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Published paper

Lane, R., Watson, M. (2012) *The stewardship of things: Property and responsibility in the management of manufactured goods*, Geoforum (In Press)

<http://dx.doi.org/10.1016/j.geoforum.2012.03.012>

Stewardship of things: The radical potential of product stewardship for re-framing responsibilities and relationships to products and materials

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The definitive version of this paper is published as:

Lane, R and M Watson (2012) Stewardship of things: The radical potential of product stewardship for re-framing responsibilities and relationships to products and materials, *Geoforum*

<http://dx.doi.org/10.1016/j.geoforum.2012.03.012>,

The definitive version should be used for citation purposes wherever possible.

Keywords: Product stewardship; ecological modernisation; waste; recycling; reuse; property; sustainability; responsibility; household; scale

Abstract: In the context of broad-based concerns about the need to move towards a more sustainable materials economy, particularly as they are expressed in debates around ecological modernisation (EM), we argue that product stewardship has radical potential as a means to promote significant change in the relationship between society and the material world. We focus on two important dimensions that have been neglected in approaches to product stewardship to date. Firstly, we argue that immanent within the basic concept of stewardship is a problematisation of dominant understandings of property ownership in neoliberal market economies. In the space opened up by notions of stewardship, different ways of enacting both rights and responsibilities to products and materials emerge which have potential to advance the sustainability of material economies. Secondly, through exploration of existing expressions of product stewardship, we uncover a neglected scale of action. Both policy and dominant articulations of EM focus primarily on the efficiency of production processes; and secondarily, the attitudes and behaviours of individual consumers. Missing from this is the 'meso-scale' of social collectives including households, neighbourhoods, more distributed communities and small scale social enterprises. Based on a review of existing research from Australia and the UK, including our own, we argue that understanding of embedded practices of material responsibility at the household scale can both reinvigorate the concept of product stewardship as a potentially radical intervention, and reveal the potential of the meso-scale as a challenging but worthwhile realm of policy intervention.

1. Introduction

Over two centuries of modernisation and industrialisation the increasing scale of resource use has been accompanied by increased waste as materials fall through the gaps in industrialised processes of production and consumption (Christoff, 1996; Graedel and Allenby, 2003). Current modes of social organisation in affluent industrialised countries are profligate in their use and disposal of finite material resources. However the contemporary resurgence in the political salience of issues of resource scarcity is beginning to change the ways in which flows of materials through society have been dealt with over recent decades. The linear path of material flows – from extraction to production to consumption to disposal that characterised the second half of the twentieth century has been steadily contested (Hart, 1995; Fischer-Kowalski and Hüttler, 1998; McDonough and Braungart, 2002; Watson et al., 2008). Since the closing decades of the twentieth century, policy discourses and actions to move towards a more sustainable materials economy have gathered pace in materially affluent industrialised countries. In this paper we focus on how these issues play out in countries governed through liberal democracies such as the UK and Australia, recognising that there are significant differences in governance regimes around the materials economy associated with different forms of government and their historical trajectories (Gille 2007, 2010, Dong and Goldstein 2006). From corporations adjusting to Extended Producer Responsibility (EPR) legislation (Ehrenfeld, 2000; Walls, 2006) to householders washing and sorting used packaging into different bins (Hobson, 2004, 2006; Barr and Gilg, 2006), established social relations around materials that could be waste have been unsettled. In combination, a succession of policy changes and modest transformations in countries like the UK or Australia aim to move material economies towards convergence with principles of Ecological Modernisation and Industrial Ecology (Huber, 2000; Graedel and Allenby, 2003).

However, it is clear that more radical transformations are required if material economies are to become sustainable. In this paper we explore the idea of product stewardship as a means to promote significant change in the relationship between society and the material world, anchoring our arguments within broader debates around the relationship between environmental sustainability and the material economy (Bridge, 2009). We contend that the concept of product stewardship brings to light two key realms of potential action which are presently missing from mainstream political action; and which are obscured by dominant interpretations of both Industrial Ecology (IE) and Ecological Modernisation (EM). First, we argue that immanent within the basic concept of stewardship is a problematisation of dominant understandings of property ownership in neoliberal market economies. In the space opened up by notions of stewardship, different ways of enacting both rights and responsibilities to products and materials emerge which have potential to advance the sustainability of material economies. Second, through exploration of existing expressions of product stewardship, we uncover a neglected scale of action. Both policy and dominant articulations of EM focus primarily on the efficiency of production processes; and secondarily, the attitudes and behaviours of individual consumers. Missing from this is the ‘meso-scale’ of social collectives including households (Reid et al., 2009), neighbourhoods, more distributed communities and small scale social enterprises. Engaging with existing research from Australia and the UK, including our own, we argue that understanding of embedded practices of material responsibility at the household scale can both reinvigorate the concept of product stewardship as a potentially radical intervention, and reveal the potential of the meso-scale as a challenging but worthwhile realm of policy intervention.

We begin by examining how approaches to waste management that aim to promote a more circular materials economy can be understood in terms of industrial ecology and ecological modernisation and consider the extent to which they share some of the conceptual weaknesses that various scholars have identified in these approaches. We then consider the concept of stewardship, its origins, and its use in natural resource management, focusing in particular on how it frames understandings of property in relation to environmental public goods. Current interpretations of product stewardship are then contrasted with other forms of environmental stewardship, highlighting the lack of consideration of the dimension of property and the role of consumers acting at the meso-scale of households and neighbourhoods. This provides the context for our review of existing research (including our own) on motivations for and characteristics of the circulation of second hand goods and materials among households. In this, we focus upon research in the UK and Australia, the two countries explored in the collaborative research project from which this article results. These countries were chosen to represent two affluent industrialised countries, both of which are seeking to tackle the challenges of establishing a more sustainable materials economy under distinctive structures of government and regimes of governance in this field of policy. While both operate with a Westminster system of representative government, they differ in their structures of governance in relation to the management of

materials and waste, reflecting their distinctive geographical characteristics. While the UK has adopted regulated approaches to EPR in line with various EU Directives, EPR initiatives in Australia have so far been voluntary. While these regulatory regimes play out in distinct ways, we argue that neither approach is effective in promoting the strength of EM agenda required to re-shape socio-material relations onto substantially more sustainable lines. Our focus on Australia and the UK enables us to use both the social political parallels and distinctions to draw out arguments which have some transferability to other industrialised liberal democracies. We conclude by arguing for recognition of the potential of factoring in meso-scale circulations and associated understandings of shared property to approaches to product stewardship, in order to leverage the radical potential required for a much stronger version of EM.

2. Waste and progress towards a sustainable materials economy

In Australia and the UK, new approaches to waste management that promote 'resource recovery' are consistent with ideas from both Industrial Ecology and Ecological Modernisation. Both these schools of thought highlight the link between environmental degradation and energy and materials-intensive economic development and argue for systemic change towards more environmentally efficient use of resources (Huber, 2000; Mol and Spaargaren, 2006; Mol and Jänicke, 2009; Deutz, 2009). Industrial Ecology (IE) draws its metaphors from ecology, specifically from matter and nutrient flows through ecosystems and principles of symbiosis, to describe the 'metabolism' of industrial processes (Huber, 2000; Graedel and Allenby, 2003) while Ecological Modernisation (EM) is more concerned with broader socio-economic transformations (Mol and Jänicke, 2009). In a recent analysis of producer responsibility, Pauline Deutz notes that, the 'system' of concern to IE is defined either a) geographically, in terms of industry regions where clusters of firms might develop symbiotic relationships for the transfer of waste products from one firm to form resources for another or b) by product, process or material, where the focus is on minimising the environmental impacts of a product, process or material-based system (Gibbs and Deutz, 2007; Deutz, 2009). The latter system definition is more relevant to current policy approaches to product stewardship. IE emphasises industrial material flows in terms of inputs, throughputs and outputs, each of which have different levels of environmental impact that can be measured through Life Cycle Assessment (Graedel and Allenby, 2003).

The relevance of IE to contemporary agendas of sustainable waste management can be recognised in the foundational commitments of waste legislation over recent decades. Foremost amongst these is the waste hierarchy, which is frequently a key foundation for waste management policy in both Australia and the UK, at least at the declarative level. While there is recent debate about its ongoing utility within the industrial ecology literature (Allwood et al., 2011), the hierarchy endorses the 'input-throughput-output' principles of industrial ecology by highlighting where the greatest gains in waste reduction can be achieved, in a hierarchy which places avoidance of consumption at the top and disposal at the bottom (Gertsakis and Lewis, 2003). However waste management policy, at the level of declarative principle, can be seen to have grown closer to the ideas of EM. While IE focuses on the flows of materials and other resources through an industrial system, EM recognises more of how those flows are imbricated with broader patterns of social organisation. It consequently emphasises that society might be re-organised so that political, economic and social institutions internalise care for the environment. Its origins are in social science and it focuses on social practices that govern material flows through society and examines their embedded logic in modern institutions (Mol and Spaargaren, 2006; Mol and Jänicke, 2009). If social and institutional practices can be changed, along with regulatory regimes, economic development can precipitate the development of environmentally favourable technologies and practices. Christoff (1996) drew attention to the differences between weak versions of EM, that see it as industry led and voluntary, and stronger versions that focus on significant roles for government policy and regulation. Stronger versions of EM contain ideas of regimes of socio-material production and consider processes by which regime shift might occur through institutional and political change (Deutz, 2009).

There have been many critiques levelled at IE and EM in terms of their capacity to really deliver a more environmentally sustainable industrial system. In particular the political dimension is held to be under theorised (Harvey, 1996; Christoff, 1996; Gibbs, 2006) and too little consideration is given to how to achieve the kinds of institutional changes required, and the appropriate role for government in promoting these changes (Gibbs, 2006; Gibbs and Deutz, 2007). David Gibbs argues the value of linking EM with understandings of political economy developed in economic geography, in particular regulation theory (Gibbs, 2006). Like most theories of regime shift, regulation theory takes a broad interpretation of the term 'institution' to include informal social norms and conventions, not just change in formal organisations within government or industry

(Gibbs and Jonas, 2000; Jessop and Sum, 2006). This can be framed in scalar terms: the macro-scale (of governments and large corporations), the meso-scale of households and neighbourhoods, and the micro-scale of individual behaviour. While social research in relation to materials recycling and reuse has been conducted at a range of analytical scales, from the macro-scale of changing waste management regimes (Gille 2007, Cooper 2008, Bulkeley et al, 2007), the meso-scale of the household and neighbourhood (Gregson et al 2007, Williams and Widebank 2005, Lane et al 2009, Watson and Lane 2011), through to the micro-scale of individual behaviour (Barr and Gilg 2006), these understandings of social institutions and processes operating at multiple scales have not yet come to inform waste management policy generally or approaches to product stewardship in particular. This may be in part due to the lack of explicit engagement with the themes of IE and EM within social research in this area.

The input-output dimension of IE and the institutional change dimension of EM together offer a useful framing for critical analysis of the dominant direction of waste management policy. While states have adopted the waste hierarchy as an underpinning principle, the emphasis of practical interventions has not followed the priority set out in the hierarchy (Watson et al., 2008; Lane et al., 2009). For example, in the UK, concerted action since the turn of the century has seen very rapid increases in the proportion of household waste recycled or composted rather than disposed to landfill, rising to almost 40% in 2009-10, compared to 8% in 1997-8 (DEFRA, 2011). However, in the waste hierarchy recycling is identified only as the third priority. Reduction and reuse are given higher priority, as they result in an overall reduction in inputs, but have seen much less policy priority. A range of reasons for this imbalance can be suggested. First, recycling rates are much easier to measure than are reduction and reuse. Second, while making the processes of waste management more challenging, interventions to promote recycling are less radical than those to promote reduction or reuse. While engaging householders to clean and sort recyclable waste into a dedicated bin, and redirecting collected recyclables to enter global resource markets rather than a hole in the ground, have been significant achievements they have not significantly affected consumption of new products. Substantial progress on reduction or reuse, and progress toward stronger forms of EM, requires interventions at different levels – from the macro-scale change in economic processes that would reduce the flow of new materials through to the complex relations at micro-and meso-scales that characterise the routes that stuff travels to be reused.

Here critical analysis of waste management policy is consistent with broader arguments that the meso-scale, between production processes and individual attitudes and behaviour, has been missing in much environmental policy (Reid et al., 2009; Lane and Gorman-Murray, 2011). Key characteristics of this missing meso-scale are the diversity (or heterogeneity) of actors, their collective interests in goods and materials, and a shared social identity in the form of language, norms and values that is to some extent grounded in a material setting (Reid et al., 2009: 9). To a large extent, members of households share household goods and materials as common property or 'club goods' (Cornes and Sandler, 1996). At a slightly larger scale, members of neighbourhoods share the local infrastructure of streets, footpaths and parks. This dimension of shared property is particularly important for more sophisticated understandings of the agency of consumers in purchasing, using and disposing of goods and materials. The neglected meso-scale is critical to realising the more radical potential of ecological modernisation, beyond its use as discursive resources with which to negotiate the inescapable tensions within dominant interpretations of sustainable development. In what follows, we explore the implications which emerge when ideas of product stewardship are brought into communication with contemporary research on how households and communities relate to material goods, illuminating the radical potential of the concept. In the next two sections we explore the development and implementation of the concept of product stewardship. We begin by going back to basic definitions, and to the primary implementation of stewardship in contemporary environmental policy, within natural resource management.

3. Stewardship, property and products

The concept of stewardship has a long history in framing relations between people and material resources. It speaks of a distinctive mode of the social relations through which property is constituted. At its most basic, as in the Oxford Dictionary of English, stewardship is 'the management or looking after of another's property' (Soanes and Stevenson, 2005). Stewardship therefore problematises concepts of individual ownership and property rights over things or land, and with it rights and responsibilities. With roots in theology (for example

Christianity's framing of man (sic) as the steward of creation on behalf of God) and in feudal social relations (where the steward is responsible for management of resources on behalf of the master), stewardship evokes a sense of responsibility for something that is primarily the property of another person or entity. Legal geographers and critical legal scholars understand property as distinct forms of social relations (Blomley 2004, Macpherson 1978) drawing on Marx. For example, Mansfield argues:

'property is not a thing (the object being controlled) but a social relation (Cohen, 1927; Macpherson, 1978). It is a social arrangement that allows one certain rights to certain objects, and these social arrangements can change.' (Mansfield, 2009: 7)

It has been the application of the concept of stewardship to natural resource management that has made it relevant to contemporary debates about responsibility to the environment and, through that, to other people, including those living at a distance or in the future. In this context, stewardship is often invoked to highlight the responsibilities of landowners or natural resource managers for maintaining environmental values of the resources they manage, including those over which they may have legal title, so those values may endure into the future. Assertion of responsibilities for a public good associated with environmental values implies recognition of a public interest in the land or goods managed that is incompatible with more absolute interpretations of 'private property'. Debates around the most effective governance models for sustainable land management have been framed to some extent by discourse on 'the commons', drawing out tensions between advocates of central regulation, privatisation and community-based governance approaches (Ostrom, 1990; Berkes et al., 1989).

The term 'stewardship' has generally been taken up by the movement for community-based governance approaches or participatory co-management of resources (Carlsson and Berkes, 2005). It has been employed in government environmental programs in various areas of natural resource management to promote forms of adaptive co-management of resources, such as grazing lands or forests, which are recognised to have wider public good values (Worrell and Appleby, 2000; Carr, 2002; Cocklin et al., 2006). Stewardship has also been central to many development aid programs that aim to foster improved land management practices through supporting collective actions by community members sharing a common interest in the sustainability of the resource (Pretty and Ward, 2001). While there is much diversity in environmental stewardship schemes, some common elements include:

- recognition of public good values associated with environmental resources that may be held as either public or private property
- maintenance of these public good values through forms of co-management and shared responsibility
- involvement of both producers and consumers as well as government agencies
- ideas of property that are linked with civic responsibilities.

A key dimension of environmental stewardship generally is the linkage of property with some form of civic responsibility. The property may be in the land that produces the resources or in the end products that are produced from it. Stewardship schemes for agricultural land have implications for the relationship between land holders and land. They accentuate environmental values as a public good and recognise more distributed responsibilities for these values among primary producers and government land management agencies. In Victoria, Australia, the idea of farmers as stewards of the land was initially championed with the Landcare movement, which began as a voluntary farmer-driven initiative then became absorbed as an essential aspect of a regional approach to natural resource management policy within state and national governments (Curtis and Lockwood, 2000; Carr, 2002). In the state of Victoria, farmers are now able to access funds for activities to promote the public good of biodiversity conservation through a land stewardship program in which, 'A focus is on provision of public good ecosystem services from landscapes, and how landholders could be rewarded for providing these services' (Department of Sustainability and Environment, 2011). Stewardship lends itself clearly to the management of land, soil and forests. Management of these resources has self-evident implications for people other than their owners; and they can generally be expected to be passed on to future generations.

While discourses of stewardship have had a much stronger presence in relation to natural resource management, they have had existence too in relation to the product world. Initially, environmental stewardship initiatives were focused primarily on producers and production systems. The emergence of various forms of environmental certification schemes during the 1990s introduced a new focus on consumer goods derived from such production systems. Certification schemes such as those developed by The Forest

Stewardship Council and the Marine Stewardship Council, use certification labelling on products to signify that producers have complied with specified environmental standards (Taylor, 2005; Klooster, 2005; Gulbrandsen, 2010). Similar schemes are used for a range of food products produced in line with specific ethical or environmental criteria (Goodman, 2004; Clarke et al., 2007). The aim of these schemes is two-fold. Firstly, they aim to enable change in the practices of producers. Producers who comply gain the right to display a certification label that denotes the environmental values associated with responsible management practices. This label can be understood as a form of property right assigned by the stewardship scheme (Guthman, 2007). Secondly, they can aim to enable change in consumer behaviour by allowing informed consumers to make responsible choices by purchasing certified goods. While this represents some reconfiguration of property rights, the responsibility of producers ends with the sale of their products. As is conventional in market transactions between producer and consumer, property and the responsibilities that go with it transfers to the consumer at the moment of purchase.

There is a rich and expanding critical literature around certification schemes. As well as being uneven in the level of social and ecological protections they offer, labels provide a basis for producers to be financially compensated for the costs of following these standards (Eden, 2009; Eden and Bear, 2010). Julie Guthman has recently linked ethical food labelling schemes to Polanyi's double movement that pits society's movements for self-protection against the de-humanising processes of commoditisation in the 'self-regulating' market (Guthman, 2007). She sees them as being a somewhat contradictory expression of neoliberal economic policy. Part of this contradiction is contained in the type of property right they confer which attempts to commodify ethical values. However, it is this ambivalent status of property in certification schemes which indicates the potential to recognise more distributed forms of property in the context of environmental stewardship generally, but of product stewardship in particular.

Environmental stewardship certification schemes such as these have parallels with product stewardship schemes in their reliance on defining and reporting measures of environmental impact but differ in the involvement of NGOs and in the stages of the commodity chain they include. While ideas of sustainable agricultural production have not generally been framed in terms of ecological modernisation, to the extent that they implement broader institutional change in production and consumption practices along the commodity chain they are in keeping with the principles of ecological modernisation. To date, product stewardship schemes have either been industry-driven or have involved some form of collaboration between industry and government organisations. Endorsement by government authorities rather than NGOs provides the main form of legitimacy, reflecting the ongoing and proactive role of governments in driving agendas in waste management. This has meant that product stewardship schemes have been spatially aligned with the jurisdiction of national governments or groupings of national governments in the case of the EU, regardless of the spatial dimensions involved in production processes. They typically target the end of life stage of the commodity chain and rely on various forms of take-back schemes. While there is potential for producers who sign on to product stewardship schemes to charge more for their products on the grounds of their having more desirable environmental credentials compared to other products, producers also have an incentive to seek industry-wide schemes that will remove this reliance on consumers' willingness to pay more.

Where product stewardship schemes are implemented on a voluntary basis and are not industry-wide, similar issues around the role of labelling and consumer choice arise. In particular, we are concerned with how consumers (and not just producers) are framed as citizens in the context of product stewardship. If consumers somehow 'share' responsibility for the environmental management of products with the manufacturer, retailer, government service providers and others (as implied in the Australian National Waste Policy), what does this responsibility mean in practice? And to what extent is the manufacturer responsible for the environmental impacts of a product that is now owned by a consumer?

The term product stewardship is subject to a range of interpretations. Helen Lewis (2005) describes it as a contested but wide ranging discourse that includes extended producer responsibility. She traces the first use of the term 'stewardship' in an environmental management context to the Canadian Chemical Producers Association's (CCPA) Responsible Care Code developed in the late 1970s/mid-1980s (Lewis, 2005). Since the 1990s product stewardship has become increasingly prominent within discourses around material responsibility (Hart, 1995, 1997; Michaelis, 1995) including in principles espoused by corporations such as Xerox (Maslennikova and Foley, 2000) and Hewlett-Packard (Preston, 2001). However, discourses of product stewardship have been subsumed and displaced by corporate commitments and, increasingly, legal obligations, framed as Extended Producer Responsibility (EPR), especially in schemes such as those in place in

the EU for end-of-life vehicles. Ideas about product stewardship appear to have developed from an early focus on responsible management of hazardous wastes towards a broader focus on resources conservation and recycling that connects more strongly with the Industrial Ecology agenda of improving the efficiency of industrial material flows. As we explore in the next section, in both the UK and Australia, PS and EPR have overwhelmingly interpreted as end-of-life take back schemes, failing to address relations of production 'upstream' from manufacture and retail, and also the role and potential contribution of consumers. When compared to other forms of environmental stewardship discussed above, these schemes emerge as limited in their capacity to implement an EM agenda. This critical exploration provides the basis for product stewardship to also feed into the more profound shift in socio-material relationships implicit in stronger interpretations of Ecological Modernisation.

4. Product stewardship in Australia and the UK

In Australia and the UK, despite the endurance of the waste hierarchy in government rhetoric and policy for waste management, the primary emphasis has been on post-consumption materials recycling rather than avoiding unnecessary forms of materials consumption in the first place. Existing product stewardship schemes, because they have been driven by a waste management agenda, have tended to focus on the end of a product's useable life. They have focused on avoidance of environmental harm and have often been regarded as a form of landfill diversion rather than the starting point for new formations of commodity networks. Table 1 provides a comparison of PS schemes in the UK and Australia which, while not attempting comprehensive coverage, provides an indicative cross section of the more common forms implemented in each country. Within the UK, ideas of product stewardship find partial expression through gathering legislative obligations imposed by the European Union through a range of 'Product Responsibility' Directives (Deutz, 2009). Starting with obligations upon producers of packaging and packaging waste in 1994, successive European Union directives have addressed end of life vehicles (2000), waste electrical and electronic equipment (2002) and waste batteries and accumulators (2006). All are now incorporated under Directive 2008/98/EC. As implied by the classifications here, the emphasis is on the responsibility of producers for the collection, sorting, treatment and recycling of their products, once they have entered the post-consumer waste stream. Part of the logic is that this responsibility will impel producers to improve product design to facilitate the recycling of end-of-life products. However success has been mixed, with companies preferring to contract out their PR obligations to third parties rather than make significant changes in product design (Spicer and Johnson, 2004; Deutz, 2009). The three UK schemes outlined in Figure 1., Fonebak, ERP UK, and DTS, all take this form. In this respect the EU directives remain at the weak end of the EM spectrum, despite their regulatory dimensions. The EU is the primary source of contemporary PR regulation within the UK, where the government's Department for Business, Innovation and Skills is primarily responsible for the enforcement of European Legislation around specific product categories, including batteries, end of life vehicles, packaging and electrical and electronic equipment. Across these distinct product categories, each covered by distinct legislation, the overwhelming emphasis is upon the post-consumer treatment of products, variously reducing the release of hazardous materials to the environment, reducing landfill and increasing recycling. EPR initiatives are substantially framed through compliance with EU regulation and legislation, with that compliance often offered as a service by commercial organisations offering to collect and process end-of-life products to honour the liabilities of producers, distributors and retailers under the relevant legislation.

In Australia, the focus for product stewardship has also been primarily on materials recycling at the end-of-life but through voluntary participation by producers and consumers in take-back schemes that receive various forms of government or industry subsidy. Product stewardship for packaging (Table 1.) is governed by a 'coregulatory' arrangement, which combines voluntary industry-government agreements (through the Australian Packaging Covenant) with regulations that impose EPR obligations on industry 'free-riders' (Lewis, 2005). Not surprisingly, companies have chosen self-regulation through the Covenant to avoid individual EPR obligations. There are also a wide variety of voluntary, industry-funded product stewardship schemes for products including newsprint, printer cartridges, mobile phones (Table 1.) and agricultural chemical containers (DEWHA and EPHC, 2010). These voluntary schemes only consider the agency of consumers in terms of their purchase choices and their participation in organised collections for end-of-life products. In both the UK and Australia, while producers are assumed to require financial incentives or legislative demands to participate, consumer participation tends to be taken for granted. Citizen-consumers (Soper, 2007; Mol, 2009) are assumed to make responsible choices, first about what they purchase and, second, how they dispose of it.

Table 1. Governance arrangements for indicative PS schemes in UK and Australia arranged in order from the least regulated to the most regulated.

Scheme	Participants	Mode of governance	Regulation/Implementation	Principles
AUSTRALIA				
Mobile Muster, 1999	Managed by the Australian Mobile Telecommunications Association (AMTA) - (i.e. handset manufacturers and network carriers) Involves collaborations with retailers, local councils, state and federal government agencies who provide collection points.	Voluntary industry-led scheme. Funded and supported by industry members with support for collection from collaborating partners.	No regulation. Handset manufacturers pay a voluntary advance recycling levy raising 42 cents for every handset they import into Australia and this money is used to fund a collection and recycling scheme that processes mobile phones, batteries and accessories	Principles of EPR and industry self regulation.
Australian Packaging Covenant 1999	Key stakeholders in the packaging supply chain and all spheres of government - Australian, State, Territory and Local.	Co-regulatory arrangement. The covenant is the voluntary component of a co-regulatory scheme.	<i>National Environment Protection Measure on Used Packaging Materials (NEPM).</i>	Principles of shared responsibility through product stewardship
National Television and Computer Product Stewardship Scheme 2011	Manufacturers, brands and importers of computer and TV equipment and Infoactive, an ewaste management company	Industry-government partnership with potential for regulation – while NGOs have been effective in lobbying for PS legislation and for the type of scheme that is now being rolled out for TVs and computers, they have not sought an ongoing role in the governance arrangement.	<i>Product Stewardship Act 2011.</i> Ewaste management and logistics firm, Infoactiv manages and delivers all operational aspects of the service, from collection and transport through to equipment disassembly, recycling and community education.	Principles of EPR for recycling end of life TVs and computers
Product Stewardship for Oil Program 2001		Fully regulated - administered by the Department of the Environment, Water, Heritage and the Arts through the Oil Stewardship Advisory Council	<i>The Product Stewardship (Oil) Act 2000</i> establishes the general framework and benefit entitlements of the PSO arrangements	The arrangements comprise a levy-benefit system, where a 5.449 cent per litre levy on new oil, helps fund benefit payments to used oil recyclers.
UK				
Fonebak 2002 http://www.fonebak.com	Fonebak, a subsidiary of Regeneris (a European technology outsourcing company). Prominent mobile phone handset manufacturers and mobile phone retailers are both clients and endorsers of the service.	Commercial service provision for compliance with WEE legislation - Commercial organisation providing services to mobile industry actors and direct interface with consumers and charities that benefit from phone donations	<i>Directive 2008/98/EC</i> Emerged as a result of market opportunity and industry willingness in light of obligations under European WEEE legislation (Canning, 2006).	Commercial response to opportunities arising between European EPR legislation and growing industry concern for corporate social responsibility.
European Recycling Platform 2002 http://www.erp-recycling.co.uk	ERP UK Ltd; Electrical and Electronic Equipment (EEE) manufacturers for whom ERP provide compliance services;	Commercial service provision for compliance with WEE legislation - Commercial organisation providing	<i>Directive 2008/98/EC</i> Regulated by the Environment Agency (statutory body) as a WEEE producer	Commercial response to demand for compliance services resulting from the EU Waste Directive. 'cost effective

	Local Authorities for whom ERP provide Waste EEE (WEEE) collection services.	services to product manufacturers and Local Authorities responsible for waste management.	compliance scheme. Producers pay an annual membership and further volume related fee to EPR in return for EPR carrying out WEEE collection and recycling on their behalf, in accordance with the producer's liability under the Directive, substantially through providing WEEE collections for Local Authorities.	compliance'
Distributor Take back Scheme (DTS) 2007 http://dts.valpak.co.uk/dts/	Valpak, as appointed operators by the Government, EEE distributors/retailers, Local Authorities for whom WEEE collection is provided	Government contract for service provision for compliance with WEE legislation - Valpak is a commercial organisation providing producer responsibility services. They were appointed by the UK government's Department of Trade and Industry in 2007, to provide compliance services under the WEEE Directive for distributors and retailers of EEE, through Local Authority WEEE collection services, and education initiatives. Membership of DTS is the only scheme through which distributors and retailers can avoid providing free of charge disposal of customers' WEEE when equipment of equivalent type is being purchased.	<i>Directive 2008/98/EC</i> Regulated by the Environment Agency (statutory body) as a WEEE producer compliance scheme	State provision of means for EEE distributors and retailers to achieve compliance with the WEEE Directive

The only exception to this in the Australian context is state government regulation in South Australia for Container Deposit Legislation which has been in place since the 1970s. It provides a financial reward for consumers who return containers to a range of dedicated collection points. However no other state government in Australia has enacted such legislation and there has been considerable resistance to NGO proposals for national container deposit legislation. While there has been significant NGO input into the new National Product Stewardship Act and large areas of consensus around this, the issue of national container deposit legislation remains an area of tension between government, industry organisations and NGOs.

Table 1. provides examples of the three main forms that PS schemes take in Australia and the UK: 1) Fully voluntary schemes initiated and managed by industry bodies. In Australia the Mobile Muster scheme provides the best example of this, 2) co-regulated schemes involving a partnership between industry organisations and government. The examples of this form are all Australian. While the new legislation for Product Stewardship in Australia allows for fully regulated schemes, it appears that co-regulation is currently favoured, 3) fully regulated schemes which may be implemented either through a government agency (e.g. PS for Oil in Australia) or a commercial business that assists clients in meeting regulatory requirements (the most common form in the UK).

Key areas of contestation of these mainstream implementations of EPR and product stewardship are around the extent to which the primary responsibility lies with producers or should be shared among all actors involved in the supply chain including government and consumers and the extent to which these responsibilities should be enshrined in legislation or rely on voluntary agreements (Lewis 2005). Attempts to engage producers in assuming responsibility for the environmental impacts of products throughout their life-cycle should ultimately result in a feedback loop whereby products are designed for re-manufacturing or recycling (Deutz et al. 2010). However there is considerable debate about the best incentives for encouraging innovation in product design and how to avoid inherently wasteful design involving built in obsolescence (Allwood et al., 2011).

Product Stewardship and EPR schemes, while potentially addressing environmental impacts across the whole of a product's life cycle, have been critiqued for their focus on production and end-of-pipe recycling while largely ignoring the issue of consumption, a critique that has been levelled at EM more generally (Jackson, 2005; Spaargaren, 2003; Carolan, 2004). A further criticism, particularly of industry-driven voluntary schemes, is that they align with the broader shift towards neoliberal governance approaches where environmental responsibilities are devolved to the level of individual consumers making responsible consumption choices that offer market advantages to companies able to supply this demand (Hobson, 2004; Soper, 2007; Mol, 2009).

The expression of product stewardship through EPR fails to realise the full potential of the concept. While a significant component in the shift towards the cyclical materials economy essential to sustainable resource management, dominant framings of EPR leave major sections of the cycles of materials obscure. The often complex paths and processes products and materials follow from retail as new to final disposal to the waste stream are 'black-boxed', reduced to a system component into which new consumer products are the input; potential raw materials, and disposal responsibilities, the output. The consumer's stewardship of the product under this model extends only to responsible purchasing decisions, and acceptance of the disciplining of disposal to ensure waste products reach the appropriate treatment.

However within this limited framing of the role of consumers in product stewardship, there is a growing body of relevant research. In relation to the 'input' end of the black box of consumer practices, there has been increasing research into willingness to select and to pay higher prices for environmentally preferable products (The Co-operative Bank, 2008; Stengel, 2009). As household recycling has become a normal part of waste management, research on attitudes and behaviour towards recycling and the effectiveness of different schemes has burgeoned (Barr et al., 2005; Davies, 2007; Faye and Davies, 2007; Alexander et al., 2009; Lane et al., 2009; Nixon and Saphores, 2009). Mainstream research most closely related to policy tends to be undertaken within the framework of conventional neoclassical economics, which assumes that individuals make these decisions on the basis of perceived costs and benefits. The role of policy makers, in this view, is to ensure that the external costs of disposal (including the environmental impacts of landfill) are included in disposal charges, and that disposal charges are based on weight or volume (e.g. Porter, 2002). It is assumed that higher disposal costs will encourage consumers to avoid or recycle their waste.

Australia's new National Waste Policy (DEWHA, 2009) appears to open the door for a broader interpretation of product stewardship with increased government involvement through a legislated Product Stewardship

Framework. This provides the federal government with several options for individual products: accreditation of voluntary industry schemes, co-regulatory arrangements (e.g. for televisions and computers) or fully regulated EPR schemes. This initiative is based on the principle of 'shared responsibility for reducing the environmental, health and safety footprint of manufactured goods and materials across the manufacture-supply-consumption chain and at end-of-life' (DEWHA, 2009: 9). For the first time, explicit reference to 'consumption' signals an intention to consider the role of industry and consumers in the life cycle management of products and packaging. While constrained by the jurisdiction of national government, and consequently not addressing design or manufacturing processes directly, there does seem to be potential to broaden understanding of the role of consumers and to recognise forms of stewardship practiced between purchase and disposal.

However, extending the reach of product stewardship to situations of consumption, use, exchange and divestment, rather than only of acquisition and disposal requires opening up the black box of the stages between first purchase and final disposal, and gaining a better understanding of relevant practices already undertaken at the household scale. It requires a broader understanding of consumers' agency beyond their participation or 'willingness to pay' for recycling. This involves engaging with how householders as consumers acquire, use, reuse, maintain and dispose of goods. It involves tracing how householders interact with an assemblage of objects, infrastructure, and government waste management services, and their use of a wide range of avenues for acquisition and disposal. Improved understanding of consumer agency will go some way to understanding the social and cultural factors that influence practices at the scale of households and neighbourhoods which we argue is critical to the broader socio-material changes required for strong forms of EM, although not sufficient in themselves. More innovative policy initiatives such as those intimated by Australia's new National Waste Policy begin to open up some of the complexities and challenges at stake in conceptualising the models of agency and responsibility underlying different understandings of product stewardship, not least in relation to the meso-scale.

In the next section, we review a range of existing research, including our own, which illuminates this scale and the relevant complex processes which occur there.

5. Agency, responsibility and the meso-scale

While considerable research has been conducted at the meso-scale of households and neighbourhoods aimed at understanding how social norms of relating to products and materials connect with emerging social movements around green consumerism and household sustainability (Lane and Gorman-Murray, 2011) the insights from this kind of research have not yet informed approaches to product stewardship in either the UK or Australia. A focus on the meso-scale is more than simply filling a gap, between the macro-scale economic production processes on one hand and the micro-scale of individual attitudes and behaviours on the other. Rather it carries with it, implicitly at least, a different way of approaching social organisation and with it the character of agency and responsibility. In this sense it is critical for understanding aspects of the informal and unconscious social institutions present in everyday life that could promote or inhibit transformations towards stronger forms of EM. In essence, it to some extent decentres the human individual to recognise social action, and with it the meanings and motivations usually attributed to human individuals, to the social collectivities, of which any human individual is typically a part of several. From this follows a problematisation of mainstream understandings of environmental ethics and responsibilities encapsulated in neo-liberal individualistic understandings of the 'citizen consumer'.

Research from Australia and the UK shows that consumers are motivated by a range of factors, not just economic dimensions and not just environmental ethics (Hobson, 2003, 2004; Gregson and Crewe, 2003; Gregson et al., 2007; Lane et al., 2009; Lane, 2011; Barr and Gilg, 2006; Watson, 2008). As the provision of kerbside collection of materials and associated infrastructures have made recycling a great deal more convenient, new social norms have emerged. Hawkins (2006: 95) for example, notes that in Australia people recycle because it makes them feel good and because recycling, particularly for packaging, has become the social norm. This latter point is particularly significant. Rather than simply a matter of individual ethical motivation or pursuit of economic interests, recycling is significantly shaped by processes of collective normalisation of recycling practice, partly because a household's participation is visible to their neighbours. This research is important in helping policy makers and service providers to design effective recycling programs that encourage people to participate.

Research across a range of disciplines reveals diverse traces of the practical ethics of product stewardship in often well embedded practices of purchase (Miller, 1998), gifting, second-hand exchange (Gregson and Crewe, 2003; Alexander and Smaje, 2008), storage, maintenance and reuse (Williams and Windebank, 2005; Watson and Lane, 2011). These understandings of existing ethics and practices reveal both fresh insights and new opportunities for product stewardship. First, products often do not follow a smooth flow as the section between first purchase and final disposal in the simple cycle implied by EPR. Rather, many products can follow numerous small cycles between these stages, passing between commodity and non-commodity phases (Kopytoff, 1986), in and out of use, or from one owner to another. Within each of these small cycles products are valued in different ways. Second, following from these insights, ownership of consumer products can often be less individualised and absolute than is implied within models of market capitalism. Both in terms of the sometimes complex routes that products follow through valuation, use and exchange, and in the often open ideas of ownership attached to products, there appears potential to advance understanding and realisation of a fuller idea of product stewardship.

Cultural approaches to understanding the role of things in everyday life emphasise ongoing relations of care for at least some sorts of things in some situations. When it comes to certain classes of possessions, such as valuable antiques, family heirlooms or a cherished vintage car this is unsurprising, but it nevertheless already problematises any easy characterisation of a 'throwaway society' (Gregson et al., 2007). Indeed, work on enthusiastic hobbyist groups who invest substantial time, energy, money and skill in the maintenance of particular highly valued things, such as wooden boats (Jalas, 2006) reveals much about the potential depth of people's caring relation for things. However, care for things is evident in much more mundane contexts. Gregson et al (2009) document the often routinised practices of repair and maintenance of household objects, and how such practices mediate relations between people and consumer products. More broadly, research has documented aspects of an 'ethics of care' or feelings of responsibility towards specific objects (Miller, 1998; Gregson and Crewe, 2003; Hawkins, 2006). Skills such as carpentry or sewing are important for the repair and maintenance of second hand goods, and the physical spaces of people's dwellings facilitate these activities (Gregson et al., 2009; Horne, Maller and Lane, 2011). In some cases, people consider themselves responsible for the care of objects inherited through their family, although these may not necessarily fit with their own aesthetic preferences (Dowling, 2008).

This sense of responsibility to materials and care for things, expressed through active practices of maintenance and repair, finds more passive forms of expression also. Cooper (2005) reports on research with consumers on expectations and attitudes towards the longevity of household appliances, revealing issues about the effective technical life of products, but also of technical and aesthetic obsolescence. Forms of care and recognition of value are also shown through the storage in cupboards, lofts and garages of goods and materials with no immediate value, and often with no prospect of future use. In many homes certain liminal spaces act as a holding area for things no longer of sufficient use or value to keep in the lived space of the home, but with sufficient residual value or obligation to be kept the right side of disposal.

For example, a survey of household electrical and electronic products in Australia (Katos and Hoye, 2005) found that 6% of laptops, 5% of personal computers and 3% of TVs are in storage and not working. Another 8% of personal computer hard drives and 5% of TVs are in storage in working order. The most common disposal method for products—around one-third of all respondents—was 'gave away to family or friends'. Australian consumers are even more reluctant to throw away old mobile phones given that they are generally still in working order. According to the industry recycling program in Australia, 'there is an estimated 14–16 million old and unused mobile phones stashed away in cupboards and drawers at home and work' (Australian Mobile Telephone Association, 2010). Their most recent survey found that 83% of people choose to keep or give away their old mobile phones and only 3% throw them out. While this hoarding of obsolete electronics is generally environmentally detrimental – they would be better moving on to situations of reuse or recycling while they are still relatively current – these practices are indicative of common senses of responsibility to the residual value even in useless assemblages of plastic, metal and the diverse harmful substances of electronica.

These forms of respect, care and valuing of products while in a person's possession already indicates the traces of an ethic of stewardship in relation to manufactured products. However, such an ethic, and more particularly its relation to concerns of property is demonstrated through the processes and dynamics of reuse. Formally, reuse is distinctive from recycling in that the product retains its integrity as an object but is passed on from one use to another. In the passing of property rights from one owner to the next through processes of reuse, ideas of stewardship in relation to products are clearly enacted, perhaps most especially where the exchange

of goods is not mediated by a money transaction. Reuse demands that an object which in one situation does not have sufficient value to justify the demands of space for storage or time for maintenance can travel, through time and space, to a situation where it has sufficient value to be acquired and put to new use. A wide range of channels are used to enable things to follow the journey to find new use. These range from international trades of second hand goods through independent second hand retailers, to informal retail spaces like car boot sales in the UK. Beneath this market level, though, exists a vast flow of things between people mediated by online spaces like eBay® or Freecycle™ or by printed classified ads; or mediated only by ties and obligations of family and friendship through gifting of used items like furniture or white goods; or by practices of disposal as in bulky waste collection or skip hire which mean leaving things where others might be able to scavenge them (Lane et al., 2009; Lane, 2011).

Different channels of reuse are powered by different constellations of concerns and motivations, from realising the potential to regain financial value from a past purchase by auctioning online to performing relations of family and friendship and in the process imbuing goods with fresh meanings of care and obligation. Universally, though, reuse demands either the person divesting themselves of the product and/or the person acquiring it, to recognise value within what could be considered waste, and with it the responsibility to make some level of effort to let the product find new ownership and new use. Gregson and Crewe (2003) argue that passing goods on to a further use, whether through sale or donation, is partly about the responsibility people feel to durable possessions in which they recognise persistent embedded value. They suggest that a conservative ethics of care was a significant part of respondents' accounts of why they participated in second hand exchange, an ethics with only tenuous connections to the environmental or social implications of buying new. Similarly, Cooper (2005) found a sense of responsibility to possessions, with respondents commonly reporting the desire that items they dispose of should go to some further good use.

This broad picture of the patterns of reuse begins to reveal the complex situatedness of performances of product stewardship, represented by the relation of such performances with characteristics of household composition and the details of domestic space. This situatedness becomes clearer, however, with a closer focus. The scavenging of other peoples' waste throws into sharp relief the dynamics of ownership and responsibility around products. First and most obviously, it requires that someone has the means and motivation to recognise in something sufficient value to warrant the responsibilities of taking ownership of it, when someone else has judged it to be of too little value to warrant retaining ownership, or even to warrant taking the trouble to sell the thing to realise residual financial value. In many countries, including in the developed world, informal scavenging of discarded goods provides a livelihood for sectors of the population alienated from more formal economic opportunities (Reno 2009, Tremblay et al. 2007, Sembiring and Nitivattananon (2010), Guttberlet 2008, Whitson 2011). More pertinent for our purpose here, however, is what close grained empirical work reveals about how the people throwing stuff away through channels open to scavenging can be using those channels specifically in the hope that their responsibility to the materials they are discarding can be realised by someone else putting their discards to good use (Lane et al., 2009; Lane 2011).

In Melbourne, many local councils provide a scheduled hard rubbish (or bulky waste) collection where households receive a notice in their mailbox notifying them two weeks ahead of the collection and advising on the types and amount of material that can be disposed of in this way. Residents then set out piles of discarded goods and materials on the kerbside in front of their homes. While some provisions are made in contracts between councils and the waste management companies that undertake the collections for separate treatment of specific goods or materials, including scrap metals and items already designated in product stewardship schemes, most of the material collected is compacted and land filled, with official figures indicating a 13% landfill diversion rate for all hard rubbish for Metropolitan Melbourne (Victorian Government, 2009). However during the period between setting out materials and the scheduled collection, a great deal of informal scavenging takes place. Lane (2011) reported on the results of a survey conducted by sixty-nine Melbourne households recruited to monitor the types of goods scavenged from their own hard rubbish piles prior to the council collection. Over 35% of all items were taken indicating a much higher rate of landfill diversion from hard rubbish collections than officially recorded. In the recent Waste and Resource Recovery Strategy for Metropolitan Melbourne, scavenging is mentioned only in terms of a problem for local governments to manage (Victorian Government, 2009). Residents themselves have mixed feelings about these activities, with some participating in scavenging themselves, others pleased that their discarded items are being reused by those in need rather than land filled, and others more concerned about the disorderly mess resulting from scavenging activities.

Property in hard rubbish is difficult to contain as the act of setting it out in a public space, the kerbside or 'nature strip', is effectively a relinquishment of property rights by the previous owners. While in law it remains the property of the householder until collected, in practice this material is understood as a form of common property (Lane, 2011). Some Melbourne councils have enacted local ordinances proclaiming scavenging illegal, however these have proved difficult to enforce. Future changes to hard rubbish are anticipated, driven by occupational health and safety concerns as well as enhanced product stewardship programs (Victorian Government, 2009). In particular, 'Future contractual arrangements may need to include requirements for the practical recovery of 'product stewardship recoverable items' to maximise resource recovery from hard waste services' (Victorian Government, 2009: 39).

The above discussion of existing research reveals much of the complex dimensions to the 'practical ethics' of what we identify as domestic product stewardship. The theme of shared property and responsibilities for the public good value of reusable products and materials provides a coherent thread, both motivating and enabling materials circulation at the meso-scale. They indicate the grounds for recognising the 'diverse economies' (Gibson-Graham, 2008) that constitute the flows of materials and products through our homes. In the face of the global scale of resource consumption and waste, these small scale and mundane practices may seem insignificant. However, fully appreciating the range of practices and motivations which exist in the meso-scale, many of which are under-determined by what can be accounted for through conventional economic approaches, may yet provide foundations for a fundamentally different materials economy to begin to emerge.

5. Implications and conclusions

In comparison to intervening in this complex field of domestic product stewardship, requiring manufacturers to attend to their responsibilities for products at the other end of these processes of use and reuse represents a far more straightforward intervention, bringing relatively easy wins (notwithstanding the difficulties identified by Deutz, 2009). However, while impossible to quantify in any absolute terms, these complex domestic practices of stewardship clearly play an enormous role in the mass balance of the materials economy. By understanding the complex systemic relations which have the potential to make a useful difference to the flow of materials through our homes and economy, an expanded product stewardship policy agenda could identify points of intervention and leverage to further enable such practices and realise their potential to link with macro-scale transformations for ecological modernisation.

Our brief review of existing studies of the flows of second hand materials at the meso-scale indicates that the linking of responsibility towards objects with responsibility towards other people, and the enactment of various forms of group or common property, are essential characteristics of extended networks of circulation of domestic goods and materials. There are many parallels here with understandings of stewardship in the management of natural resources although, here, the potential for sharing or extending social benefits appears to be far more significant as a motivator than environmental benefits. While recognised by charity sector organisations (often well suited to meshing in with and intervening in relations at the meso-scale), this recognition is so far missing from product stewardship models embedded in national and EU policy which focus only on the responsibilities and motivations of producers of goods. By contrast environmental stewardship schemes in natural resource management, despite the criticisms levelled at various models, have gone much further in making connections between producers' responsibilities for maintaining environmental public good values and the agency of consumers.

What then would an expanded version of product stewardship that takes meso-scale consumer agency into account look like? It could include not just arrangements between producers and waste management agencies but also new arrangements between consumers and waste management agencies that promote and facilitate the multiple circuits of material flows at the meso-scale as a strategy for reducing overall inputs. This rationale could complement the current model of end of life take-back schemes and would take in a much wider range of goods than the current targets of whitegoods, Ewaste, etc. However it would also need to incorporate the wide range of community and charity sector organisations that currently facilitate these circulations and which are particularly prominent in redistribution of clothing and furniture (Watson and Lane, 2011). Our argument therefore implies an altogether different model of PS which addresses the fundamental gap in each of the three existing forms of PS identified in Table 1. Each of these neglects the potential of the manifestations of product stewardship we have identified which lie between point of first purchase and the moment of final

disposal to the waste stream. A different and additional model of product stewardship would focus on reuse and would be characterised by collaboration between government agencies and consumer and charity sector organisations. These organisations might be supported to develop greater skills and capacity in repair and maintenance of a wide range of household goods. Further, the consumer-led expansion of new forms of shared property through online tools that facilitate sharing of products ranging from cars through to lawnmowers might also be considered complementary to the principles of product stewardship and linked to existing forms of end-of-life recycling.

One of the key criticisms levelled at EM so far has been its failure to engage with the political and institutional dimensions (including the role of government agencies) that are needed to move from the weak version of EM that characterises current PS towards a 'strong' version that engages with socio-economic change at a deeper level. Our focus on re-framing and expanding ideas of product stewardship in affluent liberal democracies such as the UK and Australia has allowed us to unpack the black box of consumption, however a broader macro-level analysis, beyond the scope of this paper, is needed to link consumption-related activities in affluent countries with the many forms of production and salvage activities occurring in other parts of the world. Despite the flaws of environmental stewardship certification schemes such as FSC and MSC they do engage with the global nature of contemporary production systems and attribute economic value to compliance with environmental standards. While in some countries there are signs of government driven investment in extracting economic value from post-consumption goods and materials, especially in response to increasing scarcity of metals and 'rare earth minerals' (reference to Japanese waste mining investment), the bulk of activity and innovation in this area currently occurs outside regulatory regimes in developing countries where wages are minimal and working conditions precarious (Gregson et al. 2012). If EM is to become a meaningful global project, further theoretical work is needed to understand it in terms of the political economy of material flows across all scales from the global to the micro, without missing the opportunities which lie at the mesoscale.

Our particular contribution to this debate has been to highlight the way in which understandings of property and responsibility manifest in collective forms at the meso-scale and draw on non-market framings of the relationship between social and material worlds. We argue that one way of engaging with institutional change might be through re-conceiving the mode of governance of PS so that government waste management agencies engage with a much wider range of community sector actors and organisations, with social as well as environmental rationales, to facilitate meso-scale material circulation as well as end of life materials recycling.

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