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Accumulation by contamination: Worldwide cost-shifting strategies of capital in waste management

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ABSTRACT

With this article, we propose an analytical and conceptual tool to illuminate connections between capital development and environmental injustices. The research examines how capital-driven industrial policies foster changes in social metabolisms and cause new socio-environmental impacts, leading to ecological distribution conflicts. It also explores why diverse actors mobilise and resist these changes. Building on Kapp's ecological economics theory of social costs and David Harvey's concept of accumulation by dispossession, we highlight the role of capital accumulation in environmental injustices through cost-shifting strategies, terming it "Accumulation by Contamination" (AbC). In this context, AbC refers to the process wherein capital socialises the costs of contamination, degrading the means of existence and bodies of human beings who oppose these processes of capital valorisation and engage in environmental conflicts. We make a compelling case for AbC by exploring waste-related conflicts at various industrial developmental stages. Waste, viewed as a 'common bad,' emerges as a strategic realm for capitalists seeking to expand the scale and scope of accumulation. The intricacies of waste management, its market potential, and guaranteed profitability through subsidies and processes of financialisation attract significant investments globally. Quantitative and qualitative waste management assessments demonstrate that waste policies often favour businesses, leading to cost-shifting of waste management to society (in Naples, Italy; and Delhi, in India) and the dispossession of waste-pickers (in Delhi). More broadly, we emphasise the importance of integrating ecological economics and Marxist critical geography to address environmental challenges. We also analytically study the diverse actors responding to various capital strategies, fostering transformative political actions for a sustainable future. Climate change is arguably the most significant waste disposal conflict due to excessive carbon dioxide production, representing a quintessential example of Accumulation by Contamination (AbC).

1. Introduction: Forces that drive ecological distribution conflicts

Political ecologists and ecological economists contend that the most vulnerable groups in ecological distribution conflicts (EDCs hereafter) render the economy less unsustainable (Martinez-Alier, 2021; Martinez-Alier et al., 2016; Scheidel et al., 2018). These conflicts stem from clashes between social metabolic profiles (Scheidel, 2023) that represent the interplay of consumption and production patterns between a specific socioeconomic system and its environment. The rifts between sociometabolic configurations revolve around the materiality (i.e., resources extracted, consumed, and disposed of) and the political economy and social institutions (i.e., norms, rules, and organisations) that

dictate resource appropriation and distribution (Demaria & Schindler, 2016; Demaria, 2023).

These conflicts generally occur between very different sociometabolic systems. An example is the case where an industrial mining company displaces an Indigenous community: the miner's extractivistindustrial profile versus the Indigenous community's subsistence profile. Not surprisingly, indigenous communities vigorously resist alterations to their metabolic patterns and ways of life and, by so doing, oppose disruptive mining initiatives. EDCs are concerned with the distributional aspect of socio-metabolic change by identifying who gains and who loses from the expansion of the extractivist industries (Martinez-Alier, 2021, 2023). Environmental justice scholarship, a foundational tenet of this paper, also encompasses recognition and

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participation in socio-ecological transformations (Schlosberg, 2007). This scholarship stresses the importance of inclusive decision-making for equitable and sustainable conflict resolution, specifically amplifying subalterns' voices (Scheidel et al., 2020). Nonetheless, EDCs scholars have not sufficiently analysed the primary drivers of environmental conflicts (e.g. the expansion of mining driven by the escalating demand for raw materials for profit maximisation), nor have they deeply investigated the formation of alliances originating in such disputes (e.g., indigenous group alignment with environmentalists to oppose mining) (Scheidel et al., 2018, 2020). The existing literature indicates that mobilised actors often derive from marginalised segments of society. For instance, over 40 % of Environmental Justice Atlas (EJAtlas) cases involve indigenous groups or those experiencing discrimination (Scheidel et al., 2020). Scholars studying EDCs often overlook the reasons that spur these actors to mobilise and to form alliances, thus neglecting the forces of global political economy that influence their actions. This research seeks to address this gap.

Our investigation sheds light on two interrelated issues: 1) why social metabolism changes in the way that it does; and 2) why different actors come together and mobilise in environmental justice movements. We analyse how capitalist dynamics shape societal metabolism patterns and conflicts. We strive to understand how different motivations coalesce to oppose profit-driven pursuits and how local struggles become politicised to challenge established orders (Velicu & Kaika, 2017; Swyngedouw, 2011).

We propose an integrated framework for our investigation that meshes ecological economics with critical geography (Fig. 1). Our approach is anchored in Kapp's (1950) ecological economics theory, which emphasises the tendency of enterprises to shift environmental costs. We then connect Kapp's framework with Harvey's (2003) concept of accumulation by dispossession, thereby illuminating contemporary capital strategies. However, Harvey does not thoroughly analyse environmental aspects nor whether they imply different accumulation dynamics from those of dispossession, although he does interpret social movements as responses to the impact of neoliberalism on the working class and vulnerable groups in society. We propose complementing Harvey's perspective with Kapp's notion of cost-shifting to address this gap. This synthesis offers insights into how capital circulates, illuminates the strategies of dispossession, and highlights the significance of costshifting for capital accumulation.

Kapp's model is instructive in this synthesis. It demonstrates that accumulation is fuelled not just by dispossession but also by socialising environmental costs. We term this phenomenon 'Accumulation by Contamination (AbC),' thereby highlighting the resulting environmental injustice. This analytical framework aids in understanding 1) the drivers of industrial metabolic expansion and 2) potential alliances between environmental and social justice advocates in response. On the one hand, the framework is a vital tool for ecological economists to reveal connections between the political economy of capitalist expansion and global environmental injustice. On the other, critical geographers can deepen their analyses of contemporary ecological challenges by examining cost-shifting practices.

To illustrate our framework, we draw on our extensive experience studying waste-related environmental conflicts.¹ Our interest is in the commodification, marketisation, and industrialisation of waste management that incite ecological distribution conflicts globally, resulting in the formation of unexpected alliances (Demaria, 2023; Falcone et al., 2020).

We chose waste as the subject of our investigation for several reasons. Firstly, there is a growing scholarly emphasis on investigating the entire lifecycle from resource extraction to waste disposal. Ecological economics and political ecology, while historically focusing on extraction, urge attention to 'sinks', including waste (Marín-Beltrán et al.,

2022; Ernstson & Swyngedouw, 2023; Armiero, 2021; Martinez Alier et al., 2010). Secondly, waste poses a significant challenge because of the pollutants released into ecosystems, the need for new disposal space, social disruption related to facility localisation, and resource/energy loss. Economic and demographic changes, technological advancements, and socio-environmental conflicts, often stemming from locally undesirable land use, exacerbate these problems (Bullard, 1990; Mohai et al., 2009; Anguelovski, 2015). Thirdly, waste management involves diverse actors and varying levels of industrialisation globally. This emphasises the need to view the issue as a complex social and political process that extends beyond techno-managerial solutions to affect world development more generally (Bisson & Proops, 2002; Winiwarter, 2002; D'Alisa et al., 2010; Demaria, 2023). Fourthly, capital investors regard waste management as a burgeoning global market attracting significant investment and signalling its potential, already a decade ago, as a multibillion dollar industry (e.g., Bank of America Merrill Lynch, 2013). This financialising of waste has increased substantially in recent decades by employing Clean Development Mechanisms (CDMs hereafter), a combination of ecological modernisation projects that foster technomanagerial solutions and global capital interests in waste industries. CDMs, even if they fail in their stated objective, have consistently contributed to consolidating the view that environmental transition to a low-carbon future is possible only if commodification is enforced, capital accumulation is enacted, commons are enclosed, and waste pickers are dispossessed (Ernstson & Swyngedouw, 2023). Fifthly, financialisation via CDMs has contributed to further marginalise the most vulnerable (Martinez & Bowen, 2012). They hide the fact that waste pickers, communities, and cooperatives can be active in a just transition, as cases in Brazil demonstrate (Gutberlet, 2021).

Capitalists themselves perceive waste management as a realm within which to expand the scale and scope of capital accumulation, extending waste-based commodity frontiers (Schindler & Demaria, 2019). The complexity of waste management offers profitable opportunities, making it an appealing market for over-accumulated capital seeking new ventures. Our hypothesis is two-fold: firstly, appropriating a 'common bad', such as waste, is a strategy for expanding the scale and scope of capital accumulation (O'Hare, 2022). Indeed, where possible, businesses tend to avoid the cost of properly managing waste, preferring to shift it to society. Secondly, different socio-environmental actors contest the implementation of industrial-led solutions to waste issues. We argue that, by doing so, they are reacting to both capitalist dispossession and contamination practices.

This paper is structured as follows. In Section 2, we introduce Kapp's theory of social costs and Harvey's accumulation by dispossession theory. We combine these theories into a new concept: accumulation by contamination. In Section 3, we illustrate two waste-related conflicts to demonstrate the analytical potential of the framework. The first case assesses Naples' history of waste mismanagement, exposing citizens' collective struggle against abuse of power and criminal practices. The second case examines waste conflicts in Delhi, India, showcasing the impact of industrialisation on informal recyclers and civil society organisations. In Section 4, we conclude by emphasising the importance of integrating ecological economics with critical geography. We contend that our conceptualisation of practices of accumulation by dispossession and contamination offers an effective framework through which to address environmental challenges and to identify transformative political actors for a fairer, sustainable future.

2. Theoretical framework: Accumulation by dispossession and contamination

2.1. Strategies of accumulation by dispossession

"Accumulate, accumulate! That is Moses and the prophets!" Karl Marx (1957, Capital I, ch. 24, sect. 3).

¹ In this respect, the EJAtlas documents worldwide 300 waste-related EDCs.



Fig. 1. Theoretical framework (authors' elaboration).

The process of capital expansion, involving the separation of the means of production from wage labourers and the appropriation of surplus value on a larger scale, presupposes an extra-economic process. Marx (1957, Capital I, part. VIII, chapter XVI²) refers to this process as primitive accumulation (hereafter PA). PA is "the historical process of divorcing the producer from the means of production", transforming "the social means of subsistence and of production into capital" and "the immediate producers into wage labourers" (1967: 714, cited by Glassman, 2006). The classic example is land enclosure, which displaces farmers and creates a landless proletariat, as land acquisition conflicts still show (Dell'Angelo et al., 2021). PA alters the social relations of production and releases the means of production (e.g., land) and surplus labour for capital accumulation. It involves privatisation and proletarianisation that impact on property relations and human-environment dynamics, termed societal metabolism (Glassman, 2006). Marx's examples of PA include enclosures, colonialism, the slave trade, modern taxation, usury, and national debt creation.

Marxists engage in a long-standing debate about whether PA is a singular historical event or an ongoing process. In the first scenario, PA is seen as a distinct event in the past, establishing the prerequisites for a capitalist mode of production and initiating the accumulation process. In the second scenario, PA is viewed as a continuous process, where the extra-economic acquisition of human and non-human resources becomes a precondition for new cycles of capitalist accumulation. According to this perspective, PA is an inherent and ongoing aspect of capital expansion. De Angelis (2001) asserts that Lenin, Dobb, and Sweezy advocate for the first interpretation, labelling it as 'Historical Primitive Accumulation,' while Luxembourg, Amin, and Wallerstein support the understanding of PA as 'Inherent-continuous Primitive Accumulation.' The Italian political economist De Angelis suggests that both interpretations are present in Marx's analysis. What is crucial in the accumulation process is the *separation* between labourers and their

means of production, as accumulation processes (simple, expanded, and primitive) generate and perpetuate this separation. Based on this premise, and following Gramsci's methodological versus organic distinction used to explain his main theoretical contributions, such as the integral state³ and bourgeoise hegemony, we maintain that the distinctions between accumulation typologies are methodological rather than organic features of capital expansion. Substantially, they are all forms of separation between the (re)producer and the means of (re) production. Therefore, organically, PA encompasses both the creation of this separation and its continuous reproduction, adapting to the diverse challenges of capital expansion (Hall, 2012).

Harvey (2003), a Marxist geographer, introduced the locution 'Accumulation by Dispossession' (AbD) to overcome the ambiguity associated with the term 'primitive accumulation.' He highlighted the continuous and intrinsic nature of appropriating assets and labour to revive capital valorisation, especially during periods of capital overaccumulation. He asserts that what AbD "does is release a set of assets (including labour-power) at very low (and in some instances zero) cost. Overaccumulated capital can seize hold of such assets and immediately turn them to profitable use" (Harvey, 2003: p. 149). Harvey (2005: pp. 160--65) outlines four main forms of AbD: privatisation and commodification of previously non-commodified assets, financialisation of the economy, crisis management and manipulation, and state wealth redistribution from the poor to the rich. Critical geographers have employed Harvey's conceptual framework extensively to describe, for example, various dispossession processes in agribusinesses and mining (Brenner, 2006; Glassman, 2006; Prudham, 2007; Levien, 2012), the epistemic dispossession that waste pickers suffer (Samson, 2015), and the financialisation of the waste sector (Ernstson & Swyngedouw, 2023).

Harvey provides an expansive definition of AbD, according to Brenner (2006). Levien (2012), however, finds it challenging to pinpoint a clear-cut definition of AbD in Harvey's work. Consequently, AbD has been interpreted variously. For Levien, 'the significance of Harvey's reconstruction of [PA] as [AbD] lies, above all, in its attempt to explain the

² Available here https://www.marxists.org/archive/marx/works/1867-c1/ch26.htm.

³ For example, the integral state is the dialectical unity of the political and civil society; they are two substances of the integral state, and their distinction is analytically important to study separately their laws of regularity (Gramsci, 2007; Thomas, 2009). Consequently, "If the State [the political society] is to be understood organically, then it can no longer be described in distinction or in opposition to the civil society" (D'Alisa & Kallis, 2016, p. 232).

contemporary upsurge in political struggles centred on the dispossession of land and various other resources rather than the exploitation of labour' (Levien, 2012: p. 938). Following this interpretation there is a continuous need to valorise new resources to sustain labour exploitation. The primary examples of AbD encompass land grabs (Dell'Angelo et al., 2017), privatisation of collective social assets, biopiracy, and the various predatory strategies of financial capital, including the partial recapture of wage-labourers' income (e.g., by lottery). Glassman (2006) adopts a means-specific definition for AbD (and PA), describing a process of accumulation as AbD when capitalists utilise extra-economic means to drive capital expansion. Prudham (2007: p. 411) uses a similar definition, in that AbD implies the expansion of 'the scale and scope of capital accumulation via so-called "extra-economic" means'. Levien (2012: p. 940) expands this definition, affirming that [AbD] 'is not simply an economic process of over-accumulated capital seizing hold of undercommodified assets, but fundamentally a political process in which states – or other coercion-wielding entities - use extra-economic force to help capitalists overcome barriers to accumulation'.

For the scope of this paper, we adopt the more general interpretation of PA and AbD, illustrating that the concept of 'accumulation by contamination,' which we develop below, complements PA and Harvey's reinterpreted concept. What is significant here is that the PA and AbD conceptual frameworks describe: a) the inherent necessity of the capitalist system to, via extra-economic means, separate labourers from the means of production to reinitiate capitalist social production relations; and b) identify fresh profitable valorisation opportunities for over-accumulated capital. Both analytical tools have proven to be highly valuable in elucidating the driving force behind many social and environmental conflicts, by highlighting the actors resisting the capitalist appropriation of the means of production and the value labourers produce. However, in our experience, unveiling the dynamics of wasterelated conflicts reveals that capital expansion is also facilitated through a different process beyond separation (and dispossession). Notably, capital employs the strategy of avoiding costs and effectively shifting them to other actors or society at large. One such form of costshifting is contamination. In the next section, we elucidate the dynamics of this process of socialising costs.

2.2. Strategies of accumulation by cost-shifting

Kapp (1910–1976) was a prominent institutional economist and a significant figure in ecological economics. Prior to his ground-breaking work, social science scholars constructed theoretical frameworks without directly considering environmental concerns. Kapp, in contrast, applied an institutional perspective to environmental matters early on. His concepts of a) pervasive and systemic 'externalities,' b) fundamental uncertainty, and c) interdependencies of social and ecological systems have since become foundational tenets of ecological economics (Martinez Alier & Schupmann, 1987; Røpke, 2005).

Kapp's work that is most relevant to our discussion is 'The Social Cost of Private Enterprise (1950), later expanded and reissued (1963). This work offers a 'detailed study of how private enterprise under conditions of unregulated competition tends to give rise to social costs which are not accounted for in entrepreneurial outlays but instead are shifted to and borne by third persons and the community as a whole' (Kapp, 1963: XXIX). This idea emerged from his critique of what he termed 'external diseconomies' concerning Marshall's concept of external economies. For Kapp, social costs possess an 'external' and 'non-economic' character; nevertheless, they must have two attributes to be defined as such. Firstly, they must be avoidable, and, secondly, they must be part of productive activities shifted to third parties or the wider community. Hence, water or air pollution resulting from industrial activities constitutes a social cost, but damage from an earthquake does not. Kapp underscored the inadequacies of the market system in addressing these non-economic processes, being primarily concerned with the social costs they engendered. He contended that economic and political actors failed to sufficiently acknowledge these social costs. He advocated for assessing and quantifying these costs yet simultaneously urged caution in their monetisation, warning against excessive emphasis on precision and measurement. From his perspective, policymakers and economists cannot measure social costs and social benefits solely in monetary terms because they are phenomena beyond the market.

Kapp elsewhere confirmed that 'the term "external" refers to the fact that the diseconomies (costs) or economies (savings or benefits) are outside the frame of reference which serves as the foundation of microeconomic cost analysis, namely entrepreneurial costs' (Kapp, 2011: p. 273). Welfare economists, institutional economists, and environmental economists analyse externalities as 'exceptions' that the framework of private enterprise regulation and taxation can address (Pigou, 1920; Turner et al., 1993) or through an appropriate definition of property rights that facilitates individual bargaining between the affected actors (Coase, 1960). Kapp rejected this approach as it implies that social costs are accidental and potential, and that power asymmetry does not affect the final solution. Instead, the socialisation of costs is inherent to running the business. He agreed with neoclassical economists that social costs are a form of non-market interdependency. However, he stressed that 'the output of a firm is not independent of its ability to shift part of its costs to other sectors of the economy or the individual' (Kapp, 1963: XXV). Businesses are strictly dependent on it. Furthermore, Kapp argued that 'uncompensated costs are both pervasive (the rule rather than the exception) and systemic (predictable and widespread rather than incidental)' (Swaney & Evers, 1989: p. 8). Thus, rather than being external to the (market) system, environmental damage (a particular type of social cost) is intrinsic to business activities. Following this approach, the ecological problems are endogenous (costs-shifting), not exogenous (externalities) to markets. The modern business enterprise operates based on shifting costs onto others as standard practice to increase profits, i.e., the more they can shift their costs, the more effective they are in expanding their businesses.

Scholars who use the concept of externalities assume that environmental and social problems are minor aberrations in an otherwise perfectly functioning economic system. For Kapp, on the contrary, they are routine practices that enterprises use to increase profits; internalising the odd externality does nothing to address the structural, systemic problem and fails to recognise the pervasive nature of social costs. According to Kapp, the remediation of social costs remains a political issue. He stated: 'The history of economic and social legislation as well as economic history could well be written as the history of the success or failure to make sure that private interests are not pursued at the cost of collective interests' (Kapp, 1963: p. 45). He, therefore, explicitly recognised the conflictual nature of social cost remediation. In its relationship with power, he argued that the 'political history of the last 150 years can be interpreted as a revolt of large masses of people (including small business) against social costs [...] an integral part of the gradual access to political power by groups formerly excluded from such power' (Kapp, 1963: p.15).

Following Kapp (1963), many ecological economists reject using the term 'externalities' as it is employed in conventional economics and instead propose 'cost-shifting'. Some political ecologists and ecological economists prefer to speak about cost-shifting success when analysing the impact of the growing industrial metabolism and the increasing economic power of businesses (Martinez Alier & O'Connor, 1999; Martinez Alier, 2002; Gerber, 2016). Kapp went even further and noted that social costs, such as water and air pollution, 'do much more than shift some of the costs of production to people living outside of a given area. They create a new physical environment for man' (Kapp, 1963: p. 87). According to Erik Swyngedouw, a prominent contemporary critical geographer, social costs create a new socio-nature and continuously reorder the exploitative capitalist relation (Swyngedouw, 2004). However, the uncritical analysis of environmental harm as "externalities", even when successfully demonstrating that decarbonisation strategies risk enhancing the vulnerabilities of the already most vulnerable (Sovacool et al., 2021), defines everything as dispossession and contributes to

unveiling potential alliances among the plurality of affected communities.

2.3. Accumulation by contamination: the cost-shifting successes of businesses

Political ecologists and ecological economists have argued in favour of an emerging global environmental justice movement (Martínez-Alier, 2020: Martinez-Alier. 2021: Martinez-Alier et al., 2016: Martinez Alier. 2023), which also fights against the unhealthy consequences of toxic activities (Navas et al., 2022). Critical Marxist geographers challenge this narrative because environmental justice scholarship has too often privileged the local scale as their unit of analysis. Further, it falls short on the theoretical generalisation of the claims of such conflicts as well as their political and economic drivers (Swyngedouw & Heyen, 2003). However, as explained above, Kapp long ago clarified that economic change generally occurs for the benefit of some groups and at the expense of others, either existing or future generations (Hornborg, 2009). Furthermore, cost-shifting practices can be an effective way for the capitalist elite to displace the costs of societal metabolic change to others. Thus, on the one hand, the idea that contamination makes others pay for the costs of polluting activities is very much part of an ecological economic epistemology (Berger, 2008). On the other hand, we agree with Marxist geographers who criticise ecological economists for too often overlooking the strategic role of contamination in the processes of capital accumulation. In this regard, Kapp offers a political economy framework to contemporary political ecology and ecological economics (toward what could be called 'political ecological economics') to describe a strategy that capitalist forces use to expand their accumulation cycles and thereby driving many global environmental struggles.

We maintain that effective use of Kapp's framework can reconcile ecological economists and critical geographers for advancing compelling political ecological economics research on the unfair and unsustainable consequences of capital expansion. Building on Kapp's analysis and in synergy with Harvey's reading of extra-economic dynamics of capital expansion, we propose the concept of Accumulation by Contamination⁴ (AbC hereafter).

As previously discussed, cost-shifting implies the systematic ability to displace costs to others; it is pervasive and external to the economic process of producing, selling, and buying. Although costs are immanent to economic activities, they do not appear in business balance sheets. In this sense, they are extra-economic. Thus, social costs create a form of non-market interdependency and dominance. As Kapp (1963) argued, the disruptive forces of capital can expand their capacity to accumulate by shifting the costs of such expansion. Once cost-shifting is interpreted as a successful practice of business entities, it is easy to understand the logic that underpins it, i.e., the strategy of capital Accumulation by Costshifting. There are different types of cost-shifting: one is the bailout of banks, in which policymakers promote socialising the debts of private banks with the extensive use of public money; another emerges from the invisibilisation of the reproductive work that unequally falls upon women.

In the present contribution, we aim to focus on a particular process of cost-shifting, i.e., the process that socialises the costs of contaminations. We maintain that this capital strategy complements PA and AbDs described above. Taking this line, we define AbC as the process by which

capital socialises the cost of contamination. This successful costs-shifting ploy degrades the means of existence and bodies of human (and non-human) beings, which consequently oppose such processes of capital valorisation and trigger EDCs. Examples of AbC are waste dumping, soil pollution because of the pervasive use of pesticides, water pollution from toxic chemicals, air pollution from excessive CO₂ emissions, and the consequent alteration of biogeochemical cycles, most notably climate change.

To synthesise, there are two interrelated circuits of capital accumulation that continuously and organically separate workers from their means of production and existence (See Fig. 2 below). The first is the circuit of expanded reproduction through economic means, i.e., the appropriation of what workers produce, but which capital does not repay as wages; the second is capital accumulation by extra-economic means. The latter refers to the capital appropriation of the circulating value beyond market transactions, the value that capital harnesses via either legal or non-legal means. However, we argue that it can occur via two different processes or strategies, and here is our main theoretical contribution. The firstly is via dispossession, i.e., the ex-novo separation of workers and their means of production for finding new and profitable outlets for capital over-accumulation; and the second is via cost-shifting, or the successful socialisation of costs that minimise the cost of capital functioning and that fuel new cycles of over-accumulation.

3. Accumulation by contamination and dispossession in action: waste practices in Naples (Italy) and Delhi (India)

3.1. Why waste?

This work represents a product of situated political ecology and ecological economics: an interdisciplinary contribution founded on theoretical and empirical understanding drawn from extensive research on waste-related environmental conflicts (Demaria, 2010; D'Alisa et al., 2012; Demaria & D'Alisa, 2013; D'Alisa & Demaria, 2013; D'Alisa & Di Nola, 2013; Armiero & D'Alisa, 2012; D'Alisa & Armiero, 2013; D'Alisa et al., 2014; Demaria & Schindler, 2016; D'Alisa et al., 2017; Schindler & Demaria, 2019; Demaria, 2023). We contribute to scholarly discourse by examining how both illegal and legal waste practices influence, challenge, and politicise environments on a global scale across various contexts. Our approach involves a comparative illustration of two waste management systems at different waste industrialisation stages: one in Naples (Italy), the other in Delhi (India). The relational comparative approach allows us to recognise the difference between the two cities embedded in their histories, geographies, and political dynamics (Ward, 2010), while acquiring original insight into capital accumulation strategies worldwide. D'Alisa has dedicated over a decade to studying waste conflicts in Campania, Italy (D'Alisa et al., 2010; Falcone et al., 2020). Demaria conducted his PhD research on waste conflicts in Delhi, India (Demaria, 2010; Demaria, 2023).

3.2. Global waste generation statistics

The exact figures for global waste production remain elusive, yet it is evident that waste generation is rapidly outpacing global population growth (Kaza et al., 2018). According to the World Bank (Kaza et al., 2018), in 2016, the average global municipal waste generation was approximately 0.74 kg per person per day. However, these rates vary significantly, ranging from 0.11 to 4.54 kg, a proxy of the different contributions between people at different stages of opulence. Waste production is closely linked to income levels and levels of urbanisation. During the same year, 2016, an estimated 2.01 billion tonnes of waste were generated worldwide, with projections indicating an increase to 3.4 billion tonnes by 2050, assuming a business-as-usual scenario. Lower-income countries produce primarily municipal waste of food and organic matter. In contrast, high-income countries generate nearly 50 % of their waste as dry materials, such as plastic, paper, metal, and glass

⁴ We are aware that the words 'pollution' and 'contamination' have slightly different meanings, although they are often use as synonyms and etymologically, they are equivalent (meaning 'to defile'). Following the Oxford dictionary, we prefer 'contamination' as it expresses 'the action or state of making or being made impure by polluting or poisoning', while pollution is defined as 'the presence in or introduction into the environment of a substance which has harmful or poisonous effects'. In brief, we interpret contamination as the act, while pollution is the state.



Fig. 2. The circuits of capital accumulation (authors' elaboration).

(Kaza et al., 2018). As countries experience increased incomes, the proportion of recyclable materials in their waste stream also rises.

Economic growth drives waste increase in stable-population Europe, allowing relative decoupling of economic growth and waste generation (European Environmental Agency⁵). Nonetheless, green policies in European countries often shift environmental damage globally (Fuchs et al., 2020). However, global peak waste is not imminent with rising urban population and economic growth. Around one-third of the 2.01 billion tons of global municipal solid waste is not environmentally disposed of (Kaza et al., 2018). Furthermore, municipal solid waste is a small fraction, possibly less than 10 % of total waste by weight.⁶ Marín-Beltrán et al. (2022) estimate that the world population generates at least 23.5 Gt of solid waste annually, including industrial and municipal waste. Of note is that the toxicity and environmental impact of industrial and hazardous waste overshadow urban waste. Corporations minimise their waste disposal costs, leading to a rise in illegal waste trafficking, a serious environmental crime (Rucevska et al., 2015; Sollund et al., 2016). Such trafficking is a serious environmental crime globally and results in considerable economic gain, according to the UN's former Executive Director of the Office on Drugs and Crime (Costa, 2008). Estimates are rare, although an Italian environmentalist NGO in one of their EcoMafia reports issued more than a decade ago, calculated that, in 2000, this business generated tens of billions of euros in Italy alone (Legambiente, 2013).

3.3. The political ecology of waste and discard studies

Waste is quintessentially an ecological economics issue (Bisson & Proops, 2002). Contrary to mainstream economic belief, waste is not an externality but an inherent production feature of business (Baumgartner, 2002). As Georgescu Roegen stated (1975: p. 357), 'given the entropic nature of the economic process, waste is an output just as unavoidable as the input of natural resources'. The historic evolution of the industrial socio-metabolic production system has pushed the economy away from circularity, leading to increased waste generation (Martinez

Alier, 2021; Haas et al., 2020). This globally growing industrial metabolism, overriding other existing socio-metabolic profiles, causes ecological distribution conflicts, thereby amplifying the visibility of the global justice movement (Martínez-Alier & O'Connor, 1996; Martinez Alier et al., 2016; Temper et al., 2018).

Activists fighting waste dumping in North Carolina most likely first coined the term 'environmental justice' (Martinez-Alier et al., 2014). Therefore, examining waste struggles is crucial to analysing capitalism as a successful system of cost-shifting that generates unfair ecological distribution (Kapp, 1950) and ecological distribution conflicts (Martinez-Alier, 2021). Waste has increasingly become a site of social conflict as powerful actors seek to transfer the cost of waste generation and management to those with less power to resist it. However, subaltern environmentalists (Armiero & Sedrez, 2014) do resist the detrimental consequences of such cost-shifting practices and the slow violence referred to later in this article (Navas et al., 2022).

Waste and its disposal is gaining more attention from public authorities, aligned with the current policy emphasis on implementing a circular economy (Savini, 2018). New regulations (e.g., waste management privatisation) and processing methods (e.g., waste-to-energy incineration) promote the shift from waste-as-externality to the wasteas-resource narrative. Capital forces, moving from a throwaway society to a circular economy, are re-centring the valorisation process on waste. Waste has thus become a new 'commodity frontier' for overaccumulated capital (Moore, 2015; Schindler & Demaria, 2019;). This shift towards waste in the green accumulation regime (Savini, 2018), termed the 'Wasteocene' by political ecologists (Armiero, 2021), is accompanied by a surge in critical scholarship on waste. As an example of this blooming interest in the matter of waste, the reader is referred to the Discard Studies website,⁷ an emerging interdisciplinary network of scholars, activists, and professionals putting waste at the core of their research interests and who offer critical alternative readings of the contemporary discourses and practices of wasting.

We contribute to this burgeoning field by explaining how waste, as a relational process, critically influences new cycles of capital expansion. We now turn to the case studies to illustrate how waste matters for capital accumulation and those reacting to it.

⁵ See the official website, last access June 9th, 2024.

⁶ According to the info-graphic on waste generation in the EU available on the European Parliament website, in 2016, EU countries generated 2.5 billion tons of waste, and only 8.8% was household waste (a proxy for what Kaza et al., 2018 define as municipal solid waste). Last access, October 28th, 2023.

⁷ See https://discardstudies.com/. Last access October 28th 2023.







Fig. 3. Italy, the Campania region and its capital Naples. (authors' elaboration). Source: https://d-maps.com/

3.4. Case study one: Campania's waste struggle (Southern Italy)

In 2008, Naples, the capital of the Campania Region (outlined in Fig. 3 below), gained notoriety across Europe due to widespread waste mismanagement, as highlighted in viral international media images (Armiero & D'Alisa, 2013).

The then Italian Prime Minister, Silvio Berlusconi, was notably concerned about the negative impact of alarming images of waste management on Italy's international reputation. Consequently, he took decisive action, implementing stringent measures to suppress the 'troublemakers'⁸ who had hindered the execution of the region's urban waste plan. This worsened further the long-standing democratic deficiencies in waste management, which have been prevalent in Campania since the State of Emergency was declared in 1994. In 2009, the Prime Minister made a declaration signifying the apparent resolution of the waste crisis by effectively clearing the streets of Naples with the assistance of the national army. A discrete amount of waste also disappeared from the official dataset, possibly buried or burnt illegally with other imported toxic waste (D'Alisa & Armiero, 2013). Despite the clean-up efforts, activists continued to highlight the persisting socioenvironmental and health impacts stemming from mismanaged waste and illegal waste trafficking in the region. Measures aimed at penalising

protests near waste facilities temporarily reduced conflicts between activists and law enforcement officers (D'Alisa et al., 2010). Nevertheless, in 2013 a resurging waste-related social movement saw concerned old and new individuals and communities rallying under the banner 'Stop biocide.' This united platform refocused the struggle around the detrimental health impacts of contamination resulting from wasterelated activities in Campania (Falcone et al., 2020). Most activists perceived themselves as victims of environmental crimes from legal and illegal waste activities. Citizens faced substantial social costs, notably a surge in morbidity and mortality due to the proliferation of legal and illegal waste dumping (D'Alisa et al., 2017).

Determining the full extent of the socialised (economic) costs engendered by businesses and policymakers amid this Campania waste crisis is complex. This problem arises not only because, as Kapp emphasised, social (health) costs cannot always be strictly converted into economic terms (Kapp, 1963). To offer some perspective on magnitude of the problem, it is worth noting that Italian Fiscal Court⁹

⁹ We refer to the Fiscal Court report prepared in 2010: Corte dei Conti, Sezione regionale di controllo per la Campania, Deliberazione n.155/2010, adunanza del 28 settembre. The Fiscal Courts audit the public spending of Italian public authorities.

⁸ This is how the PM, Silvio Berlusconi, literally defined the waste activists in Campania (See Armiero & D'Alisa, 2013).

prosecutors highlighted that, following 15 years under the waste emergency regime in Campania, the waste commissioners¹⁰ had amassed a public debt of two billion euros due to the ineffective management of waste and the persisting 'crisis'. The figure demonstrates the squandering of public funds related to the waste issue. Notably, the Fiscal Court's calculations omit the financial penalties imposed by the European Court of Justice on the Italian government for failing to comply with EU waste regulations, particularly prominent in Campania.¹¹ In this paper, we desire "only" to show the process that makes the accumulation by contamination a successful strategy for waste businesses in Campania and not its exact measure. Thus, as follows, our focus lies on the subsidies national governments granted to the consortium managing urban waste. These subsidies aimed to promote energy production by incinerating a portion of the waste generated in the region. Interestingly, the substantial subsidies led the corporation's manager to unlawfully store Refuse Derived Fuel bales in the Campanian countryside (Fig.4), resulting in soil and air contamination and negatively impacting the health of the surrounding population (D'Alisa et al., 2010).

3.5. Waste-to-energy and the cost-shifting success in Campania

The Italian government encourages renewable energy production by granting subsidies for wind, solar, and hydropower electricity generation well beyond the average market price. These subsidies are often granted through the well-known feed-in tariffs, which even scholars promoting Waste-to-Energy (WtE) facilities consider necessary to recover these technologies' full costs (Siddiqi et al., 2020). The public officers at the "Gestore dei Servizi Energetici (GSE)" (Italian for "Managing Authority of Energy Services")¹² manage this national policy by regulating energy markets and advancing energy efficiency and renewable energy generation. Additionally, the Italian legislature has extended these subsidies to companies producing energy from "assimilated sources", i.e., "energy generated by the transformation of organic and inorganic waste and vegetable products" (Art. 3 Law 10/1991, our translation). Due to this definition, Italian waste incinerators are eligible for economic incentives like those granted to renewable energy producers. Under this law, governments oblige GSE officials to purchase the electricity generated by WtE incinerators at a predetermined rate. This agreement is specified in the contract between the Italian Government and the selected businesses following the tender for waste plan implementation. Activists expressed concern that companies receive financial incentives for polluting the air and producing toxic ashes destined for specific landfills. For details on the health effects of incinerators, refer to Goldberg et al. (1995, 1999), Comba et al. (2003), and Parodi et al. (2004). Simultaneously, the Italian government socialises the cost of these subsidies for contaminating activities by increasing the electricity bills for Italian households by 7 %. This indirect taxation was implemented through the inter-ministerial ordinance CIP6¹³ (the Price Interministerial Committee). CIP6 provides funds to GSE officers to purchase electricity generated by incinerators and supplied to the national energy grid. Nevertheless, in 2003 the European Court of Justice ruled¹⁴ that incineration should be considered waste disposal, not an act of energy recovery.

The latter interpretation conflicts with the classification of renewable energy and violates European law. It overlooks the adverse effects of defining incineration as energy recovery while promoting the crossborder waste movement. This contradicts regulations that recommend treating waste locally. Consequently, the European Court condemned the Italian Government for infringing multiple European environmental regulations. Despite this ruling, the Italian Government continued to defy the mandate, keeping waste management in Campania under a state of emergency that allowed authorities to suspend other legal regimes.

In 1994, amid extensive waste mismanagement in Campania, the Italian Government declared a state of emergency. The Prime Minister authorised a special commissioner to devise a waste management plan and initiated a tender to choose a private corporation to implement the region's urban waste management. Four years later, an Italian-German consortium won the bid, promising to activate the incinerator within a year at minimal cost, a commitment they failed to fulfil (D'Alisa et al., 2010). Despite the European Court of Justice declaring these incentives illegal, before signing the contract in 2002 and thanks to the lobbying of the General Manager of the Association of Italian Banks (ABI), the special commissioner granted the tender winner two more contracts beyond the subsidies key incentives: namely, a mandatory waste supply from Campania municipalities to the incinerator or a set payment to the company,¹⁵ and permission to store Refused Delivered Fuel (RDF) bales in Campania, even before the incinerator was operational.¹⁶ Consequently, the local municipality officers had no incentive to improve recycling rates, resulting in the accumulation of Refused Delivered Fuel (RDF) on agricultural lands, primarily in the northern province of Naples. This rural area gained the infamous title of the 'Land of Fire,' a term associated with systematic illegal incineration and waste dumping since the 1980s. These environmental transgressions, which posed a threat to public health, not only reduced costs for larger legal businesses but, in the absence of incinerators, also saved the Italian-German consortium from the expense of disposing of RDF outside the Campania region. Furthermore, the option to stockpile RDF consistently shifted the financial burden of land remediation due to contamination onto the broader society (D'Alisa et al., 2017; Falcone et al., 2020). Of note is that the accumulated RDF exceeded 5.5 million tons in 2009 (D'Alisa & Armiero, 2013).

Why did the General Manager of the Association of Italian Banks fund the industrial operation to stockpile the RDF in Campania, even while the incinerator remained inoperative? This action was motivated by the fact that, following the condemnation of the European Court of Justice, the only operational incinerator eligible for substantial CIP6 subsidies was in Campania. The state of emergency provided exceptional legal justification for the Italian Government against the European judges' decision. Moreover, the company faced substantial risks of financial loss if the waste was disposed of outside the region, making the investment potentially unprofitable. Official data¹⁷ reveal that from 2009 to 2014, the incinerator-operating companies in Campania received €669,032,255.59 in subsidies, with the right to claim these subsidies until 2017. Totalling eight years, the cumulative incentives

¹⁰ The national government appointed an ad hoc public authority with state of emergency power from 1994 to 2009 to deal with the waste emergency in Campania. We call this special officer here: the waste commissioner.

 $^{^{11}}$ Court of Justice of the European Union Press Release No 86/15: "Italy is ordered to pay a lump sum of $\pounds 20$ million and a penalty of $\pounds 120.000$ per day of delay".

¹² For details about the agency, see: <u>https://www.gse.it/en/company</u>. Last access 2nd November 2023.

 $^{^{13}\,}$ The text of the ordinance CIP6 is available here. Last access 2nd November 2023.

¹⁴ Read the judgment here. Last access 2nd November 2023.

 $^{^{15}}$ With the ordinance N° 2774, the national government included a clause called 'the deliver or pay' condition for the local Government.

¹⁶ On the contrary, with the cabinet order of 1994, the Prime minister issued to send the Refuse Derived Fuel to others disposal facilities while the incinerator was still under construction.

¹⁷ D'Alisa had access to the official data in 2015 thanks to a request of an Italian Parliamentarian to the officers of the "GSE". Data treated as confidential until the end of the state of emergency.



Fig. 4. Aerial photos of a waste storage facility for Refuse Derived Fuel balls in Giugliano (locality: Taverna del Re). Courtesy of Pacilio Raffaele.

Table 1

Total subsidies granted to the Enterprise managing the incinerator located in Acerra. The actual data the GSE officer sent to the authors is in green; in red are the hypotheses that establish the last three years of subsidies at the level of 2013. (Authors' elaboration based on data from GSE).

	Energy Transferred to GSE Grid	CIP 6/92 subsidy	Total subsidy recognised for the Incinerator
Year	KWh	€/KWh	Euro
2009	183.320.966	0,0966	17.708.805,32
2010	450.812.067	0,2153	97.059.838,03
2011	548.996.829	0,2297	126.104.571,62
2012	552.527.395	0,2486	137.358.310,40
2013	591.300.449	0,2482	146.760.771,44
2014	597.180.592	0,2412	144.039.958,79
Sub-Total			669.032.255,59
2015	590.000.000	0,2400	141.600.000,00
2016	590.000.000	0,2400	141.600.000,00
2017	590.000.000	0,2400	141.600.000,00
Total			1.093.832.255,59

amassed around €1.1 billion¹⁸ (Table 1).

3.6. Case study two: Delhi's waste struggle (India)

Delhi (see Fig. 5 below) has spearheaded the transformation of solid waste management in southern cities in India since the early 2000s, notably through privatising collection and embracing waste incineration (Schindler et al., 2012; Demaria, 2023).

Delhi's waste management system unified the production network, blending formal and informal value chains, as illustrated in Fig. 6 below. Waste is deposited at small transfer stations (measuring approximately 15 square meters) before municipal authorities manage its collection and disposal, mirroring approaches in industrialised nations. This formal chain has shifted increasingly toward privatisation and incineration in the past two decades, as highlighted in the Fig.

Delhi's formal waste management, under pressure for some time, has relied heavily on an extensive informal recycling sector (Chaturvedi & Gidwani, 2011: p. 131). Before privatisation, approximately 150,000 to 200,000 waste pickers bridged the formal and informal sectors. These informal recyclers, identified at leakage points in Fig. 6, collect, sort, and sell recyclables to small dealers who then supply wholesalers (Gill, 2010; Agarwal et al., 2005; Hayami et al., 2006; Gidwani & Reddy, 2011). By 2005, waste pickers recycled approximately 15 % of Delhi's waste (Talyan, 2008). Even though waste picking has served as a last-resort livelihood for many, privatisation has increasingly marginalised waste pickers, intensified by competition for high-calorific value fractions essential for incineration viability.

Before the policy shift, Delhi's urban authorities struggled with waste management, leading to significant waste overflow. Up to 30 % of waste remained uncollected, often resulting in illegal dumping or openair burning (Talyan, 2008). In 2012, former Chief Minister Sheila Dikshit criticised the inefficiency and corruption of the Municipal Corporation of Delhi.¹⁹ Framed as a managerial failure, the crisis prompted privatisation and the adoption of incineration, because establishing new landfills in densely populated Delhi was challenging. Alternatives, such as transporting waste to neighbouring states, were impractical due to high cost and local opposition. Incineration, offering up to 90 % volume reduction and energy generation, emerged as a solution, although concerns about emission toxicity continue.

Delhi's waste management has changed significantly since the early 2000s, altering material flows, management entities, and processing methods (Demaria & Schindler, 2016; Demaria, 2023). This shift began in the early 1990s, driven by economic growth. Waste composition

 $^{^{18}}$ The consortium received an average of €145,000,000 in 2013 and 2014; if we infer that it had received the same amount for the remaining three years, it would add up other €435 M.

¹⁹ 'MCD trifurcation will benefit Delhi'. March 5th, 2012. *The Hindu*. Available here: (Accessed on 31/11/2023).







Fig. 5. India, its capital Delhi, and its district. (authors' elaboration). Source: https://d-maps.com/

evolved, with recycling rates increasing from 8.3 % in the mid-1980s to 17.2 % by 2002 (Talyan, 2008). Economic expansion led to decreased organic waste and a rise in recyclables, with waste generation tripling from 1990 to 2010 (Ghosh, 2000; CPCB, 2006). These developments have dramatically transformed Delhi's waste landscape.

3.7. Waste-to-energy, dispossession and cost-shifting success in Delhi

The reorganisation of solid waste management in Delhi has ignited significant socio-environmental conflicts between established informal and formal waste collection systems. The move towards industrialised waste management, for instance, endangers the livelihoods of waste pickers. Further, mass burn technologies incinerate high-calorific value materials, such as paper and plastic, and directly compete with waste pickers who sort through these items. Waste pickers have garnered support from middle-class residents in their fight against this top-down industrialisation. Since 2011, those living near Delhi's WtE incinerators have actively opposed the plants, calling for their closure. The past decade has seen continuous protests involving waste pickers, residents, and environmentalists.

The Okhla WtE plant, operational since 2012, processes about 2000 tons of waste daily, generating around 20 MW of power. However, concerns over air quality deterioration arose even before its inception, especially among middle-class residents near the proposed site. For them, the issue is tangible: particulate matter permeates their living spaces, clothing, and even bodies. As the plant began operation, it blanketed nearby neighbourhoods in ash, exacerbating concerns. The Okhla Anti-Incinerator Committee, formed by residents, launched multiple legal actions, including a human rights violation case with the National Human Rights Commission. A study in 2013 by the Central Pollution Control Board (CPCB) revealed that the plant's emissions, including dioxins, exceeded safe limits 30–40 times, posing severe health risks. In 2016, the National Green Tribunal fined the plant 2.5 million rupees (about \$US30,000) for environmental contamination, yet it remains operational.

Waste-pickers and middle-class residents formed an unusual



Fig. 6. Flow diagram of waste management in Delhi and the three stages of policy shift (authors' elaboration).

alliance, bridging class and caste divides. The General Secretary of AIKMM, a prominent waste-pickers union, explicitly refers to both dispossession and contamination when expressing that: "Local residents are concerned about the potential injurious consequences to the health of their families due to the plant's toxic emissions (i.e., carcinogenic dioxins and furans). Instead, waste-pickers are concerned about the loss of their livelihood, fearing that recyclable materials will be burnt in the incinerator."

Notwithstanding their differences, residents, waste-pickers, and environmentalists have united against waste privatisation and incineration, championing decentralised, zero-waste alternatives. However, the conflict for waste-pickers centres on access to waste. As property rights shift, waste pickers lose access to their livelihoods, impacting on recycling rates. Meanwhile, residents and environmentalists oppose the health risks of incineration and contamination costs. This scenario illustrates how capital accumulation has dispossessed waste pickers and exposed residents to contamination (see Fig. 6).

Earlier attempts to implement incineration in India and the Global South failed, presenting ongoing material and economic challenges. The low calorific value of waste necessitates additional fuels, such as diesel for combustion, due to its organic content and removal of recyclables by waste pickers. Authorities often overlook this, while private companies confront waste pickers, sometimes violently, to exclude them from the value chain. Dispossession, in this context, occurs through extraeconomic means, forcing waste-pickers out.

Economically, the high capital, operational, and maintenance costs pose significant challenges. Capital accumulation in Delhi, akin to Naples, benefits from substantial subsidies for incineration from national and international bodies. In 2011, AIKMM protested outside the United Nations office in Delhi against including Okhla and Ghazipur plants in the carbon credit scheme under the Clean Development Mechanism. The rationale is supposed superiority of incineration in reducing greenhouse gases compared to methane-emitting landfills. However, this ignores the significant carbon reduction by informal recycling, which is unaccounted for due to a lack of approved methodologies, illustrating the incineration lobby's influence in defining what constitutes carbon emission reduction.

Carbon credits, ironically provided for 'green projects' by an international initiative, are just one of several subsidies fuelling incineration in India. The Ministry of New and Renewable Energy offers an interest subsidy, reducing interest rates to 7.5 % for borrowed capital. Urban local bodies contribute by providing waste free of charge at the incinerator site and leasing land at a nominal rent for 30 years. Additional incentives include support for techno-feasibility reports, project promotion, and concessional duties on imported technology parts. These subsidies, covering around 40 % of project costs, are crucial for the financial viability and subsequent capital accumulation in WtE projects. A Delhi-based expert from the Center for Science and Environment pointed out the dependence on these subsidies, stating that, without them, electricity from WtE plants would be unaffordable. For context, electricity from coal and solar plants costs about three to four rupees per kWh, compared to seven rupees from the Okhla plant. Distribution companies often avoid this costly electricity, leaving public authorities to purchase it, representing another form of indirect subsidy.

The exact amount of subsidy for specific incinerators is hard to determine due to a lack of transparency. However, their impact is significant. The *Economic Times* reported that since Okhla's establishment

in 2012, over 90 plants have been established in India with a total capacity of about 250 MW (Koundal, 2019). These subsidies have been key to making WtE a profitable venture. The 2015 "Value of Waste" report of the Associated Chambers of Commerce and Industry's valued the sector at \$US1.5 billion, projected to reach \$US11.7 billion by 2052. With an estimated potential of 5,600 MW from waste, India could meet Delhi's entire power demand. Unfortunately, this projection fails to consider the critical aspects of recycling and contamination that are intricately connected to the profit-making processes of private companies that are yet absent from their balance sheets.

4. Discussion: the complementary strategy of accumulation by contamination and dispossession

Increasing waste generation is driving global industrialisation in waste management. The impact of this waste sector development and its management models are visible across diverse regions worldwide, as the composition and volume of urban waste are not only rising but also becoming qualitatively diverse. Consequently, incineration has become a crucial component of waste management facilities in the prevailing political economy policies. Various social power dynamics and economic incentives influence the decision-making process regarding the location and technology of incinerators. These decisions determine who will be primarily affected by the incinerators' implementation and who will bear the cost and consequences of their polluting activities. This world development in the waste sector drives waste-related environmental conflicts across geographies. Thus, we maintain that as waste generation serves as a proxy for economic growth, it emerges as a catalyst in the capital accumulation process, and it is crucial to understanding the composition and diversification of capital accumulation strategies.

In support of our argument, we have presented two environmental conflict scenarios related to waste management: one in Campania (Southern Italy) and the other in Delhi (India) to highlight the diversity of capital strategies associated with this type of ecological distribution conflict. Specifically, we have highlighted the cost-shifting practices of capital to unfurl its accumulation dynamics further.

We began with the Campania case to illustrate how substantial incineration subsidies, totalling €1.1 billion between 2009 and 2017, have ensured significant capital revenues and incentivised malpractice in waste management. The consortium that secured the tender received notably low scores for technical proficiency and the technological value of its facilities (D'Alisa et al., 2010). Nonetheless, subsidies were granted to them, even though no concerted effort to minimise the health impact of incineration pollutants was undertaken.²⁰ Involved companies were also permitted to locate Refused Derived Fuel bales on agricultural land, contributing to soil contamination for nearly two decades. While these choices reduced business costs, they shifted the environmental and so-cial burdens of these polluting activities onto the citizens of Campania. Numerous epidemiological studies have demonstrated increased morbidity and chronic diseases among residents in the northern

province of Naples (Capocaccia et al., 2012; Fazzo et al., 2008), where these waste facilities were located. Furthermore, the prevailing extraeconomic strategy of accumulation by contamination elucidates why the key actors animating the waste-related conflict in Campania are primarily individuals and communities whose health has been directly or indirectly affected by waste mismanagement and traffic (Falcone et al., 2020).

Secondly, we introduced the Delhi case to illustrate how the waste development industry in India enables capital to employ both extraeconomic accumulation strategies, namely, accumulation by dispossession and accumulation by contamination. In Delhi, capital expands through Accumulation by Dispossession (AbD), facilitated by legislation (Solid Waste Management Rules 2000 and 2016) and the waste plan that industrialises waste management in the Indian city, rendering traditional waste pickers' practices illegal. AbD disrupts long-standing commons-based waste management practices and the selective methods employed by waste pickers in the city, separating them from their means of production. Additionally, capital in the Delhi waste sector utilises Accumulation by Contamination (AbC). Indeed, capital accumulation expands indirectly by shifting the costs of pollution and health damage to the population affected by the toxins produced during waste incineration while, at the same time, receiving subsidies in the form of carbon credits through the Clean Development Mechanism.

The explanatory power of these complementary conceptual tools, i. e., AbD and AbC, emerges not only to analyse the capital expansion in the waste sector but also to explain the improbable alliances between actors belonging to middle and high castes in India and the Untouchables, to which waste pickers mainly belong. The former group reacts against the AbC strategy of capital, while the latter reacts mainly against the AbD strategy (Demaria, 2023). In a recent study, Navas et al. (2022) demonstrated how health-related environmental conflicts can unite workers and environmentalists in a collective struggle against polluting activities that harm both the environment and people. While AbD effectively describes the reaction of Delhi waste pickers to the industrialisation of waste, it needs to complement the AbC conceptual framework to elucidate how waste pickers formed alliances with different classes (both economic and caste-based) of neighbours and environmentalists to resist incineration. Waste pickers protest the dispossession of their means of production and livelihood, such as access to waste crucial for their income, which capital seizes through extraeconomic means.

The industrialisation of waste management and its transfer to corporations results in the outlawing of hundreds of thousands of waste pickers, depriving them of their livelihood through their dependence on access to the city's recycled waste. WtE technologies, for example, are increasingly presented as fundamental for green economic transition (Siddiqi et al., 2020). Still, very often, they dispossess waste pickers, particularly women who, because of their work, can experience dignity and a meaningful life despite adverse circumstances (Wittmer, 2021). This phenomenon is expanding in megacities of the Global South, including Delhi, Cairo, and Bogotá (Schindler et al., 2012; Demaria et al., forthcoming). The EJAtlas reports over 70 conflicts, showing how new global policies sideline southern waste pickers.²¹ Additionally, waste pickers oppose cost-shifting, voicing concerns about health risks incurred during waste sorting when residents fail to segregate waste at the source. They also demand compensation for their unpaid management and environmental services. Middle class residents join this opposition to WtE due to perceived deleterious effects to air quality and associated health risks, forming alliances with waste pickers against the incinerator.

One might argue that citizens are being dispossessed of clean air and, consequently, their health. However, interpreting this as separation

 $^{^{20}}$ The consortium that won the tender in 2001 was compelled by various tribunals to enhance the environmental performance of the incineration through technical adjustments between 2006 and 2009. In 2009, they were obligated to transfer ownership of the incineration to the Campania Region but received a compensation payment of \pounds 355 million from the Italian Department of Civil Protection. Consequently, the subsidies were redirected to different legal entities managing the incineration after 2009, specifically: the Waste Commissioner Agency from November to December 2009, the Italian Department of Civil Protection from January 2010 to June 2012, the corporation Parthenope Ambiente from July 2010 to November 2013, and the corporation sourced from the "Note on the CIP6 convention for the Acerra Incineration," obtained by D'Alisa through a parliamentary inquiry on the operations of the Acerra incineration.

 $^{^{21}}$ For an analysis see this article in The Conversation: Accessed 28th November 2023.

extends too far from Harvey's definition of AbD and Marx's PA and implies a loss of explanatory conceptual power. Therefore, analytically, we find it more useful to distinguish between the two dynamics. They share the use of extra-economic means; however, with dispossession, capital encloses and appropriates resources to expand accumulation, whereas, with contamination, capital expands by shifting the costs to society at large. In our example, clean air is not appropriated by capital for production. Instead, it is merely contaminated to save costs on better technologies or alternative waste management techniques that are more expensive, do not receive subsidies, and are therefore less profitable, such as separation at source, recycling, and composting efficiently undertaken by waste pickers (Demaria, 2023).

AbC serves as an analytical complement to AbD by delineating a distinct strategy employed by capital for continual expansion. Hence, global capital growth is not solely driven by dispossession but also by the gradual and insidious impact of contamination, known as "slow violence." This concept refers to the process from initiating polluted activities to manifesting toxicity in ecosystems and human bodies (Nixon, 2011). Through AbC, capital effectively externalises the costs associated with its activities onto society. Moreover, AbC synergises with AbD by offering the capability to identify and precisely distinguish the actors engaged in environmental conflicts responding to processes of cost-shifting. In summary, AbC is a theoretical contribution that elucidates a distinct extra-economic strategy that capital employs to achieve effective cost-shifting. This analytical framework is crucial in revealing diverse actors who resist capital expansion and identifying potential alliances among diverse groups. Climate finance depoliticises the process of decarbonisation, promoting techno-managerial solutions (Ernstson & Swyngedouw, 2023). However, the complementary lens of AbD and AbC can help critical scholars analyse potential repoliticisation, which is likely to emerge as alliances to struggle against capital expansion.

5. Conclusion: capital's strategies of dispossession and contamination and the alliances emerging in response to them

It is important to highlight Kapp's acknowledgement of the contentious nature of addressing social cost and its connection to power dynamics. In his words, "the political history of the last 150 years can be interpreted as a revolt of large masses of people (including small business) against social costs [...] an integral part of the gradual access to political power by groups formerly excluded from such power." However, he also underscores the potential for distortion and abuse, stating that, "pressure groups and vested interests have been able to distort and abuse the legitimate struggles for a more equal distribution of social costs, to the detriment of society" (Kapp, 1978 [1963]: pp. 15-16). In this context, a countermovement emerges. Kapp noted, "the emergence of an 'anti-capitalist' mentality and an intense quest for greater security by large masses of people who have to bear the brunt of the social losses of rapid change" (Kapp, 1978 [1963]: pp. 18). Our work builds on Kapp's insights and complements Harvey's conceptual tool of Accumulation by Dispossession, emphasising the significance of what we term Accumulation by Contamination as part of a broader strategy that can be defined as Accumulation by Cost-Shifting.

Our contribution to the scholarship on ecological distribution conflicts and Marxist critical geography is clear. Through the examination of two illustrative waste management cases in Campania (Italy) and Delhi (India) we have demonstrated that over-accumulated capital seeks new profitable opportunities (referred to as capital valorisation) through two distinct extra-economic processes: Accumulation by Dispossession (AbD) and Accumulation by Contamination (AbC). While capital seizes assets and extracts value in the former, in the latter, it externalises costs onto society. In both cases, capital effectively expands. The focus on capital accumulation through extra-economic means helps elucidate the connection between capital accumulation and the socio-metabolic transformations that clash with the existing socio-metabolic profile. The circuits of capital accumulation are intricately linked with sociometabolic reconfigurations, fostering social and environmental degradation conditions that eventually lead to conflict to highlight injustice and seek reversal. Capital accumulates by expanding industrial social metabolism and capitalist markets through two primary strategies: dispossession and contamination.

However, diverse actors emerge from these conflicts in reaction to capital expansions. Campania is a paradigmatic case of a capital costshifting strategy, triggering reactions from affected individuals and communities. In Delhi, both strategies are observable, leading to an unexpected cross-class/caste alliance between citizens and informal waste workers. These alliances, resisting capital accumulation in the waste sector and seeking alternatives, transcend local and national boundaries, finding expression in global initiatives such as the interconnected GAIA (Global Alliance for Incinerator Alternatives), the Global Alliance of Waste Pickers, and the Zero Waste Initiative.

As generally occurs, theory follows reality, attempting to capture its complexity broadly. However, a theory that unveils the plurality of actors and better understands the dynamics of environmental conflicts arising from necessary socio-ecological transformations should not be merely a scholarly whim. This theory holds broader implications beyond the examined case studies. Climate change is arguably the most significant waste disposal conflict due to excessive carbon dioxide production, representing a quintessential example of Accumulation by Contamination (AbC). This perspective extends to various ecological distribution conflicts, if not to the majority. Conflicts arising from natural resource extraction often stem from local and global contamination. Landgrabbing conflicts, on the other hand, are primarily related to Accumulation by Dispossession (AbD). Some conflicts involve both aspects, such as the effect on irrigation for agricultural fields of a factory extracting water from a river and subsequently discharging contaminated water back into the river. Further research into these two often mingled capital strategies could contribute to a comprehensive theory of EDCs, addressing "the question of why, through whom, how, and when conflicts over the use of the environment may play an active role in shaping transitions toward sustainability" (Scheidel et al., 2018: p. 585). Such research would illuminate the intricate relations between materiality and political economy.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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