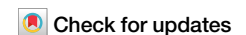# Countering exclusionary infrastructure in apartment waste management: Towards a relational place-based governance in Victoria

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In this paper we illustrate how normalised practices and strategies of waste management pay insufficient attention to social life and distributional impacts by excluding apartments and placing them at the margins of domestic waste management. In considering shifts towards more circular post-consumption systems, this paper describes the problematic policy and regulatory imaginary of apartment waste management within the Circular Economy narratives of sustainable domestic waste management. We present an argument for a relational approach to domestic waste as a counterpoint to technocentric and market-based approaches, with implications for governance and infrastructures of apartment waste management. We illustrate how spatio-temporal and socio-material bundles of practices could chart new directions for reduction and collection. We seek to demonstrate how relational place-based measures and shifts in practices in Victoria and elsewhere could counter exclusionary infrastructure by more purposefully including the marginal spaces that apartments inhabit.

As policy frames in westernised countries seek to respond to multiple pressures on household waste – including lack of landfill space, bans on exports, and public imperatives to radically reduce greenhouse gas emissions - the rise of the Circular Economy (CE) idea presents as an aspiration to shape policy and action. For current purposes, this CE idea envisages elimination of waste and the recirculation of materials into society as a continuous flow[1] especially through recycling[2].

The problematic policy and regulatory imaginary of apartment domestic waste unfolds within this context. Across westernised cities, apartments are generally associated with lower recycling rates compared to other housing typologies[3]. Given the growth in apartment living and the urgency to reduce waste[4], there is a commensurate urgency to understand CE-society relations as they pertain to everyday apartment living, and how these relate to (un)sustainable patterns of consumption and waste[5].

After presenting the methods, we illustrate through the second section of the review that amidst efforts to increase recycling from apartments, urban waste management tends to adopt a model of intensification that extends end of pipeline, methodologically individual, technocentric and market-based approaches. These pay insufficient attention to the role of social life in general and, specifically, distributional impacts and inclusion. As a result, domestic waste management systems do not work as envisaged, and indeed, CE initiatives could exacerbate already-existing exclusionary infrastructure, failing both in themselves, and by generating more extreme forms of inequality[6]. The third section of the review reveals relations that shape and are shaped by apartment waste management include uneven patterns of infrastructure, and variable local government arrangements, strata governance, and household capabilities. In the fourth section we propose that apartment-based waste is thus essentially place-based, practice-based, and contextual, and thus efforts to address it require a place-based relational governance response.

This review discursively charts the literature on waste management and apartments to propose relational frameworks as presented in several reviews in this journal[7]. Starting with a place-based focus on Melbourne, Australia, a review was undertaken of grey and academic literature on case studies/pilot projects/guides involving waste collection and participation associated with apartment developments. The articles were chosen locally, then nationally, then internationally and the search was stopped when new themes could not be developed[8]. While some papers received a cursory

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reading, other papers were chosen specifically if they were literature reviews, case studies or reviews of case studies, helped develop new themes and/or provided new approaches for apartment waste management within the themes. The critical review proceeded as follows (all are not listed in the references due to word count limitations):

1. Review of city-wide strategies of urban waste management and apartment waste management (n = 27).
2. Review of academic literature studying apartment building waste management - (n = 35)

The review primarily revealed work across the Global North, including Australia, Europe, and North America, with a smaller component of literature related to Asia. We recognise that broader cultural practice is heterogeneous, and this shapes waste governance and practice in apartments across jurisdictions, cities, and social classes. Grey literature produced by institutions that advised governments and were involved in waste management design and implementation were specifically sought. Other reports that provided state, country and region level waste management and Circular economy recommendations such as by Sustainability Victoria[9], the Ellen McArthur Foundation[1], and those commissioned by the European Union[10] were also studied for an overview. We also examined high level papers that had examined waste management at the city level. The terms used in several databases such as Scopus, Web of Science and Proquest Central provided by the University Library and Google scholar database included "apartment waste management" "apartment recycling", "waste and recycling in apartments" and similar searches that substituted 'apartment' with 'high rise' and 'multi-unit developments'. We prioritised articles from 2010 to the present (2023) but included some before 2010 due to lack of much material available on apartments.

Coding (initial themes) was done and analytical themes that were generated were a result of a qualitative, non-positivistic and interpretivist stance. The initial themes were generated based on the elements that are used in waste management, including waste prevention, recycling, contamination, and disposal. The codes that were used for mapping the findings are

- Ontological and implementation approach.
- Materials and technology
- Temporality
- Organisation of waste management
- Policy making

Using the codes (or initial themes), two analytical themes were generated as the 'central organizing concept' of the data[11]. The sections below present the two themes: interventions and their fate and the reinforcement of apartment waste exclusionary infrastructure reflect the two main ways in which we created "interpretive stories about the data" (p. 594)[11]. Section 1 interprets the codes as techno-behavioural interventions to understand how change is implemented and section 2 interprets the codes together as waste infrastructure to understand who or what may be excluded from it.

Techno-behavioural interventions and their fate

Interventions that have focussed specifically on addressing apartment waste behaviour have had mixed results in terms of increasing participation rates, including a decline following initial upsurge in participation, as seen in Melbourne[12]. So much so that recent investigations found that recycling infrastructure had been pared back after the initial pilot funding ended[13]. Another example, 'Making recycling work for people in flats'[14] was a two-year project (August 2017 to July 2019) led by Resource London, examining apartment residents behaviours and deterrents to recycling. Despite interventions to promote increased recycling rates, they did not match those in equivalent low-rise properties in London. The projects concluded that, despite many learnings in how to increase recycling rates in flats in London, a variety of design and societal factors constrained recycling performance.

Behaviour-change programs assume households have a free choice and hold them responsible for tasks such as sorting and recycling. The

Northwood brown bin project[15] piloted food waste collection (February to October 2019) in apartments and found that apartments present particular needs and challenges, and that initiating and embedding behavioural change is difficult. This is perhaps unsurprising, particularly given that, despite legally binding regulations, very few new apartments were provided with an option for a brown-bin waste collection. Infrastructures, sorting technology, scheduling, and human resources were all highlighted as problems.

New York Department of Sanitation (DSNY) sought to increase recycling through Single-Stream Recycling Capture (combined paper, cardboard and metal, glass and plastic)[16]. While this co-mingled or single stream method decreases the value of some waste streams, and separation is dependent on the sorting technology, the approach does reduce onsite infrastructure needs and mileage of different waste trucks. While this focus on supply side infrastructure is a departure from behaviour change based approaches, there is other work on New York city showing how a lack of janitorial services in buildings rented to lower socio-economic groups may have been responsible for low recycling rates[3].

Moreover, there is a gap in research and interventions in social housing apartments especially in studies that address marginalised communities and spaces. For example, a London study on flats found management of recycling in the social housing flats to be neglected, and non-existent in the case of specific services such as food waste, electrical waste, textiles, and reuse[14]. Research has also suggested that social contexts of flats can be a barrier, including social isolation and lack of a sense of community. Aldape Garcia[17], in her study 'Moral Positioning in Sites of High-Rise Public Housing in Australia and Mexico' found that there are other ways of looking at this issue. Her study found that emotional and historic ties to the site shaped how waste practices were produced in these public housing high-rise apartments. There was a lack of reinforcement of social rules and fear and concern for safety that shaped how waste and consequently waste management was practiced.

This also raises the question of the time over which practices of waste management are established and the continued success of the interventions. Some successful pilot projects designed as interventions for recycling specific materials such as food waste[17], or specific sites, such as social housing[11] were not given extended time or concentrated focus, or were designed on a different premise, that is, for short term goals to be successful over the long term.

The next section uses a relational approach to reveal critical entanglements of everyday life in apartments and items designated as waste. As a techno-behavioral focus becomes increasingly inadequate, as shown above, attention turns to relational approaches that account for the spatio-temporal, institutional and infrastructural dimensions of everyday waste management[18]. Addressing the question of what waste means culturally, relationally, and what meanings, contingencies, and variations exist in these relations across society can shed new light on how waste management (dis) enables and (dis) advantages participants[19,20].

The reinforcement of apartment waste exclusionary infrastructure

Important differences exist between the arrangements to collect waste from apartments compared to other housing. Waste management systems – regularly removing bins from kerbsides – was established as a locally-organised activity for detached/semi-detached houses prior to the proliferation of apartments. Local governments, such as in Victoria, typically absolve responsibility for collection when apartment designs depart from accommodating standardised kerbside collection systems, such as bin sizes and bringing bins to the kerb for collection. The private contractors operate in various ways, without obligations or reporting requirements[21], across privatised individual landholdings and buildings across cities; in other words, they inhabit and reinforce a splintered set of urban arrangements. A survey conducted in Victoria, Australia, revealed a dearth of data collection and reporting systems for kerbside waste management particularly multi-unit developments[21]. In Victoria, not all local governments offer new recycling programs like food waste to apartments or hard waste collections,

with apartments that were serviced by private contractors asked to make their own arrangements[22]. Further to reporting by councils and private contractors, a recent study shows that there is a dearth of academic research on apartment waste management, especially social housing[23].

In the US (New York is an exception)[3], the following reasons were presented to not provide recycling facilities to apartments:

- apartments are associated with commercial developments where local governments exercise little control.
- contractual arrangements between private waste contractors and condominium management in apartments are another area where local governments exercise little control.
- apartment dwellers are perceived as less likely to participate in recycling programmes than single family dwellers.

The latter of course becomes a self-fulfilling prophecy; if apartments have little or no recycling infrastructure then apartment dwellers are less likely to be able to participate. Thus, contextualised within place-based, regulatory, or practice-based epistemologies of housing and waste management, apartment waste infrastructure is excluded from the mainstream; it is neglected, privatised, undocumented, hidden, and problematised. As recent evidence in social housing in Victoria illustrates, rudimentary or no recycling infrastructure was provided after successful pilots were concluded[13]. At the same time, apartment dwellers are responsibilised and held culpable even as evidence of lack of fitness for purposes of infrastructures and services were laid bare as shown in pilots in Canberra, Ireland, and Northwood bin project[15,24,25]. A focus on behaviours, such as believing "the majority of people are 'getting it wrong' simply because they do not understand how to get it right"[26] exacerbates the exclusion, directing attention away from the real differences at play between apartments and other typologies, as many studies above concluded.

Orienting apartment waste systems through socio-material relations and practices

Recognising that what people do in managing waste in apartments is largely routinised, embodied and unreflective practice, it follows that social practice theory provides a useful means to observe the elements and relationships with other practices and materials[27]. The dynamics of waste practices then becomes the locus of transformation for circular economy discourses. As the smallest unit of inquiry (as opposed to an individual or a material), practices themselves are organised entities, as well processes of performing, with both these understandings being mutually interdependent. It is in the constant reproduction of practices that small adaptations and negotiations between the elements of the practice that can bring about change. At the same time, social life is understood to be constituted by multiple practices that overlap in the form of bundles that have various characteristics, such as temporalities, spatialities, materialities and so on. For example, eating and storage practices are closely related to food waste and disposal practices along with social norms, and family and cultural practices[28,29].

Governance. Governance approaches are therefore needed that extend beyond normative explanations of waste being a matter of choice and behaviour. Numerous challenges face attempts at innovative governance that accommodate relational perspectives, not least of which are incumbent discourses of technology and market-based logics, and siloed existing departmental responsibilities and related governmentalities. An example of innovation in this regard is the zero waste governance approach in Scotland analysed by Wishart and Bebbington[30], which included the setting up of a specialised delivery body, a reuse labelling scheme, and local volunteer program. The importance of networks and boundary organisations and the potential dominance of measurable targets in zero waste are highlighted, together with suggestions such as developing broader and pluralistic zero waste indicators[31,32].

Adaptive governance is one way of reflecting how recycling measures require multiple foci and inputs, including considering temporalities. From creating trust, to how well-functioning infrastructure is maintained and

adjusted, what becomes evident is that "institutional quality is linked to reported recycling behavior, and both institutional trust and generalized trust are also correlated with reported recycling behaviour"[33]. Adopting integrated approaches to governance beyond recycling may also highlight other sites of intervention and investment as "the factors that appeared to influence re-use and waste reduction practices are different to those which govern recycling behaviours"[34]. Altman[35] contends that 'wish cycling', where consumers put non-recyclables into recycling streams, is best seen not as poor behaviour to be corrected, but as a production failure, requiring a shift of focus onto producers.

Place based relationalities. Geographers such as Massey[36] and Soja[37] have asserted that space is not a container for objects to be placed in or upon. Instead, it is socially produced, with shifting relationalities. For Latour[38] and Schatzki[39], space and place are constantly made and remade, albeit through actor networks and shared understandings and notions of place[40]. In contrast, some studies concluded that, where policies and strategies were implemented for apartments, these were generally designed and implemented without taking account of the socio-material specificities of apartments. According to Zhang, et al.[41], the context of the apartment was side-lined when talking about recycling programs leading to low recycling and high contamination rates. Ordoñez, et al.[42] in their study on apartments found that user's needs and resources and services offered were mismatched. Sorting errors that ensued as a result led to a loss of almost 70% of material that could have been sorted into other streams for better recycling outcomes. They proposed design interventions that accommodated place and practice-based relationships and connections.

The concept of the 'site of the social'[39], by giving ontological priority to practices, provides the means for engaging with the relations between phenomena over space and time, constituted through practices and material arrangements. For example, the concept of lived space[36,37,43], considers the limitations of spatial understandings that purely emphasise and prioritise the built environment. It provides a way to understand the temporality and spatiality of practices that goes beyond 'objective' time and space to understand how practices are organised teleologically, that is, determined by their end goals[39]. By understanding space as lived space, as produced by the interplay of interrelated practices and their material arrangements including physical space, and using this concept empirically, connections across space and time can help to broaden our understanding of sustainability outcomes. Researching e-waste across two continents, Lepawsky and colleagues[44] use the concept of 'site multiple' to follow practices as a place-based way to understand the 'cityness' and it's more than human geographies (of waste). The concept of site multiple, like body multiple, is not so much multi-sited as multi-faceted and multi-layered and allows the understanding of a city or place in the making rather than as bounded and determinate[44].

A case for place-based relational and material approach calls for integrated qualitative and quantitative research. This is demonstrated by the case study of Hong Kong high rise apartments[45], where food provisioning from wet markets makes the food (and thus the waste) fresh yet prone to early decay compared to places where there is more reliance on frozen or dry food[45]. This requires a different approach to food waste disposal in apartments, especially given the shared nature of common spaces and infrastructure. Hygiene and cleanliness are a specific issue for apartment shared areas and infrastructures, including waste, with concerns about participation heightened following the outbreak of the COVID-19 pandemic[45,46].

Research has also pointed out that, especially for social housing, and given the various social contexts, no single research or practice may be directly applied to those of another[23]. For example, assuming that low income or transience is the cause of low or contaminated recycling streams not only takes the focus away from other variables such as infrastructure, but it also directs attention away from reuse and reduction infrastructure and strategies, or the lack thereof. Therefore tailoring specific interventions to everyday practices and spaces and a consistent standardised but flexible approach is proposed[23].

Towards relational place-based governance

Turning to the final objective of this paper, how might relational place-based measures and shifts in practices counter exclusionary infrastructure by more purposefully including the marginal spaces that apartments inhabit? Thinking about waste management as social practice, this becomes a question of creating possibilities for new socio-material bundles of practices to take hold, that might reduce waste and lead to used materials becoming minimised, reused, or redeployed without fuelling consumption.

Everyday waste routines. Everyday waste routines have been and are more than ever set to play an important role in organising future waste infrastructures, shaping, and being shaped by waste management practices of councils and governments. The number and kind of bins will shape designs of houses (for example: larger or better utilisation of space in kitchens for sorting multiple streams) and individualised requirements for the size and kind of bins from householders[47–49]. More bins, in different places and in different ways means that waste researchers and planners need to engage with the attempts of various stakeholders to configure how waste is sorted, collected, and disposed of, especially at the nexus of household and city level - and to do this while trying to manage the extra waste burden on vulnerable households[50]. Moreover, recycling and reuse strategies, including the sorting infrastructure that encompasses the routines of apartment dwellers may enhance the efficiency and effectiveness of recycling[42].

Katan and Gram-Hanssen[51] use the potentiality of practice theory in studies of waste and recycling, specifically waste sorting by illustrating how cultural norms connected to the way we care for our relationships may break the transition of everyday life practices towards sustainability. In this study what might appear as an occasional abandonment of an otherwise well-established sorting routine, emerges as an indication of subtle and mundane relationalities that may more generally slow the transformation towards sustainability, of not only waste practices but also more social practices. Their study also illustrates how bundles of practices can be collaborative or competitive, resulting in various outcomes[52]. As Shove and Walker[53] argue, practices are always 'emergent', defined by 'uncontrollable trajectories' and that 'we need to attend to ongoing processes of transformation'.

Organisation of waste at the city and global level. In terms of how waste management is viewed, waste diversion from landfill (and incineration in some countries) has been the primary perspective[5]. However, researchers and many governments are exploring alternative metrics, such as impact based metrics[54]. For example, the city of Toronto has considered a GHG avoidance per tonne of waste from landfill. These alternative metrics have been proposed due to the 'evolving tonne', whereby in the last decade or so, not only the volume, but material differences in waste, such as several kinds of packaging material, which may be lighter, may not be recyclable or in the same way. have emerged in the waste stream[5]. As it is uncertain what the composition of the recycling stream will be as new policies and materials come into play, how and which waste is collected becomes difficult to ascertain and plan for[55]. The challenge is to consider how waste, its production and disposal in apartments and different contexts has ethical, inclusion and sustainability impacts and how to streamline waste-diversion in line with waste prevention, production, and sorting[54], beyond recycling and perhaps quantitative assessments. For example, by analysing how plastics and other waste streams are entangled in everyday apartment living[49], enhancing the sustainability and well-being capabilities of low-income apartment dwellers[56] as well as paying more attention and resources to waste prevention[57].

Chappells and Shove[47] review the organizational futures of households and waste utilities, and the power plays between these groups. They contest some claims made by waste authorities in terms of lack of spaces for various bins and the reluctance to include high rises in multi stream collections because of financial and time reasons. They frame such claims in terms of how waste companies may want to justify their current practices and future interests, rather than what infrastructure can be put into place to ensure sustainable waste practices.

Infrastructures and affective bundles. Reimagining waste collection services as infrastructures for the neighbourhood, when goods and materials are (re)circulated close to sites of consumption, opens possibilities for value creation at neighbourhood level[58]. This not only reduces travel and courier logistics, it also potentially allows for relationships of care, community capacity, and communitarian processes to become established as an antidote to marketized waste logics. A shift from 'waste as commodity' to 'waste as vector for care and community' prompts connection to degrowth and its instinctive inclusive and just environmental orientation.

Considerations of social life are essential in efforts to close the loop on supply and demand of waste[59]. Without these, transactional assumptions about market-material relations clash with the expression of positive values associated with not-wasting, caring for others, and social responsibility. Social isolation, social stigma, and lack of capacity, opportunity and somatic aspects such as smell and disgust fundamentally shape uneven engagement with waste[60,61]. Given these entanglements of circular economy and society, policy interventions that target consumer behaviours and/or ignore social life can only be expected to have marginal, if any, impact on domestic waste. Oversimplification of CE-society relations thus prompts the need for critical reflection on CE[62].

Final reflections

An implied assumption in much of the waste management literature and CE is that recycling/repurposing waste instead of landfilling it is likely to reduce greenhouse gas emissions and thus address climate change. Two key problems can arise from this assumption. First, it leaves out much important detail of waste in society and potentially allows current systems of consumption and production to continue, with the proviso of more attention to recycling, which does not automatically mean a reduction in virgin material consumption[63], unless specific measures are taken to curb virgin material and fossil energy production. Second, waste policy is largely positioned as an end-of-pipe material management issue, with consumers/citizens (we use the term householders) as the main target[29,64], relying on simplistic understandings of consumption and place such as this paper shows in the case of apartment waste management. Design of pilots and research, providing infrastructure and its organisation, and implementing policies is based on dominant detached dwelling waste practices or as a just in time measure, and the responsibility of waste management is assigned to apartment households. This further means that (a) producers and marketers of consumption are excused, and (b) the waste produced by industries, agriculture and construction activities is ignored[65].

Apartments are currently in the 'too hard' basket of waste management policy; they are excluded by virtue of being inherently different to the detached, semi-detached, and unit-based housing that kerbside systems were designed for. In this paper, we have sought to review and juxtapose ideas of circular economy waste management with relational understandings of social life. Accepting that "life histories and chances are inter-woven with material cultures and practices"[63], requires careful work to map and understand the linkages between everyday life, discard practices and the uneven - unfairness - of existing arrangements that purport to advance the circular economy. This provides a basis to then revisit governance arrangements and what can be done to counter exclusionary infrastructure by more purposefully including the marginal spaces that apartments inhabit. There is an opportunity here for engagement with established notions of rights to the city, equity, and place as loci for renewed directions towards inclusionary apartment waste infrastructure.

Reporting summary

Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability

The data that support the findings of this study are available from Google Scholar, Scopus, Web of Science, JStor and Proquest Central but restrictions may apply to the availability of these data, which were used under licence (from the University) for the current study and so may not be publicly available. The data are, however, available from the authors upon request. There is data that is open access and is available on Google search. Links to those data have been provided in the article.

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Author contributions

Both authors have made substantial contributions to the conception or design of the work; First author has led the acquisition, analysis, and interpretation of data, as well as drafting and revision; Second author has contributed to the interpretation of the data and has substantively contributed to the drafting and revision of the work. Both authors approve the submitted version. Both authors have agreed to be personally accountable for their own contributions and have ensured that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, have been appropriately investigated, resolved, and the resolution documented in the literature.

Competing interests

The authors declare no competing interests.

Additional information

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