

# Trapped in trash: ‘Modes of governing’ and barriers to transitioning to sustainable waste management

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## Abstract

The disposal of municipal solid waste can be costly and environmentally destructive. This article asks why, given many alternatives, most waste material is still disposed of in landfills or incinerators. Building upon the ‘modes of governing’ framework proposed by Bulkeley, Watson, and Hudson as a means of identifying and interpreting the relationships among the many actors and artefacts that constitute a municipal solid waste management system, this article explores the barriers to transitioning between modes. The case of solid waste management in Boston, Massachusetts illustrates how key factors – limited enforcement of existing policy, institutional and physical fragmentation, financial incentives, and the vested interests of the private sector – protect the disposal mode of governing. Meanwhile, the actors most interested in moving towards more sustainable waste management techniques lack access to decision-making processes and daily operations, limiting their ability to influence policy and practice. The analysis of barriers suggests an alternative way of classifying modes – dominant, incremental, visionary, and aspirational – that explicitly captures the relative entrenchment of each mode, while also opening up the framework for application in other geographies, and for other systems that may or may not share similar governmental rationalities, technologies, or capacities.

## Keywords

Modes of governing, waste management, entrenchment, environmental governance, Boston, Massachusetts

## Introduction

In the United States, opportunities for recycling, reuse, and composting have increased dramatically in recent decades. Since the 1980s, kerbside recycling programmes have become nearly universal (Simmons et al., 2006). Despite the prevalence of kerbside recycling, however, nearly all communities still provide more frequent collection of trash than recycling, and there are still many households that are not served by any kind of recycling service. The U.S. EPA estimates that the percentage of waste diverted from landfills and incinerators through

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recycling and composting has reached almost 35%, meaning that nation is still dependent on landfills and incineration for large quantities of recyclable, compostable, and otherwise reusable material (U.S. EPA, 2016). Zero waste and sustainable consumption movements provide a framework for reimagining waste generation and management activities, but these movements have yet to imprint on municipal waste practices in most U.S. cities. Given that popular awareness, technology, and opportunities for more sustainable waste management have all increased in the United States in the last half-century, why do waste management practices in most cities remain stuck in a disposal paradigm?

Bulkeley et al.'s (2007) 'modes of governing' framework provides a means of identifying and interpreting the relationships among the many actors and objects that constitute a municipal solid waste management (MSWM) system. Modes of governing are

defined in terms of [their] objectives, and [their] components include: a governmental rationality, and associated objectives and programmes (policies); governing agencies; institutional relations between the agencies involved; technologies of governing; and the entities, in human and non-human terms, which are governed. (Bulkeley et al., 2007: 2739)

Within this framework, the above question becomes: why do most cities in the U.S. remain stuck in the disposal mode of governing solid waste?

This article builds upon the original modes of governing framework by empirically examining infrastructural entrenchment and barriers to transitioning between modes. The case of waste management in Boston, Massachusetts reveals that a variety of social, institutional, political, and financial barriers trap the actors and organizations with daily responsibility for waste management in a 'disposal mode'; actors and policies driven by more environmentally protective rationalities lack enough influence over operations and decision-making processes to overcome barriers to mode transition.

The barriers that protect the disposal mode in Boston are not inherently tied to disposal per se, but rather to the fact that disposal, as the dominant waste management strategy for the last century, has become deeply entrenched. Governmental rationalities, private sector interests, physical infrastructure, professional norms, public expectations, and system financing procedures combine to protect waste disposal as the primary means of managing Boston's garbage. To acknowledge this condition, and as way of analysing system entrenchment and system change, this article offers an alternative mode classification. Rather than classifying modes by governmental rationality or management technique, the new classification organizes modes by their relative entrenchment. The proposed approach allows the modes framework to be applied in places that may not share similar values, technologies, or governing strategies for waste management, while still maintaining the emphasis of the original framework on rationalities, agencies, technologies, and human and non-human participants in urban infrastructural services.

This article first discusses some key terms and concepts, and introduces the original and the adapted modes of governing frameworks. It then reviews a series of barriers to system change from solid waste, environmental, geographic, and planning literatures. After presenting research methods, the article then discusses how barriers protect the dominant mode within the empirical case of Boston. The article concludes with a discussion of the adapted modes of governing framework and how it might be expanded upon in the future.

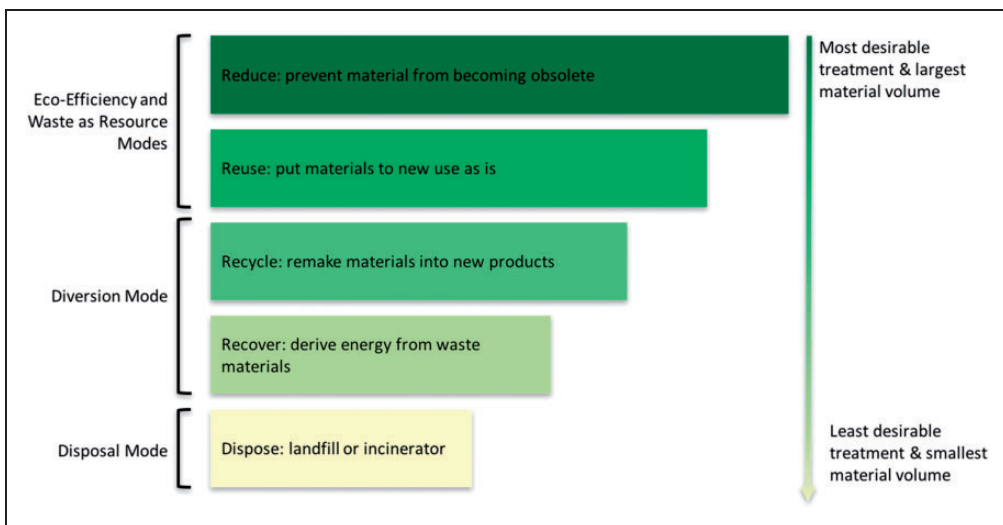
## **Modes of governing municipal solid waste**

Municipal solid waste is any material generated through everyday household and commercial activities that must be disposed of in some way. For the purposes of this

article, sustainable waste management is taken to mean practices for managing municipal solid waste that are situated higher on the integrated waste management hierarchy (see Figure 1). The hierarchy prioritizes waste prevention above all. Any remaining wastes should be diverted through reuse and recycling, then energy recovery (through incineration or other technologies), with disposal as a last resort. In recent years, the U.S. Environmental Protection Agency has been promoting a sustainable materials management (SMM) framework alongside the hierarchy. SMM extends beyond the hierarchy by accounting for complete material life cycles and reducing the use of toxic components in consumer products (Memon, 2010; U.S. EPA, 2002, 2009).

### *Modes of governing municipal solid waste*

The following analysis makes use of the modes of governing framework defined by Bulkeley et al. (2007). The framework combines the governance frame that has been traditionally used in the analysis of infrastructure and urban system management with theories that build on Foucauldian governmentality to capture the complex and dynamic nature of how these systems are governed in practice. The framework allows distinct modes to coexist, sometimes in tension with one another, within any infrastructural system. Bulkeley et al. (2007) identify four modes of governing in their assessment of solid waste management in the UK that loosely correspond to the waste hierarchy (see Figure 1): a disposal mode characterized by governmental rationalities of economic efficiencies, public health, and environmental efficiencies; a diversion mode characterized by a rationality of reducing the environmental impacts of landfills; an eco-efficiency mode which seeks to reduce the impacts of waste by prioritizing reduction; and finally the ‘waste-as-resource’ mode, which seeks to



**Figure 1.** Sustainable materials management hierarchy + modes of governance. The hierarchy represents an ideal system in which the majority of consumed materials never enter the waste stream; materials that do become obsolete are either reused or recycled. Only a small quantity of remaining residuals are disposed in landfills. Energy recovery is not included in the diversion rate for Boston; but since most cities do consider energy recovery to be a form of diversion, it is represented here as fitting within the diversion mode (figure by author based on EPA hierarchy diagram (U.S. EPA, n.d.)).

reduce the environmental impacts of waste and capture potential economic and social benefits from material reuse.

In the original framework, the disposal mode of governing refers to systems that depend primarily on landfilling and incineration. According to the logic of the waste hierarchy, this is unsustainable. Although landfilling in some U.S. contexts remains low cost, and control technologies have improved the environmental performance of both landfilling and waste-to-energy incineration, disposal-dominant material management systems depend on the continued extraction and processing of virgin materials. This one-way material flow is fundamentally unsustainable: it depletes natural resource reserves and threatens economic and ecological security (Costanza and Daly, 1987; Daly, 2002).

The diversion mode, as defined by Bulkeley et al. (2007) prioritizes recycling and composting and may be understood as weak sustainability. It is a market-based solution that does not threaten the overall economic order of consumption and waste practices (Gibbs et al., 1998), but nevertheless has the potential to reduce demand for virgin materials (recycling) and restore organic nutrients to soil (composting).

The third mode, eco-efficiency, prioritizes the reduction of the negative impacts of waste and waste management through more dramatic and transformative action including an emphasis on material reuse instead of more energy-intensive recycling. Unlike the diversion rationalities, eco-efficiency rationalities prioritize waste reduction on the front end, not just end-of-pipe treatments. This mode moves substantially up the waste hierarchy towards the most environmentally desirable waste management techniques.

Finally, the waste-as-resource mode aims to derive social and environmental benefit by reframing waste-making and waste management. Waste-as-resource rationalities redefine waste management as process of social and environmental stewardship. This could include, for example, the consideration of good, well-compensated jobs generated through the repurposing of goods or reprocessing of materials, as well as the ecological benefits from reducing the extraction of virgin materials, reduced disposal, the return of nutrients to soil, and reduced transport of waste and virgin materials. The eco-efficiency and waste-as-resource modes sit at the top of the waste hierarchy and can be understood as 'strong sustainability'; more transformative, but more difficult to achieve (Gibbs et al., 1998).

The goal of this project is to understand why infrastructural systems generally, and waste systems in particular, are so difficult to change. Therefore, this article proposes that classifying modes based on their preferred management technique obscures the forces that entrench daily practice. When the goal is to understand lock-in and change, the modes can be more usefully defined by the nature and degree of their lock-in. In making this shift, the key characteristics of the original modes of governing framework – governmental rationalities, governing relations, governmental technologies, etc. – can be analysed for the ways that they promote progressive policy visions or reinforce lock-in.

The four original modes identified by Bulkeley et al. (2007) are also visible in different parts of Boston's waste system, and each mode has a unique position relative to the fully entrenched, 'dominant mode'. Table 1 presents a modes of governing framework, reconfigured according to the degree of entrenchment. In Boston, the 'dominant mode' corresponds to the 'disposal mode', and it is held in place through a full spectrum of political, institutional, social, and financial barriers. The 'incremental mode' corresponds with the original 'diversion mode'. In Boston, this mode is codified in policy but is not fully enacted due to lack of enforcement and conflicting incentives. Nevertheless, when changes have been implemented, they shift municipal operations from the dominant mode to the incremental mode because it is already supported by private sector interests, a policy framework, and infrastructure.

**Table 1.** Reconfigured modes of governing in Boston.

Mode of governing	Relative entrenchment	Approach to waste treatment (original mode of governing)	Governmental rationality	Governing agencies	Tools/technologies	Barriers to shifting to/ from modes
Dominant	Fully entrenched	Disposal	Economic efficiency; public health/cleanliness	MassDEP; local authorities; private sector	Functional and affordable disposal capacity; collection contracts with private sector waste haulers	<p><b>Barriers to shifting from</b></p> <p><b>mode:</b></p> <ul style="list-style-type: none"> <li>Political:                             <ul style="list-style-type: none"> <li>–Weak enforcement of diversion policies</li> <li>–Interests of the private sector</li> </ul> </li> <li>Institutional:                             <ul style="list-style-type: none"> <li>–System managers insulated from alternative perspectives</li> </ul> </li> <li>Social:                             <ul style="list-style-type: none"> <li>–Values and priorities of professional waste managers</li> </ul> </li> <li>Financial:                             <ul style="list-style-type: none"> <li>–Free disposal for residents</li> </ul> </li> <li>–General budget financing</li> </ul> <p><b>Barriers to shifting daily practice to mode:</b></p> <ul style="list-style-type: none"> <li>Political:                             <ul style="list-style-type: none"> <li>–Weak enforcement of existing diversion policies</li> </ul> </li> </ul>
Incremental	<ul style="list-style-type: none"> <li>–Encoded in regulation;</li> <li>–Supported by existing infrastructure</li> <li>–Closest to dominant mode and easiest mode to adopt through operational changes</li> </ul>	Diversion	Reducing environmental impacts of landfill and incineration; reducing costs of disposal	MassDEP; local authorities; private sector	<p><b>City:</b> Mandatory recycling</p> <p><b>State:</b> Waste bans</p>	

(continued)

**Table 1.** Continued.

Mode of governing	Relative entrenchment	Approach to waste treatment (original mode of governing)	Governmental rationality	Governing agencies	Tools/technologies	Barriers to shifting to/ from modes
Visionary	-Encoded in policy -No supportive regulations or infrastructure	Eco-efficiency	Reducing the environmental impacts of waste; recovering value in materials	MassDEP	Solid waste master plan	<i>Barriers to shifting daily practice to mode:</i> Financial: -Limited funding Political: -Limited implementation power
Aspirational	-No policies, regulations, or infrastructure	Waste as resource	Reducing the environmental impacts of waste; capturing social and economic benefit	NGOs, individuals	Alternative proposals; information provision	<i>Barriers to shifting daily practice to mode:</i> Institutional: -Advocates lack access to decision processes

MassDEP: Massachusetts Department of Environmental Protection.

The 'visionary mode' in Boston corresponds with the original 'eco-efficiency mode'. This mode is elaborated in policy documents that have been legitimated through a public process, but have not been codified in regulation, embodied in service or infrastructure, or otherwise implemented. Finally, the 'aspirational mode' corresponds with the original 'waste-as-resource mode'. This mode, in Boston, is advocated for only by actors working outside of Boston's waste management operations. Lack of access to policy processes has prevented their voices, ideas, and proposals from entering into operations decisions.

One of the key innovations of the original modes of governing framework is that it allows for multiple, competing modes to characterize different aspects of waste management. This reclassification is intended to maintain that critical subtlety, while also acknowledging the relative power of various actors, operating within various modes, to determine system outcomes.

The 'Barriers to mode transition within Boston's MSWM system' section will explore in detail the barriers to transitioning from the dominant mode to the other modes in the empirical case of Boston. But before turning to the case details, we will first examine the premise of 'sustainable waste management' and explore the literature on barriers to socio-technical system change.

### *Can a municipal waste system be sustainable?*

The original modes of governing framework mirror the waste hierarchy (Figure 1), implying that the waste-as-resource mode represents a more desirable approach than the disposal mode. In the version of the modes proposed here, the 'aspirational mode' represents the most advanced, progressive model of 'sustainable waste management' within solid waste discourse in Boston. But can waste management – the tail end of the destructive global network of extraction and production – ever be 'sustainable' in itself?

Municipal waste – a combination of household and commercial waste – is a small fraction, as little as 3%, of the total waste generated through processes of material extraction, product manufacturing, and shipping (Liboiron, 2014; MacBride, 2012; Royte, 2005). Given the insignificance of municipal waste in comparison to industrial waste, and the ample available landfill capacity, focusing on municipal waste alone to resolve the environmental impacts of waste in general is therefore misguided.

Relatedly, by encouraging individuals to recycle, environmentalists confuse the scale of the problems they seek to solve. The recycling habits of individuals have no relationship to the processes and systems of resource extraction and production that are substantially more harmful than landfilling (Ackerman, 1996; Liboiron, 2014). Further, the emphasis on the individual distracts from well-hidden industrial activities and promises little in the way of systemic change (Maniates, 2001). In the U.S., these critiques must be understood within the context of the history of municipal recycling, which was promoted by industries seeking to deflect regulatory attention away from the production of increasingly disposable products (Dunaway, 2015; Elmore, 2012).

The emphasis on individual action that is promoted by environmentalists and demanded by household-focused waste schemes is also problematic because, as Zsuzsa Gille has noted, the classificatory schemes used to define waste – municipal versus industrial in particular – 'assume that consumers actually have control over how much waste they generate' (Gille, 2007:14). In reality, as Gille and others argue, consumption choices are circumscribed by a variety of social, infrastructural, and economic factors including low-quality products that demand frequent replacement (Gille, 2007; Schor, 2000; Southerton et al., 2004).

The emphasis on individual action, whether in terms of consumption or recycling, is thus unfair and ineffective.

Despite these critiques, municipal solid waste remains an important component of urban and global sustainability. First, municipal governments control municipal waste, which means that meaningful action can happen at the local scale, a critical factor given the stagnant, and even hostile, political climate at higher levels of government, at least in the U.S. context. Perhaps even more importantly, however, local policy around waste management can ripple upwards and outwards, leapfrogging across boundaries, pushing industry to develop more recyclable or less toxic products, reducing or eliminating the use of particularly difficult-to-recycle materials, and changing social norms about waste and consumption (e.g. plastic bag bans: Clapp and Swanston, 2009).

Though individuals' recycling habits may not directly influence the global web of production, consumer choice remains an important lever of individual power. For individuals who are fortunate enough to have options,<sup>1</sup> the choice to not consume or to consume differently – so-called political consumption – can sufficiently pressure industry to make costly changes in manufacturing and production, including the use of recycled feedstocks and less toxic components, or socially responsible material sourcing (Adugu, 2014; Hayes, 1990).<sup>2</sup> Sustainable waste management is, therefore, one component of the necessary transition towards society-wide sustainable consumption patterns. Given this, the question is whether, and how, existing systems can migrate towards more effective and efficient material management practices, and what are the barriers to doing so. The following section will review the literature on barriers to infrastructure change in order to set the stage for the exploration of barriers to mode transition in Boston.

### *Barriers to infrastructural system change*

Numerous factors reinforce the ways that infrastructural systems function, making transitions to new practices difficult. Many have observed that as infrastructures evolve, actors, artefacts, and institutions co-evolve, making it increasingly difficult to move away from the status quo (Ben-Joseph, 2005; Hughes, 1983; Tarr and Dupuy, 1988; Unruh, 2000). Physically, infrastructures evolve 'on an installed base', which shapes the possibilities and direction of future investment; institutionally, they are embedded within a variety of 'other structures, social arrangements, and technologies' (Star, 1999: 381). The more mature a system, therefore, the more difficult it is to change. The networks of actors, institutions, and physical artefacts that constitute an infrastructural system interact in observable ways to keep systems operating within a limited set of parameters. These interactions, or barriers, fall roughly into three categories: social and political, institutional, and financial.

The first category of barriers, social and political, includes relations among system actors, entrenched power dynamics, and professional and popular expectations for waste service. These all serve to reinforce the status quo in waste systems in multiple ways. In the U.S. context, early sanitation engineers successfully established solid waste as an engineering problem for which their new profession was the natural problem solver (Melosi, 2005). This legacy means that most solid waste systems continue to operate in a technocratic domain, insulated from overtly political processes and alternative ideas and views. The established practices of expert managers, the technologies they have developed and the regulatory regimes that they have crafted, all serve to buttress patterns of practice (Chatzis, 1999). This dominance is sometimes expressed through a lack of political support for new types of programmes, or even a lack of interest in waste management entirely, from residents and elected officials, another key barrier to waste system change



(Ben-Joseph et al., 2016). Relationships formalized through contracts also restrict system innovation. Long-term contracts that tie cities to particular contractors or facilities, or direct investment in infrastructure development, can inhibit investment in systemic change (Corvellec et al., 2013; GAIA, 2011).

Relations not just among professional waste managers, but also between people and their wastes can serve as barriers to change. In particular, aversion to waste and popular expectations about cleanliness reinforce the daily habits of waste generators; aversions to handling garbage can deter people from wanting to clean or sort materials once they have been labelled as trash (Boyle, 2002; Hawkins, 2006; Strasser, 1999). Behavioural research reinforces these observations: people are more likely to participate in programmes like recycling or home composting if they already felt positively towards such activities (Edgerton et al., 2009). Further, popular and dearly held assumptions about the value of recycling mean that decision-makers are hesitant to make changes to existing programmes, even when current practices may not be financially or environmentally efficient (Luke, 1997; MacBride, 2012). Though resident recyclers can hold significant power in the politics of solid waste decision-making, another set of actors with intimate knowledge of waste practices and place is largely ignored in policy debates: the waste collectors (Parizeau, 2011; Perry, 1998). The perspective of waste workers has not been systematically analysed either as a potential source of change or as a barrier to change. This is perhaps because waste workers have been marginalized in both urban space and the waste discourse (Nagle, 2013; Zimring, 2004). These relational barriers, constructed among waste managers, publics, and waste itself, can be difficult to measure, but nevertheless play an important role in maintaining the status quo.

Institutional and spatial fragmentation constitutes a second category of barriers to system change. Though a fragmented system might function coherently to provide waste services in an urban area (Van Horen, 2004), a fragmented regulatory environment can cause confusion about who is responsible for which aspects of the waste problem, making it difficult to enforce change from the top down (Bulkeley et al., 2005). The introduction of additional actors into the system, even those intended specifically to implement new sustainable practices, can instead diffuse power and responsibility (Entwistle, 1999). Further, in the current landscape of privatized service provision, competing infrastructural networks can splinter the urban environment itself, creating new geographies defined by different levels of service (Graham and Marvin, 2001; Guy et al., 1999). Even in places with a coherent macro-level waste policy, the 'sectoral' nature of waste systems has been observed to keep waste management organized along traditional lines (Davoudi, 2000). Fragmentation can also impede coordination, making it difficult for systems to adapt to changing contexts (Bakker et al., 2008). Overall, systems that are highly fragmented, with many responsible actors and organizations, will be harder to change than systems that are centrally controlled.

Institutional fragmentation can have a scalar aspect as well. Although municipal waste is generally a local or regional responsibility, higher levels of government frequently try, and fail, to instigate waste management policy change. In seeking to explain the failure of higher levels of government to influence local practice, many researchers have identified a mismatch between local municipal waste management goals and priorities established by higher levels of government (Bulkeley et al., 2005; Davies, 2005, 2008; Davoudi, 2009; Howell, 2015a). Both in waste management and in other policy arenas, observers have noted that policy that originates at a functional distance from the site of implementation – most frequently at another level of government – can morph and transform when it comes in contact with the particularities of place. In this process, policy can be implemented unevenly across jurisdictions with unpredictable results, or simply fail altogether to shift local policy and practice in the desired directions (Howell, 2015a, 2015b; Murdoch, 2000). In relation to state

policy for waste management, Howell (2015a: 2154), following Murdoch (2000), finds that 'greater distance from actual processes of [solid waste management] results in diminished power to enact a preferred mode of governing. ...'

The issue of scale surfaces as a constraint in other ways as well. Supra-local policy may fail if it expects local authorities to cooperate around regional infrastructure in the absence of regional institutions (Boyle, 2002). The global economic geography of material flows also presents a scalar tension for municipal waste systems. Recyclables are sold on global commodities markets; this makes it difficult for municipalities to count on revenue streams from recycling at the local level (Ackerman, 1996; Bulkeley et al., 2005).

A third category of barriers is financial. Foremost among these is a lack of financial resources. Limited funding is often cited as a reason why more aggressive programming or policy is avoided or why existing policies are not implemented (Ben-Joseph et al., 2016; Boyle, 2002; Bulkeley et al., 2005; Troschinetz and Mihelcic, 2009). Waste systems are also creatures of the broader political economy, and thus shaped by the same political economic forces that constrain and shape other infrastructural systems. In the case of waste, flows of capital may prioritize certain modes of disposal – capital-intensive waste-to-energy incinerators in the U.K., for example (Gandy, 1994), or landfills in the U.S. – making prioritization of waste reduction or recycling next to impossible. Finally, at the municipal scale, local financing mechanisms can also impede system change. For instance, waste systems that are funded through general budgets lack an independent funding stream; these systems must justify every expenditure in ways that make experimentation and change difficult (Layzer et al., 2013).

The following modes of governing analysis reveal how and where these barriers manifest in the context of Boston's waste system. The dominant mode, which prioritizes cleanliness and hygiene through efficient waste disposal, is reinforced by numerous barriers. More environmentally sustainable modes go unimplemented because they are advocated for by actors who lack influence over the daily practice of waste management.

## Methods

In the U.S., where cities and counties manage solid waste with limited participation from higher levels of government, in-depth examination of urban-scale cases is necessary to understand day-to-day waste handling practices and barriers to change. Boston was selected for this study of entrenchment because it has changed relatively little in recent decades. The city's residential recycling rate, which is about 19% (MassDEP, 2016), is well below the EPA's estimated national average,<sup>3</sup> and the city has invested almost nothing in solid waste planning or infrastructure in recent years.

The study relies on in-depth interviews with key waste management personnel, representatives from private sector waste companies that work in Boston, and a range of intermediaries – NGOs, activists, researchers, and consultants that have reported on and worked to reform Boston's waste sector. Intermediaries can play instrumental roles in the sustainability transitions of socio-technical systems (Guy et al., 2011; Moss, 2009), and in Boston provide critical alternative views of system management. Interviews were conducted between 2012 and 2014 and included three representatives from the private sector; four public sector employees, two from the city government and two from the state government; six intermediaries representing labour rights, environment and environmental justice, recycling, and waste reduction. Site visits and informal conversations with employees at three regional, privately owned and operated waste treatment and recycling facilities complemented interviews with representatives of private sector firms. Observation of a

series of public meetings relating to the roll-out of new state food waste policy supplemented a series of interviews with a representative of the Massachusetts Department of Environmental Protection (MassDEP). Participant observation as a member of the Zero Waste Task Force, a subgroup of the Boston Recycling Coalition (BRC) that met intermittently between 2012 and 2014, supplemented interviews with representatives from the advocacy sector. Finally, to fill in details and triangulate data from other sources, the study relies on document analysis of the city's contracts with private service providers from the mid-1990s through 2010, public reports and plans, local press, and city and state regulations. This research does not directly include the perspectives of waste generators. Conclusions reflect the perspectives of actors with some level of professional engagement with waste management in the city.

### **Barriers to mode transition within Boston's MSWM system**

Boston's MSWM system is constituted by many public and private sector actors, stakeholders, regulators, enforcers, intermediaries, and service providers, some of whom act on the system in multiple ways and advance multiple goals. As a result, Boston's waste system is governed through a variety of modes, but operations are disposal oriented. The actors, policies, and stakeholders that work within visionary and aspirational modes have no pathways through which to nudge operations towards more sustainable practices. Meanwhile, the actors with the most agency over day-to-day practice are driven by interests and rationalities that prioritize disposal. So, while three modes of governing are expressed in state and local policy, and the fourth is actively advocated for, the more sustainable approaches to waste management remain abstract and functionally distant from everyday waste management.

### ***Regulatory and operational structure of Boston's MSWM***

As with most municipal waste management in the United States, Boston's system is regulated at the federal, state, and local levels. Federal law establishes standards for disposal infrastructure. The Clean Air Act (Clean Air Act, section 129; 42 U.S.C. section 7429) regulates emissions from combustion facilities; the Resource Conservation and Recovery Act (RCRA), initially passed in 1976, requires state governments to produce waste management master plans and sets design standards for sanitary landfills (RCRA 42 U.S.C. section 6944). These regulatory frameworks improved the environmental standards of disposal, but they did not challenge the dominance of disposal at the city level. The federal regulatory framework also leaves much – collection, storage, and transportation of non-hazardous solid waste – unregulated. State and local laws cover some of this territory.

The Commonwealth of Massachusetts maintains a broad policy vision for solid waste management in the state and has three legal apparatuses for regulating municipal waste operations. The policy vision, promulgated through its 2013 plan, emphasizes practices and technologies that fit within Bulkeley et al.'s eco-efficiency mode, but here represents a visionary mode of governing – it is a vision legitimized through a public process, but it has not influenced waste management in practice. The plans seek to facilitate recycling and reuse to save money currently spent on disposal and to set the stage for a Zero Waste future (MassDEP, 2013). The plan functions as general policy guidance. MassDEP has no formal implementation authority and lacks sufficient funding to directly invest in widespread programming or infrastructure (MassDEP representative, Interview, 2012).

In addition to the master plan, MassDEP has two other regulatory tools. The first is ‘site assignment’, a process that allows MassDEP to comment on sites for new disposal facilities and issue operations permits.<sup>4</sup> Because few new disposal facilities are anticipated in the coming years, site assignment is not likely to shape the waste management landscape in the near future. More significant are ‘waste bans’. The waste bans prohibit the disposal of certain recyclable materials,<sup>5</sup> including paper, recyclable plastics, glass, metal, and a variety of construction material. By emphasizing prohibitions on disposal, state law promotes diversion within well-established and well-infrastuctured pathways. This represents an incremental mode of governing: it is supported by many of the same interests and actors that support the dominant mode. Practices and technologies that constitute this incremental mode can be employed without threatening the underlying rationalities of the dominant mode. It seeks to nudge rather than reorient the dominant mode of governing.

The city of Boston supplements state policy with an additional set of ordinances and tools. The primary tools are the city’s recycling ordinance and contracts for residential waste and single-stream recycling collection.<sup>6</sup> The city’s recycling ordinance, like the state waste bans, represents an incremental mode of governing. The ordinance requires households to separate recyclable material from waste and empowers the commissioner of the Public Works Department (PWD) to educate residents and implement the programme. In 2016, the city reported a 19% recycling rate for the residential sector, substantially lower than the national average (MassDEP, 2016).<sup>7,8</sup>

Boston’s lacklustre recycling rate demonstrates that despite diversion-oriented local policy, and a diversion and eco-efficiency state policy framework, disposal dominates in practice, defining the dominant mode of governing. Many barriers prevent the diversion-oriented state and local policy from influencing Boston’s disposal-oriented practice.

At both the city and the state level, a lack of enforcement contributes to the dominance of disposal. While city and state laws promote a *de facto* recycling mandate,<sup>9</sup> limited resources leave enforcement largely in the hands of private sector haulers and disposal site operators. If trash cans or dumpsters contain beyond a certain threshold of recyclable material (thresholds are material specific and issued as part of enforcement guidance to haulers, rather than as part of the regulations), haulers are empowered to not collect. But, practical obstacles to this enforcement strategy abound. First, haulers do not always know the composition of the material they are collecting.<sup>10</sup> Second, in both the residential and commercial sectors, failure to collect waste causes problems for the haulers and for city workers. In the commercial sector, private waste haulers fear that if they reject loads their clients will switch to a less scrupulous contractor. So, unless a load is obviously hazardous, some haulers are not likely to leave waste uncollected (Private sector haulers, interviews, 2012; PWD representative, interview, 2012).

Similarly, for residential waste that is collected by city contractors, rejected loads present headaches for city workers. Boston has established procedures for communicating with residents about violations, such as ticketing, fines, or not collecting trash with too much recyclable content. But, when haulers reject loads, waste remains in the street. PWD employees emphasized that cleanliness was the priority; leaving waste on the street not only results in complaints from constituents, but it also violates their own sense of pride in their work (PWD employees, interviews, January, 2012).

State waste ban enforcement also occurs at disposal facilities. Facilities are required to monitor each load that is dumped and report ‘failed loads’ – loads that upon visual inspection have significant quantities of recyclable materials – to the state. State inspectors periodically visit disposal facilities, monitor dumping, and review for

compliance. The disposal facilities can be fined for allowing failed loads, and haulers can be fined for depositing failed loads. While haulers do periodically get fined for non-compliance, their job is tricky. Once the load reaches the disposal facility, chances are it contains waste from several different buildings, residences, or businesses, making it difficult to determine where non-compliant loads originate. Further, the infrequency of state inspection means that the fear of losing business is worse than the fear of enforcement.<sup>11</sup> The lack of enforcement thus acts a barrier to shifting both waste generators and private sector haulers towards diversion in practice. For most actors in the system, disposing of material is still the most efficient way to do business. Patterns of lax enforcement, which are supported by the expectations of waste generators, the demands of a competitive market, and city employees' priorities, reinforce the dominant mode of governing and result in more disposal than the regulatory frameworks predict.

Boston also reinforces the dominant mode through its system financing. Boston does not charge for residential waste collection and disposal, and the operating budget for waste management comes from the city's general budget. This method of financing reinforces disposal in two ways: first it fails to incentivize recycling at the household level, and second, it means that public works must beg for every penny from the city budget, making it more difficult to fund planning, monitoring, and experimentation. Boston is one of only a handful of large cities in the United States to provide unlimited waste collection service for free to residents (Citizens Budget Commission, 2015).<sup>12</sup> Pay-as-you-throw (PAYT), or charging per unit of collected waste while providing unlimited recycling collection, is widely credited with increasing diversion rates in other municipalities (Folz and Giles, 2002; Hallas-Burt and Halstead, 2004; Jenkins et al., 2003; MassDEP, 2015). PAYT financing also provides waste managers with a dedicated income stream, which can help to support programmatic innovation (Layzer et al., 2013). Although the city has studied the issue, PAYT has not been on the agenda in Boston. As one PWD employee described it:

You can provide the carts, but you can't make people recycle. There's no motivating factor. We've looked at other cities, they have pay-as-you-throw, and I don't think the appetite is there for the city to start charging for a service that's relatively inexpensive. (PWD employee, interview, January 2012)

This employee's explanation indicates the degree to which disposal rationalities are embedded in system management. Because elected officials and system managers do not view diversion, reduction, or other waste-related goals as priorities, there are no competing rationales besides cost to drive the system agenda. System financing ultimately operates at cross-purposes with the recycling ordinance; it is a policy of the dominant mode.

The city's residential waste contracts also reinforce the dominant mode of governing. The Boston PWD organizes solid waste collection for all residential properties in the city under eight stories and uses contracts to maintain tight control over collection and hauling activities (Municipal Hauling Contracts, 2009–2014). But, PWD employees reported more concern for the proper appearance of the trucks and efficient and tidy collection than for compliance with recycling rules (PWD employees, interviews, 2012). Cleanliness and customer service are typical and traditional concerns of municipal waste managers in the U.S. context; these values are strongly associated with an emphasis on disposal as the most efficient means of removing waste from the urban environment (Melosi, 2005). The contracts could be a tool for enforcing diversion. But system managers, operating from a strong set of traditional professional values, instead use them to reinforce hygienic collection and disposal, thus buttressing the dominant mode.

The city government is a key actor in the residential waste sector, but it is not the only stakeholder defining policy and practice at the city and state level. The private sector is responsible for almost all waste collection, hauling, transfer, sorting, and disposal in Boston. Many large waste firms make more reliable income from disposal than recycling (Grodén, 2015), and the industry is not known for innovating around waste reduction. One interview respondent from a local NGO referred to the commercial waste hauling sector as a ‘wild west’ in terms of oversight (interview, January 2012). A representative from the private sector made the same observation approvingly (interview, January 2012).<sup>13</sup> Any suggestions that the city might take over commercial contracting, or even try to coordinate among haulers and commercial clients has been met with fierce opposition from the private sector (NGO representative, interview, 2012). City policymakers, absent strong demands for policy change from constituents, have not had good reason to challenge the politically connected and well-organized private sector with more aggressive policies. Lack of oversight over commercial operations further reinforces the dominant mode as it allows industry interests to operate relatively unchecked.

The preceding ensemble of policies, regulations, contracts, operational procedures, system financing, and industry interests protect the dominant mode of governing in practice, even when elements of the ensemble promote alternative rationalities and practices. But there are several other characteristics of Boston’s system that make it particularly resistant to shifting from the disposal mode. Boston, like many cities of its size, does not host any disposal infrastructure within its own boundaries. Boston’s waste disposal sites are distributed throughout the state and region. This means that residents of recipient municipalities bear the burden of Boston’s waste. Because the environmental and health costs of disposal are born elsewhere, there has been no political motivation for city leaders to reconsider their reliance on disposal. Residents of recipient communities have struggled to find levers for influencing solid waste policy and practice in Boston (NGO representative, interview, January 2012). The disposal facilities are privately owned so even elected officials in recipient communities have limited influence about facility operations. Though elected officials from recipient communities have criticized Boston’s waste decisions in the past (Quill, 1985), and have occasionally advocated for better pollution control at disposal facilities (Russell, 2011), they have no electoral power in Boston, and so lack a formal voice in Boston’s policy decisions.

Furthermore, Boston has never had a formal, public planning process for solid waste. Such a process might, as it has in other settings (Lilja, 2009; Wagner, 2007), create space for a discourse to challenge the dominance of the disposal mode. In the absence of such a process there is almost no public discourse about waste in the city beyond questions of collections schedules and daily nuisances. The lack of planning, inclusive discourse, and channels for external stakeholders to engage with policy or operations has sheltered Boston’s system managers from voices and perspectives that might challenge the dominant disposal mode of governing.

In sum, the structure of Boston’s solid waste management system contains a number of social, political, institutional, and financial barriers to altering practices at the city level. Responsibility is spread across many parties, and it is not always in the best interest of actors to enforce existing policies. The priorities of local waste managers, the lack of financial incentives for residential recycling, the geographic distribution of disposal infrastructure, and the lack of waste planning at the city level further reinforce the dominant disposal mode. A modes-of-governing analysis of some recent efforts to change the solid waste picture in Boston presents further indications of how various barriers work to maintain dominant mode of governing.

### *Challenging Boston's dominant mode*

Several actors have worked at different levels to challenge Boston's dominant mode of governing. The following section explores efforts by the private recycling industry and the advocacy sector to shift solid waste management practice. Only the private sector succeeded in instituting change in the residential waste sector – the segment managed by the city of Boston. This change was incremental; it was limited to the technologies of governing, rather than the rationalities or other relations of the dominant mode of governing.

In 2009, following a regional trend, Boston moved from dual-stream to single-stream recycling (Nierstedt, 2009). Waste managers hoped that it would substantially increase recycling rates (Carroll, 2008). The move resulted in a 45% increase in the amount of recyclable material collected. This leap, however, only took the residential sector from about a 12% recycling rate to a 17% recycling rate (City of Boston, 2009, 2011), still well below the national average.<sup>14</sup>

The transition to single stream was driven by private investment rather than public policy. The private firm that held the recycling collection contract for residential waste in Boston retrofitted its sorting plant to accept single-stream materials and encouraged their customers to adapt. Boston had no budget for programmatic innovation. The city was enticed to shift to single-stream recycling only when a private company offered a free trial of 64-gallon recycling carts. The city implemented a pilot in one neighbourhood. Other neighbourhoods, seeing the convenience of a single receptacle for recycling, requested the larger carts immediately. A bump in recycling volumes and the flood of requests convinced city leaders to pay for the carts for the whole city. But what really impressed the city's waste managers 'was...the cleanliness of it. The superintendent of sanitation...really liked the cleanliness part and wanted to take the carts that we had leftover to a downtown neighbourhood that has a real trash problem...' (PWD employee, January 2012). The transition to single stream was partly motivated by a desire to increase the city's diversion rate and can thus be understood as within the incremental mode of governing. But, as the quote shows, the tidiness of the new, larger, single-stream carts was a material factor in convincing waste managers to find the funding to take the program citywide. As evidenced by the emphasis on shipshape collection in city contracts, a key feature of the disposal mode of governing in Boston is an emphasis on cleanliness and efficient removal of waste. Thus, not only was the transition to single-stream recycling not initiated by the city, but it also ultimately served to reinforce one of the key rationales underpinning the reliance on disposal. Although waste managers will always have a public health responsibility, this episode reveals the degree to which Boston's waste managers view the system and their role in it from within the rationalities of the dominant mode. It is further evidence of how professional expectations, budgeting practices, and private sector interests restrict transitions between modes of governing.

A second example of an attempt to change municipal practice was initiated by a group of intermediaries. The BRC is a group of labour and environmental activists that cohered around the idea of Zero Waste.<sup>15</sup> The BRC viewed Zero Waste as a win for both workers and the environment (BRC representative, January 2012). In a proposal to the city of Boston, they argued that the city could promote job creation, community participation, and reduced disposal costs through a Zero Waste programme (Boston Recycling Coalition, 2014). By emphasizing reuse, community-driven recycling and composting, green job creation, and the protection of natural resources, the BRC's proposal reorients waste management as socially aware, economically redistributive, and environmentally beneficial. Implementing such a vision would represent a dramatic transition from the dominant mode (see Table 1 for a summary of the modes).

In 2013, the BRC group took advantage of an ongoing mayoral campaign to educate candidates about the state of solid waste management in the city and sought to influence a contract renewal process for the city's haulers. The mayoral candidates, and then ultimately, the new mayor met with representatives of the group, but the BRC was unable to make any substantive changes to the city's collection and disposal contracts. Over 2015 and 2016, the BRC secured meetings with many key members of the Mayoral administration. While the BRC reported interest across city government, members also noted that competing priorities in the environmental sphere threatened to keep Zero Waste off the political agenda (personal email from BRC member, 2015).

The BRC's vision, and its failure to nudge policy and practice, represents an aspirational mode of governing. The organization's members have a fully articulated set of rationalities, practices, technologies, and implementation plans, but these ideas remain outside of day-to-day practice. They operate at odds with existing policies, infrastructures, incentives, waste managers' professional values, and budgeting practices. Without a substantial reorientation of priorities from the highest levels of city leadership, the BRC's vision will remain unimplemented.

The role of the private sector in the transition to single stream, when viewed alongside the limitations of intermediary action, strengthens Howell's (2015a: 2154) finding that 'private firms... directly responsible for collecting and disposing of waste were better able to achieve their desired mode' than more 'functionally' distant actors. The private waste management sector in Boston maintains functional proximity to waste collection, transportation, and treatment, as service providers in both the residential and commercial segments of the city's waste system. They were, therefore, able to promote the first major operational shift in the system since the institution of kerbside recycling in the 1990s, thereby implementing an incremental mode of governing. Meanwhile, the advocacy sector has yet to find a way to close the distance from key decision-making processes. The tools employed by the advocacy sector – the provision of information and alternative visions to system managers and elected officials – were not sufficient to overcome the variety of barriers reinforcing the dominant mode of governing.

## **Discussion: Modes of governing reframed around entrenchment**

The original modes framework is organized according to waste management approaches – disposal, diversion, eco-efficiency, and waste as resource. The logic of this organization is based on the governmental rationalities that define each mode, but the modes are actually defined by the *outcomes* of waste management practice. The nature of the barriers to mode transition explored here, however, suggests any set of practices can become entrenched. Forces evolve to protect the status quo of any system, regardless of what that status quo is. In Boston, as in most American cities, the status quo is disposal.

As the preceding discussion showed, waste disposal is the *product* of the dominant mode of governing. It is reinforced by the weak enforcement of existing policies and regulations that promote diversion, as well as by the incentives provided by waste system financing, the interests and infrastructures of the private sector, an institutional structure that shields waste decision-makers from alternative visions and viewpoints, and by the values and priorities of waste managers themselves (see Table 1 for summary). These forces combine to ensure that disposal remains the outcome of waste management practice in Boston; the interaction of these forces is the dominant mode of governing.

If Boston were to increase enforcement, recycling in the city would likewise increase, perhaps even tipping management practice from disposal dominant to diversion



dominant. This shift would not alter the modes of governing in themselves, but would create a new dominant mode of governing, oriented around rationalities of diversion. If this were the case, private sector interests and the landscape of incentives would shift slightly and residents and businesses would become accustomed to the new procedures. Over time, diversion would develop a 'momentum' (Hughes, 1983) similar to what disposal has currently.

Such a situation would be similar to some American and many European cities where waste systems are not strictly disposal oriented. Seattle, for instance, diverts about 60% of its municipal solid waste from the landfill. This diversion rate, which far outpaces the national average, is the product of an entire system oriented around waste reduction and diversion activities, including alternative rationalities, formal goals, and professional expertise that extends beyond traditional waste management interests (Pollans, 2017). Similarly, in municipalities in Switzerland – European cities whose waste systems have not been dictated by ambitious E.U. directives – the status quo is advanced systems of material diversion through recycling, composting, and energy recovery (Herczeg, 2013). The dominant mode of governing in both Seattle and throughout Switzerland is characterized by rationalities of reducing environmental impacts of waste disposal in addition to capturing the economic value in waste materials. Given the nature of these dominant modes, the incremental mode in cities like these might be characterized by 'waste-as-resource' rationalities; the visionary mode might be driven by even more radical attempts to reduce consumption.

In Boston, where the dominant mode supports disposal, the incremental mode is characterized by diversion rationalities that are limited in scope. As the case of the transition to single stream demonstrates, the incremental mode of governing builds on interests, values, and infrastructures that also support the dominant mode, while simply nudging practice towards slightly more material-efficient practices. In contrast, the visionary mode of governing is grounded in more radical possibilities, the implementation of which would require new infrastructure, new regulations, and new practices from all system participants. But, despite its ambition, the visionary mode is actually a legitimized public vision. In the Boston case, this mode is embedded in Massachusetts's Solid Waste Management Plan; it was crafted through a robust public process and captures the desires and goals of both lay people and experts in the state. It remains visionary, however, because it has not yet been connected to concrete implementation pathways.

Finally, the aspirational mode of governing is grounded in rationalities that remain completely segregated from waste management practice and decision-making. In the Boston case, only intermediaries with no formal channels for input into city decision-making processes operate within this mode. They promote radical possibilities: a new set of rationalities that views waste as a stream of resources that can help create jobs, empower communities, and be part of the solution to enormous societal challenges including climate change and inequality. This vision is compelling, but it has not been publicly legitimized through a planning process, nor has it found its way into any formal planning or decision-making processes at the city scale.

The original modes framework put theories of governance and governmentality in conversation. It was intended 'to combine an understanding of the forms and processes of governing, and to recognise the multiplicity of modes through which they are established and exercised' (Bulkeley et al., 2007: 2739). The reframed modes framework builds on this essential contribution. By reframing the modes around degrees of entrenchment, the framework becomes a tool for extending our understanding of infrastructure lock-in, and the ways that complex systems relate to societal goals for sustainability. The critical

contribution of the new framework is that it allows observation of the multiple pathways of lock-in; it reveals the ways that barriers not only reinforce current practices, but how they simultaneously limit the viability of alternatives already at work within the system.

### **Conclusion: Changing the nature of the dominant mode?**

This article builds on the modes-of-governing framework developed by Bulkeley et al. (2007) by empirically demonstrating barriers to transitioning from the disposal oriented to more sustainable waste management practice in Boston, Massachusetts. Based on this barriers analysis, the article proposes a new way to organize the modes of governing framework based on relative entrenchment, rather than specific waste management techniques or governmental rationalities.

The case of Boston illustrates various ways that disposal – the most historic and traditional waste management approach for most cities in the United States – is entrenched, as well as the ways that alternative modes are prevented from influencing waste management outcomes. Even when concerted efforts are made to alter practices and policies, a variety of barriers protect the status quo. In the case of Boston, these barriers include a lack of enforcement of existing policy, fragmented commercial and residential management, financing that incentivises disposal, and the functional distance of those most interested in change from decision-making processes. The result is that the most environmentally optimal mode of governing has the least agency to influence practice.

A key benefit of organizing the modes by degrees of entrenchment rather than by governmental rationalities and waste management techniques is that it can be adapted to contexts with different ranges of values and priorities. It is important to note that, irrespective of any systemic change to date, none of the modes of governing competing in Boston's waste sector, or within the original modes of governing framework, emphasize waste reduction. None of the original modes, therefore, presents a radical break from current economic and social practice, demonstrating the degree to which even activists are embedded in the current system.

These findings suggest several avenues for future research. First, it is necessary to test the new framework, preferably in sites that have successfully transitioned from a disposal-dominant system to a different set of practices, in order to understand the mechanisms that allow barriers to be overcome and transitions to take place.

Similarly, while questions of scale and system geography have been well documented as barriers to effective system governing, more comparative work is necessary to understand the relative impacts of these variables on governing outcomes. For instance, there have been no systematic analyses comparing solid waste systems that operate at metropolitan and local scales; or highly centralized and controlled systems versus those that are diffuse and fragmented. This work also does not substantially address the question of how to include residents in the transition to different kinds of practices and waste management technologies. Some scholars have begun to examine the role of individuals and households (see e.g. Bulkeley and Gregson, 2009; or for a more general sustainability transitions perspective: Shove and Walker, 2010), but much work remains to be done to connect individuals' habits to transitions in system governing. And finally, the modes of governing framework have been used predominantly for the study of solid waste systems. But given the widespread and urgent need for infrastructure and urban services of all types to move away from traditional, resource and energy-intensive practices, and the opportunities in the new iteration of the framework presented here, there is potential for the framework to become a useful tool in

understanding how system governing is connected to societal aspirations in new ways, across multiple system types.

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### **Notes**

1. It is key to recognize that many, if not most, consumers have little choice; this was part of Gille's point. If only low-quality products are available, the consumer has no choice. But given American habits of consumption, much of what is purchased cannot be considered essential for survival, though it may be essential for self-presentation within a particular social setting (Schor, 2000). Even within these constraints, some individuals do have a reasonable option of consuming less. Some, but not all. A key challenge for proponents of sustainable consumption is to reconcile demands for reduced consumption with the reality of an unequal world in which many still struggle to consume enough (Land, 2016).
2. How to encourage consumers to make different choices is the subject of much debate; information alone has not proven to be sufficient in most instances – the so-called values-action gap – although it was widespread consumer education and subsequent pressure that ultimately led to stricter regulation of CFCs (Hayes, 1990).
3. Though energy recovery through incineration or other methods is often counted as part of waste diversion, neither the U.S. EPA estimate, nor the city of Boston counts energy recovery as part of their diversion rates. Both figures include composted food and yard wastes and traditional recycling.
4. Although MassDEP comments, the local board of health ultimately issues a site assignment for a new solid waste facility.
5. Massachusetts is prohibited from policies like a recycling mandate because of a 'state-mandate, state-pay' expectation from municipalities that results from a ceiling on local property tax increases. Lacking the funds to support mandatory municipal recycling in all Massachusetts municipalities, the state instead resorted to waste bans (MassDEP employee, interview, January 2012).
6. Massachusetts General Law Chapter 111, Section 31 endows municipal boards of health with broad authority to 'make rules and regulations for the control of the removal, transportation or disposal of garbage, offal or other offensive substances'. However, few municipal boards of health in the Commonwealth take advantage of that authority, especially in cities and towns where solid waste management has been delegated to a different department, such as public works. One waste reduction advocate interviewed for this paper suggested that the lack of local solid waste regulation is 'a matter of tradition, not authority' (interview, environmental activist, January 2012).
7. These recycling rates are based on data reported by the city to the state. The rate is total diverted (tonnage recycled + yard waste) divided by the total waste generated (tonnage disposed + recycling + yard waste).
8. A large portion of Boston's waste is brought to a waste-to-energy incinerator in a nearby city. While many cities consider waste to energy a form of diversion, Boston does not. In any case, the fact that it is a WTE incinerator is immaterial to Boston's policy decision to send waste there; that decision is made on the basis of cost alone (PWD employee, interview, 2012). Since Boston's system managers

- consider the WTE facility to be a disposal facility, this analysis considers waste sent to the WTE incinerator as 'disposed'.
9. The state of Massachusetts is prohibited from enacting unfunded mandated on municipalities; the bans are a work around and serve as an accepted regulatory tool through which MassDEP can guide MSWM practice in the state.
  10. One representative of the private sector noted, 'It's not our fault! We don't have x-ray eyes, we can't help what the customer puts in it' (interview, January 2012).
  11. There is no available data to assess waste ban infractions by sector, but public and private sector representatives suggest that waste ban compliance is most problematic for commercial collection, mainly because of the volume of paper and cardboard in the loads. It should also be noted that as of this writing, MassDEP has expanded the use of third party inspectors to increase waste ban compliance as part of the new organics ban (MassDEP employee, personal email, February 2014).
  12. The service is not actually free, of course; residents pay through property taxes. But since there is no separate bill, residents do not pay directly for waste collection or have any sense for what the service costs.
  13. Not all haulers benefit; one smaller independent hauler noted in an interview that the larger companies have established near monopolies on service provision and infrastructure capacity, particularly in recycling. They are able to muscle out smaller companies (private hauler, interview, 2012).
  14. Evidence suggests that single-stream recycling actually results in higher material contamination. The gain at the point of collection is reduced because of the amount of material that is disposed after sorting, which potentially makes the leap even less impressive (Lakhan, 2015; Morakawski, 2010).
  15. 'Zero Waste' is a term that has been developed by environmental and waste reduction advocates to describe product manufacturing and waste management cycles where no material is unnecessarily sent to a landfill or incinerator. Rather products are manufactured to be easily disassembled and reused or recycled and all waste generated in homes in businesses is reused, recycled, or composted (Zero Waste International Alliance, n.d.). The concept is intimately related to industrial ecology, and McDonough and Braungart's 'cradle to cradle' concept, but has been more broadly adopted by solid waste managers at many scales and in many sectors (McDonough and Braungart, 2002).

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