



Unmaking waste in Policy and Practice

Session 13

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Unmaking waste in the global commons: local legislation and regional governance as policy solutions for “garbage patches” in oceanic gyres

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This paper takes a significant environmental problem – the ‘garbage patches’ in the world’s oceans – and looks at whether it might be solved through a combination of local legislation and regional-level governance. It outlines the physical and technical facts of the ‘garbage patches’ and identifies their governance ramifications as a multi-level ‘commons’ problem. It notes the actors/stakeholders and the responsible institutions. It considers one possible solution – sub-national legislation – proposed by a legal scholar. It extends her idea by asking whether local-level policy instruments (laws) might more effectively engage values if they are implemented within and by countries that are part of a regional governance community of practice. It draws on recent environmental governance scholarship to assess the advantages of working regionally on problems in the global commons. It considers these ideas by evaluating collective action and social practice governance as part of the solution to commons problems.

Keywords: *garbage patches, oceans, commons problems, environmental governance, local legislation, regional fora*

An introductory map

This paper takes a significant environmental problem – the ‘garbage patches’ in the world’s oceans – and looks at whether it might be solved through a combination of local legislation and regional-level governance. It begins by briefly describing the physical and technical facts of the problem and its governance ramifications, given that it is a multi-level ‘commons’ problem. After identifying those who might be considered actors/stakeholders and the institutions attempting to manage the problem, it considers a possible solution – sub-national legislation – proposed by a legal scholar. It extends her idea by asking: can local laws be more effective if they are implemented within countries that are part of a regional governance structure? Drawing on recent environmental governance scholarship to assess the benefits of regional collaboration for problems in the global commons, it will consider the possibilities of collective action and regional governance as socio-political practices that might solve such problems.

While it offers a contribution to the literature on environmental policy and governance, this paper has been informed scholarship in four disciplines: law (Coulter 2010; Hudson & Rosenbloom 2013; Kotzke 2012); economics (Hepburn 2010), especially game theory (Ostrom 1990; 1999; Ostrom et al 1999); international relations and environmental politics (Andresen & Rosendal 2009; Conca 2012; Dryzek 2005; Faure & Lefevre 2005; Morin & Orsini 2013; Vogler 2012); and current work on environmental governance (Balsiger & VanDeever 2012; Brousseau et al 2012; Downie 2005; Gale 2014; Gouldson 2009; Johnson-Freese & Weeden 2012; Lebel, Garden & Imamura 2005; Selin 2012; Tynkkynen 2013; Warner & Marsden 2012).¹ It aims to synthesise the approaches presented in this diverse body of scholarship, by arguing that a ‘both and’ approach, while more difficult to achieve, is actually more viable as a long-term solution than an ‘either/or’ formulation. This argument is consistent with trends in environmental policy scholarship to integrate approaches (Hogl et al 2012; Niles & Lubell 2012; Young 2013) and pay attention to empirical evidence of private actors’ contributions to governance (Bled 2009; Gale 2014). Furthermore, a ‘broad church’ view is essential if we hope to solve — as opposed to tinker with — such complex (or ‘wicked’) problems.

The problem’s physical and governance elements

The problem of ‘garbage patches’ in the oceans came to world attention when Captain Charles Moore publicised his finding what became known as the ‘Great Pacific Garbage Patch’ in the north Pacific Ocean (Coulter 2010, p. 1962). Inadequate terrestrial waste management means that human-made products, especially plastic items, are getting into waterways and being washed out into oceans (UNEP 2009; Sheavly & Register 2007). These products may break into smaller pieces, but are not biodegradable. The currents of rivers carry them to the coastlines and they drift out to sea, mixing with rubbish thrown overboard from boats and ships. Gravity and the oceans’ currents swirl this waste into basins, where gyres’ centrifugal forces assemble them as loosely drifting ‘patches’ of debris (Maximenko 2008; 5 Gyres Institute 2014). Translating these facts into the conceptual language of environmental governance, this is a *transboundary, multi-sectoral, multi-stakeholder* and *multi-level international collective action* problem; marine litter is a policy problem caused by waste generated by humans that ends up swirling around, unwanted, in the oceans (Friedheim 1999; Kullenberg 1999; Warner & Marsden 2012).

¹ Because this paper makes an argument using the work of others as evidence, I will not paraphrase all of it in an initial literature review; instead, I will draw upon it as this paper’s discussion unfolds.

This environmental problem is occurring in a space that is outside the jurisdiction of any nation-states, in the 'high' or 'open' seas (Coulter 2010, p. 1966), i.e. the global commons. It is a problem that begins with human beings and thus involves all levels of our governments – local, national and regional – and also our governance structures and practices, because of the diversity of actors whose involvement is essential to its solution. There are multiple actors/stakeholders, including plastics manufacturers and businesses reliant on plastics, consumers, all levels of sovereign states' government, international organisations supported by governments, and various non-government organisations that represent environmental or industrial interests.²

The formal institutions that could help manage this problem include the 1982 UN Convention on the Law of Sea (effective since November 1994) and the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA-LBA), adopted by an intergovernmental conference in Washington DC in 1995.³ Despite there being plenty of arrangements and agreements that could – if fully implemented – help rectify the problem, it continues to worsen (Kullenberg 1999; UNEP 2009). In this, it is like other problems of global environmental governance: the regulations are 'weak, non-binding [and] inefficiently implemented' (Bled 2009, p. 154), perhaps because there was/is a lack of representation in the creation of the underpinning principles and norms, which undermines their legitimacy and authority (Hogel et al 2012; Kotze 2012, p. 24). What, then, might be done?

A legal scholar's policy solution: local legislation

The likelihood of global actors agreeing to implement a sufficiently aggressive treaty on land-based marine pollution is so low that local solutions must take priority in the short term (Coulter 2010, p. 1973).

Given that: (i) international agreements are proving ineffective in reducing marine debris; and (ii) the garbage patches are outside states' jurisdiction under the relevant international covenant (Law of the Sea), North American legal scholar Jessica Coulter (2010) argues that the best way to solve the problem is via local legislation to stop the creation of this global problem at its source. Coulter's position is that we have a moral responsibility to protect the environment and therefore, regardless of the economic costs, equity demands that we do so.⁴ Citing the fact that voluntary self-regulation by plastics manufacturers in California has not been enough to get all of that state's producers to improve their methods, she concludes that laws are necessary to compel all of them to work harder to prevent their products from entering waterways. Perhaps similarly, she shows that efforts to engage values and encourage consumers to recycle plastic bags voluntarily have had little impact. While she concedes that innovative practices (making bags biodegradable and increasing recycling) and more traditional policy instruments (imposing taxes on their use) would all help, her position is: 'a ban [on single-use bags] is the best kind of regulatory measure' because they are 'too dangerous' to be allowed to keep damaging the environment (Coulter 2010, pp. 1977, 1978, n. 114).⁵ Coulter acknowledges that local US governments that have banned

² Please see Appendix 1 for a list giving examples of specific actors.

³ Please see Appendix 2 for a list of components of the global marine governance regime.

⁴ The structure of Coulter's article, and her references to 'average Americans' and changing 'American social and political thought' (2010, pp. 1962, 1995) also make it clear that, while she knows this is a global problem, she is looking for solutions that policy-makers in the United States can apply. For the purposes of this paper, I'll assume that her argument for local legislation is applicable to similar societies, i.e. democratic, (post)-industrialised, consumer capitalist.

⁵ Perhaps because there was community consensus and political agreement that 'something had to be done about them', South Australia's ban on free, single-use plastic shopping bags was introduced relatively easily, according to then Environment Minister John Hill (Environmental Policy and Governance seminar, Flinders University, Adelaide, South Australia, 11 April 2014).

single-use plastic bags might experience ‘first mover’ or ‘free-rider’ problems (2010, pp. 1987-1989) but she offers the Montreal Protocol⁶ as an example of how to deal with these risks, arguing that acting collectively and in concert avoids the ‘first mover’ dilemma, and pre-empts a stalemate. Coulter is less convincing when she claims that a combination of punishing actors who breach the ban and extending the ban to as many regions as possible (exactly how is not something she explains) will reduce free-riders. Coulter seems to have let a sense of moral urgency about the need to do something about the problem blind her to a logical gap in her argument — while much of the debris in the patches may have come from the United States, not all of it has (Maximenko 2008). Even if the US were to prevent its pollution from entering the oceans, pollution from other countries would still be a problem.

Coulter’s approach has two other shortcomings: (i) its narrow scale and limited scope and (ii) its reliance on the state and belief in compulsory policy instruments’ ability to force changes in people’s values and attitudes as well as their behaviour. Because Coulter is determined to find solutions within the confines of the United States’ system of laws and *governments*, she does not give enough credit to the possibility that an international *governance* regime of state and non-state actors, including those from the private sector, might work together at the regional level. This blindness to governance in favour of government is partly why she dismisses the potential of innovative practices, describing recycling efforts and the development of biodegradable plastics as ‘less viable alternatives’ (Coulter 2010, p. 1989).⁷ Secondly, she seems to believe that the impact of laws on society is a relatively simple, top-down and linear process; however, much of the current scholarly discussion of environmental governance and policy — informed by ecological science — points out the need for iterative processes and structures that mimic ecosystems in their flexibility and adaptability to uncertainties (see, for example, Karkkainen 2004; Brousseau et al 2012; Young 2013). In short, she has overemphasised disadvantages to alternatives so that the solution she favours ends up looking like the ideal. But it is only ideal in the abstract. In practice, solving this difficult problem will require various policy instruments (voluntary, mixed and mandatory), many actors, and links between and across all levels of governance. The particular contribution that regional governance can make is what I will discuss next.

Linking national communities for global solutions: regional level governance as an innovative contribution of social practice

Rather than seeing an untidy structure as a problem, however, we should be open to the possibility that such arrangements are, through the interplay of institutions they induce, more resilient than counterparts that are more centrally designed (Lebel et al 2005, p. 14).⁸

Lebel and his co-authors highlight regional governance’s strengths due to the plethora of organisations that can gather at this level to exchange information. While they argue that regional governance can encourage participation and thus promote solutions, they are well aware that a sound frame cannot be made out of weak wood, i.e. a regional governance structure will not overcome failures in national organisations (Lebel et al 2005, p. 8). Selin (2012) shows that the regional level is a valuable linking platform

⁶ The Montreal Protocol on Substances that Deplete the Ozone Layer (1987) is the best example we have of the international community acting collectively to solve a serious environmental problem.

⁷ Environmentally-minded industrial chemists, however, disagree: see Sheavly and Register (2007).

⁸ While I agree that we should accept that ‘the best is the enemy of the good’ so that we can get on with trying to act despite our limitations, we can see here the influence of the political context — authoritarian south-east Asian states that are somewhat reluctantly decentralising — on Lebel and his colleagues’ argument.

between states and their international obligations, one where states' capacity to understand and address a given problem can be improved in partnerships with non-government and/or private sector organisations. Using the Baltic Sea as a case study, Tynkkynen (2013) demonstrates the essential contribution that private and non-state organisations working in partnership with states can make to multi-level regional governance. The practice of cooperation by diverse actors is what will develop a regional governance structure. In a tricky political situation, a regional structure that involves all institutions and recognises various seats of authority is the most effective because it is the most likely to minimise conflict by maximising opportunities to participate and collaborate. Contra Coulter's concern that international agreements lack the power to punish transgressors, Tynkkynen (2013, p. 403) argues that a genuine commitment to governance practices that are deliberative and participatory means that a voluntary association's lack of sanctions and coercive powers are less important than they would be in a traditional government's top-down, command and control structure. (This is consistent with Ostrom's work, as will be discussed below.)

Still following Tynkkynen, the other important advantage that regional governance offers as part of a solution to this particular problem is that it is an appropriate scale. Thanks to Oran Young's work, it is pretty much a received truth that environmental management should 'fit' and be on a level appropriate to the scale of the resource/ecosystem being managed (Young 2013). While the world's oceans are a global resource, the garbage patches are concentrated in five gyres: in the North and South Pacific, North and South Atlantic, and Indian Oceans. States' regional affiliations (derived from the reality of geography) can be matched to responsibilities for their proximate marine environments and, under UNEP's Regional Seas Programme (which administers the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities), they are.⁹

We have evidence of regional level governance's efficacy in the six-year South Pacific Regional Environment Program's marine pollution and control project (SPREP POL), described by Morrison (1999). He shows that, despite some cultural and economic differences, 'regional cooperation involving a number of technical organisations in a large number of different countries can be established' (Morrison 1999, p. 518). There were three major reasons for the SPREP POL project's success: (i) local communities were consulted by administrators and acted as 'citizen-scientists' in gathering raw data; (ii) they were informed of the results by the scientists who interpreted them; and (iii) the project involved collaboration between wealthy and poor countries. We know that community involvement and interest, backed by expert advice, is mostly likely to help 'nudge' governments into continuing to work on any issue, but perhaps particularly an environmental one. What's missing from Morrison's example of successful regional cooperation for marine management is involvement by the private sector, but this is possible. Tynkkynen's Baltic case study describes private actors' involvement in high-level discussions with states and non-government organisations and, even more importantly, their shared and 'various commitments to targeted actions' (2013, p. 399); these being publically available on the internet help ensure two elements of good governance – accountability and transparency. Timing is a final point currently in favour of the regional level.

Environmental policy scholars have documented a trend towards regional governance – perhaps due to 'global fatigue' – which means that it may be the best (window of) opportunity for addressing this problem at the moment (Balsiger & VanDeveer 2012;

⁹ Note also, the Group of 77's support for UNEP is largely due to its regional approach to environmental management (Andresen & Rosendal 2009).

Morin & Orsini 2013). Ken Conca warns us that adding up regional governance's successes and failures does not necessarily mean it comes out ahead, 'for every Baltic Sea of cooperation, there seems to be a South China Sea of contention' (2012, p. 130). He argues, however, that working at the regional level does seem to be more conducive to the management of common resources, mainly because it is more straightforward and cheaper to organise a cast of international actors regionally than globally; it is also easier, on this slightly smaller scale, for there to be a buffer of time and space between actors and sudden changes. Ostrom (1990) has shown that actors can manage common resources, so long as they have 'the capacity to adjust' (Conca 2012, p. 129). The question of collective action and the commons is the third piece of this paper's puzzle, which I will consider in the next section.

Commons problems, governance solutions

Garrett Hardin's 'tragedy of the commons' thesis (1968) that resources will inevitably be exploited has been disproved by Elinor Ostrom (1990, 1999), whose work in political economy won her the 2009 Nobel Prize. Her demonstration that: (i) actors can recognise a resource as shared property, and (ii) they will therefore organise cooperatively to use it without destroying it, offers a theoretical way forward for the management of public goods. Friedheim (1999) applies Ostrom's insight to argue that the way to solve the problems of marine pollution is to increase states' rights over (and thus responsibilities for) the ocean. Instead of 'open seas', national areas should be demarcated. Kullenberg (1999) makes a similar point, suggesting that the already-existing Law of the Sea, which gives coastal states rights over waters 200 miles from shore, is a suitable framework. Extending the Westphalian concept of state sovereignty over oceans might well be the only way to make states take responsibility for the garbage patches; Vogler (2012) demonstrates that trying to solve commons problems by designating areas as 'the common heritage of humanity' has not succeeded. All of this is in keeping with an assessment of the challenges that global commons present by Ostrom and her colleagues (Ostrom et al. 1999). As they explain,

[b]uilding from the lessons of past successes will require forms of communication, information and trust [i.e. practices] that are broad and deep beyond precedent, but not beyond possibility (Ostrom et al. 1999, p. 282).

Ostrom and her colleagues have a myriad of case-studies which demonstrate that, although there is no one-size-fits-all property regime to solve commons problems, so long as the actors are able to 'communicate, sanction one another, or make new rules' they *can* manage common resources fairly and sustainably — even though individuals are on different places along the altruism-egoism spectrum and have diverse norms and values (1999, p. 279).

The most recent environmental governance scholarship supports the logic of multi-party collaboration by public and private organisations. For example, Fred Gale (2014) has shown that non-state actors are creating forums to resolve commons problems; he describes how a multinational corporation and an environmental NGO established a Marine Stewardship Council to mediate the interests of the many different actors in the fishing industry. Gale's conclusion, that democratic interest-mediating structures 'with high levels of legitimacy can achieve highest common denominator compromises' (2014, p. 10) for the environment, is in keeping with the point made by other environmental governance scholars that 'actors are [...] taking action in the absence of, or in areas that are beyond the reach of, the state' (Gouldson 2009, p. 2).

Conclusions: integrating values and practices

In considering an environmental problem that is not, under current national laws and international conventions, the direct responsibility of any particular state, this paper has explored some of the governance and policy issues we need to consider if we are to 'unmake waste' in the global commons. I suggest that a solution might be found if regional governance structures encouraged local communities to implement appropriate policies. Some of those policies would be laws, compelling behavioural changes by banning certain products and requiring polluters to pay for the harm done by their objects and/or processes (Miekle 1997). But others would be market-oriented 'mixed' instruments (supporting innovative production practices through tax credits) or socially-engaged voluntary ones (education and information campaigns) to encourage the iterative development of values that favour sustainable consumption practices (Dauvergne 2010). This synthesis of approaches, implemented by states reporting to a regional governance forum should — in theory — be the best set of policy solutions, particularly when we are confronted by the need to collectively 'unmake waste' in the commons (Faure & Lefevre 2005; Niles & Lubell 2012).

As the widespread discussion of 'framing' problems shows, much of the trouble humans have in finding solutions to problems is due to our conceptual (mis)construction of them, and the values and beliefs that inform our thinking (see, for example: Crompton 2013; du Plessis 2013). Hardin's original (1968) 'tragedy of the commons' concept was built on the idea that rational humans are self-interested and selfish rather than cooperative. Ostrom (1990) demonstrated that rational self-interest can favour co-operation. Are humans motivated by self or other? Such a binary framing of the question is at the heart of the problem, because the answer is *both*. That is also why relying exclusively on either the state or the market is insufficient. Local legislation that bans certain items and a regional governance structure within which knowledge can be shared and capacity built can help, but so can non-state actors' innovative technologies, citizens' education by trusted organisations, and advocacy that ensures signatories to international treaties have and meet specific goals. It will be difficult to 'unmake' the waste that we have put into the world's oceans, but not impossible; humans are clever and adaptive creatures.

Appendix 1

Actors with a stake in marine litter and/or an interest in ocean governance

This list is incomplete for two reasons. First, as Dryzek (2005, pp. 183-185) reminds us, a “deep ecology” perspective recognises non-human beings (such as sea turtles, fish species, oceanic ecosystems and the planet itself) as agents affected by this problem. Thinking about this from a more conventional policy perspective has led me to limit “actors” to humans and their organisations. However, given our context of environmental governance, it seems important to acknowledge that other beings also act and can be “stakeholders” in this situation, even if, within our current (anthropocentric) paradigm, we do not really have space to acknowledge their claims on equal terms with our own. Secondly, there are many more human organisations, communities and groups of individuals interested in or reliant upon the oceans than I have had time to document. But I hope that those listed here help give a sense of the diversity of “stakeholders” who might be “engaged” in order to deal with this issue effectively.

International organisations

United Nations Environment Programme

ASEAN

International Maritime Organisation

Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection

Public entities

Sovereign states

Local governments of coastal communities

Private entities

Plastics manufacturers

Non-government organisations

Greenpeace

Ocean Conservancy

5 Gyres

World Wide Fund for Nature

World Business Council for Sustainable Development

Coastal and riverine communities

Waste management authorities

Appendix 2

Global ocean governance regime(s): principles, rules, operating procedures and institutions applicable to marine pollution

Downie (2005, p. 70) explains that an international governance regime is “a system of principles, norms, rules, operating procedures, and institutions that actors create or accept to regulate and coordinate action in a particular issue area of international relations”. When trying to understand who can and should do what to solve the problem of the oceanic garbage patches, and how they might go about it, it is helpful to have a sense of the relevant governance regime, i.e. of the world’s oceans. This is not a list of all the formal elements that make up global marine governance, but it gives a sense of some of them, and their variety. The ‘softer’ elements of governance regimes (principles and norms) will be discussed in the second part of this paper, in relation to commons problems as challenges of collective action and social practice.

International Union for the Conservation of Nature, *10 Principles for High Seas Governance*

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (‘Basel Convention’), opened for signature 21 May 2003, entered into force 8 October 2009

Convention for the Protection of the Marine Environment and Coastal Areas of the South East Pacific, 1981

Convention for the Protection of the Marine Environment of the Northeast Atlantic (‘OSPAR Convention’), 1992-1993

Convention for the Protection of the Natural Resources of the South Pacific Region (‘Noumea Convention’), 1986-1987

Coordinating Body on the Seas of East Asia (COBSEA)

Partnerships in Environmental Management for the Seas of East Asia

Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (‘Kiev Protocol’), opened for signature 21 May 2003, entered into force 8 October 2009

United Nations Convention on the Law of the Sea, opened for signature 10 December 1982, entered into force 16 November 1994

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Waste vs zero waste: The contest for engaging and shaping our ambient 'waste-making' culture

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Research Interests: Zero waste, industrial ecology, product stewardship / extended producer responsibility and living labs.

Waste and zero waste are, for different reasons, both controversial and polarising concerns. Today, waste is viewed as a significant and multi-dimensional global issue (aka 'super-wicked' problem). A clear value proposition exists for addressing the issue of waste. Yet, for all the investment to date into 'conventional' waste management, only limited progress has been made in holistically resolving this issue. As a global community of practice, zero waste exists as a response to this nexus of crisis, failure and inertia. Zero waste promotes the most assertive regime of policy instruments and interventions aiming to conserve and cycle resources, avoid pollution, address climate change and to actualise sustainable development. In terminology and 'campaign posture', zero waste is strategically controversial and can be a magnet for criticism. At one extreme, this critique has characterised municipal zero waste to landfill (ZwTL) as a chronic failure and doomed. In contrast, a more balanced examination suggests that actually, relative to other provocations and pathways to sustainable development, zero waste is both a scientific and successful choice for industry and communities. This paper explores some critique around zero waste and uses this as a window to explore the real world contest of ideas and influence seeking to shape the future of 'waste-making' and management.

Keywords: Zero waste, waste, circular economy, sustainable development

Introduction:

Interpreted inclusively, zero waste is a heterogeneous and evolving global community of practice, encompassing:

- Industrial, municipal and activist / community spheres of practice.
- The spectrum from developing to developed socio-economic settings (Allen et al. 2012; Hill et al. 2006).
- Academic, strategic policy-making and governance worldviews (IPLA 2013, 2011, 2012; EC 2014; Lehmann and Crocker 2012; Lehmann 2011).
- The duality and creative tension of proprietary definition and becoming, simply “*shorthand*” for better resource management (Levitzke 2012).¹
- Both upstream and downstream conceptions. In the former, the nascent pathology around current products, production, consumption and urban systems are addressed through transformative design and social innovation. In the latter, the theory, policies and practices of conventional waste management are radically reimaged and reformed, so that material flows preordained for linearity and disposal, are treated as what they really are - resources.

Such diversity, combined with, no shortage of ambition (i.e. complete socio-economic redesign, culminating as a ‘2nd – green - industrial revolution’, (Murray 2002, 1999; Williams 2013)) ensures that zero waste generates much critical debate. Derivative of a wide ranging review of this critique, this paper explores three strands of discussion.

Namely:

- The paradigm of failure in which zero waste is situated and responds.
- Perspectives on zero waste’s outright success and evolution.
- Using New Zealand as a case study, examining the politics and external influences which sometimes subvert the implementation of zero waste.

The failure of waste... and zero waste?

The most, stark characterisations of zero waste failure, arise in the municipal setting, where zero waste to landfill (ZWtL) programmes have not achieved time-bound, ‘stretch targets’ for waste diversion. The starting point for examining this contention is to recognise that, the predominant economic status quo of making and managing waste, is itself a deeply embedded paradigm of failure. At its simplest, this failure is a breach of the ‘nature principle’, whereby the human economy is out of sync with the evident success and inherent sustainability demonstrated in nature. Zero waste is only one of a growing chorus calling for urgent transition from a failing, lineal, ‘take-make-waste/dispose’ economic model, into the circularity illustrated (i.e. so called ‘ecosystem metaphor’ (Isenmann 2008)) in natural systems (Lehmann et al. 2014; EC 2014; Ellen MacArthur Foundation 2013; Morgan, Mitchell, and Green Alliance / WRAP 2015; McDonough and Braungart 2002; Jessen 2003).

Solid waste is a physical artefact of the Anthropocene’s accumulating failures of: product, production and socio-economic design, as well as human ethic and future aspiration (McDonough and Braungart 2002; Hawken, Lovins, and Lovins 1999; Zaman and Lehmann 2013). This is the normative context of failure, against which claims around zero waste (and any other similarly aspirational brands² of thesis and action) are

¹ Zero Waste International Alliance (ZWIA) official definition (<http://zwia.org/standards/zw-definition/>)

² Broadly similar / synergetic ‘brands’ of thesis / action in the eco-ideas marketplace, such as: Circular economics (EC, 2014; Ellen MacArthur Foundation, 2013; McDonough & Braungart, 2002) ‘Industrial ecology /symbiosis’ (Ayres and Ayres 1996; Bourg and Erkman 2003; Graedel and Lifset 2002), ‘Zero emissions’ (Pauli 1997; Kuehr 2007).

situated and should be measured. In assessing the value, or otherwise, of the phenomena of zero waste, the key question is not whether this knowingly impossible³ end point has been 100% achieved, but rather, as a respondent in waste's spectre of dis-achievement, is zero waste more or less effective, relative to other provocations for enhancing environmental progress?

The widely accepted convention for prioritising management responses to the issue of waste is, generically expressed, in the ubiquitous (5R) 'waste hierarchy'. For around four decades⁴ this broad theoretic and methodological consensus has solicited enormous investment in aligned rhetoric, programmes, infrastructure and technology. Yet, for all of this, approximately half of the global human community does not have access to the most basic sanitary waste management systems (D-Waste 2013). Approximately 40% of the total waste generated is estimated to be treated via uncontrolled burning, which exacerbates already chronic pollution and climate concerns (Wiedinmyer, Yokelson, and Gullett 2014; Thompson 2014). Currently, globally only one quarter of the 3.4 – 4 billion tonnes of municipal and industrial waste produced annually is recycled (Chalmin and Gaillochet 2009). The combined effects of population growth, increasing consumption and urbanisation means that, total municipal solid waste (MSW) generation of the world's cities is projected to increase (Hoornweg, Bhada-Tate, and Anderson 2012).

Whilst any and all progress is laudable, conventional waste management, as the predominant global approach, is not delivering on its principle goals, at either: the bottom (disposal), nor the midpoint (recycling), nor the top end (reduction) of the waste hierarchy. Beyond just this snap-shot of dysfunction, the other interrelated dimensions⁵ of issue appear to justify waste's 'super-wicked' descriptor (Krausz 2012; Levin, Cashmore, and Bernstien 2009; Levin et al. 2012). Reason suggests that, where convention fails, innovative alternatives, even the hyper-aspirational 'idealities' (Schnitzer and Ulgiati 2007) should be explored with an open mind and balanced evaluation. Elkington argues that, disruptive outliers being pursued by, so-called 'zeronauts', are where sustainability breakthroughs are pioneered (2012).

Can Zero Waste be Considered Successful?

Questions around the success and ultimate plausibility of zero waste in a municipal setting, need first to be preceded by the understanding that programmes in this context, are derivative of a remarkable track record of success, pioneered by industrial practitioners of zero waste (Murray 2002). It is critical to understand that, the translation of zero waste success from an industry to municipal context, encounters an exponentially steep learning curve, through increasing complexity and challenge. Any given policy imperative in a municipal setting is 'checked' by countervailing realities, such as the interrelationship of social norms with commercialised media / marketing drivers and meta-trends, such as the privatisation of infrastructure and services. In a municipal setting, the zero waste programme facilitator is, in contrast to the business owner, only an 'influence bearer', rather than a direct controller of what enters, happens within and exits their organisational jurisdiction.

³ In simple terms, zero waste is not about zero. Key authors in the zero waste community denote a grounded, rather than absolutist view, i.e. *"It's important not to get hung up on the zero. No system is 100% efficient"* (Snow and Dickinson 2001) *"We have got to get over this idea that we are talking about 100% diversion"* (Leroux 2001).

⁴ Although for example, U.S. recycling data is reported from 1960 (Kollikkathara, Feng, and Stern 2009), (Wilson 2007) dates the waste hierarchy from *"approximately 1977"*.

⁵ i.e. ocean plastics, disaster waste management, emerging new ('NBRIC') & old & unresolvable waste issues, chemical toxicity and dissipation, food-waste, organised criminality, ewaste, all of which overlay geographic, historical, infrastructural and technological, public, personal socio-economic complexities.

However, in spite of the complexity and challenge of municipal settings, indicators suggest that the crucible of heightened transparency and community expectation associated with a public zero waste declaration, may actually correlate with success. The 'Transforming Trash in Urban America' report, rated a selection of thirty seven U.S. cities on a 'sustainable recycling system' metric, which included, "*zero waste source reduction and reuse strategies*" (Owens-Wilson 2013). The findings show that all five of the cities in the top two ranking, were pursuing various forms of named (city or state) zero waste programmes. In contrast, there are only three recently committed zero waste cities in the bottom two ranking brackets, containing twenty cities. Does this suggest public declaration of a zero waste correlates with higher overall sustainable waste management performance? On its own, of course the answer is no. Anymore that, any single measure, or partisan, or premature judgement, should be the basis of sweeping declarations of absolute zero waste failure. For most tax payers, common-sense dictates that, societal evaluation should balance the necessity of keeping environmental aspirants firmly grounded in reality, whilst recognising the role of aspiration in shaping and motivating excellence and success.

Recent case studies, published by Zero Waste Europe, are suggestive of exactly this potential. For example, the municipality of Capannori in Italy is profiled as leveraging off an anti-incineration sentiment, to develop and implement a zero waste strategy. This is reported as achieving a 39% reduction in waste generated (2004 – 2013) and as at 2013, a 82% recycling rate of separately collected waste (Van Vliet 2014). Both outcomes exceed the reported national and EU averages (EEA 2013). Additionally, the Capannori zero waste programme reports a range of other innovations, catalysed by public zero waste declaration.

Arguably, the critical question is not whether zero waste should be labelled as success or failure, but whether 'real-world' learning is being incorporated to improve the chance and trajectory of future progress. Recent indicators of municipal zero waste policy declaration, are illustrative of this learning requirement. In spite of New Zealand's challenging and fluctuating experience with zero waste, the Sustainable Business Council recently published a 'Vision 2050' with goal statements including "*...New Zealand has zero waste*" (2012). Auckland, New Zealand's largest city, documented the "*long-term aspirational goal of zero waste by 2040*" (Auckland Council 2012). At face value these latter zero waste policy framings appear cognisant of past experience and the inherent challenge associated with a municipal setting. These initiatives appear to demonstrate learning and evolution, in balancing the 'aspirational stretch function' of zero waste targets, with more realistic timeframes.

Internationally, the recent Zero waste industrial networks (ZeroWIN) project, whilst adopting and adapting the ethos and lexicon of zero, also chose to set pragmatic (i.e. non 100%) targets⁶, which were realistic for the project timeframe (ZeroWIN accessed 2013). The ZeroWIN project demonstrates evolutionary integration, whereby 'preventing rather than managing' waste, is allied in synergy with industrial ecology, extended producer responsibility/product stewardship, cleaner production and design for sustainability, etc (den Boer et al. 2012; RCBC 2009; Lehmann and Crocker 2012; Spiegelman 2006). These latter iterations and other interpretive miscellany within the zero waste movement (Anderson 2011) demonstrate the mutability and envisioning function of zero as a '*stylistic*' for innovation, and optimistic meme for a, 'future and solutions focused', freedom of thinking⁷.

⁶ Reductions of: GHG - 30%, waste - 70% and fresh water usage - 75%.

⁷ Examples of spheres of acute and far reaching innovation, which are colonising, re-interpreting and are simultaneously manipulating, stretching and actualising the plausibility of zero waste are:

New Zealand: An example of political shifts and vested push back on zero waste.

New Zealand forms an interesting case history in the global experience with zero waste. Instrumental in this was the Zero Waste New Zealand Trust campaign (1997-2010) which, at its peak, resulted in the adoption of zero waste policy by, over 70% of New Zealand Councils (ZWNZ Trust accessed 2015). Reflective of the influence of this campaign, the New Zealand Waste Strategy (NZWS: 2002-10) was entitled *“Towards zero waste and a sustainable New Zealand”* (Ministry for the Environment 2002). A further indication of endorsement of change in thinking around waste during this period, was the synonymous, *‘Life after Waste’* campaign, by the Waste Management Institute of New Zealand.

In hindsight, New Zealand’s implementation of zero waste seems insufficient and naïve, relative to opposition by vested industry interests and what transpired as quantum shift in political ideology, associated with a change in elected government. Illustrative of industry ‘push back’, *‘Business New Zealand’*, a highly influential lobby group, funded *‘Waste or Rationality? Economic perspectives on waste management and policies in New Zealand’*. This report, by the *‘New Zealand Institute of Economic Research’*, was specifically developed in response to perceptions that New Zealand’s waste policy had entered an *“activist phase”* and was subject to environmental capture.

This report’s key recommendation (which bears a striking resemblance to what unfolded politically) was to: *“Replace references to ‘resource use efficiency’ in all policy documents with ‘economic efficiency’... Remove all references to ‘zero waste from documents expounding serious waste policy”* (Clough 2007). In effect, this report superimposed a business centric view on the *‘economics of waste,’* over the then democratic consensus. In layperson’s terms, the report’s blunt economic dogma declared that, whilst the first percentage of waste diversion may only cost a \$1 / tonne, the last percentage, to reach 100% waste diversion, will cost \$millions / tonne. Therefore, it defies economic good sense to target zero waste. Troublingly the, then and since further evolved, counterpoint to this argument is simply, observable reality.

Today, most of what is called the ‘waste-stream’ is, in fact, valuable resources, whose value is destroyed by disposal orientated waste management treatments, which progressively accrue social, environment and economic costs. This reality is why there are now many large successful global business entities, at or near achieving zero waste. It seems safe to assume that these business organisations are neither levitating above NZIER’s questionable, neo-liberal economic prescription, nor needlessly haemorrhaging millions of dollars, for their last few percentages of waste diversion. In fact, accumulating reports suggest this sphere of activity demonstrates high rates of achievability, net economic benefits, whilst at the same time aligning participating organisations with future consumer and community expectations (Phillips et al. 2011; Anderson 1998; Barnish 2013). Moreover, strategically enhancing resource efficiency / conservation, is a hallmark of international policy consensus⁸ in this sphere, of which, New Zealand now appears increasingly out of step.

In spite of the ongoing catalogue of industry and municipal zero waste adoption and success, in 2010 the aspirational and cooperatively developed NZWS:2002 *“Towards zero waste...”* was abandoned and replaced by the more perfunctory, new, New

Nanotechnology (Tsuzuki 2010; Nanotechnology Development Blog accessed 2013; Gibbs 2011) 3D printing (Cubify accessed 2014; PS accessed 2014; Taylor 2014) and in the context of space travel (ESA 2013; Morgan 2013), clothing (Electrolux accessed 2014; Korge accessed 2014), housing (Wainwright 2014).

⁸ i.e. UN (UNEP accessed 2013), EU (European Commission 2011), OECD (OECD accessed 2013), World Bank (Hornweg, Bhada-Tate, and Anderson 2012).

Zealand Waste Strategy (NZWS:2010) entitled “*Reducing Harm, Improving Efficiency*”. In the development of NZWS:2010, New Zealand discarded the previously high levels of democratic engagement, the opportunity of targets by which to inspire and measure progress and the assertive, but largely unfulfilled, environmental rhetoric of zero waste. The New Zealand zero waste story illustrates that, sometimes the fickle tides of political ideology, contingent with the influence bearing of lobby groups, takes precedence over democratic consensus and/or scientific evidence.

Conclusion

Today, a clear value proposition and method exists for addressing the issue of waste and these will only strengthen over time (Graedel 2010; Platt et al. 2008). Furthermore, ultimately it is said to cost less to effectively address the issue of waste, than it does to endure the long-term cost of not doing so (Hoorweg, Bhada-Tate, and Anderson 2012). A balanced examination of zero waste’s diverse and evolving global experience shows that, in spite of significant challenge and complexity, this policy can be a successful (Hood and Ministry of Environment British Columbia 2013; Van Vliet 2014; UN-Habitat 2010) and scientific (Sound Resource Management Group Inc 2009) choice for industry and communities.

However, in spite of some positive indicators, progress in ‘unmaking- waste’ and debate around transforming production, consumption - and what happens next, can be fraught. This paper explores elements of the critique around zero waste and uses this as a venue for discussing the ongoing contest of ideas and influence seeking to own the future of ‘waste-making’ and waste management. Overall, this debate informs and challenges both conventional waste and zero waste schools of thought and provides insight and encouragement in efforts to address the, largely, unresolved crisis of waste. As zero waste continues to evolve in a globalised free-market of ideas and participating initiatives (Allen et al. 2012; Brandon 2012) a track record of innovation, learning and progress emerges, as a positive contribution to resource management and the long-term societal challenge of sustainable development.

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Measuring the Waste Management Hierarchy

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The measurement of various pro-environmental (or ecological) behaviours of householders has received attention stretching back over 40 years from a range of disciplines including: sociology, marketing, psychology and environmental science. The multidisciplinary nature of these investigations has seen the research strands developing in relative isolation, creating a legacy of disparate measurements and methods, hampering the comparability of research findings. Additionally, research has mainly focused on the disposal and recycling behaviour of householders, reflecting the historical attention given to these areas by government and environmental agency policies and programs. Recently, however, government policy has shifted to “higher order” pro-environmental behaviours such as reusing, repairing, reducing, and avoiding. The full range of these pro-environmental behaviours is captured in the European Commission’s Waste Management Hierarchy, an internationally accepted guide for prioritising waste management practices for optimal environmental outcomes. Activities start at the bottom of the hierarchy with ‘dispose’, moving up through ‘treat’, ‘recover’, ‘recycle’, ‘reduce’ ‘reuse’ and finally ‘avoid’.

To date, the higher order behaviours have had only cursory investigation in the literature and are not included in the behaviours typically used to compute measures of pro-environmental behaviour or to set government behaviour change policy targets. This paper addresses this gap through synthesising academic and industry literature to develop a measurement battery that spans the range of waste-related behaviours, from “lower” to “higher” order, across the Waste Hierarchy. The battery is piloted through telephone interviews with 573 South Australian householders. The results provide a quantified benchmark of how established these behaviours are in the population and empirically validate the Waste Management Hierarchy, the framework underpinning the nation’s waste strategies.

Additionally, the research identifies the key perceived drivers of pro-environmental (green) behaviour amongst respondents. Using a Best-Worst method, it uncovers the strongest and weakest factors householders perceive motivates them to undertake pro-environmental (green) behaviour in general.

This paper’s contributions include a measurement approach that overcomes the problem of existing (partial) measures of pro-environmental behaviour. The findings provide important benchmarks for waste strategy and policy.

Keywords: pro-environmental (green) behaviour, waste management, sustainable marketing, waste hierarchy

Background

Measuring pro-environmental or “green” behaviour

Research on pro-environmental behaviour has interested academia for more than forty years, across a range of disciplines including sociology, marketing, psychology and environmental science. Over this time, the approach to the conceptualisation and measurement of pro-environmental behaviour has evolved significantly. For example, researchers have gradually abandoned rather simplistic frameworks of awareness that first emerged in the '70s (see for instance the New Ecological Paradigm by Dunlap and Van Liere, 1978), embracing at first more elaborated psychological and economic models that were popular in the '80 and '90s, and ultimately focusing on the development of pro-environmental behaviour scales in the '00s. Additionally, pro-environmental research has moved away from single item measures to more recent attempts to develop multi-dimensional measures, i.e. exploring different types of pro-environmental behaviour at once. This is evidenced by the widely cited works such as the Environmental Concern model by Stern et al. (1995), the model of Environmental Behaviour by Grob et al. (1995), the General Ecological Behaviour index by Kaiser (1998) and the New Ecological Paradigm Scale by Dunlap et al. (2000).

While making valuable contributions towards understanding and measuring pro-environmental behaviour, an underlying issue common to these works is the limited consideration placed on drivers and barriers of pro-environmental behaviour. Most of these studies show inconsistent and weak correlations between individual perceptions and pro-environmental behaviour, often suggesting that specific beliefs and values pertaining to the environment might be the *outcome*, rather than the source of pro-environmental behaviour (see for example Stern et al. 1995; Karp, 1996; Schlegelmilch, Bohlen and Diamantopolous, 1996; Dahlstrand and Biel, 1997; Stern et al. 1999; Schulz and Zelezny, 1999). Additionally, the use of disparate measurements and methods has hampered the comparability of research findings and extent of replication. This has led to academic findings not being leveraged to the full extent by policy makers in the environmental area.

One area where there is such a noted void between academic research and government waste policies is the Waste Management Hierarchy. This hierarchy was introduced by the European Commission Directive 75/442/EEC in 2006 as part of the Waste Framework Directive. This Directive sets the basic concepts and definitions related to waste management, such as definitions of waste, recycling, recovery. It also states that waste legislation and policy of the EU Member States need to apply as a priority order the waste management hierarchy (European Commission, 2015a). The hierarchy is structured with prevention (through avoidance and reduction), re-use, recycling, recovery, treatment and disposal.

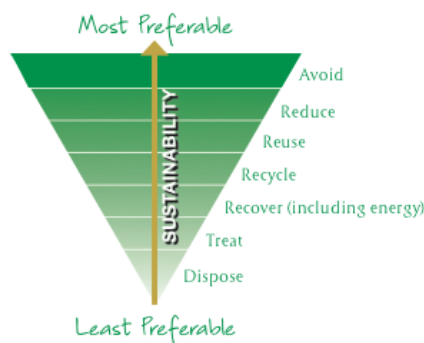


Figure 1: The Waste Hierarchy (Zero Waste South Australia 2012)

In this hierarchy, prevention of waste is denoted as the most preferable point for policy initiatives. This is because prevention usually results in the least environmental and economic life cycle costs because it requires no collecting or processing of materials.

The reuse of waste is the next most desirable policy focus. Reuse does not require any structural changes to the material and so requires collection but relatively little or no processing.

The recovery of waste encompasses both recovery of materials and recovery of energy - whichever of these two options is better for the environment and human health is the preferred one.

Finally, disposal is the least preferable policy option, only considered once all other possibilities have been explored.

The framework is now recognised internationally as an aspirational framework for sustainability (Zero Waste SA, 2011) and a guide for prioritising waste management practices for optimal environmental outcomes across nations. Unlike the many scales and measures of pro-environmental behaviour offered by academic research, this framework postulates a certain hierarchy of pro-environmental behaviour and assumes that the policy can act upon driving such behaviours. With the increasing articulation of waste strategies by countries, this hierarchy has been commonly used as a means to prioritise policy initiatives in the UK, USA and Australia.

To date, the majority of policy efforts and program deliveries have been focused on the lower order behaviours such as lifting diversion rates through infrastructure improvements (e.g. high performing, consistent kerbside household recycling systems). Yet with increasing interest in the concepts of a circular economy and cradle-to-cradle thinking, there is a need to look beyond the easy wins of reuse and disposal to the higher order behaviours. This is now being reflected in policy and agency focus with agencies such as the UK's progressive WRAP agency rebranding as "circular economy and resource efficiency experts." Additional evidence of this shifting focus comes from the Waste Framework Directive which requires that EU Member States shall establish Waste Prevention Programs not later than 12 December 2013 under Article 29 (European Commission, 2015b).

To date, few existing approaches to measuring the public's pro-environmental behaviour have been mapped against this Waste Management Hierarchy. Early work in the area by Barr, Gilg, and Ford (2001) was the first notable effort in the area and their paper called for research to better reflect in academia the prominence given to the higher order waste behaviours amongst households by government. They also noted the need to describe the level of each behaviour in comparison with other behaviours and the extent to which these differ not merely in the population as a whole, but within population groups. They hypothesized that finding differences in the incidence of behaviours across the hierarchy would suggest there are different antecedent drivers of such behaviour and this needs to be established before policy makers can tackle the range of waste hierarchy behaviours. Their work, built largely on North American literature, extended the findings to the UK. This paper takes a similar approach, describing the extent of pro-environmental behaviours across the Waste Hierarchy, but in this instance validating the UK and US literature in an Australian content. This is the first known such published effort. Additionally, this research examines respondents' perceived drivers and barriers to pro-environmental behaviour to reveal the strongest and weakest factors motivating them to undertake pro-environmental behaviour across the Waste Management Hierarchy.

Methods

The research was undertaken in partnership with a leading environmental agency Zero Waste (SA) in Australia, responsible for development of policy and delivery of programs in the Waste Hierarchy in South Australia. South Australia is a leading state for householder waste management initiatives, being the first to introduce container deposit legislation, standardise kerbside bin systems across councils, and ban single-use plastic bags from retail grocery outlets. This state was chosen because its environmental leadership provides the greatest chance for the “higher” order behaviours being displayed.

To develop robust measures for the range of pro-environmental behaviours that could be explicitly linked to the Waste Management Hierarchy, a phase of desktop research of both academic and industry published literature was undertaken, aimed at conceptualising and measuring pro-environmental behaviour. This shaped the methods for the second step of this project - quantitative analysis of householders’ pro-environmental behaviour. Eighteen key articles were identified in this literature review process, covering marketing, social and environmental psychology, and health disciplines as well as (grey) industry literature.

From this review, a questionnaire was developed to cover the range of behaviours. Quantitative telephone interviews were then conducted with 573 randomly selected householders from metropolitan and regional South Australia. All interviews were conducted using quality accredited interviewers.

Respondents were asked whether they had previously undertaken a series of pro-environmental behaviours in the past year (Yes/No questions). The pro-environmental behaviours tested in this research were grouped into two broad categories developed to reflect the Waste Management Hierarchy. These were:

Compliance behaviour: used to group questions about those behaviours that householders may undertake to reduce environmental impact but for which there are generally developed infrastructures or incentives. These reflect the lower order of the Waste Hierarchy of dispose, treat, recover and recycle. The behaviours measured were: saving water/energy; collecting bottles/cans and returning to depot; recycling electronic waste; recycling light globes; installing water tanks; switching to a green energy provider; installing solar panels; using a compost bin/worm farm for kitchen scraps; regularly making a shopping list prior to shopping; regularly checking your fridge and pantry before going shopping; regularly taking own shopping bags. Creating shopping lists and checking the pantry were behaviours that had been linked to minimising food waste in prior research (WRAP (UK), 2014).

Thoughtful consumption behaviour: used to describe behaviours that required some effort and reflecting the higher order of the Waste Behaviour Hierarchy. These included: purchasing environmentally friendly products, purchasing a specific brand because it came in a reusable or refillable pack or container; reducing the use of a car; donating to charity; swapping with friends/family; buying or selling through garage sales; buying or accepting second hand clothes; buying or accepting through online sites such as Gumtree, Ebay, or Freecycle; buying second hand furniture; taking something from a kerbside hard waste collection; using online or social networks (outside family/friends) to borrow infrequently used items; considering carbon emissions/footprint when making travel plans; repairing something. These equate to the reuse, reduce and avoid levels of the Waste Hierarchy.

As found in the desktop research phase of this project, responses gathered with this approach can be used to develop objective measures of pro-environmental behaviour at aggregate level (i.e. across all householders), by calculating benchmarks of: (i) which behaviours are more and less established (estimated from the actual incidence across the sample); and also (ii) which behaviours provide a more robust description of the overall pro-environmental behaviour across the population and of the likelihood of future recurrence (computed with one-way ANOVAs).

Respondents were also asked to identify the most and least relevant drivers of pro-environmental behaviour, choosing from a list of ten potential factors identified in prior literature that may motivate or influence the householder decision to undertake such behaviours (all potential factors considered were randomised across respondents and different subsets of factors were prompted to each respondent, to avoid bias). The responses were gathered with a Best Worst method, which is commonly used in consumer research to uncover drivers of consumer decisions (Marley and Louviere, 2005). For each of the drivers examined we calculated a score derived from the ratio between two values, namely: (i) the difference between the count of respondents identifying it as most relevant and the count of respondents identifying it least relevant driver of pro-environmental behaviour; and (ii) the number of times that particular driver was randomly prompted to respondents, multiplied by the total number of respondents in the survey. We inspected the scores calculated with this method across all drivers of pro-environmental behaviour considered, in order to identify the strongest (highest positive score) and the weakest (highest negative score) drivers. When doing so, we ensured that the patterns emerging in the scores were consistent across all respondents by examining deviations from the mean responses given for each driver considered (carried out with linear regression and the analysis of the sum of standard square errors). The inclusion of this additional step of analysis provides a more comprehensive measurement of pro-environmental behaviour through supplementing the indication of how established and how likely to recur pro-environmental behaviour is, with insights into the strongest and weakest underpinning motives for undertaking the behaviours at all. The battery of drivers is shown in Table 3.

Results

As might be expected, given the government policy emphasis they have historically received, compliance behaviours were generally more established than thoughtful consumption behaviours. As shown in Table 1, the most established behaviours were conserving water and energy, and using 'green' shopping bags, with 98% and 95% of householders claiming to have undertaken these behaviours in the past year. Given there had been water restrictions imposed on the state and a ban on single use plastic bags being given for free by retailers, such high figures are not surprising. The least established compliance behaviours were the use and installation of alternative sources of energy and the recycling of light globes. These are areas that have had less infrastructure investment. Overall, across the battery of eleven compliance behaviours, there was 69% participation.

Table 1: Compliance Behaviours

Behaviours	Yes	No
Deliberately tried to conserve water and energy use in your home?	97%	3%
Consistently taken your own bags shopping rather than buying store bags?	95%	5%
Regularly checked your fridge and pantry before going shopping?	88%	12%
Regularly made a shopping list prior to shopping?	88%	12%
Collected bottles and cans and returned them to a depot to collect the money?	87%	13%
Recycled your electronic waste?	77%	23%
Used a compost bin / worm farm or collected kitchen scraps rather than putting them in the rubbish?	64%	36%
Installed water tanks in your home?	63%	32%
Switched to a green energy provider?	42%	56%
Installed solar panels?	35%	60%
Recycled used light globes through the Back Light service run through some hardware stores?	23%	77%
AVERAGE INCIDENCE	69%	31%

In the past year half of the householders interviewed had undertaken thoughtful consumption behaviours. In particular, as illustrated in Table 2, the most established behaviours were donating, swapping, reusing, and consumption choices in general. Thoughtful consumption behaviours linked with using, buying or purchasing or accepting second-hand goods occurred relatively less frequently, all receiving under 30% claimed occurrence.

Donation was the most frequent thoughtful consumption behaviour, and the most common way of disposing of goods no longer wanted was through donating them; followed by purchasing environmentally friendly products. Repairing was also a quite common pro-environmental behaviour.

Table 2: Thoughtful Consumption Behaviours

Behaviours	Yes	No
Disposed of your unwanted possessions through donating them to charity?	90%	10%
Deliberately chosen to purchase an environmentally friendly product?	77%	23%
Had something repaired so you didn't have to buy a new one?	69%	31%
Swapped unwanted possessions with family and friends?	66%	34%
Bought or accepted clothing that was second hand?	57%	43%
Deliberately purchased one brand because it came in a reusable or refillable pack or container?	55%	45%
Reduced your use of a car through choosing to take public transport, walking, cycling or car-pooling?	51%	49%
Bought or sold items through an online site such as Gumtree, Ebay, or Freecycle?	36%	64%
Bought or sold something through a garage sale?	35%	65%
Considered carbon emissions and your carbon footprint when making travel plans?	30%	70%
Bought second hand furniture	28%	72%
Taken something from a curbside hard waste collection that you thought would be useful to you?	19%	81%
Used online or social networks (outside of friends/family) to borrow infrequently used items?	17%	83%
AVERAGE INCIDENCE	49%	51%

To investigate the need for policy and interventions to tailor to different demographic segments (e.g. across different age brackets, gender, or for regional householders) the rank and sheer proportions of householders undertaking pro-environmental behaviours across the various demographic groups was examined against norms for the entire group of surveyed respondents. The analysis did not identify any statistically significant differences across these demographics that would mean program tailoring was required. This is a positive, but surprising finding. Any marketing action related to maintaining or increasing the level of establishment of pro-environmental (green) behaviour can be undifferentiated across demographic groups.

When considered together aggregately, as an overall measure of pro-environmental behaviour, thoughtful consumption behaviours provided a more reliable indicator of future likely pro-environmental behaviour. That is, although slightly less established across householders, Thoughtful consumption behaviours provided a more accurate indication of the likelihood of future occurrence of pro-environmental behaviour within the sample considered (as indicated by the result of ANOVAs analyses with significant Crochane’s F tests at $p < .001$ confidence). This highlights the importance of considering such higher order Waste Hierarchy measures when seeking to understand and plan for future waste management behaviours in a population.

For the perceived drivers of pro-environmental behaviour, the most influential factors indicated by respondents were that such behaviours would be beneficial to the environment, followed by that they had become an entrenched habit. By contrast, the least influential stated driver was the amount of effort required and the influence of others. This is illustrated in Table 3 and Figure 2, which report the Best-Worst scores obtained by each of the various drivers of pro-environmental behaviour found in the survey. Importantly, this pattern in the scores was consistent across all respondents (R^2 of 0.95), reflecting a consistency of view across the population.

Table 3: Strongest and weakest drivers of pro-environmental behaviour

<i>Factors influencing taking up green behaviours...</i>	Best Worst score
It's beneficial to the environment	0.11
Habit - just being used to doing it - growing up with it	0.05
Makes me feel socially responsible - I make a difference	0.04
Receiving info on the environmental impact of my actions	0.04
Having an understanding of climate change issues	0.03
It's a way to save money	0.00
My children and what they learn and bring home	-0.02
Having time to do it - when I'm not too busy	-0.04
It doesn't require too much effort - if it's easy I'll do it	-0.07
Other people's influence on me to behave that way	-0.12

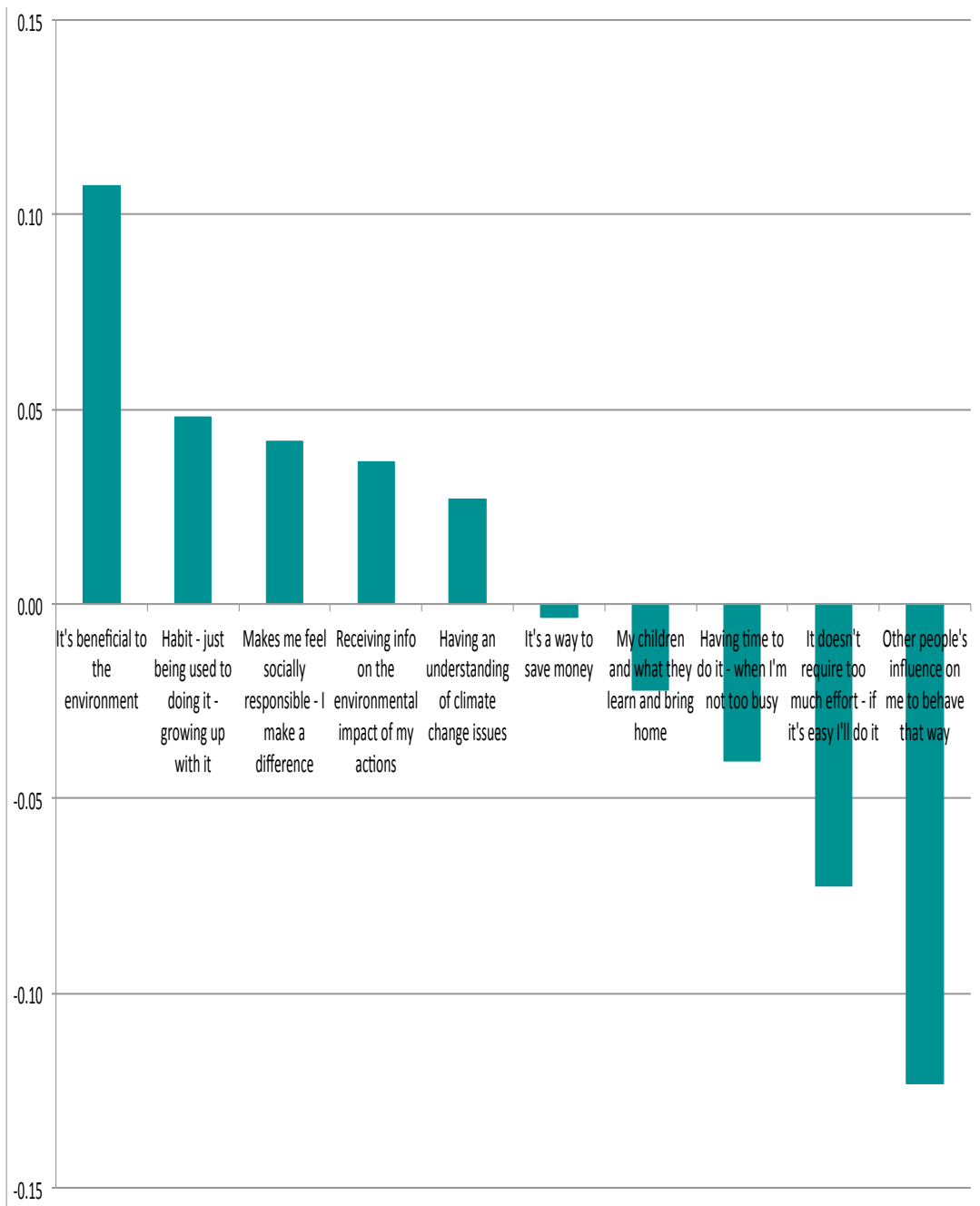


Figure 2: Strongest and weakest drivers of pro-environmental behaviour

Discussion

A number of important conclusions can be drawn. Most importantly, this research has validated and benchmarked the range of Waste Management Hierarchy behaviours amongst South Australian respondents. The results provide clear direction for waste management priorities by: (i) highlighting which pro-environmental behaviours are well-established across householders and which ones are not; and also (ii) identifying which pro-environmental behaviours (if undertaken) are more likely to indicate future occurrence at the aggregate level. As such, this work has strengthened a much-needed link between government policies and infrastructure and academic research in relation to the conceptualisation and measurement of pro-environmental behaviour.

This research also makes a contribution through illustrating how to establish explicit links between objective measurement of pro-environmental behaviours amongst a population and tactical tools used for policy making, such as the Waste Management Hierarchy. That is, our research illustrates that by measuring the Waste Management Hierarchy it is possible to both monitor and benchmark the level of establishment of pro-environmental behaviours across the hierarchy and track the effectiveness of policies in reinforcing established behaviours and nudging less established ones.

The results serve as benchmarks or potential indicators of the future chance to undertake these behaviours. If read in this way, it can be concluded that high incidence compliance behaviours are those with a higher chance of occurring again and are already well established across households. Low incidence behaviours, instead, are those on which future interventions and policy could focus.

Finally, by identifying the key perceived drivers of pro-environmental behaviour, we provide a clear path to design informed policies tapping into the strongest drivers of pro-environmental behaviour, e.g. increasing awareness of the environmental benefits and aiming at turning pro-environmental behaviour into current householders' habits. Interestingly, it is not effort or time required, or the influence of others that are perceived by respondents to be the key motivators to behaviour change.

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