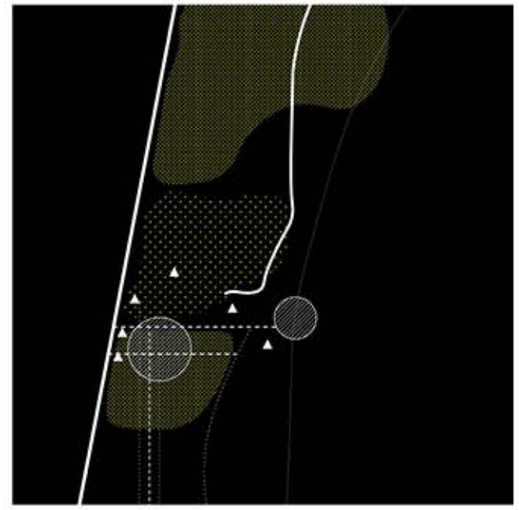
THE CITY AS A MACHINE

COMPANY TOWN IDEALISM

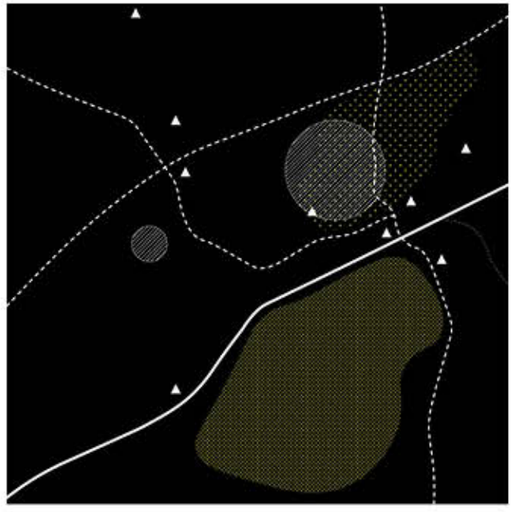
The company town was long thought to be an industrialist fragment of the past - traditionally, they have been set in resource-rich towns doomed to become cannibalized landscapes, exploited by monopoly franchises and enterprises. They were based in expediency and laid out pragmatically, as fictional environments of total efficiency. Paternalism and welfare capitalism were the main tactics employed by companies to control the workers living in the towns they built, and was developed as a response to growing tensions between management and workers in railroad, coal, and steel industries. A societal class conflict had been building up due to over-exploited laborers and uncaring employers, up until American welfare capitalism was introduced. These socially-engineered cities were owned and managed by the companies themselves, and the working class were offered basic standardized housing, healthcare, education, and other amenities far from the industrial disaster of metropolitan cities. Although these amenities are now standard in most parts of the world, they were considered a luxury for the working class in the 19th and early 20th centuries. These company towns were often associated with utopian idealism, and big industrialists of these towns as ways to reduce the negative consequences of industrialization and ensure uninterrupted production in their factories. The notion of communities run by and for companies has been a fixture in the United States almost from the beginning, but these places were often exercises in plunder. They eventually met their demise with state intervention, with the government establishing housing, health, and education programs that eliminated the need for the company to provide the same things.



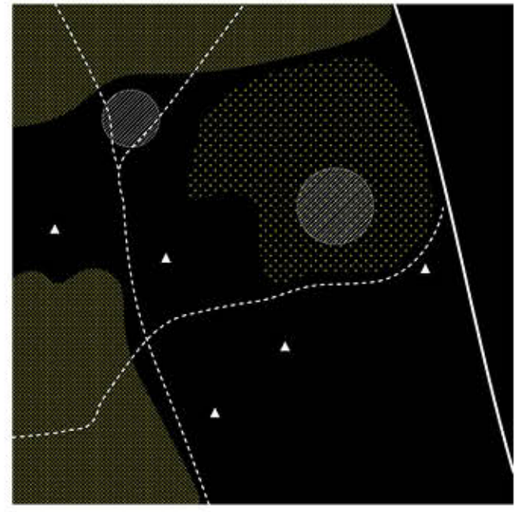
Fordlândia, Brazil



Pullman, USA



Hershey, USA



Bournville, United Kingdom

Fig. 3.1

IMAGE OF THE CITY

KEVIN LYNCH

The Image of the City is a 1960 book by American urban theorist Kevin Lynch. It considers the visual quality of the city by studying the mental image of its citizens. By examining three American cities: Boston, Jersey City, and Los Angeles, he concluded that people formed mental maps of their surroundings based on five elements, namely: the landmark, the path, the node, the edge, and the district. The landmark is a point of reference- it is unique or memorable in their surrounding context. These typically include buildings, signs, markets, and natural phenomenon. The path is a common route that are taken by people, be it either by foot, bike, car, bus, or train. They create movement between spaces. The node is the foci of the city- they are large, public areas that are usually at intersections of distinct, busy paths. The edge is a boundary, whether real or perceived. They help to distinguish between different conditions of they city. Lastly, the district defines a common area within the city with common characteristics. They are usually larger in scale than nodes. We use this book and its conclusions as a lenses of analysis into these company towns as an attempt to identify commonalities in the urban fabric. The company town phenomenon emerged as a way to pair production space with residences to ensure that they are always ready and accounted for. It has been studied mostly though social and economic means, but not much through physical. We intend to look at the way physical boundaries help to contain the workers in a closed, consistent routine. By creating a more "pragmatic" city that operates much like an assembly line, production can be optimized.

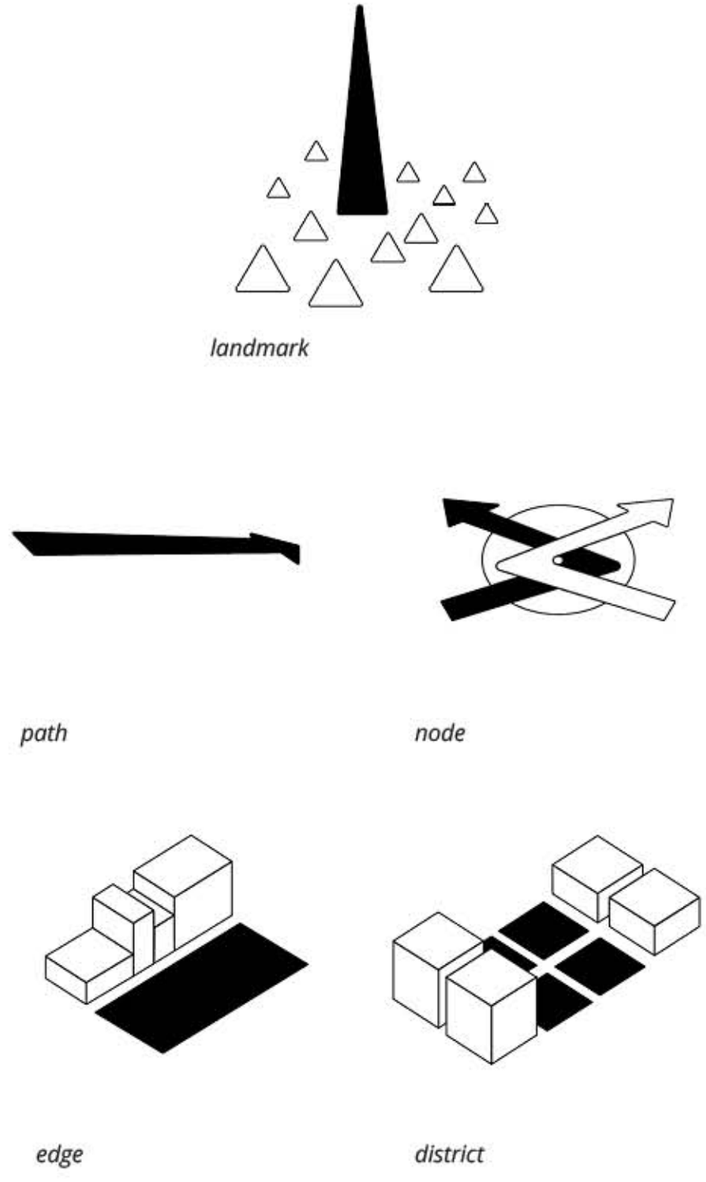


Fig. 3.2: Symbols from Image of the City

FORDLÂNDIA

AVEIRO, PARÁ, BRAZIL
FORD MOTOR COMPANY

Fig. 3.3.1: Timeline

The legacy of Henry Ford's failed attempt to create his own extravagant utopian fantasy in the jungles of Brazil has been long-lasting. In the 1920s the US industrialist, who was most well known for popularizing the assembly line, wanted to found a city based on the values that made his company a success – while, of course, producing cheap rubber. The vastness of South America has always been a focus for romanticization, discovery, and potential profit by European and North American explorers and industrialists. He acquired the land in northern Brazil in 1927, envisioning a booming rubber plantation and town. But with this myth of boundless opportunities came another unfortunate one - the jungle as impenetrable nature, immune to modernity. Fordlândia was meant to be a commercial enterprise but was framed as a mission to "civilize" and attempt to create an ideal American society. He envisioned a replica Midwestern town amidst the jungles of the Amazon, with modern plumbing, hospitals, schools, tennis courts and even a golf course. He viewed these amenities as the cornerstones of productive and morally righteous society. He offered Brazilian workers 35 cents a day in addition to food, lodging and healthcare, which were living standards well above the standard of the day. But this town also had a strict set of rules to enforce a more idealized American lifestyle- alcohol, women, tobacco, and football were forbidden and workers were forced to live in American-style housing, adhere to an American-style 8-hour workday and eat unfamiliar American food. This led to revolts, with the indigenous workers rioting against the alien conditions. As one Ford official complained, "it was difficult to make 365-day machines out of these people." But as Ford tried to continue to impose his mass industrial production ideals onto the diversity of the jungle, it became apparent that his project was neither successful or profitable by any means.

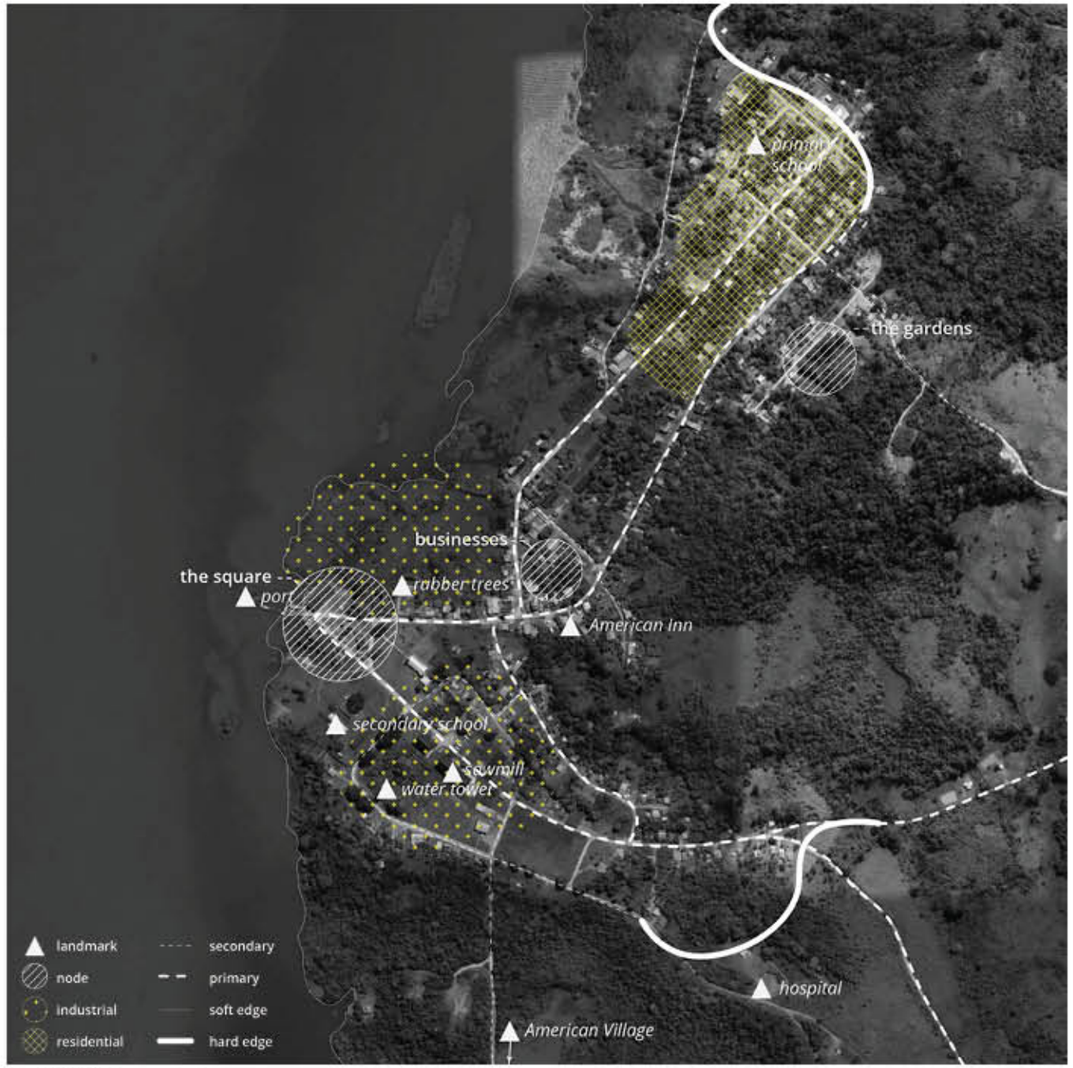


Fig. 3.3.2: Site analysis

Fig. 3.3.3: Traffic in Fordlandia

Fig. 3.3.4: Brazilian workers

PULLMAN

CHICAGO, ILLINOIS, U.S.
PULLMAN CAR COMPANY

Fig. 3.4.1: Timeline

The model factory town of Pullman in Chicago's far south side was created from scratch in the 1880s, featuring Pullman-owned factories, Pullman-owned shops, and Pullman-owned housing for workers and their families. George Pullman, an engineer and famous industrialist, believed that a reliable workforce needed to be positively incentivized by good housing, parks, and amenities. He was an early advocate for employee welfare, and when he was presented with an opportunity to integrate his ideals with manufacturing efficiency, he immediately bought 4,000 acres of land between the Illinois Central Railroad line and Lake Calumet. He hired Solon Spencer Beman and Nathan Barret to design the factories, homes, and layout for Pullman. The workers' accommodations were separated from the industrial areas, and were relatively spacious with indoor plumbing, making it well above the standards of the time. This community was a success within the first 15 years of its existence- it was known as a perfect utopia and attracted many young skilled laborers. Brick row-houses, schools, parks, and theaters were just some of the amenities available for those living in Pullman's company town. But these were not free for workers- Pullman charged rent to ensure a six percent return on the company's investment in the town, and the workers were only allowed to rent his properties. When an economic downturn reduced revenue, Pullman reduced wages but not rent, igniting the Pullman Strike of 1894. Pullman factory workers walked off the job and Pullman cars nationwide were disrupted, affecting rail traffic. Workers had grown sick of their lack of personal freedom and of the restrictions put in place by the company. Most of Pullman's working class were immigrants from Europe and were unable to replicate the traditions of their respective homes. Despite negative public sentiment, Pullman continued his company town experiment until his death in 1897, and all non-industrial land-holdings were sold a year later by order of the Illinois Supreme Court.

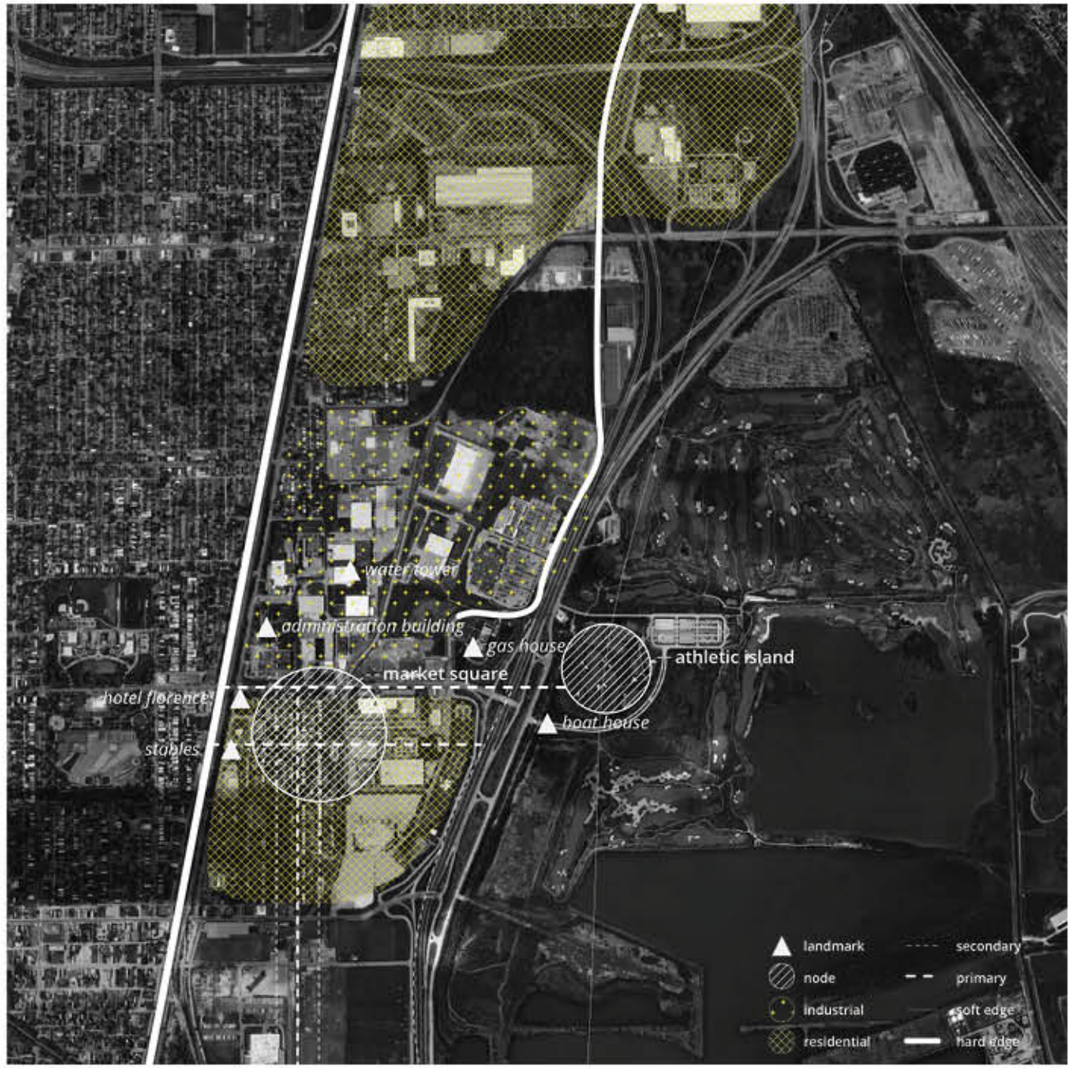


Fig. 3.4.2: Site analysis

Fig. 3.4.3: Workers at the main gate of the Pullman company in 1893

Fig. 3.4.4: Workers going home across the grade level tracks

HERSHEY

DERRY, PENNSYLVANIA, U.S.
THE HERSHEY COMPANY

Fig. 3.5.1: Timeline

Touted as a more benign example of the company town, Hershey, Pennsylvania still exists today as a chocolate wonderland and tourist destination known as "the sweetest place on earth." Milton Hershey began building his chocolate factory in 1903 at his birthplace in rural Pennsylvania, surrounding it with an ideal community where there would be "no poverty, no nuisances, [and] no evil." Apart from his personal connection to the site, there were also dairy farms in the area that could supply fresh milk for his chocolate, as well as a steady labor force. He was especially interested in the welfare of his employees and the community, and like other industrialists of the time believed that happy employees were productive employees.. He built houses for them to buy or rent, recreational facilities, and a bank. For those who did not live in his imagined community, he built them a trolley line for an easier commute. Hershey park was built as recreation for his workers and town residents.

Although the town was originally established for community use, the park soon became a tourist attraction. The chocolate factory and the town itself also, by extension became part of the attraction. Workers living in the town of Hershey would be able to enjoy medical coverage, a free junior college, parks, and a zoo in exchange for surrendering certain rights- such as participating in local elections and their privacy. Hershey and his executives made extensive efforts to police the lives of workers even after they were off the clock, and company managers were accused of showing favoritism when it came to wages and hiring practices. In 1937, this unsettlement came to a tee and Hershey factory workers organized the company's first labor union and went on strike. Although it was short-lived, it negatively affected the company's utopian image. Despite this, Hershey's company town survived, unlike many others, and chocolate is still made there today.

Fig. 3.5.2: Site analysis

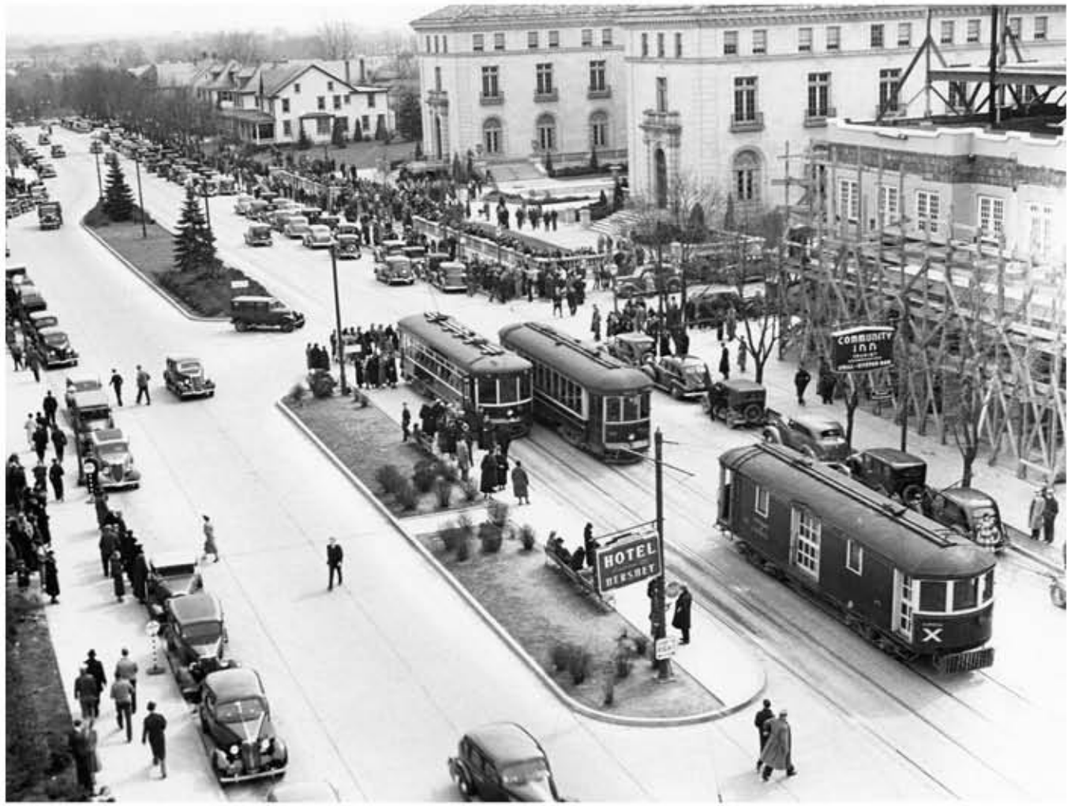


Fig. 3.5.3: Downtown Hershey

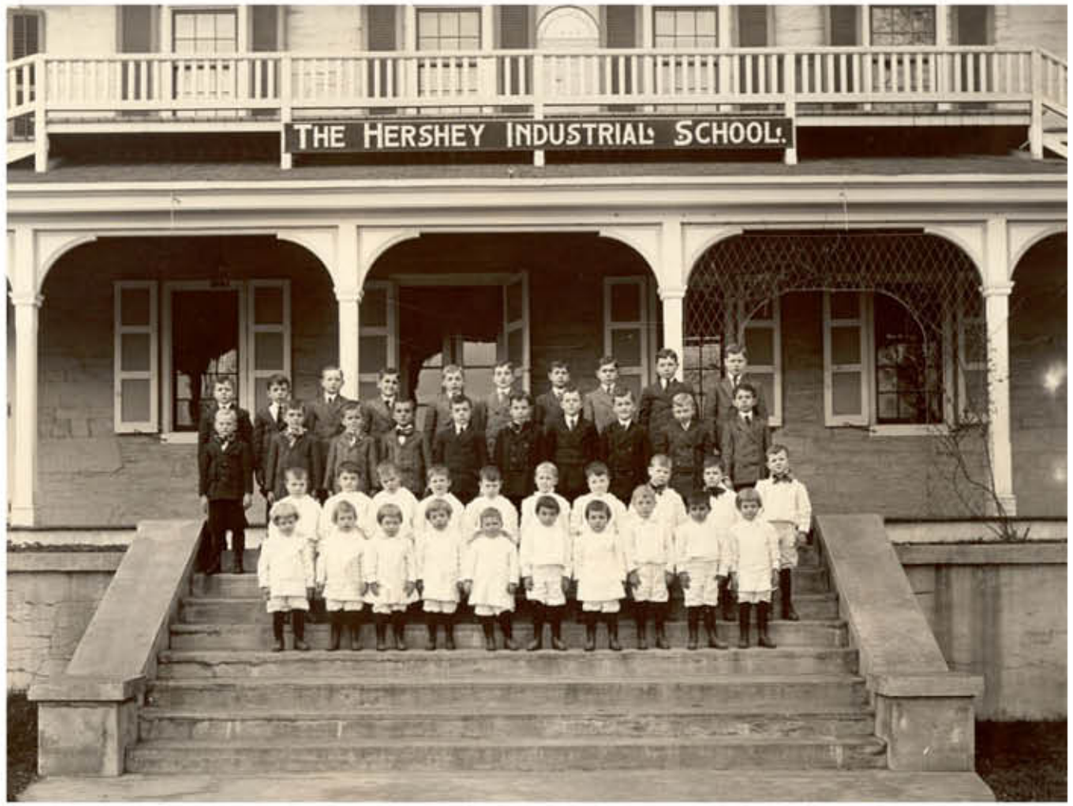


Fig. 3.5.4: Hershey Industrial School students

BOURNVILLE

WEST MIDLANDS, BIRMINGHAM, U.K.
CADBURY

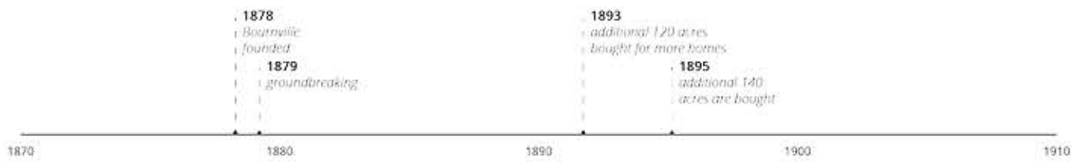


Fig. 3.6.1: Timeline

In 1879, George Cadbury, the chocolate-maker and philanthropist, developed and opened the first company town (known as model villages in the United Kingdom) in existence, at his own expense, to help "alleviate the evils of modern, more cramped living conditions." At first, there was only a factory and twenty-four cottages, expanding up to 313 cottages and houses by 1900. Now, in our present day, the model village is a large garden suburbs sporting 1,000 acres of land, with 7,800 homes and 120 acres of open space. He built this town on the principle that affordable housing for people with low-incomes would be beneficial for them. They rewarded their workers with relatively high wages and good working conditions, including pension schemes, joint works committees and a medical service. The Cadbury recreation ground and Swimming Baths were also built to help ensure the health and fitness of their workers. The company itself has long maintained an image as a healthy and socially conscious company, devoted to its workers and products. Some of their early advertisements promoted the purity of its chocolate and its health benefits to children. Their perfect garden-factory-village did have one caveat, however- as devout Quakers, the Cadburys imposed restrictions on the sale and use of alcohol. Nevertheless, the Cadburys were quite successful in using the village as an advertisement for their products, pushing the image of the "factory in a garden." The family itself also mostly used their wealth towards good causes, promoting their self-image. Bournville essentially laid the foundation for the ideal model village, and contributed to the development of the garden city and introducing the benefits of open spaces into modern town planning. Cadbury was sold to Kraft, the US foods conglomerate known for making processed cheeses, in 2010. Sir Adrian Cadbury, the last remaining practicing Quaker of the family, called the takeover "a tragedy."

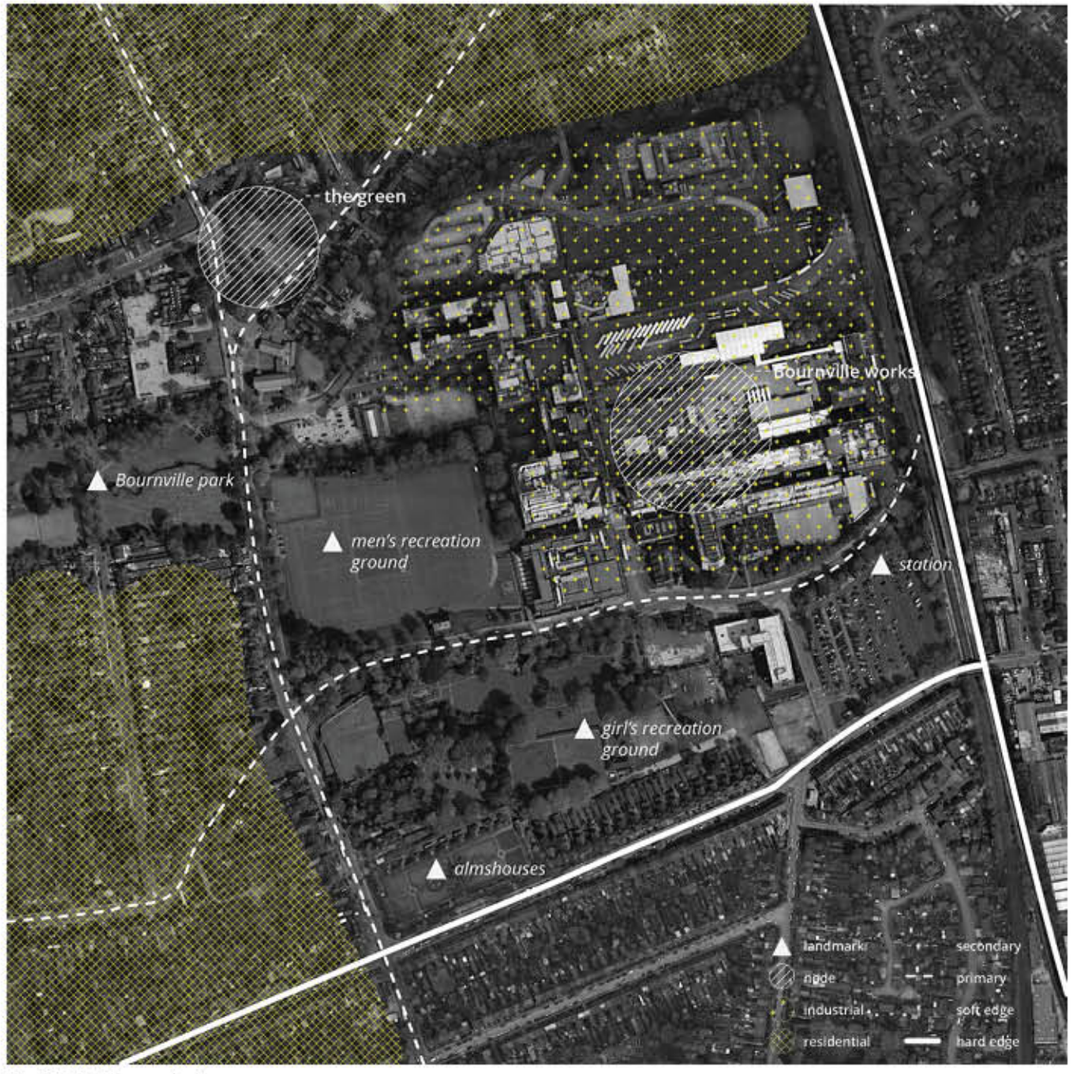


Fig. 3.6.2: Site analysis

Fig. 3.6.3: Workers cutting marzipan

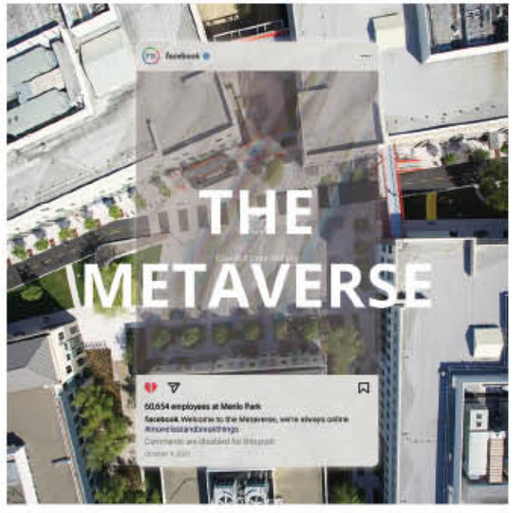
Fig. 3.6.4: Children in Bournville Infant School in 1955

COMPANY TOWN 2.0

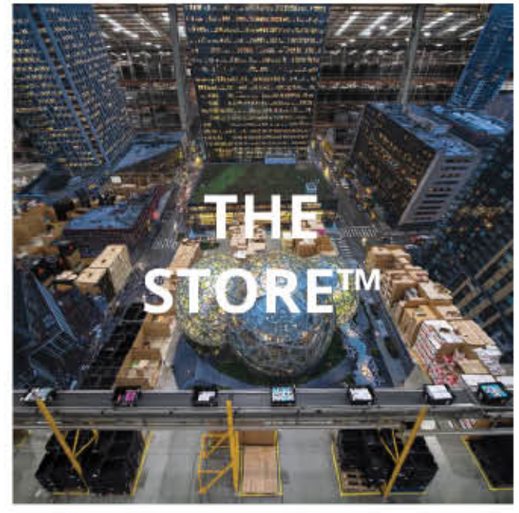
Now, with the advent of GAFA (Google, Apple, Facebook, and Amazon), elements of the company town have slowly become revived and are becoming more and more present in our contemporary landscapes. Big tech pretty much dominates every facet of our lives— from messaging apps, to the smartphone in your pocket, to how you get everything in your house, to how you pay for the things you buy. Technology and its services have started to facilitate the way we live— it comes as no surprise that the people who built circuits and social networks are now seeking to build cities, too. Especially with big tech stocks starting to rivaling the wealth of entire nations, such as Apple's 2.25tn in stocks compared to Ireland's $951bn in total wealth, they now have the capital to invest in cities and real estate - for better or for worse. According to Shoshana Zuboff, a professor emeritus at Harvard Business School, in the case of Amazon, "unlike company towns of the past, Amazon doesn't control housing for employees or replace functions of the government. Amazon goes beyond the company town phenomenon. It's a company world. Given Amazon's presence in our lives, its size and how many people the company employs, that's a combination unlike anything we've seen before." San Bernandino, California, for instance, has been ravaged by Nestlé and taken over by Amazon: millions of gallons of water have siphoned out yearly by Nestlé, and Amazon is now the largest private employer in the region, with 14 facilities and two logistics air hubs. Corporations have now become fixtures of underdeveloped cities and towns worldwide, funneling out resources for their own gain with nothing in return. Much like how company towns of the past provided housing and health insurance to its workers, dog-friendly workplaces and hardware discounts have become the new tools of economic coercion by companies to entice its workers to come and stay.

Alphabet [Google]

Apple



Meta [Facebook]



Amazon

Fig. 3.7: Big Tech collages

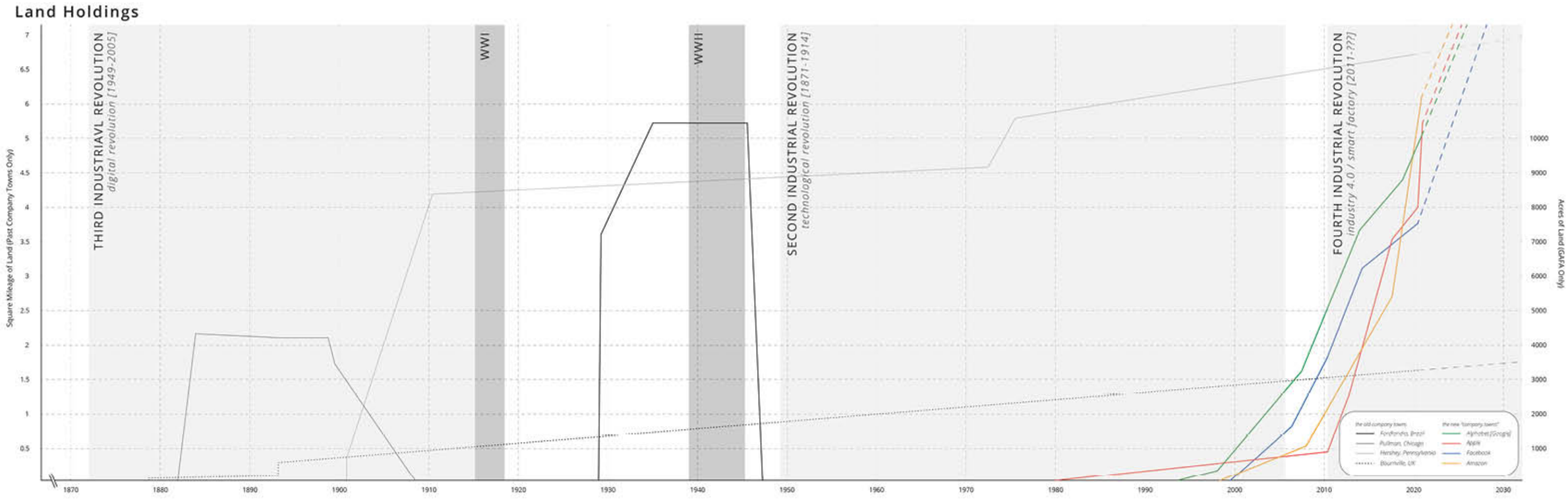


Fig. 3.7.1: The return of the ompany town: past and present

Google's Ideal Home

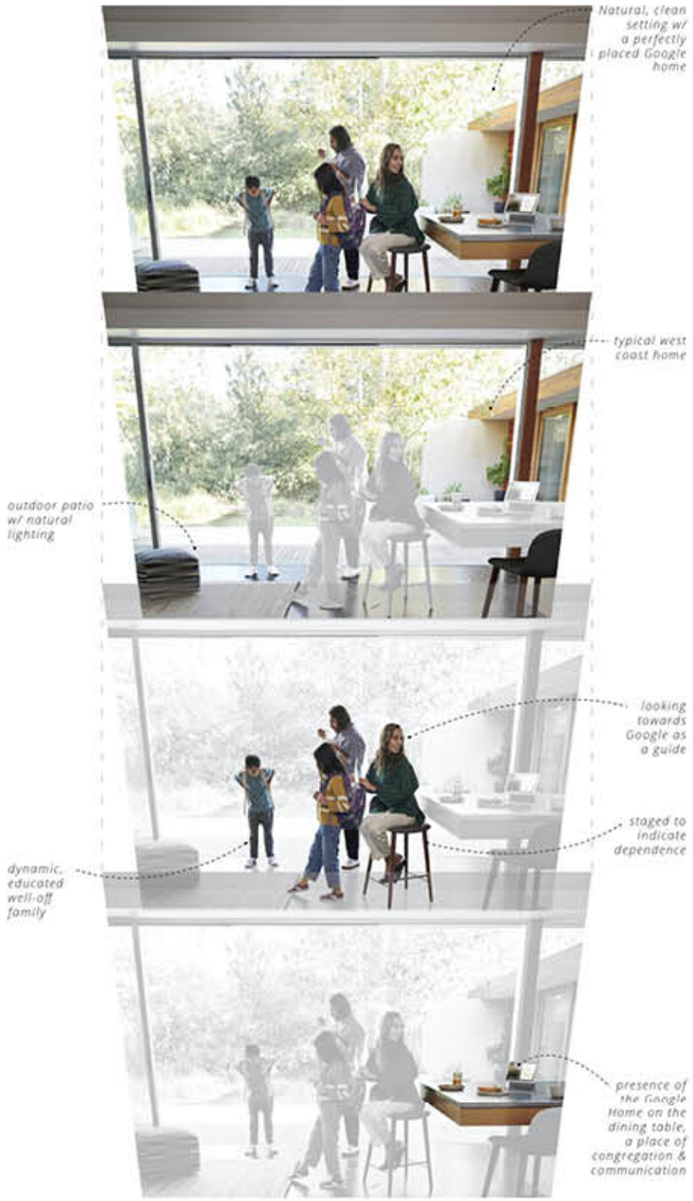


Fig. 3.7.2: Google

Apple's Town Square

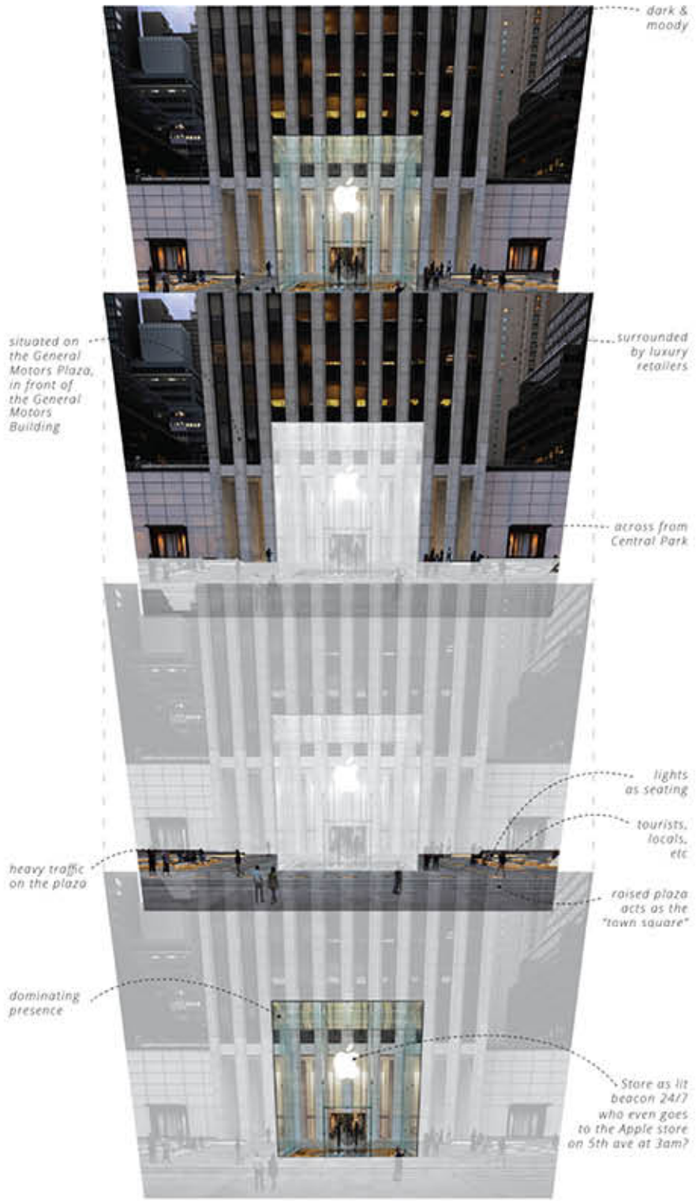


Fig. 3.7.3: Apple

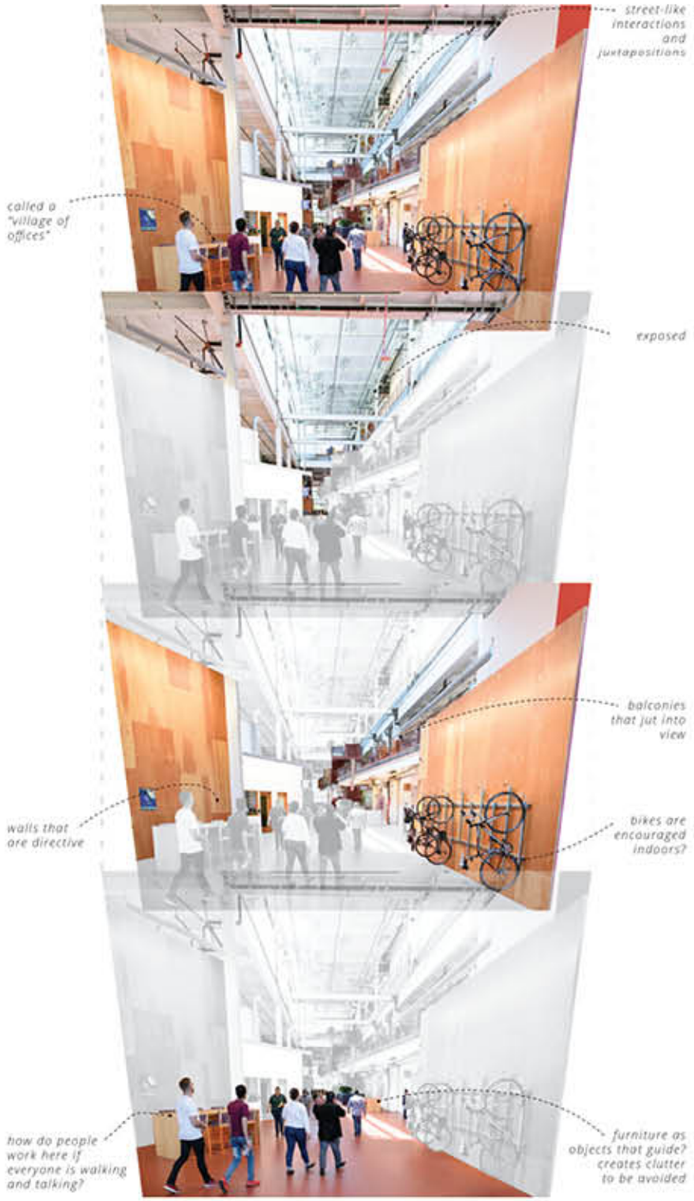


Fig. 3.7.4: Facebook

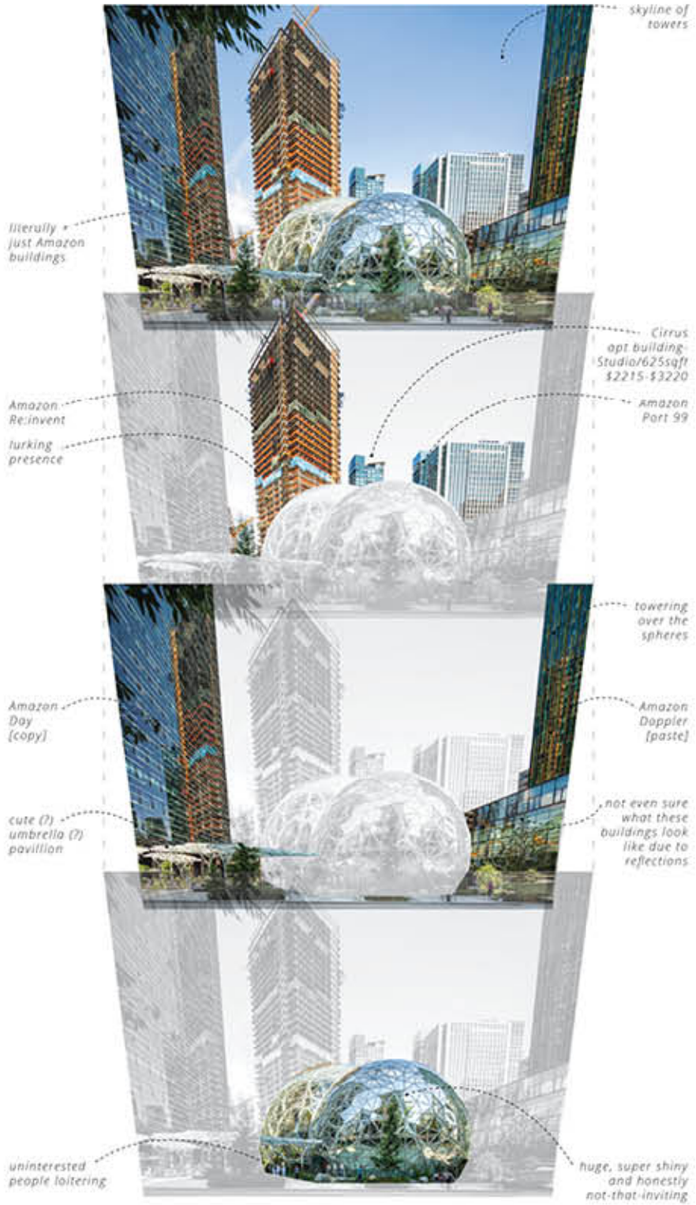


Fig. 3.7.5: Amazon

"[Big Tech] goes beyond the company town phenomenon. It's a company world. Given [Big Tech]'s presence in our lives, its size and how many people the company employs, that's a combination unlike anything we've seen before."

- *Shoshana Zuboff.* A City with Amazon at the Center

Fig. 4: Workers loading scrap metals onto a truck

THE TERRAIN OF TOMORROW

AGBOGBLOSHIE

ACCRA, GHANA

Fig. 4.1.1: Timeline

In Agbogbloshie, a wasteland near Accra, Ghana, up to 10,000 workers toil daily in a roughly 20-acre scrap yard, burning cables covered in plastic so they can get at the valuable metals, like copper, inside. Agbogbloshie, now one of the largest informal settlements in Ghana, has now become the symbol of this escalating issue for years- with some of the world's most respected media organizations re-printing this issue over and over without resolve or accountability. The rise of hyper-consumerism, planned obsolescence, and few repair options for our personal devices and products have only further exacerbated this issue- the more we are encouraged to replace our products, the more we contribute to the e-waste dilemma. Agbogbloshie was initially settled illegally by migrants from the north in the 1980s, and has since experienced waves of migration to the settlement. It began as a market for selling fruits and vegetables, eventually evolving into a "slum." There are now approximately 40,000 people living there, including the aforementioned workers. It is, at its current state, a poor, lively, spontaneous and sprawling settlement that accommodates a large range of informal work and is a critical livelihood for some of Ghana's poorest, vulnerable, and unskilled migrants. E-waste recycling activities first began in 1999, and have continued until the present day. Despite the regulations and hazardous waste laws imposed by the Ghanaian government, most of the current e-waste processing methods consist of informal, dangerous tactics such as acid baths and burning of plastics and other materials. These practices release toxins and heavy metals into the environment, harming the scrapyard workers, their families, and the greater urban community of Accra.

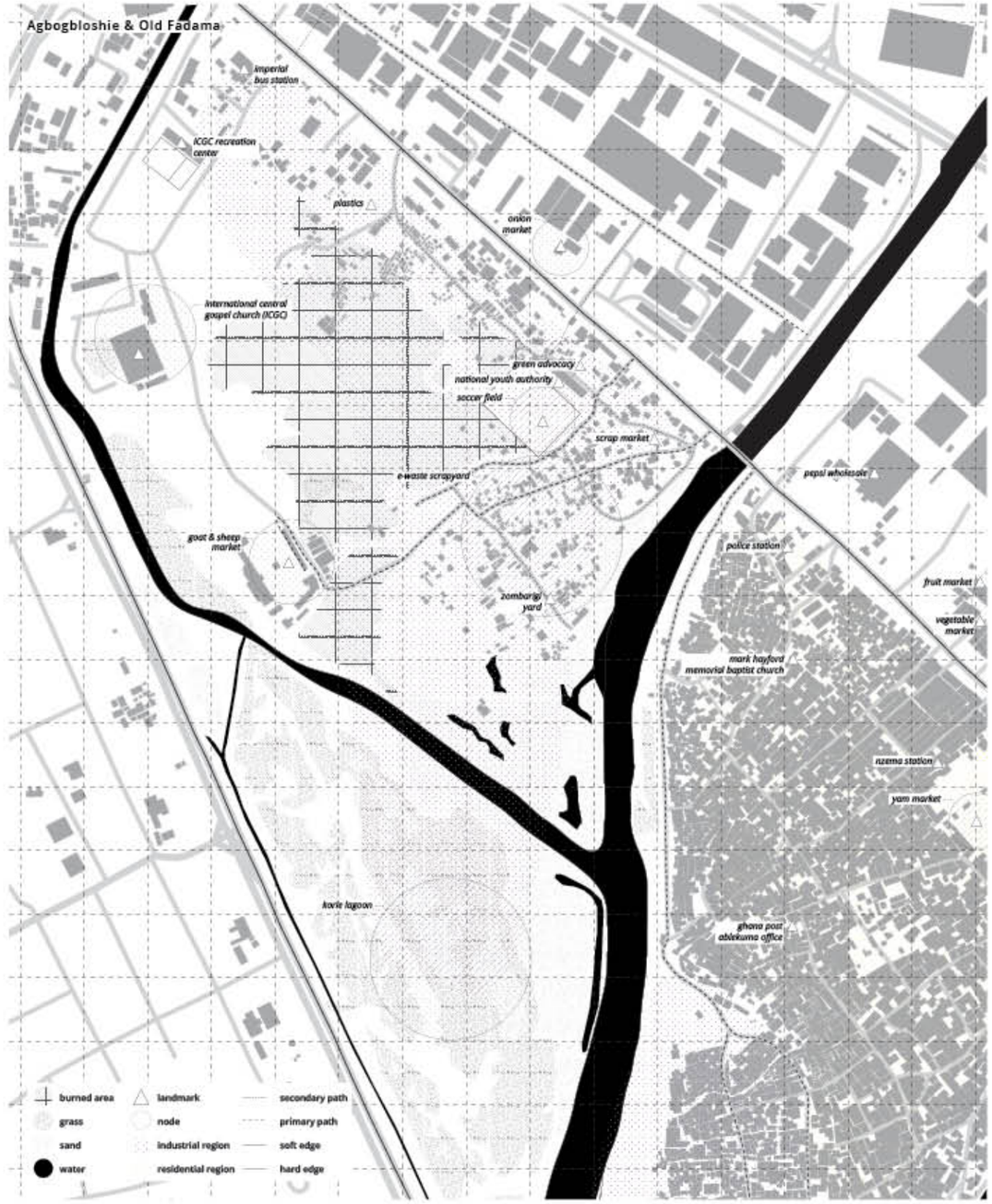


Fig. 4.1.2: Site analysis

Opinion

OPINION

Where Do Old Cellphones Go to Die?

By Leyla Acaroglu

May 4, 2013

Computer parts line the ground at a dump site in Agbogbloshie, a suburb of Accra, Ghana. Jane Hahn/European Pressphoto Agency

AMERICANS replace their cellphones every 22 months, junking some 150 million

MENU / aeon NEWSLETTER

The Waste Age

Recognising that waste is central, not peripheral, to everything we design, make and do is key to transforming the future

by Justin McGuirk +BIO

3,200 words 12 comments Save

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The opposition between 'nature' and 'culture' is problematic for many reasons, but there's one that we rarely discuss. The 'nature vs culture' dualism leaves out an entire domain that properly

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Natural resources and development

Rotten eggs: e-waste from Europe poisons Ghana's food chain

Toxins from old computers, fridges and other electronic goods are polluting chicken eggs in an area where 80,000 people live

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The Washington Post

Democracy Dies in Darkness

IN SIGHT

Making a living in the toxic world of discarded electronics

By Nick Kirkpatrick

April 15, 2015

'oung men transport materials ready to be burnt at Agbobloshie in Accra, Ghana. (Valentino Bellini)

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Fig. 4.1.3: Western media coverage of Agbogbloshie

Fig. 4.1.4: Disassembled electronics stacked in piles

Fig. 4.1.5: Worker disassembling electronics in Ghana

"Urban mining. [This process is] now more efficient for us, to mine materials from our waste. There is 10 times more gold, silver, platinum, palladium in one ton of our electronics than in one ton of ore mined from beneath the surface of the earth. In Agbogbloshie, weight is a form of currency. Devices are dissected to recover materials, parts and components with incredible attention to detail, down to the aluminum tips of electric plugs."

- DK Osseo-Asare. TED

URBAN MINERS

Agbogbloshie now accounts for 40-60% of all e-waste processing in Ghana. The social and economic opportunities have outweighed the health hazards and environmental impacts that come from the burning and dismantling of e-waste equipments. Most developed countries export their EEE to developing countries because of the high labor cost to dismantle and recycle it locally. In developing countries, the use of crude and informal methods has lowered the cost of processing e-waste. As our source of rare earth metals below the earth diminishes, a new mining industry has been created above ground, scavenged from old products rather than mined from the earth. E-waste contains many precious metals such as gold, copper, and nickel as well as rare materials such as palladium. They can be recovered, recycled, and used as secondary raw materials. This allows for the renewal of metals at a lower expense, and will out-perform digging for raw materials. Mining discarded electronics for gold, for example, produced less carbon dioxide emissions compared to mining it from the ground. There are serious issues with the unsafe handling of e-waste, however. Open-air burning, acid baths, and other tactics allow toxic materials to leach into the environment, and expose workers to high levels of contaminants such as lead, mercury, cadmium, and arsenic. These practices can lead to irreversible health effects such as cancer, neurological damage, and extreme physical exertion. The dismantling and recycling of electronic waste at Agbogbloshie is dominated by people with no formal education, with 65% of them having never been to school. The majority of workers are also incredibly young, with around 85% being between the ages of 15-35 and 11.7% being under the age of 15. For a young, unskilled population this business has become a livelihood that has allowed them to make money even without other prospects.

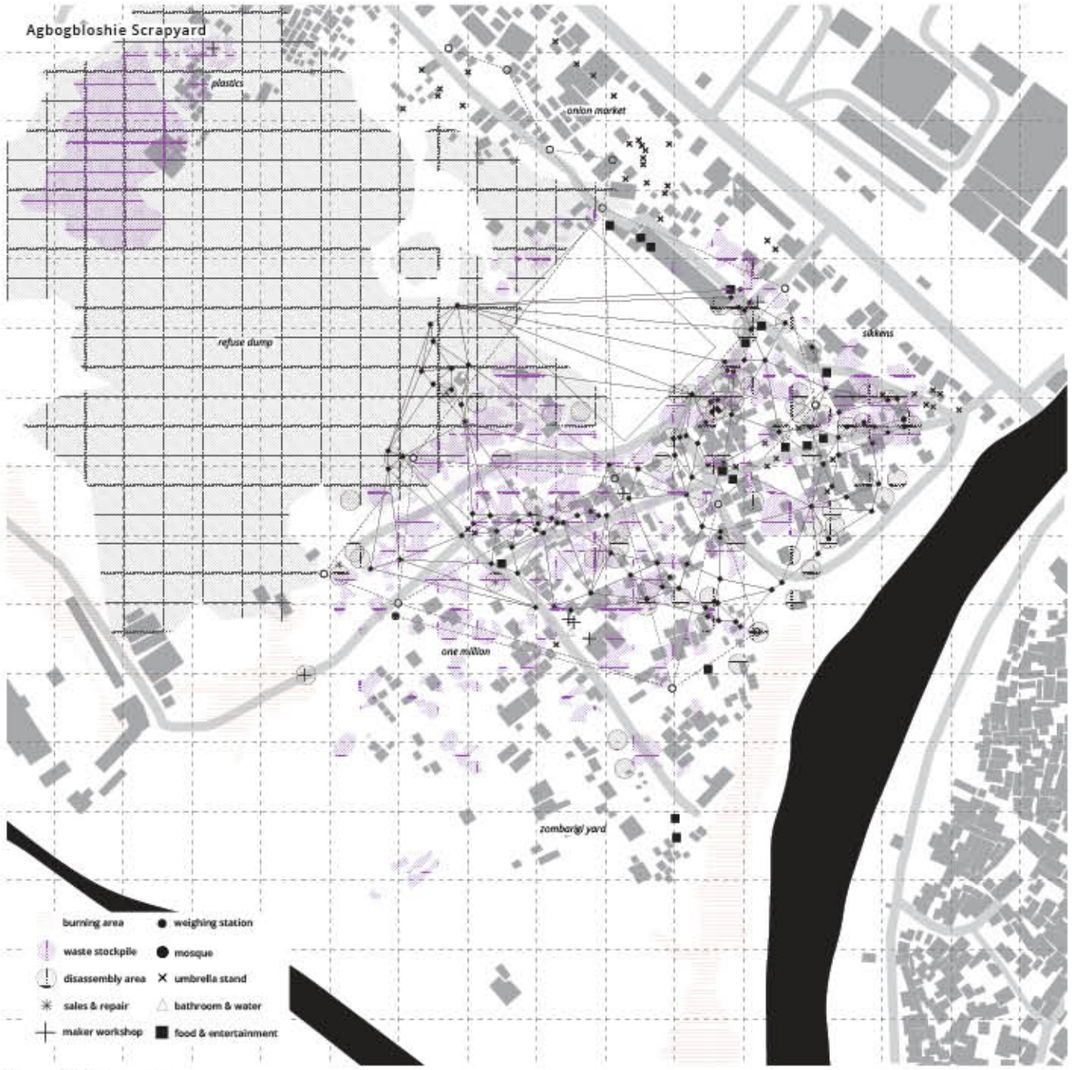


Fig. 4.2: Site analysis

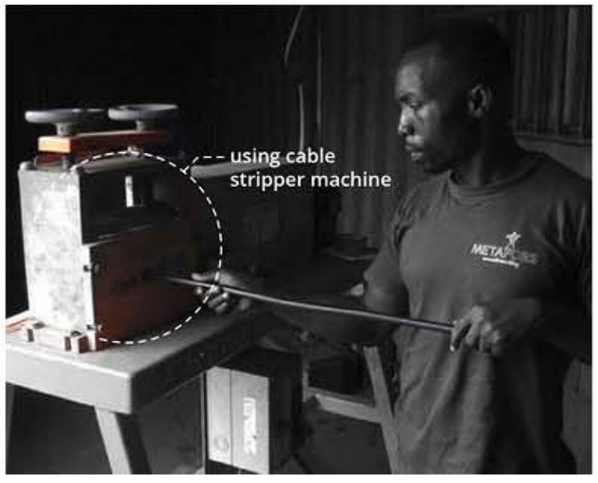


Fig. 4.2.1: Methods of material recovery

AN INFORMAL COMMUNITY

Western media has painted Agbogbloshie simply as a polluted dumpsite, all the while overlooking the complexity that comes with the newly-developed industry. The e-waste trade and informal recycling methods are brutal, but have also generated much-needed jobs for youth and contributes to a vital repair and recycling culture. Agbogbloshie, as a response to work being done there, has now become a hub for a wide range of informal economic activies such as: food markets (in the form of umbrella stands), petty trade, vehicle repair, electronics refurbishment and repair, and transportation services. Alongside its fame as the largest e-waste processing site in Ghana, it also notably houses a timber market, a lorry repair center, bus and motorcycle transportation depots, and an array of informal housing for workers. Some of the settlement's informal activities are connected with both informal industries in Agbogbloshie and formal industries elsewhere in the city: it assists in city-wide e-waste collecting, arguably providing a municipal service at no cost to the city, as well as contributing to the recycling of valuable metals, some for local industries, while also creating local ancillary "life-saving" and empowering jobs. Agbogbloshie also provides a safe haven for migrants, who are typically from the north- they are often poor, Muslim, and without land. Lacking connections and escaping criminal and ethnic violence, the informalness and anonymous nature of Agbogbloshie creates a protective space.

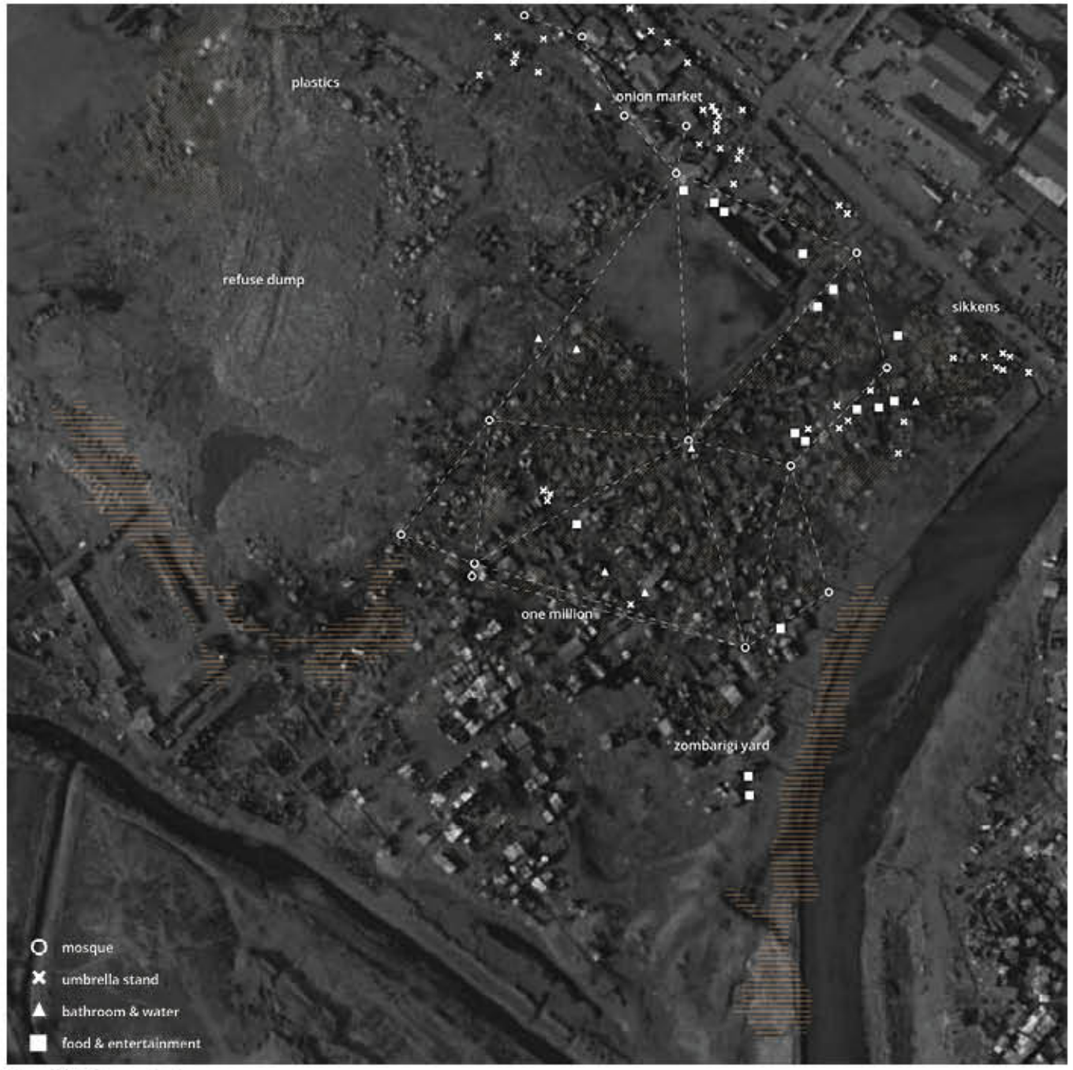


Fig. 4.3: Site analysis

AN INFORMAL ECONOMY

About 10 years ago, Agbogbloshie became a dumpsite for illegal e-waste from industrialized countries among the United States, Europe, China and India. Over time, there has been an informal economy that has emerged— where a dependency is rooted among the local residents. The communities, informal settlements, and maker's ecosystem are all in close relation to each other and help to benefit the community. The refurbishment of broken down electrical items, for example, is very common in Ghana. Items are rarely bought new because of their expense. The recovered electronic parts from EEE are valuable parts for repair works, with the Agbogbloshie e-wasteyard one of the important markets for spare electronic parts. The hierarchical nature of the informal economy also allows for upward mobility- scrap collectors can become refurbishers, then recyclers, then middlemen, and eventually become a scrap dealer, the top of the chain. For the unemployed, unskilled and less educated population who have been unable to flourish in the formal economy, going into the e-waste trade provides them with a means. The average e-waste collector or daily wage laborer earned about $3.50/day according to a research done in 2012, about two-and-a-half times the average income of other informal workers in Ghana. Aside from the comparatively high-paying jobs, the development of skills is facilitated through scrapyard employment. People are able to learn about how to refurbish items quickly, accurately, and in cost-effective ways.

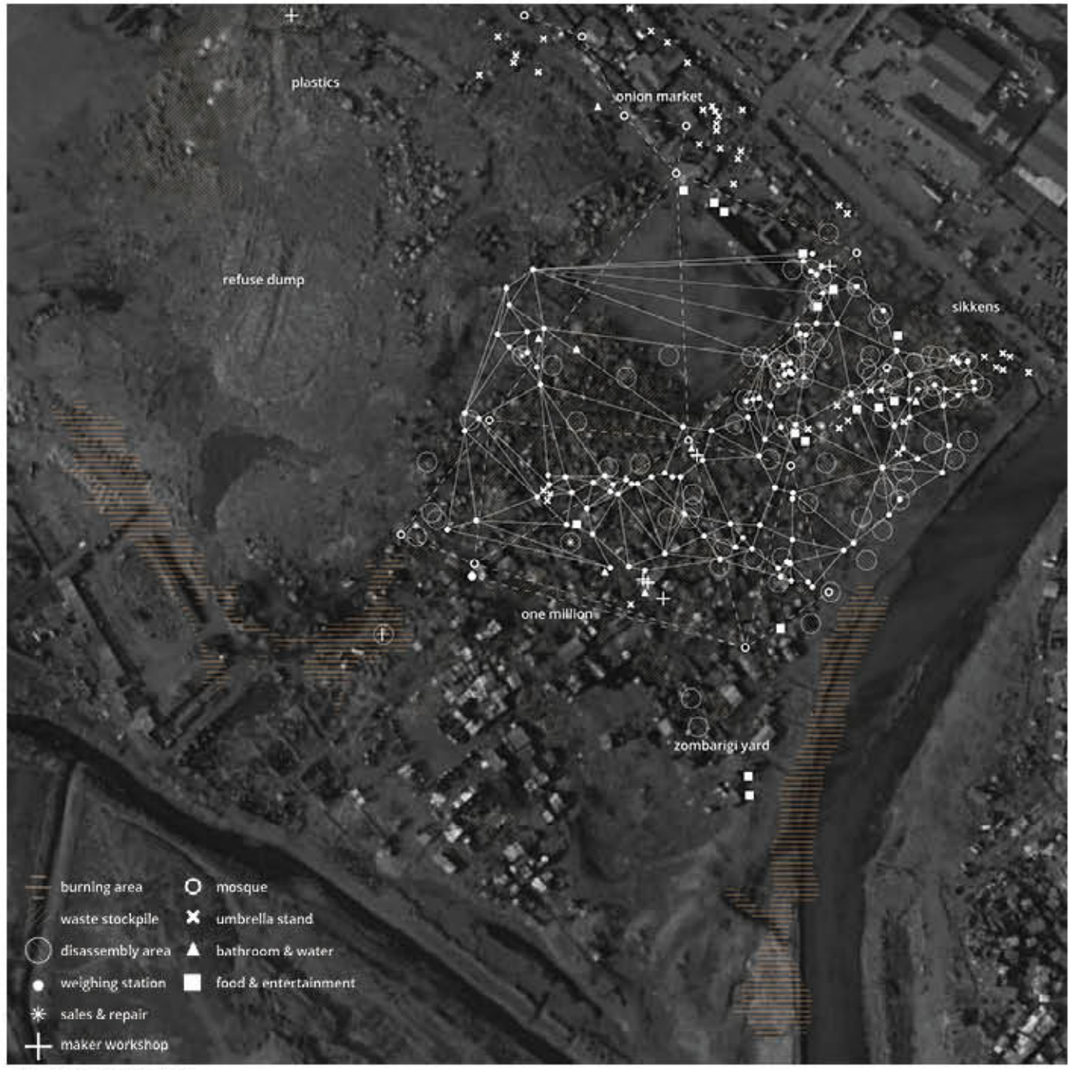


Fig. 4.4: Site analysis

"Despite supporting thousands of livelihoods, the Government of Ghana showed up with bulldozers and armed military on ***July 1, 2021*** *and* ***totally demolished the Agbogbloshie scrapyard.*** *Regrettably, the Scrapyard was not demolished due to concerns of heavy metal pollution, but as part of Henry Quartey's degongestion exercise 'Let's Make Accra Work,' a vision to remake Accra's urban landscape- utopian imaginations that put the urban poor and the spaces they inhabit in the crosshairs."*

- *Muntaka Chasant.* Agbogboshie Demolition: The End of an Era or an Injustice?

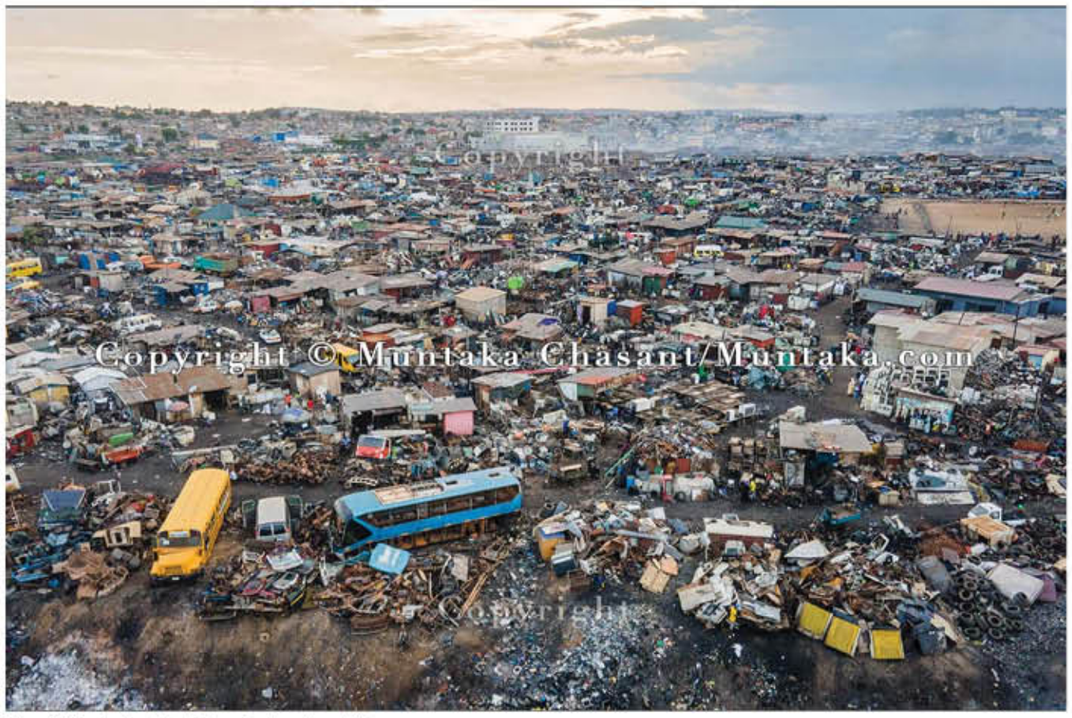


Fig. 4.5.1: Agbogbloshie prior to demolition

Fig. 4.5.2: Agbogbloshie after demolition

Fig. 5: Big tech in wasteland

THE RESOLUTE CITY

THE CIRCUIT CITY

With the exponentially rising rate of disposal of our electronics waste, this project, Circuit City, seeks to foster resistance against immediate environmental threats brought on by the manifestation of e-wastelands. Through the evaluation and redistribution of the limited resources at hand, this project serves as an outlook into the potential of our future cities to rethink the way we use and dispose of our goods. With the advent of hyper-consumerist culture has come the proliferation of electronic waste, or e-waste—our constant cycle of demand, production, and disposal has created detrimental local impacts on developing countries. Every year, consumers generate tens of millions of tons of this e-waste, with cities of consumption (mainly Western countries) mainly geared towards consumption leading the charge. Meanwhile, cities of production, where materials are mined, and disposal, where materials are then disposed of, are routinely taken advantage of. This e-waste is typically "recycled" through informal, unregulated, and dangerous conditions that threaten the health and safety of not only people but also the environment. This unforgiving process has created the physical embodiment of environmental misconduct and a new type of landscape—an electronic dumping ground now known as "the e-wasteland."

Efforts to properly recycle this e-wasteland as of late have mostly been experimental, uncharted, and contentious. In addition, there are many concerns about the availability and supply of new materials for electronics and electrical devices in the future. The improper handling of such e-waste results in the significant loss of valuable raw materials. Almost none of these rare earth minerals get extracted from informal recycling, and pollute the environment it's dumped in. In Agbogbloshie, a wasteland at the edge of Accra, Ghana, up to 10,000 workers used to toil daily in a roughly 20-acre scrap yard, burning cables covered in plastic so they can get at the valuable metals, like copper, inside. Agbogbloshie has been symbolic of this escalating issue for years.

Fig. 5.1: Site isometric

FROM WASTELAND TO ILAND

Its demolition and subsequent rezoning as a hospital on July 1st, 2021, news that has remained undetected by Western media, has highlighted serious issues with this system. The e-waste trade and informal recycling methods are brutal but have also generated much-needed jobs for youth and contributed to a vital repair and recycling culture. It was a poor, lively, spontaneous, and sprawling settlement that accommodated a large range of informal work and is a critical livelihood for some of Ghana's poorest, vulnerable, and unskilled migrants. We wish to redefine this periled future of Agbogbloshie, into one where it becomes the testing ground for e-waste reuse, recycling and detoxification. As the desire for new products continues to grow, the world needs to focus on utilizing all resources on hand. So, in this viable future where e-waste becomes the new gold, Agbogbloshie will transform from being the receiving end of discarded waste to the forefront of innovation and opportunity. By utilizing processes such as phytoremediation, or the use of plants to extract and remove elemental pollutants, and phytomining, the process of extracting metal from plants, we can begin to design for the needs of not only e-waste recycling but also the environment. First, we introduce a crop rotation of three hyper-accumulators to the site - sunflowers, sesame plants, and Indian mustard. Through a process called phytomining - these plants work together to remediate the contaminated soil by absorbing metals into the plant cells. Once matured and dried, these plants are incinerated to create bio-ores, which will then be harvested and processed through the thermochemical conversion plant that produces biofuel and separates secondary raw material, in this case, metals, from the byproduct of the process - bio-char. Then, a formal e-waste recycling plant is established, due to the vital repair and recycling culture that once existed on the site that is still much needed to process existing and future e-waste products. This recycling plant will safely and effectively process, separate, and sort the e-waste back into its raw materials, to be recycled into new electronic products.

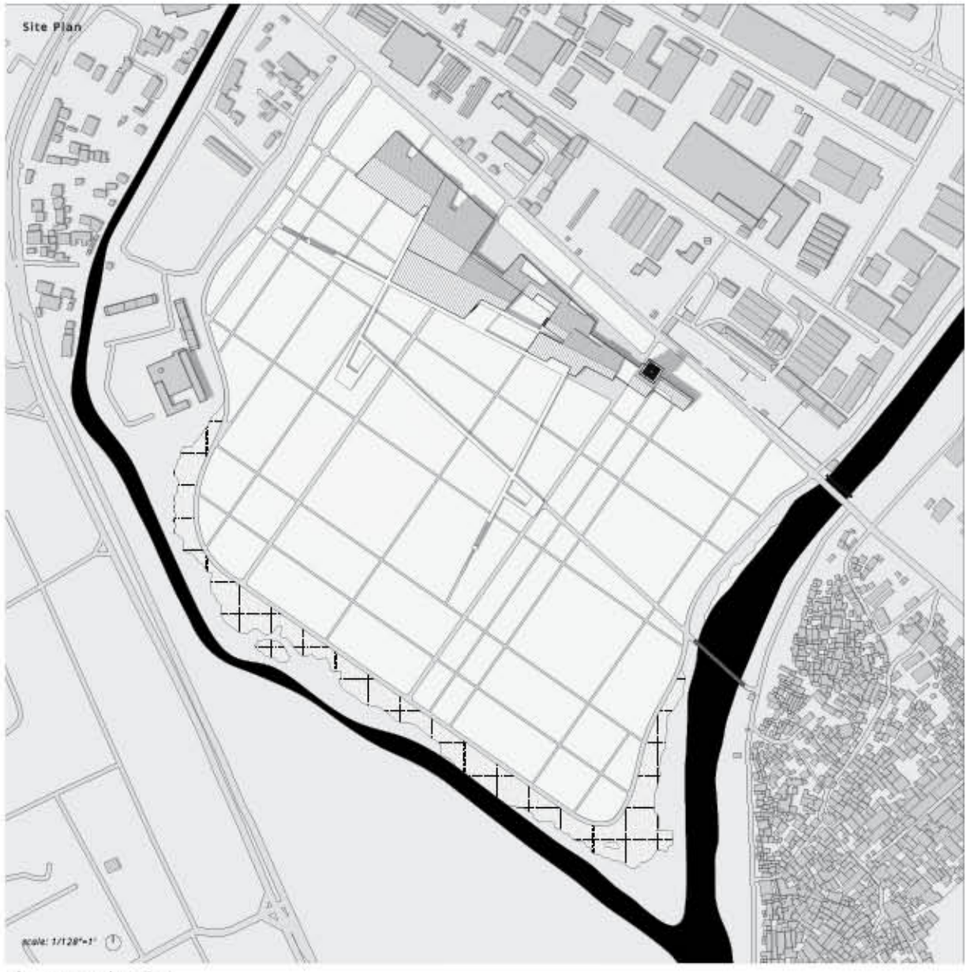
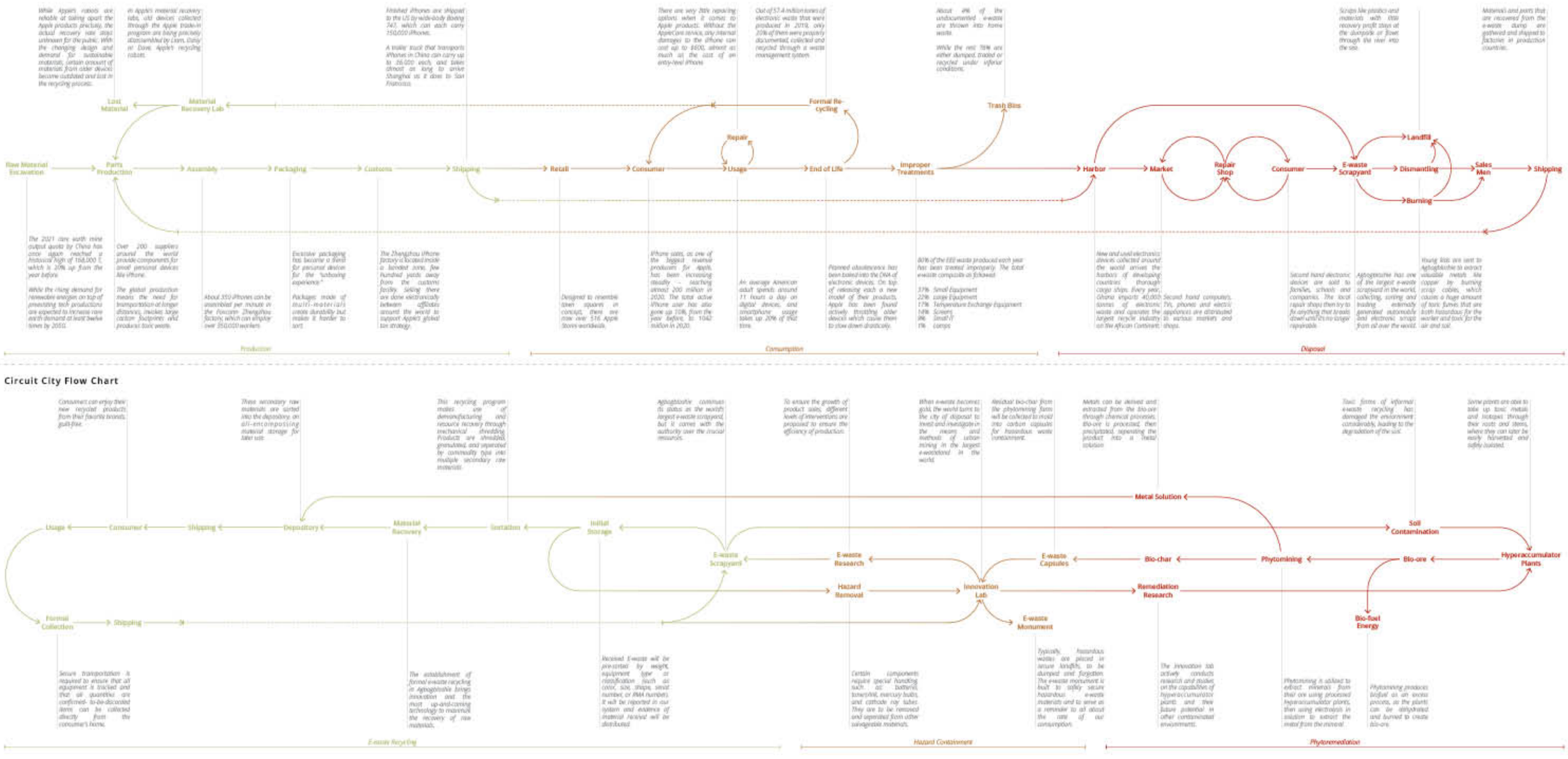


Fig. 5.2.1: Site plan

Former Agbogbloshie Flow Chart



Circuit City Flow Chart

Fig. 5.2.2: Revised flow chart

Fig. 5.2.3: Plan, section & project timeline

E-WASTE RECYCLING

The establishment of formal e-waste recycling in Agbogbloshie brings innovation and the most up-and-coming technology to maximize the recovery of raw materials. The process starts off with ensuring secure transportation, which is to be required to ensure that all equipment is tracked and that all quantities are confirmed- to-be-discarded items can be collected directly from the consumer's home, or brought to a authorized facility. Received E-waste will be pre-sorted by weight, equipment type or classification (such as color, size, shape, serial number, or RMA number). It will be reported in our system and evidence of material receival will be distributed back to the original owner. This recycling program makes use of demanufacturing and resource recovery through mechanical shredding. Products are first manually broken down into large, seperated components. Hazardous wastes that are unable to be recycled are set aside. Some of these certain components require that special handling includebatteries, toners/ink, mercury bulbs, and cathode ray tubes, due to the toxic nature of the elements that they are intertwined with. The seperated components are then shredded, granulated, and seperated by commodity type into multiple secondary raw materials. These secondary raw materials are sorted into the depository, an all-encompossing material storage for later use. These materials are sent either to the innovation lab, to research potential second lives for the materials, or shipped off to be reused in the production of new products.

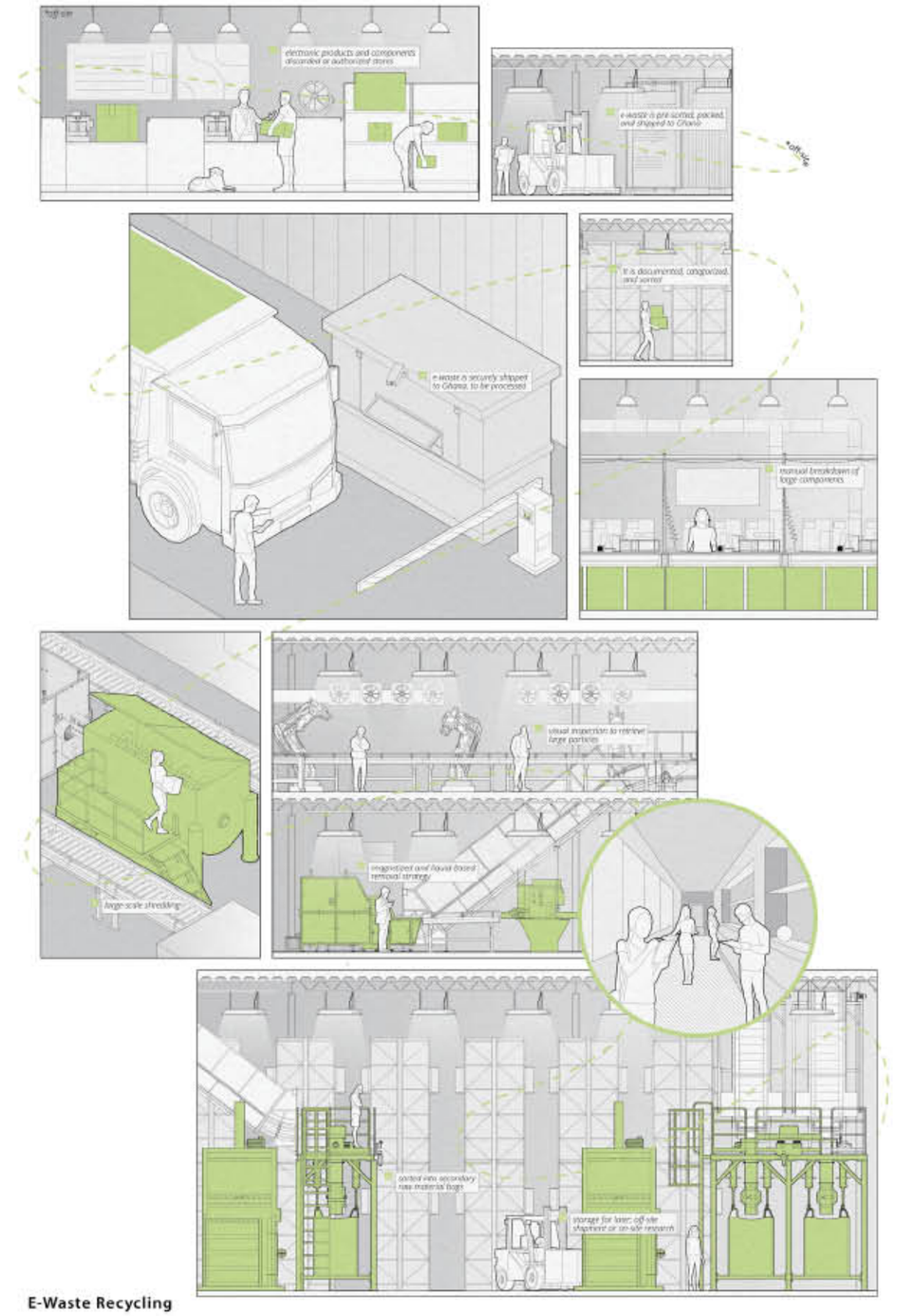


Fig. 5.3.1: E-waste recycling infographic

Fig. 5.3.2: E-waste recycling typical work space rendering

PHYTOREMEDIATION

Toxic forms of informal e-waste recycling has damaged the environment in Agbogbloshie considerably, leading to the degradation of the soil. In order to combat this and prevent further damage, environmental action must be taken. Through the use of phytoremediation, a plant-based approach to extract and remove elemental pollutants, this can be done- some plants are able to take up toxic metals and isotopes through their roots and stems, where they can later be easily harvested and safely isolated. These plants are referred to as hyperaccumulators. The use of different plants with different phytoremediating capabilities and different root sizes ensures that soil can remain stable and become cleaned gradually of most isotopes as time goes on. However, these plants can not be discarded like normal due to the metal that they contain. Fortunately, they can be phytomined in order to separate the metals from the organic plant matter. Phytomining also produces biofuel, a sustainable source of energy, as an excess process, as the plants can be dehydrated and burned to create bio-ore. Phytomining is utilized to extract minerals from their ore using processed hyperaccumulator plants, then using electrolysis in solution to extract the metal from the mineral. The innovation lab actively conducts research and studies on the capabilities of hyperaccumulator plants and their future potential in other contaminated environments. Metals can be derived and extracted from the bio-ore through chemical processes. Bio-ore is processed, then precipitated, separating the product into a metal solution.

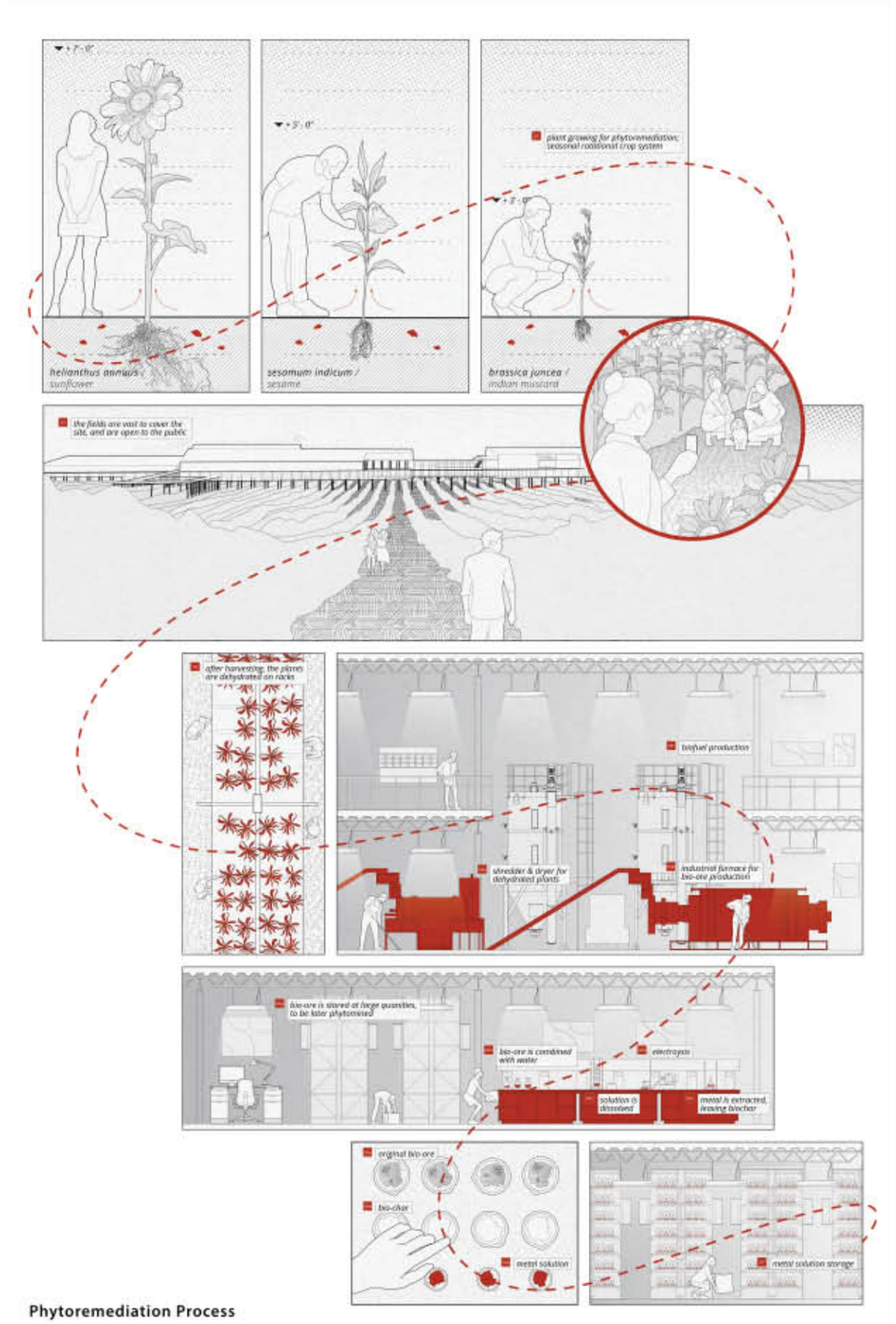


Fig. 5.4.1: Phytoremediation infographic

Phytoremediation: Sunflower Field View

Fig. 5.4.2: Sunflower field view rendering

HAZARD CONTAINMENT

Typically, hazardous wastes are placed in secure landfills, to be dumped and forgotten. The e-waste monument is built to safely secure hazardous e-waste materials and to serve as a reminder to all about the rate of our consumption. Residual bio-char from the phytomining farm will be collected to mold into carbon capsules for hazardous waste containment. The tower grows steadily each and every year, understood by all as a mounument to the past as well as our current situation. In addition, it has become the new final destination for the Accra International Marathon (AIM), a well-renowned race that takes place at the edge of Accra every year. The finish line stretches further out every year with the addition of more capsules. Ultimately, the e-waste, hyperaccumulator plants, researchers, and locals work together to shape Agbogbloshie into the blueprint for our future cities by promoting a truly circular economy where waste is no longer wasteful, but rather becomes opportunities and fuel for the next cycle of production and consumption - E-waste is turned into secondary raw materials, plants are remediating the land and generating energy as biofuel, and the people working and visiting here become in control of these processes. The Circuit City encompasses production, consumption, and recycling all in one, where our modern lifestyles are finally supported by the extended industries, and we can fully invest in the hyper-consumerism culture without the guilt of destroying the environment.

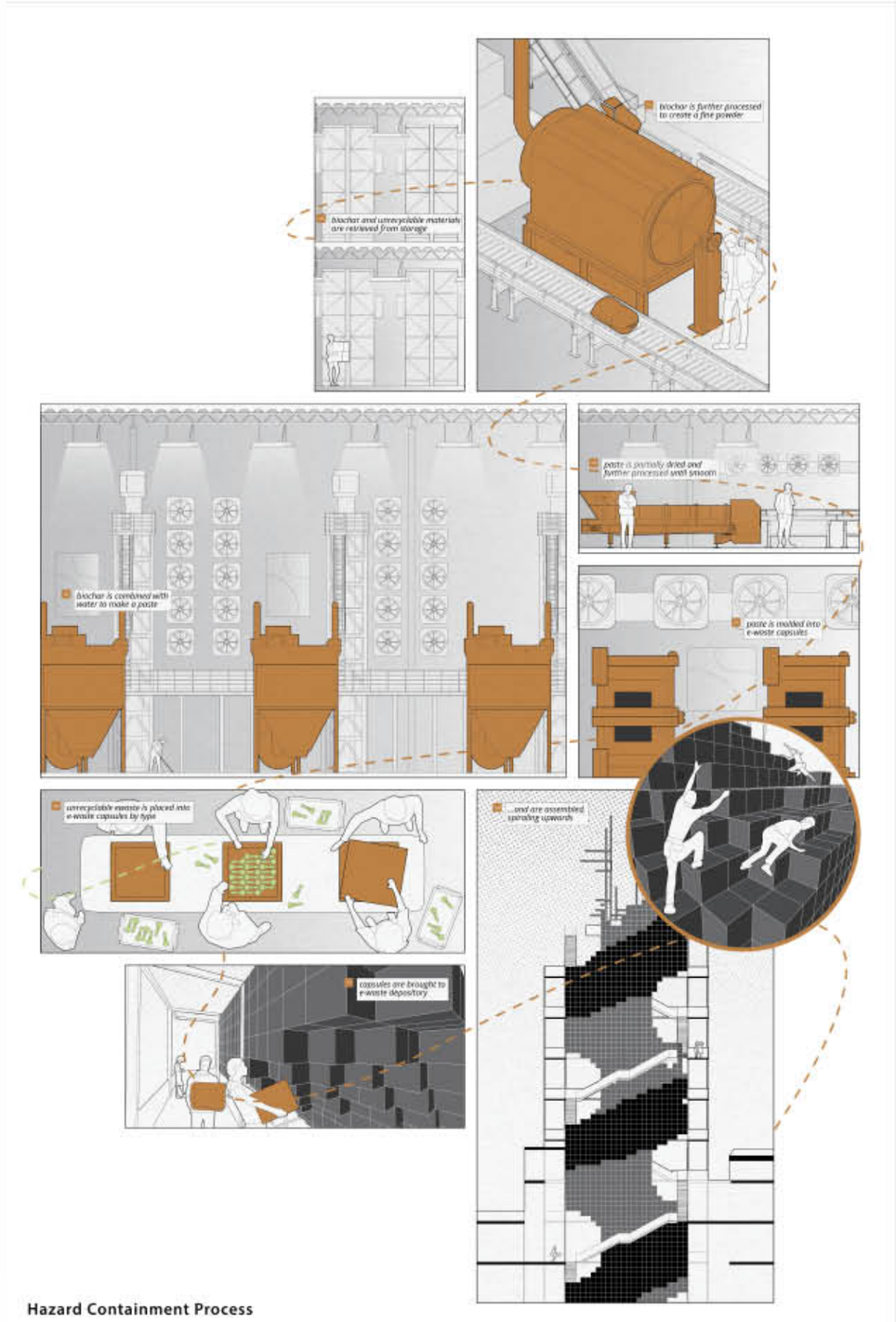


Fig. 5.5.1: Hazard containment process infographic

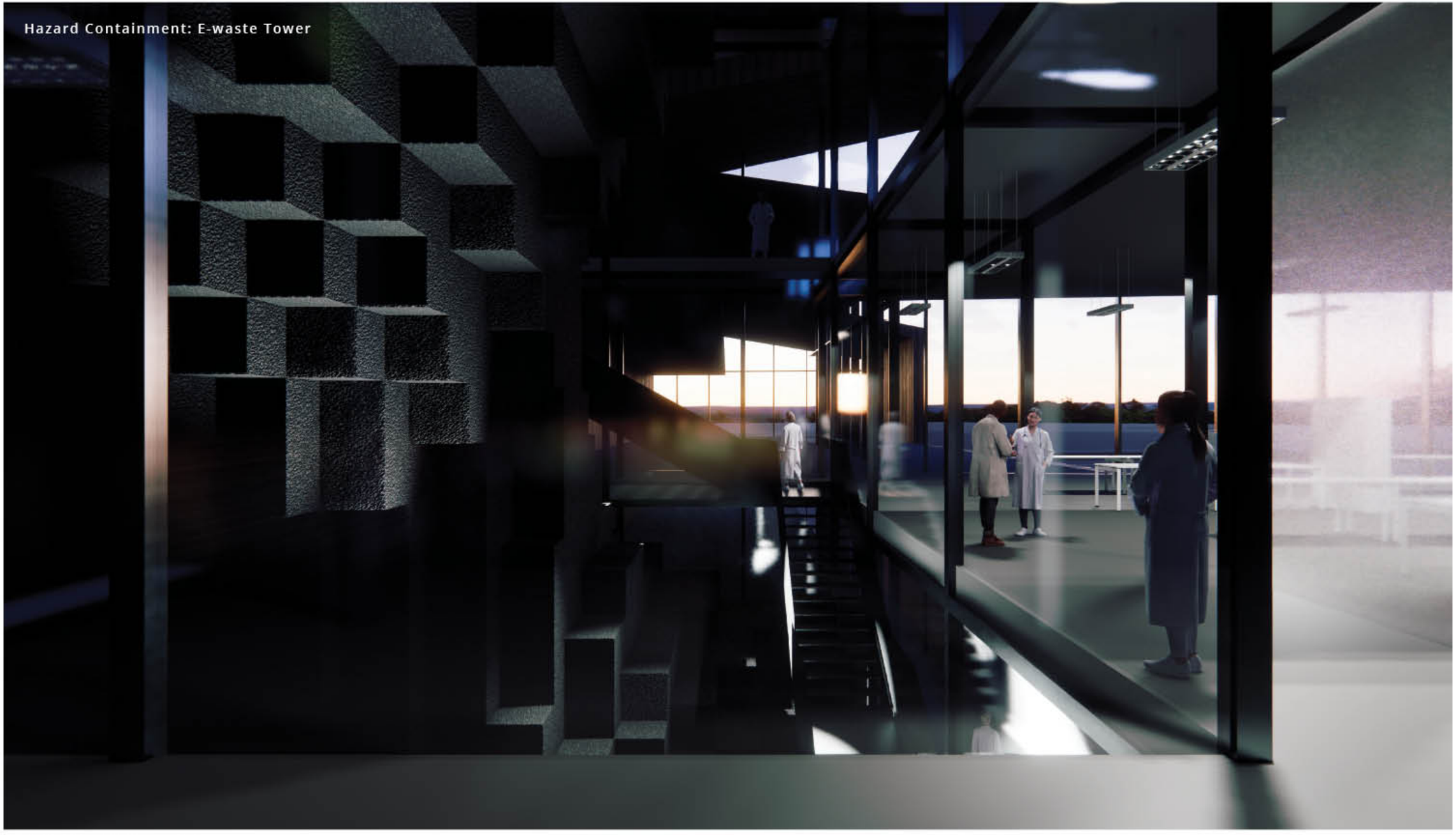
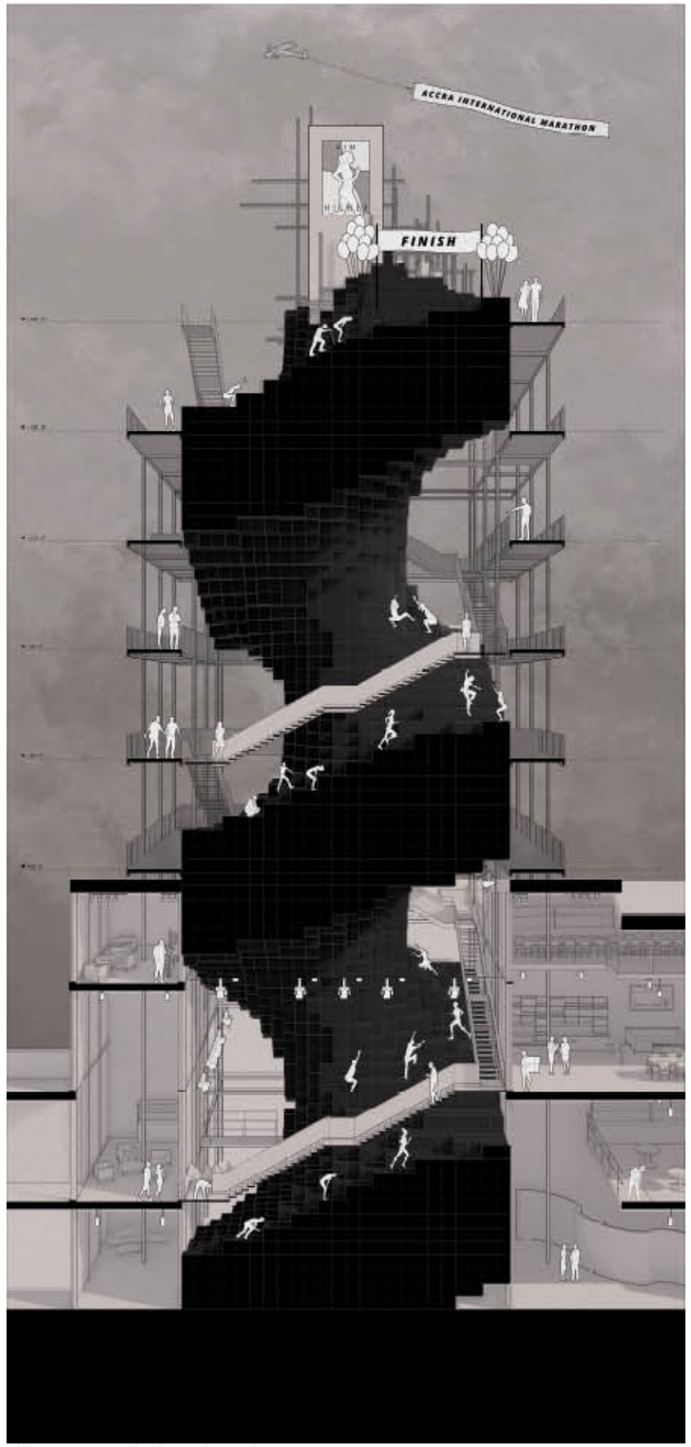


Fig. 5.5.3: E-waste tower rendering



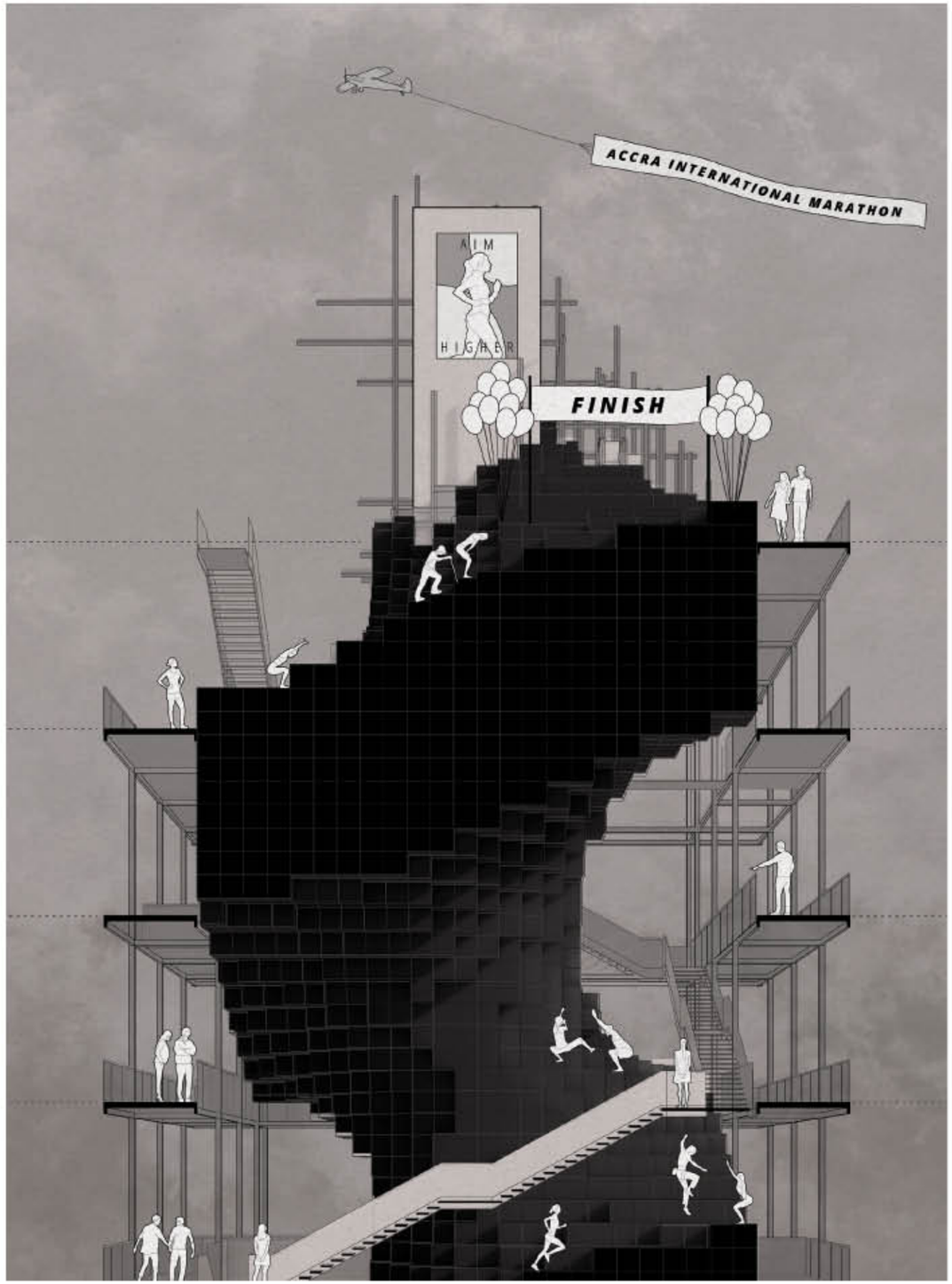


Fig. 5.5.3: Vertical section of E-waste tower

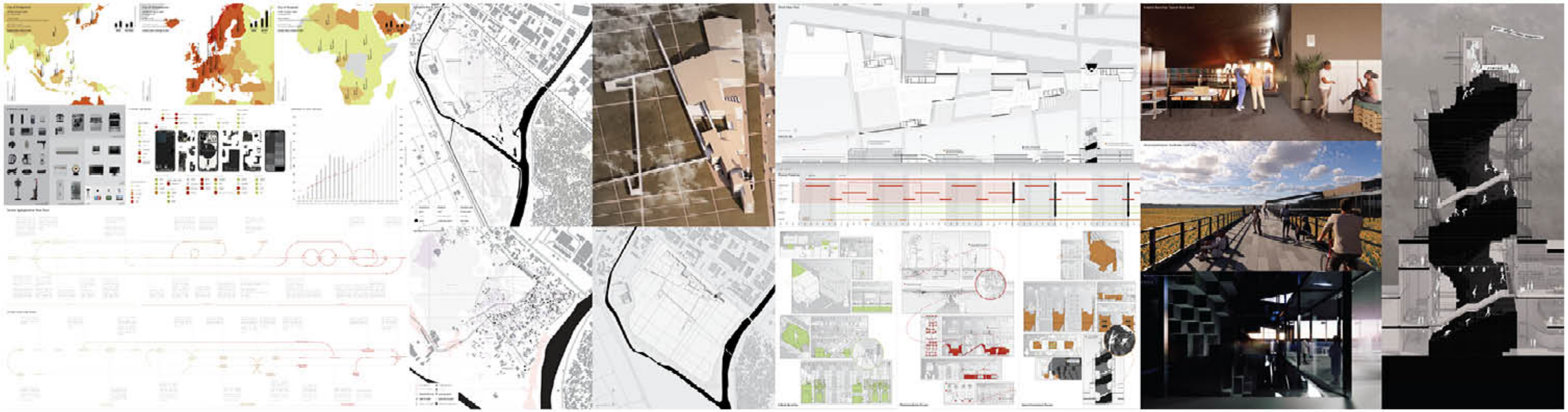


Fig. 5.6: Final board

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Fig. 1.2.2: Self-Made Diagram

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Fig. 2.1: Self-Made Diagram

Fig. 2.2: Self-Made Diagram

Fig. 2.2.1: Self-Made Diagram

Fig. 2.3: Self-Made Diagram

Fig. 2.3.1: Self-Made Diagram

Fig. 2.4: Self-Made Diagram

Fig. 2.4.1: Self-Made Diagram

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Fig. 3.7: Self-Made Collage

Fig. 3.7.1: Self-Made Diagram

Fig. 3.7.2: Self-Made Diagram

Fig. 3.7.3: Self-Made Diagram

Fig. 3.7.4: Self-Made Diagram

Fig. 3.7.5: Self-Made Diagram

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The Circuit City

Fig. 5: Self-Made Collage

Fig. 5.1: Self-Made Drawing

Fig. 5.2.1: Self-Made Collage

Fig. 5.2.2: Self-Made Diagram

Fig. 5.2.3: Self-Made Collage

Fig. 5.3.1: Self-Made Drawing

Fig. 5.3.2: Self-Made Rendering

Fig. 5.4.1: Self-Made Drawing

Fig. 5.4.2: Self-Made Rendering

Fig. 5.5.1: Self-Made Drawing

Fig. 5.5.2: Self-Made Rendering

Fig. 5.5.3: Self-Made Drawings

Fig. 5.6: Self-Made Drawings

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