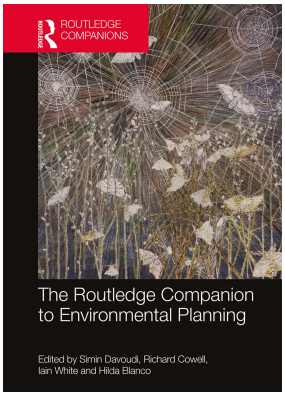

The Routledge Companion to Environmental Planning

Simin Davoudi, Richard Cowell, Iain White, Hilda Blanco

Waste and management of environmental resources

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Waste and management of environmental resources

Nick Hacking

Introduction: shifting from linearity to circularity

Wastes and resources governance is an evolving interdisciplinary domain long dominated by practice. Academic researchers from a variety of disciplines have contributed to emergent dialogue and debates about the key principles of sustainable waste management, in particular with the concepts of 'industrial ecology' (IE) and 'circular economy' (CE).

Wastes, like so many socio-economic materials, have become increasingly global in their flows over the last century (Schaffartzik et al., 2014; Krausmann et al., 2017a). Resource flows are currently reaching levels of production that are altering the planet's biogeochemical cycles and adding support to the concept that the planet is entering the Anthropocene era (Krausmann et al., 2017b). The global rise in waste production (see Figure 23.1) comes with a set of shifting normative narratives about reducing, recycling and reusing wastes and thinking of them more as *resources*. Actors in the wastes and resources sectors of both the developed and developing worlds are encouraged by institutions to abandon 'linearity' and make a 'sustainability transition' towards increased 'circularity' where less resources are buried or burned (and less energy is wasted) through improved product design, increased recycling and reuse. The idea is for improved waste governance to be driven by a mix of legislation and/or market incentives.

The latest conceptual thinking about such circular waste and resource principles suggests the CE is, however: 'still in [its] infancy and the literature is only emerging' (Korhonen et al., 2018, p. 545). At a time when the momentum for achieving sustainable development goals is perceived to have flagged amongst some public and private stakeholders, this chapter suggests that the ways that particular actors opt to 'buy-in' (or not) to particular knowledge frameworks will inevitably shape how moves towards CE unfold over time. In that context, some existing policy approaches to waste and resources are reviewed. These aims permit an assessment of the evolving nature of waste and resources governance which is closely linked to the delivery of waste and resources infrastructure via national planning systems.

The next section outlines definitions linked to various disciplinary literatures.

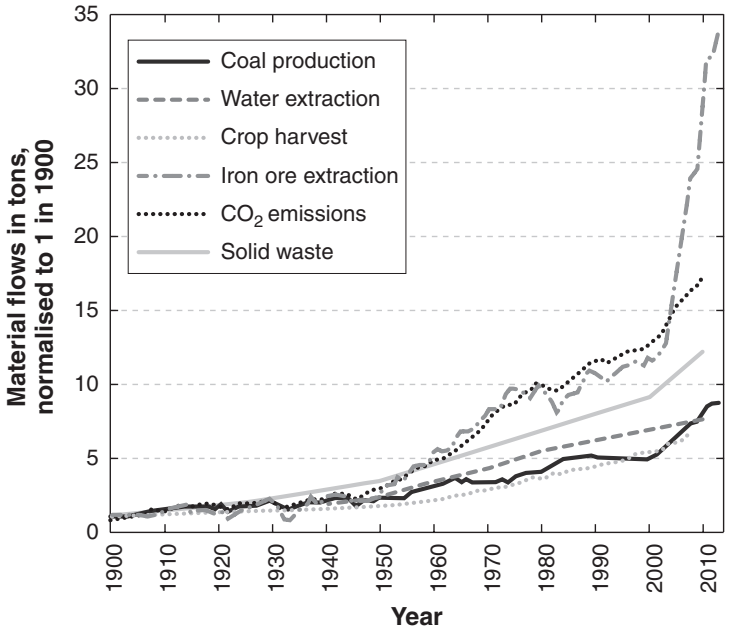

Figure 23.1 The rise of certain global material flows, 1900–2010
Source: adapted from Krausmann et al. (2017b, p. 648)

Definitions

Key to a normative shift from a linear to a circular system of waste and resources (at a range of levels) is the operationalisation of recasting wastes as reusable resources. Definitions are therefore critical, but 'waste' is hard to define (Wynne, 1987). Its materiality is contained through socially-constructed disposal practices from households through to recycling and disposal (Hird, 2012). This materiality is: 'a long ways from stuff that "just is" . . . rather it *becomes*" (Gregson and Crang, 2010, p. 1028, emphasis added) and is ideologically, symbolically and culturally contained via institutions involved in legislation, surveillance, public education, health discourse and nation-building rhetoric (Hird, 2012). By contrast, 'resources' refer to inputs immediately before 'materials'. Where materials from a waste stream are equivalent in quality to virgin materials then that waste stream is a resource. Depending on the nature of the processes associated with them, some waste items are thus either materials or resources (Nakamura et al., 2007). Such definitions are also disputed given that they cover numerous waste and resources processes in a CE (Kirchherr et al., 2017). The most prominent CE definition comes from the Ellen MacArthur Foundation (EMF), a non-governmental organisation promoting CE activity amongst industry. The CE should be:

> [A]n industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models.
>
> *(EMF, 2012, p. 7)*

In sum, materials and wastes are meant to undergo continual shifts in classification, or *becoming*, as they move through an idealised CE instead of reaching a point of 'end of use'. Yet, the materiality of wastes and resources produces a range of associated practices that further make defining and thinking about transition pathways towards CE contested and unclear (cf. Hird, 2012; Kirchherr et al., 2017). This means that waste and resources actors – including industry – are choosing to interpret CE activity in different ways as explored further in the 'Goals-based policy narratives' section.

Conceptual overview

In the 1960s and 1970s, 'industrial ecology' emerged as a response to reappraisals by natural scientists of the Earth as a *closed* chemical and biological system (apart from the input of solar irradiance) with a finite supply of resources (for example, Boulding, 1966; Meadows et al., 1972). Previously, the dominant, linear, end-of-pipe approaches to pollution control depended solely upon technical fixes. Natural resources, including water, energy, biomass, metals, and minerals, were treated separately along with waste disposal to the air, water, and soil (Weisz et al., 2015). Industrial ecology was radically different. Actors now needed to search for material value in relatively loosely governed, closed-loop biogeochemical systems and to operate at a range of scales from the local to the global.

With its biological metaphors – for example, 'positive feedback', 'homeostasis' and 'material flows' – the idea of an industrial ecology was structural, i.e. positivist in nature and advocated by practitioners and researchers: for example, economists, engineers, natural scientists and toxicologists chiefly in Japan, Germany and the United States (for example, Federal Waste Disposal Act, 1972; Stahel and Reday, 1976; Nishimura, 1977; Watanabe, 1994). Proponents built structural-functionalist systems models in which actors were assumed to have perfect knowledge and make rational decisions. Conceptions of agency and structure try to reveal the system's deeper structures and functions (cf. Nishimura, 1977). Other assumptions included the system's default orientation seeking equilibrium and sustainable system change only occurring incrementally and as a result of external, or *exogenous*, shocks to the system (cf. Geels, 2010).

Post-structural (i.e. post-positivist) shifts in the social sciences taking place from the 1960s onwards helped with critiques of the assumptions of structural-functionalism. In response, structural-functionalists updated their thinking. Actors, for example, acquired bounded rationality, i.e. they 'satisficed' rather than optimised (cf. Habermas, 1981). On this basis, a communicative approach, termed 'collaborative planning' (Healey, 1992), was developed and adopted by the UK's Labour government in 1999, for example. Collaborative planning has nevertheless been challenged for a lack of context dependency and unrealistic suppression of power and conflict (cf. Flyvbjerg, 1998).

By contrast to prior systems thinking, post-structural default model orientations are unstable (i.e. they remain in flux) and sustainable change can occur disruptively as a result of internal, i.e. *endogenous*, shocks to the system (cf. Geels, 2010). Emerging post-structural discourses then began stressing the utility of risk, trust, legitimacy, reflexivity, power and conflict, for example, via social constructions of knowledge and relational actor networks.

With this conceptual overview in mind, the following sub-sections briefly critically review three narratives promoting sustainable change in wastes and resources management in terms of their goals.

Goals-based policy narratives

The ways that waste and resources actors are hoped to move towards a CE, at a range of levels, will unfold over time depending upon the ways that particular actors advocate different

frameworks of policy and practice. The academic and grey literature on wastes and resources governance can be broadly classified into three narratives, described below, which are linked to goals-based policies for sustainable change (cf. Cowell et al., 2017).

Ecologically-based goals

Ecologically-based goals are resource efficient. They progressively diminish the impact on the environment of development and growth via reductions in resource consumption (for example, energy, materials and water). Policies include reducing the use of land, water and air as waste sinks, designing out waste and handing future generations a robust stock of 'environmental capital' as well as reducing the disposal of waste to landfill. Ecologically-based goal-setting in the CE context typically focuses on physical fluxes of materials and energy, not money. Such goals are supported by an ecocentric worldview, for example, deep ecology (Naess, 1973) and a strong commitment to the precautionary principle (Stewart, 2002), i.e. a low tolerance for environmental risks.

Naess (1973) suggests that researchers using a deep ecology agenda should, when thinking about complex living systems, be pursuing a relational understanding of how actors can fight against pollution and resource depletion. Naess feels there is a need to adopt an 'anti-class posture' (Naess, 1973, p. 94), i.e. when assessing group conflicts, researchers should be able to recognise and unpick asymmetries of power between actors in networks. This approach to power relations is also necessary when analysing the relations between developing and developed nations which can be exploitative both in terms of waste dumping and materials extraction, recycling and re-use. In the context of power relations, a researcher using a deep ecology approach should show concern for any group's plans for the future which are not consistent with 'wide and widening classless diversity' (Naess, 1973, p. 97). Making systemic changes to fight pollution and reduce resource depletion, Naess (1973) argues involves increased decentralisation and local autonomy because energy consumption can be reduced at these levels. These points will be examined in more detail in the next section.

One influential risk heuristic, the social amplification of risk (SARF) model (Kasperson et al., 1988), suggests that certain elements of hazard events and the ways they are portrayed in the media (and elsewhere) relate to psychological, social, institutional and cultural processes in ways that perceptions of risk can increase or decrease and so shape behaviour. The utility of such an approach is to help provide improved policies better tailored to effective risk communication (Pidgeon and Henwood, 2010). SARF studies suggest that where individual actors fear for their health and wellbeing by the imposition of a new piece of infrastructure, such as nuclear power plants and waste incineration facilities, they are experiencing a form of 'dread risk' where little or no public engagement appears possible (Lima, 2004; Pidgeon and Henwood, 2010; Parkhill et al., 2010). Murdock et al. (2003, p. 157) critique the SARF model suggesting it: 'cannot offer a satisfactory account of risk communication and responses in contemporary democracies' due to a 'one-dimensional' view of how the media operates and a simplistic assessment of lay knowledge. More recently, Renn has updated SARF approaches and suggests that:

> [M]ost of the worries [that community members have about risky activities] are not related to blatant errors or poor judgement, but to divergent views about the tolerability of remaining uncertainty, short-term versus long-term impacts, the trustworthiness of risk regulating or risk managing agencies, and the experience of inequity or injustice with regard to the distribution of benefits and risks. They cannot be downplayed as irrational fears.
>
> *(Renn, 2017, p. 3)*

Analysing the nature of environmental risks and uncertainties of wastes and resource governance inevitably leads to thinking about the precautionary principle, a useful framework developed in parallel with the discourse on risk/uncertainty that can help to improve decision making regarding technology, science, ecological, as well as human health. The principle also offers the potential for improved regulation of risky activities. In the mid-1970s, precaution became a key plank of European environmental policy but was only a useful approach if a realistically irreversible environmental problem could genuinely be stopped. The early strength of the precautionary principle came from a number of innovative legal and regulatory approaches to environmental policy making.

The precautionary principle has been used by policy makers to justify discretionary decisions in situations where harm may arise from a particular course of action and when extensive scientific knowledge on the matter is absent. The precautionary principle also suggests that there is a social responsibility to protect the public from exposure to harm, when scientific investigation has found a plausible risk. These protections can be relaxed only if further scientific findings emerge that provide sound evidence that no harm will result.

Eco-efficiency-based goals

Another set of goals are eco-efficiency driven. The aim is to strike an 'optimal' balance between environmental and economic goals (cf. Huang et al., 1992). There is faith in markets to monetise costs and benefits and determine policy solutions. Adverse environmental impacts and their management are seen as costly. Proponents of mathematical modelling via this approach tend to specify the 'means' (for example, incineration, recycling and/or reuse) rather than the ends. These advocates become concerned if funds get allocated sub-optimally (see, for example, Hu et al., 2017). Some consider what is economically optimal as an appropriate way of identifying policy goals (i.e. the 'ends') (for example, Kinnaman, 2016) while others suggest that markets will help efficiently achieve ends based on other knowledge (for example, science).

This approach involves a plurality of ways of achieving eco-efficiency-based goals with wastes and resources management. These range from quantitative cost benefit analysis and cost effectiveness analysis studies, for example, to more qualitative and relational social constructivist analyses of the ways actors in networks help to create and continually recreate markets for wastes and resources (for example, Çalışkan and Callon, 2009; Kama, 2015).

In the context of analysis of markets and power relations, effective delivery of eco-efficient waste and resources policies demands that a centralised state achieves its policy objectives and governs successfully at a distance over the territory that it controls. Analysis via the governmentality perspective shows how and why a state must engage with the rationalities, agencies, institutional relations and technologies of governing (Foucault, 1991; Dean, 2010).

Short-term economic-driven goals

Lastly, there are short-term economic-driven goals for actors. These goals emphasise private profits and the reduction of costs to public and private sectors over a short time horizon. Advocates of such goals challenge interventions that interfere with either of these goals. Such perspectives may be opposed to government intervention in private affairs per se in a libertarian context. The justifications of such positions can entail actors downplaying environmental risks and/or playing up any uncertainty in knowledge about environmental risks. Short-term economic-driven goals are generally felt to hinder the development of CE practices. Markets are unlikely to support such normative sustainable change which requires a degree of investment. Instead,

central and regional governments are relied upon to support and protect innovative practices in niches. A shift towards a CE, at a range of levels, is generally regarded as a long-term change.

The political power to implement policy narratives

Whichever goals are sought by waste and resources actors operating at a range of governance levels, centralised state power is typically deployed to offer (at a minimum) political support for a route map for sustainable change. Beyond this, certain neoliberal and authoritarian economies, such as in the EU and China, have shown a desire to more fully nurture/protect their own niche innovative CE activities (for example, McDowall et al., 2017).

Governmentality is one approach that suggests that normative moves towards greater sustainability (based upon whichever goals) require centralised calculations be made of statutory targets, performance indicators, audit processes, and funding mechanisms, for example, that come from distant territorial sites (Foucault, 1991; Dean, 2010; Davies, 2005; Bulkeley et al., 2005; Jeffreys and Sigley, 2014). Governmentality's top-down focus on the central state's imposition of waste and resources policies demands a commensurate bottom-up theory of localised dissent (cf. Hacking and Flynn, 2017). While centralised states try to impose their will on actors in the hope of governing economic relations, cross-cutting, bottom-up forums – so-called 'rhizomes' – create an acentred, nonhierarchical network of counter actors with the potential to communicate 'horizontally' (Deleuze and Guattari, 1987). Such opposing forces are typically held in tension as the optimal, or eco-efficient, balance between environmental and economic goals is weighed up by competing actors. This Deleuzoguattarian approach suggests that actors within certain communities with longstanding disaffection with the mechanisms of the state are reluctant to engage with less-than-meaningful engagement efforts (Hillier, 2017). Longitudinal studies suggest that, in certain places and over certain time frames, there are dynamic limits to the top-down governmentality-led approach to the delivery of waste and resources policies of central states (Hacking and Flynn, 2017, 2018).

It is in this context that the analysis of social, economic and technical barriers to and enablers of sustainable change, described in the next section, have taken hold in policy circles in the last two decades.

Barriers to and enablers of a CE transition

Moves towards greater CE activity, at various levels from the local to the global, are driven by a range of social, economic, technical, and institutional processes (cf. de Jesus and Mendonço, 2018; Kirchherr et al., 2018). The availability of financial funding is a universal enabler for actors pursuing the goals outlined previously. However, key transition pathways for actors with ecological-based goals favour greater upstream activity, for example, designing out waste, as well as downstream measures to close waste/resource loops, set standards and proactively enforce the waste hierarchy. Systemic eco-innovation is the preferred transition pathway for those with eco-efficiency-based goals (and those with short-term economic-driven goals to a lesser degree). CE policy analysis requires consideration of the processes identified in the following sub-sections which can act as both barriers to and enablers of greater CE activity.

Power relations

Case study evidence reveals structural asymmetries of power between actors at the local level in both developed and developing countries (for example, Walker, 1998; Davies, 2016; Johnson

et al., 2018; Hacking and Flynn, 2018). Beck (1999, p. 5) suggests: 'the first law of environmental risks is: pollution follows the poor'. This immediately raises concerns about environmental justice in communities with existing relatively poor health (Petts, 2004). Structurally, the perpetuation of social inequalities in particular localities can reinforce landed interests and may be linked to dominant political parties (cf. Davoudi and Atkinson, 1999). Actors can be excluded from negotiating and bargaining by institutional barriers and/or the manoeuvres of other groups. Community actors quickly spot mismatches between what they know from first-hand experience and what is missing from an environmental statement (Petts, 2004).

Perceived trustworthiness of the regulator

A polluting actor may avoid paying enforcement fines or may avoid their share of responsibilities. The state regulator may not ensure proportionality with their regulatory action when setting gains against losses. In such cases, critical trust by communities in a regulator can quickly sour (cf. Pidgeon et al., 2003). Individuals living beside waste and resources infrastructure can be more distrustful of the regulator than a plant's operator (with whom they may well have an engaged and reflexive relationship) (Hacking and Flynn, 2017). Increasing the legitimacy of the decision-making process can theoretically contribute to increasing much needed trust. However, 'misconceptions' on all sides about the roles of developer-operators and the regulator are difficult, if not impossible, to overcome (Petts, 2008).

Institutional framing

There is a need to have a programme of CE infrastructure in place or in development. In this context, the public-private mix of CE developments varies depending upon the nature of particular economic regimes and their associated legal set-ups. A coherent, state-led strategic roadmap helps to avoid mismatches and contradictory incentives (European Commission, 2011; Gregson et al., 2015; European Parliament, 2017).

Technical solutions

Eco-efficiency-based goals place particular emphasis on research and development (R&D) spending to ensure the stimulation of the best available technology ('BAT') for increasing the efficiency of resource use. Preventing waste with ecological-based goals can be similarly technical but may come down more to process innovation/simplification.

Time frame for change

The financial case for making sustainable changes now rather than in the future has been made (cf. Stern, 2006; New Climate Economy, 2014). Similarly, there is a growing recognition in policy circles that sustainability transitions, such as with the CE, will realistically take place over very long time periods, for example, decades.

Publicly versus privately funded activity

Private actors in neoliberal, market-led economies will not fully support normative sustainable change if significant investment is required in CE niches. Instead, arrangements for sharing the

burden of regulatory responsibilities between the state and industry is likely to be worked out via responsible intervention from accredited non-governmental organisations.

Contested views about the nature of sustainable change/uncertainty

Risk dialogue is now more fruitful when thought of in terms of ways that uncertainty needs to improve. In waste planning, a developer might negotiate over many iterations with the regulator what exactly is required to satisfy a political core's legal and procedural demands. The highly reflexive relationships that exist between developer/operators, local planning authorities and regulators, who share low-risk framings of waste activity, do not extend to community members where dread risk appears (cf. Hacking and Flynn, 2018). That process leads to consideration of the precautionary principle.

Pursuing the waste hierarchy

Focus as much attention on prevention of waste, at the top of the hierarchy, as on those tiers below.

Policy approaches

In sum, from reviewing the barriers/enablers to sustainable change, achieving the first two goals examined in the previous section (ecologically-based and eco-efficiency-based), could involve, for example, various degrees of the following policy mixes: (i) reuse, repair and remanufacturing; (ii) green public procurement and innovation procurement; and (iii) improving secondary materials markets (Milios, 2018).

Conclusion

Serious concerns for the governance of wastes, resources and energy appeared in the 1960s and 1970s via a new practice-led, systems approach: industrial ecology (IE). More recent discussions centre on so-called 'circular economy' (CE) principles. This practical guidance on reducing waste by closing material loops has been gaining traction with public and private actors in response to data indicating that the pressure on resources is increasing (see Figure 23.1) and the need to help get the normative drive towards sustainable development back on track (Kirchherr et al., 2018). Nevertheless, CE concepts – when considered beyond their practice origins – remain in their infancy (Korhonen et al., 2018).

Looked at via different policy goals, there are clearly different approaches to a CE transition at a range of scales each highlighting the need to overcome certain barriers in certain ways. Such policy analysis depends upon the theoretical assumptions made about the causal relationships involving agency and structure. The different theoretical approaches outlined here are not exhaustive.

Who chooses to buy-in to them or not as policy options will, in turn, impact upon how normative moves towards CE practice unfolds over time as it is scaled up, i.e. there are different transition pathways to be pursued by different networks of public and private waste and resource actors. In the analysis of the *becoming* of CE practice, academics are still playing 'catch up' in theorising this new governance territory but much of the most recent research, some of it cited here, points to the useful beginnings of different perspectives being used to contest what a CE can and should be and why.

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