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Solid waste management in the world's cities: The global garbage crisis is also our failure

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INTRODUCTION

Waste management is a dead end. Everywhere, deposits are increasing, exceeding public authorities' management capacities and leading to the current ecological crisis : whether we think of the gigantic garbage vortexes that invade the oceans or of the numerous tragedies linked to saturated dumpsites that explode or collapse.

According to the World Bank, the production of municipal waste amounted to 2 billion tonnes in 2016, 54% more than in 2012. Production is projected to reach 3.4 billion tonnes by 2050, an increase of 70%. The growth potential of the urban waste deposit lies mainly in sub-Saharan Africa (+55% by 2030), South Asia (+ 40% by 2030) and East Asia (+ 29% by 2030) (World Bank 2018).

Given the scale and gravity of this phenomenon, the responses offered – both analytical and operational – stand out for their mediocrity. Public authorities are demanding shiny trucks and treatment plants, ignoring the astounding efficiency of informal recovery agents. Private companies sell facilities that are so expensive that they are beyond the reach of most societies without reducing their sanitary requirements. Informal recycling as currently practiced in Southeast Asia takes place under disastrous environmental conditions.

The transformation of the residues of human activities into an urban 'externality' is closely linked to the rise of colonial economies (Cavé 2015), which provide emerging industries with 'virgin raw materials' from distant horizons to replace these discarded materials. Hydrocarbons, potash, phosphates and nitrogen gradually replaced rags and excrement (previously used in order to make paper and fertilise fields, respectively): raw materials extracted from 'unexploited' colonial territories replaced the reuse of 'made in France' urban waste. From the outset, the destructuring of symbiotic practices between cities, industries and the countryside - the 'invention of waste' - is inseparable from an extractive economy spread out on a global scale.

Since then, this trend has only become stronger. Mountains of waste have swarmed everywhere and grown; mines have been dug and drilled everywhere. The operating principle of waste management is now invisibility. These disgusting materials must be removed from the sight of people. And sites must be found to be sacrificed for their ultimate burial. However, the absence of piles of rubbish in the usually frequented landscape does not mean that they have evaporated.

Every day on Earth, 4 million tonnes of household waste are produced: that is about 70 tonnes of waste generated every second. The amount of waste suspended in the water is estimated at 7 million tonnes, which is more than six times the mass of zooplankton. Waste is therefore a relatively insoluble problem today. It is found everywhere in the biosphere, embedded in the soil, dispersed in its oceans, suspended in the air and even in low orbit... And for a long time its degradation extends over disconcerting time scales. The estimated degradation time for a plastic bag is 450 years, for a glass bottle 4,000 years and for a battery 7,900 years. Used tyres, forming mounds by the billions, do not degrade. So our waste is not just our problem. It is part of the living and the future.

In our anthropogenic landscapes, we seem to have reached humanly and biologically unsustainable stages, as the proliferation of plastic waste, for example, endangers oceanic fauna and food chains on which many human societies are directly dependent. It endangers

situated communities in ways that are characteristic of environmental racism. And it endangers humanity as a whole, with the risk of an irreversible unravelling of the web of life.

Given the scale of the problem, it is striking that the attention of public authorities and social science researchers is focused almost exclusively on municipal waste (or household and similar waste). Yet this represents, by weight, less than 10% of the waste produced in France, in the European Union, and on a global scale.

Considering what remains at the end of the chain or focusing on 'end-of-pipe' solutions alone appears to be a dead end, both in analytical and operational terms. There is a clear political stake in reincorporating materials and energy into society because *'by isolating the problem of waste and focusing on its management and elimination, we overlook the political, economic and social choices that led to its production'* (Monsaingeon 2017). It is therefore appropriate to highlight the socio-technical systems and power games from which waste originates, how it is appropriated, negotiated and conflicted (Gandy 1994, Cavé 2015, Demaria & Schindler 2016).

We propose here two axis for reconsideration and discussion. First of all, get out of an end-of-pipe vision and link the waste management issue to the question of extracting raw materials, from the perspective of territorial metabolism. Focusing on the downside of the economic-industrial system, without addressing the issue of extractivism and consumerism upstream, condemns us to failure. Then, conceptually move out of a binary vision, between an optic of waste-resource (private good) and an optic of waste-garbage (public ill), in favor of an understanding of waste as commons. How to transform a public service into an institution of the common, ordered to use rights and democratically governed?

THE HIDDEN IMPRINT, A SHIFT IN THE GAZE

How can we stem these huge flows of toxic waste for which there are few approved outlets and which are very expensive? We defend the idea that dealing with the issue of waste at the post-consumer stage is a dead end, both analytically and operationally. Trying to solve the equation of a growing mass of residues to be recovered or neutralised in a living environment that is both finite and saturated by human activity, condemns us to impotence, if not schizophrenia.

Can the issue of the mountains of post-consumer waste be resolved without linking it to the mines we dig, the water tables we pump and the forests we clear? Such an exploration reveals the massive issue of 'upstream' waste: during production and from the moment of extraction. From prohibited areas, let us move on to sacrificed areas.

The *Limits to Growth* report sets out a golden rule that for every tonne of waste produced by the consumer, 5 tonnes of waste must be generated during manufacture and 20 tonnes at the site of resource extraction. Yet, since this report was published, global material extraction has increased by 79% (Bednik, 2016). Fifty years later, the mass of what is made by humans even exceeds that made by living beings (Elhacham, 2020).

If we look at the issue of waste only through the lens of household and similar waste, we miss the main part of the deposit: mining, agricultural, industrial or construction waste. Yet we, as citizen-consumers, are by no means strangers to this waste, which we see even less of and

even struggle to imagine. We propose here to explore this 'hidden footprint' (Porcelijn 2018) which is spread throughout the world and the forms of resistance to which - despite the occultation - it gives rise...

Zoom out: metabolic view

Today's linear economic models depend on the continuous production of materials that are extracted, traded and transformed into goods and finally dispersed as waste or emissions. In order to understand that the production of waste downstream is inseparable from the manufacture of new products upstream, we need to change our focus and acquire a 'metabolic' vision. The metabolic approach aims to understand the dynamics of the flows and stocks of matter and energy associated with human activities, from the extraction and production of resources to their inevitable return, sooner or later, to biogeochemical processes.

In fact, a considerable proportion of the materials entering the economy are not recycled, incinerated or landfilled: they accumulate in buildings, infrastructure and consumer goods. Globally, in 2017, 100 Gt of resources (minerals, biomass, fossil fuels) were used (de Wit, Hoogzaad & al. 2020). Of this total:

- 5% was used to make products that will last less than a year, which form the bulk of the household and similar waste pool;
- 44% was accumulated in buildings, infrastructure and goods that will last for more than a year (materials stored in the man-made environment);
- More than 50% of the total corresponds to energy sources (fossil fuels and biomass), minerals and related waste.

In other words, household and similar waste is mainly made up of materials extracted to manufacture products that will last less than a year and which represent just over 6% of the total extraction.

In the same order of magnitude, in the EU, a territory whose activity is nevertheless not fully based on the extraction of raw materials, out of the 2.5 billion tonnes of waste produced in 2014, only 8% corresponds to household waste, while 30% corresponds to extractive industries (mines and quarries) (Eurostat 2015).

A heavier material footprint than expected

In the light of these statistics, we realise that our bin is just the tip of a whole iceberg of resource consumption and waste production. The total amount of natural resources involved in the production of a good is called the material footprint.

However, for all the everyday consumer products, the quantity of materials moved or used upstream is much more important than the mass contained in the final product. For example, if the whole equipment (furniture and household appliances) in a French household weighs an average of 2.5 tonnes, 45 tonnes of raw materials were required to manufacture it (Ademe 2018). More precisely, to manufacture a 79 kg washing machine, 2.1 T of materials were mobilised upstream, i.e. 27 times its weight. To manufacture an 11 kg television, 2.5 tonnes of materials are used upstream, i.e. 227 times the weight of the final object (Ademe 2018).

Similarly, although the visible consumption of a Parisian is 6.5 tonnes per year, in reality his or her ecological and material footprint is much larger due to his or her high consumption of manufactured products. These products represent 31% of the ecological footprint and are mostly manufactured outside the Île-de-France region, leading to the consumption of "hidden" materials. All things considered, the visible and invisible consumption of one Île-de-France resident is around 20 tonnes per year (IAU 2019).

Each of the apparent flows of materials or products, extracted from the territory, imported, stored on the territory or exported, are associated with "hidden" flows of materials. These include

- indirect flows of raw materials used abroad (notably fuels) but which, not being incorporated into the materials or products concerned, do not cross borders
- quantities of materials that are discarded immediately after extraction (mine waste rock, harvest residues) or moved without economic use (excavation of land during mining and construction activities, soil erosion from agriculture).

In short, in a 21st century characterised by an almost total externalisation and linearisation of the metabolism of cities, showing the metabolism of our societies means transgressing the principle of occultation that comes from the globalisation of economic-industrial processes. This principle consists in concealing the striking contrast between the cleanliness and ease of obtaining products in shop windows on the one hand and the violence and toxicity of the extraction-production processes deployed upstream on the other (Heynen, Kaïka & Swyngedouw 2006).

What if everything started at the end?

We argue that it is only by prohibiting the upstream removal of 'virgin' materials that the problem of waste - and of its recovery - can finally be considered seriously. For the heuristic of the metabolic view is that there is an absolutely massive stock of immobilised materials in our built environment, which one could undertake to dismantle with a view to rearranging these elements for new construction. Such a prospect would, however, involve devoting a significant amount of economic activity and manpower to this work. This is a far cry from the current turnover and workforce of the formal and informal waste-related trades.

To some extent, that is the aim of circular economy promoters, sometimes bio-inspired. In a non-human ecosystem, any residue of a process feeds another process or organism. Dead leaves and animal droppings make up humus, nourish the soil. An old collapsed tree trunk harbours even more biodiversity than the tree did when it was alive. Every corpse feeds other beings, other forms of life.

We often hear people say: "in nature, there is no waste". This statement is both true and false: there is a lot of waste but, above all, a lot of recycling! Between earthworms (500 million tonnes of carbon), fungi (150 billion tonnes of carbon), bacteria and heterotrophic archaea (50 to 150 billion tonnes of carbon), it is estimated that between 20 and 30% of the planet's living mass is dedicated to dismantling and recycling waste (Duquennoi 2015). On closer inspection, soils appear to be incredible biochemical factories for molecular dismantling. The quantity of decomposers is considered an excellent indicator of soil health.

To return to human societies, it is not a question of envisaging the recycling of the 'urban mine' as being able to limit the demand for virgin raw materials to a great extent. It is about banning the extraction of virgin materials in order to incomparably stimulate the recycling of the urban mine, of the stock of materials present everywhere around us, in our environments, to the point that we no longer even see them as such.

However, if a circular economy approach leads massively to a commodification and globalisation of waste, we argue that human residues would rather be considered as localized commons.

URBAN WASTE AS COMMONS

Defining waste as having zero use value is not satisfactory. The nature of waste is by no means intrinsic. A specific plastic package may be seen as a useless residue until there is a shortage, at which point it is re-classified and re-valued as a commodity: *"this is why what is waste today will not be waste tomorrow and why what was, common-sensically, waste yesterday is now incorporated as an economic 'sector'"* (O'Brien 1999). Precisely because of this fluctuating status, it is time to stop dealing with SWM issues in terms of the garbage/resource dichotomy, which ultimately implies a public/private good dialectic, and instead start considering urban solid waste holistically as a common good.

Adding conflictuality to Ostrom's approach

Acknowledging the flow-stock structure of the W deposit (cf. Cavé 2020) enables us to understand how urban waste could be managed as Ostromian Common Pool Resources (Ostrom 1990). However, the management of this resource only becomes a "common good" if the different actors work together and negotiate the rules of use.

From this perspective, we distance ourselves from the Ostromian approach to analysing the determinants of collective action. In the work of institutional economics on the collective management of BCR, the summoning of power relations is missing. Everything is described as if the systems of rules emerging within communities were the product of deliberations between equal actors. A more sociological and political science perspective reveals the fragility of this assumption. The history of commons is a history of negotiations between actors for resources allocation, a history of conflicts and forms of conflict resolution; all the more so when it comes to interactions between groups of urban actors with notoriously heterogeneous statuses.

According to D. Harvey, this passage through collective conflict is one of the essential steps in the transition from a public good (such as water or public space) to a common good: « *They first must be re-appropriated by citizens through political action before they constitute commons.* » (Harvey cited by Zapata & Zapata Santos, 2015 :98)

From rubbish to resources: the commodification of waste

With only a quarter of the world's waste being diverted from landfill, the potential for developing waste 'recovery' activities is indeed enormous. Waste is becoming a secondary material - and perhaps the fastest growing resource on a global scale.

In the global South, the notion of public good, which generally justifies the state's monopoly, can often be read as the appropriation of resources for the benefit of certain particular actors - private companies - to the detriment of other less legitimate actors - small private operators, wastepickers, traders, etc. Based on the case of *La Chureca* dumpsite, the article by Zapata and Zapata Campos allows us to highlight the process of creating a public good from a common good. International aid programmes financed the closure of the open-air landfill in order to reopen a walled recycling plant on the same site. Access to the waste dumped there is no longer free. The arguments of public health, securing salaries for these employees and sustainable development were notably put forward. Nevertheless, the structuring of this public service has led to phenomena of exclusion and a destructuring of the previous waste governance: « *The process of transforming La Chureca mirrors the transformation of waste from an open urban commons - accessible to the urban poor - to a public good only legally accessible to the municipality.* » (Zapata & Zapata Campos 2015).

Wastepickers, the new "wood thieves"?

For years, private companies, as well as some public authorities, have sought to oust informal reclaimers on the grounds that they are 'archaic' or 'dishonourable'. As long as wastepickers were collecting bits of rag from dumpsites, their plight did not move anyone. But now that they are organising themselves into cooperatives - as in Brazil - and the value of the materials they shuffle has risen, urban decision-makers are taking offence.

Such a configuration is reminiscent of the case of 'wood theft' by Prussian peasants, as analysed in 1842 by the young Marx. One of the German thinker's earliest social texts concerns the deliberations of the Rhineland Diet on the theft of "forest products" (Lascoumes & Zander, 1984).

Until then, the idea that natural goods could be used for the immediate satisfaction of basic needs prevailed. These were the famous rights of gleaning, passage or grazing that were typical of feudal societies (Varda 2000). But the idea of this legislative report was to sanction the appropriation of wood by the peasants of the region insofar as this gleaning was no longer aimed solely at the immediate consumption of wood, but also at its sale as a commodity to the region's nascent industries.

K. Marx took offence at this plan to tax the gleaning of dead wood as theft, at a time when the peasants were becoming impoverished: "*If it is a question of twigs, nothing is taken away from property. One separates from the property what is already separated from it. The wood thief makes a judgment against property on his own authority. The gatherer of twigs merely executes a judgment, the judgment that the very nature of ownership has made: you only own the tree, but the tree no longer owns the twigs in question*" (Lascoumes & Zander 1984). The abandonment of these dead branches by the tree itself therefore forbids, in the eyes of K. Marx, any talk of theft.

A regime change is underway

This debate takes place in the context of the affirmation of the modern distinction between the private and the public. Applied to property rights, this distinction suddenly calls into question a popular practice, gleaning, which was based on common use rights and not on property rights. Without idealising customary rights, Marx points out that the social elites are working to erode these popular rights, in the absence of any counter-power to limit the expansion of private property. He argues that all customary rights of the poor were based on the fact that a certain type of property had an indecisive character which did not determine whether it was ultimately private or common property (Lascoumes & Zander 1984).

This indecisiveness allows us to draw an analogy between the practices of collecting dead wood in state forests in the 19th century and the recovery of waste in contemporary cities. In the case of rubbish, we have noted that the status of this object is unclear: *res derelicta*, it no longer belongs to anyone. However, in a context of rising prices for virgin raw materials, economic actors have come to fill the 'market gap' by assuming property rights over waste.

In the light of this Marxian analysis, we realise the extent to which the penetration of the waste recovery sector by the private sector is evidence of a shift to a new order. The indeterminacy of waste ownership allowed for a form of marginal redistribution within a linear capitalist economy, based not so much on the abundance of resources as on the exclusion of those entitled to enjoy them. Today, the shift to a circular economy results in the commodification of *res derelicta*. Behind the rhetoric of environmental justification, this race to recycle waste reveals a new type of strategy of accumulation through dispossession. Private appropriation is no longer limited to natural resources, but now extends to their ersatz products.

In the same way that Prussian peasants in the mid-nineteenth century were suddenly accused of being wood thieves because they increasingly collected wood not for consumption but for resale, informal reclaimers, because they are now intertwined with industrial globalisation, are accused of archaism and illegality by infinitely more powerful actors who have never before cared about the mountains of rubbish that devastate our planet.

However, there is something deeply revolting in the idea that waste, a symptom - if there ever was one - of the bankruptcy of the contemporary capitalist system, is today the site of yet another dispossession with a view to extending the logic of accumulation for the benefit of the few.

CONCLUDING REMARKS

In short, through the metabolic approach, we have tried to reveal what our acts of production and consumption most often pass over in silence, that is to say: the toxicity in which the logistical chains in which the most ordinary acts of our lives are embedded are anchored and immersed. Far from the debates on eco-design and responsible consumption, it is in our eyes by taking an interest in the "land of fires" of Campania, the abandoned mines of Salsigne or the villages devastated by the toxic sludge of Minas Gerais, that the political stakes of material and energy flows emerge with immeasurable acuity.

Unsustainable extractivism

Such an observation shifts the focus from the incontinent production of household waste to the issue of extractivism and the unsustainability of the rate of withdrawal of available resources in the 'critical zone' (Latour 2017) that we inhabit. Resource use has more than tripled since 1970, and continues to grow. Over the past five decades, annual global material extraction has tripled from 27 billion tonnes to 92 billion tonnes in 2017, and continues to rise (Elhacham et al. 2019).

The extraction and processing of natural resources is responsible for more than 90% of the world's biodiversity loss and water stress, as well as about half of greenhouse gas emissions. If the 9 billion people who could populate the Earth by 2050 have a consumption equivalent to that of an average US citizen at the end of the 20th century, global steel production will have to increase fivefold, copper production eightfold and aluminium production ninefold. Such material flows are neither possible nor necessary. They are not possible because of the inherent limitations of the world's sources and outlets: all along the process, from source to outlet, the processing, manufacturing, handling and use of materials leaves (generates) pollution. They are not necessary, because the flow of materials in rich countries at the end of the 20th century - whether food, water, wood, energy - is wasteful.

The 'critical zone' that we inhabit is bloodless. We have already stripped the subsoil beyond reasonable limits. By absorbing everything we burn, the atmosphere is becoming unliveable for us mammals. Extraction causes the destruction of ecosystems and the collapse of biodiversity, with ever lower yields. And the (over)dumping of waste threatens to asphyxiate rivers, seas and oceans, as well as to condemn many of the creatures that live there and on which we directly depend.

The heuristic of this approach, not only to go back to the consumption phase (which gives rise to waste prevention policies), but to apprehend the process from its origin (the extraction of raw materials and the manufacture of objects) lies in this conclusion: we will not solve the waste problem through the creation of new channels: we will only give ourselves a realistic chance of solving the waste problem by ceasing to extract upstream.

The smoke screen of circular economy

"Turning waste into resources" is precisely the slogan of the circular economy. This circular economy, which remains based on the institution of private property and individual interest, however, does not solve the problem of waste. Worse, it makes it a global problem. Since the countries of the North no longer have a place to deposit their waste, since all common spaces have been privatised, waste is sent to 'the commons of others', i.e. to the global South: « *Let us repeat a common insight: in a constantly growing economy also waste has to increase, but on a limited planet there is no longer enough space on which to dump it.* » (Mies & Bennholdt-Thomsen 2011).

Through the study of two cases, one in Germany and the other in Papua New Guinea, Maria Mies and Veronika Bennholdt-Thomsen put forward the idea that the emergence of the commons in the North is impossible without the safeguarding of those in the South. They point out, however, that this process of waste reduction will not be a simple matter in the industrialised societies of the North. Communities there have been destroyed through the privatisation of land and property: « *To reinvent the commons within industrialized society,*

fed by an anonymous world-market system, would mean, first and foremost, to re-create communities who would take charge of and feel responsible for concrete ecoregions or areas of life and reality as a basis for their livelihood. We are aware of the difficulty of establishing such communities within atomized industrial society, where the dogma of individual self-interest reigns supreme. » (Mies & Bennholdt-Thomsen 2011).

Such an analysis can, however, be nuanced under the prism of the Anthropocene, at a time when the conditions of habitability of the critical zone appear increasingly precarious. The vertiginous decline of living species and the setting in motion of a new climate regime are reactivating the dynamics of local self-organisation, in particular around the satisfaction of essential needs, i.e. the commons. From this perspective, our call for a massive increase in the number of waste reclaimers is in line with B. Latour's divide between extractors and reclaimers (Latour 2021). And the idea of urban waste as commons may help us re-imagine urban policies beyond the State/market dichotomy that appears today as a structural axis of expropriation dynamics, especially in the global South.

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