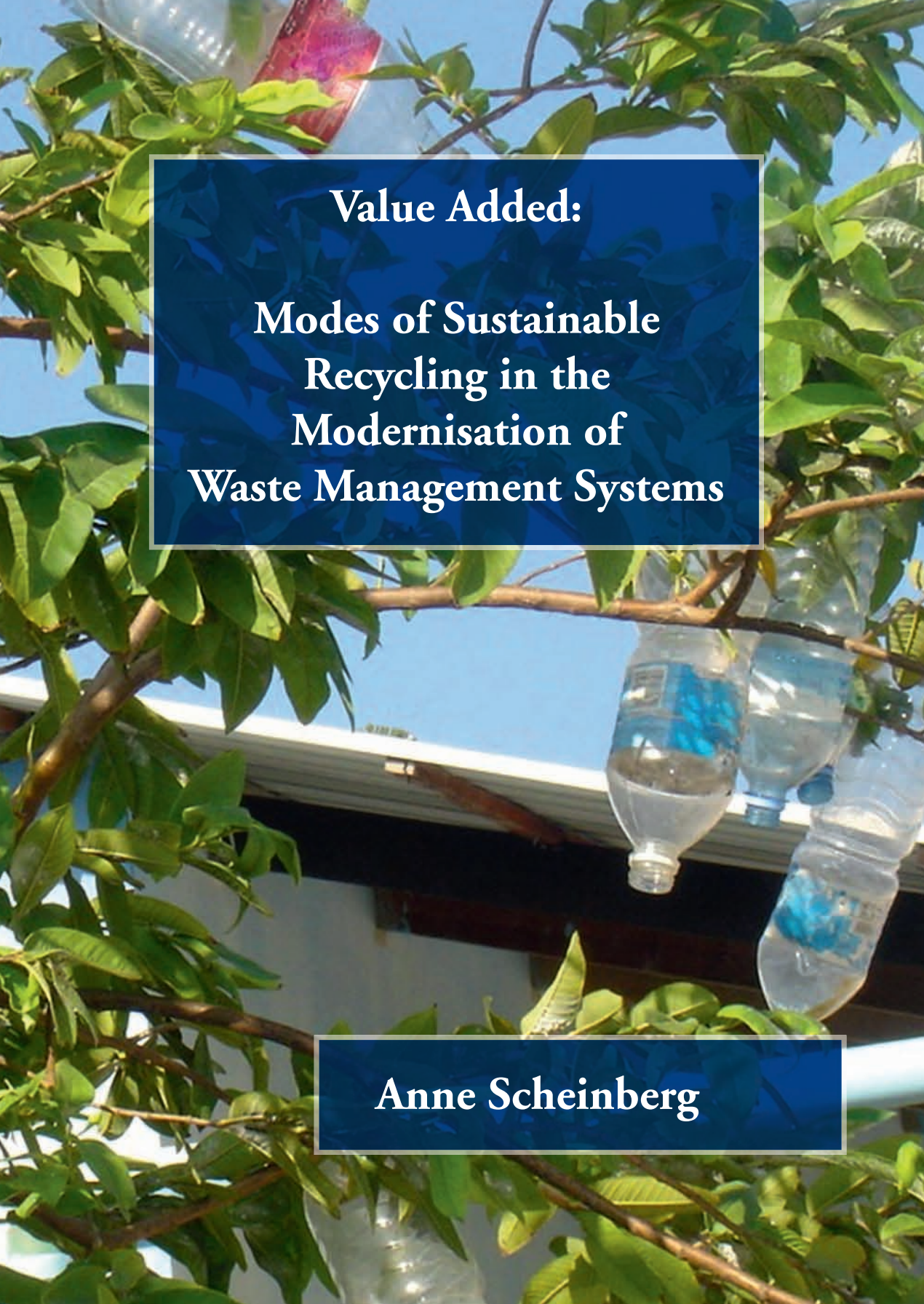

Value Added:

Modes of Sustainable Recycling in the Modernisation of Waste Management Systems

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Modes of Sustainable Recycling in the Modernisation of Waste Management Systems

Anne Scheinberg

Thesis

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To the community of practice, and to Hans.

Preface

"Mr Thompson calls the waiter, orders steak and baked potater,
He leaves the fat and gristle and he never eats the skin
Then the waiter comes and takes it, with a cough contaminates it
And he puts in the trash with orange peels and sardine tins
Then a truck comes by on Friday, and takes it all away,
And a thousand trucks just like it are converging on the bay, oh

Garbage, garbage, garbage, garbage, garbage, garbage, garbage,
They're filling up our streets with garbage.
What will we do, when there's nowhere left to put, all the garbage?"

--American folk song as sung by Pete Seeger

I turned 15 in 1968, the year when we woke up and began to "see" many things in a different way. We didn't yet use the word "alternative," and "environmental management" was not yet in the dictionary, but in some sense that year broke open our habits and ideas about what daily life was all about. In our middle class home in the peri-urban fringe of New York City, suspended between my father's ultra-urban intellectual history and my mother's shuttling between New York City and the deep countryside of the Adirondack mountains, The Weavers were the sound of the bugle, and "The Silent Spring" was the call to arms.

I myself didn't really wake up until about a year later, when I moved to a school that embraced political questioning, even while struggling with the social consequences of that questioning, and resulting evaporation of discipline in the face of demonstrations in Washington, peace vigils at the local post office, Joan Baez and Phil Ochs, Peter Brooke's theatre, and the incursions of alcohol, marijuana and sex into the lives of students and faculty.

"Seeing" garbage took a bit longer, with the help of the above verse, which I heard during the first years of the Clearwater organisation, which deserves credit for birthing of the Hudson valley environmental movement, and building and launching the 33 metre Hudson River Sloop Clearwater. Probably I first "saw" garbage from the deck of the Clearwater, and certainly I first heard about recycling from a forward-thinking garbologist called Shabazz, at a Clearwater annual meeting in Asphalt Green on Manhattan's upper East Side, probably in 1972.

But garbage didn't "get" me until a few years later, in 1979, when I returned to Poughkeepsie, New York, to work on a recycling project called "Recycle Everything Everywhere Possible," or "REEP." We collected cardboard and glass from bars and shops, sorted it on the back of a City of Beacon orange dump truck, and processed it by hand at our recycling centre in the parking lot of an abandoned municipal incinerator with a view of the Hudson river. The mayor, a different "Mr. Thompson" than the one in the verse above, brought 240-litre bags full of aluminium Budweiser beer cans to us, "from my wife," as he said with a wink. An "aha moment": garbage also tells a social story about its makers, as Dr. Rathje taught us later in his book "Rubbish". A first publication resulted, "Garbage, Invisible or Invaluable," already about who sees what, and under what circumstances.

REEP, its director Beverly Oxley Canin, and its marketing wizard Shabazz Jackson ultimately brought me into contact with the first "offspring" of the birth of municipal recycling: a young post-consumer glass, aluminium, and paper recycling industry. These value chain businesses were among the first to respond to the policy innovations in State recycling policy in New Jersey, Massachusetts, and Rhode Island, at the intersection of the young North American discourse on the role of municipal recycling as an environmental strategy, and the owners' passion and personal commitment. Buying glass for Recycling Enterprises Inc. all over the North-eastern US, I would breeze into little towns named Springfield or Chatham with a multiple assignment: teach children at school about recycling, invent a

recycling system that works for the town, have dinner with the local environmental council (usually women) or the Chamber of Commerce (mostly men), sign a contract for placement of a 40 cubic metre container for and purchase of glass with the Department of Public Works (always men), and tell my employer, the glass recycling company, where and what type of container to place, and how often to collect it, and how much to pay.

A handful of the first generation of "Recycling Co-ordinators" created the Association of New Jersey Recyclers (ANJR) in 1983, and witnessed the creation of the New Jersey Recycling Act in 1984, one of the milestones in the modernisation of waste management in North America. A position paper on behalf of ANJR, "Not Business as Usual," typed on my father's typewriter before we had word processors, about "seeing" garbage differently, was a *cri de coeur* protest against the sheer inertia of the middle aged public works directors all over North America who acted outraged and invaded by all of the attention and awareness to their profession, which they had entered because it was sleepy, out of sight, and they could go home at 3 pm every day.

And, because there were so few of us on the cusp of modernisation, we experienced the opportunity to make policy for the State of Massachusetts, to operationalise the ideas, as it were, of a much bigger discourse of how to accelerate, optimise, and institutionalise innovations in systems of provision for managing materials, in a waste management system already changing at a dizzying rate. It was a perfect education to the profession of "garbologist," a classic for the resource-intensive last quarter of the 20th century, in contact with many of the strands that weave through the discourse on waste, materials, resources, and the social and provisioning practices that support and reproduce them.

In 2009, the North American "zero waste movement" and the EU waste directive amendments that provide for an "end of waste declaration" face each other across a multi-directional global discourse about waste and materials, design and sustainability. What is this discourse really about? Is waste a problem or a resource? Is it the shameful excreta of modern society, or the flagship of sustainable development and carbon neutrality? Is it a product of capitalist conspiracy, habitual neglect, women's overwork, state socialist industrial imagination, or simply bad product design? Does waste in the beginning of the 21st century represent a problem, or an opportunity? Can we understand changes and trends in the modernisation of the characterisation of waste, and in the strategies adopted to address and manage it? Is change real, or constructed? Is it a local phenomenon, a global process, or some interaction between the two?

The goal of this thesis is, ultimately, to address this question, "what is waste," and what (with apologies to Lenin) "is to be done" about it. The ecological modernisation of waste management stimulated the emergence of municipal recycling in North America and "old" European Union countries in the 1980s, and the institutions and practices created a committed, passionate community of practice whose daily work as garbologists and recyclers ranges from picking waste at the dumpsite to writing policies in Brussels. It is to them that this thesis owes its greatest debt, because they have been – and remain – my fellow-travellers in the adventure of modernising waste management and institutionalising recycling – both municipal and value chain – and creating integrated waste management. So this work is first dedicated to the doers, and has its feet firmly on the ground of practice.

At the same time, it has a goal to support and enrich practice, and in some sense lighten the work of practitioners, with ideas and insights from social theory. In the process, there may be some opportunities to bring "reality therapy" to the theoretical discussions, but this is not a primary goal or ambition. A common theme in the thesis is the role of process and consultation in decision-making and in mediating the relationship between professionals, providers and users. This thread domesticates the "what is to be done" question, by creating channels of communication between the "doers" and the "done to's".

***

There are many too many people to thank, and to acknowledge, than there is room for here, so if your name is missing from the following text, please know that it is not forgotten.

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An equal expression of thanks goes to my employer since 1999, WASTE, advisers on urban environment and development, for supporting my PhD and providing me with insurmountable opportunities to do impossibly challenging projects that have provided much of the material for the research in the thesis. The deep thinking of Arnold van de Klundert and the way he and Jaap Rijnsburger created an organisation to respond to real world problems in low- and middle-income countries has continued to nourish and inspire my work and its expression in this thesis. Institutional support from WASTE, an NGO institute actually too small to support not one but two PhD students in the staff, has made this possible. Colleagues whose specific shared work has also made this thesis possible include Justine Anschütz, Jeroen IJgosse, and Ivo Haenen. WASTE is a partner-based organisation, and many partners have enriched the research behind the articles. For a high level of personal and professional collaboration I would like to celebrate the inspiration I get from an ongoing working relationship with Reka Soos, Natalia Dimitrova, Lyudmil Ikonomov, Victoria Rudin Vega, Susy Lobo Ugalde, Anselm Rosario, Sandra Spies, Rueben Lifuka, Alodia Ishengoma, and Lizette Cardenas. From my years working on recycling in the US I am lucky to retain a working relationship with Michael H. Simpson and Portia M. Sinnott, and Tompkins County Solid Waste Manager Barbara Eckstrom, who keep me connected to the US networks where I came of age professionally. The community of practice gathered under the umbrella of the CWG, "the Collaborative Working Group on Solid Waste Management in Low- And Middle-Income Countries," has continued to be a source of wonder and inspiration. From this group several other women working on PhD's and MSc's on related topics concurrently with me have been very helpful in reading and exchanging ideas: my WASTE colleague Lilliana Abarca, Sonia Dias, Lucia Fernandez, and Bharati Chaturvedi.

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Chapter 1: Introduction

1 Introduction

In his 15 November keynote speech at the 2010 annual meeting of ISWA, the International Solid Waste Association, Dr. Paul Bruner of TU Vienna characterises all of modern waste management as the search for and deployment of reliable sinks that provide stable, long-term disposal options for increasingly complex materials in ever-growing amounts, in an increasingly chaotic world. (Bruner 2010). When asked "what about recycling, how does it fit in this analysis?" Bruner paused, looked around, and said "Well yes, recycling is not really considered, it might make some difference." Bruner offered these comments at a moment in time where understanding the process of ecological re-structuring of solid waste management as it has taken place in high-income, or developed countries, is a high priority. This thesis takes Bruner's speech – both what he says and what he does not – as a point of departure.

Bruner presents and analyses the classic waste management idea, removal and safe sinking, in updated and streamlined language, that contextualises waste management within the modern landscape of environmental protection. Bruner's definition of solid waste, his orientation in promoting large technical solutions in high-income countries, and his bagatellisation of recycling represent a widely held vision of the waste management sector, updated to the realities of a globalised world. This vision is articulated by David Wilson as consisting of three core physical activities, driven by three policy imperatives:

1. getting waste out of the city and off of the streets to protect public health,
2. removing waste to somewhere else where it can be isolated from nature to protect the environment, and
3. recovering resources where possible (Wilson 2007).

Waste management as safe sinking is a useful point of departure for this thesis, and an opportunity to put the history of waste management into sharp relief. But understanding the central task of the waste management system as removing waste from populated areas and isolating it in safe sinks can also be dangerous, in that it inhibits practitioners and scholars from recognising, addressing, and understanding the fundamental shifts that go along with ecological re-structuring in the modernisation process.

And understanding those shifts in a deeper way is a critical challenge at this time in history, because the existing models developed in the high-GDP urbanised (social) democracies of North-western Europe and North America are increasingly serving as good practice guidelines for the rest of the world. Solid waste management is becoming the key concern of mayors and city councils in cities as far removed from each other as Lagos, Shanghai, Melbourne, or Minsk. In the 21st century, low- and middle-income countries are increasingly representing both the constituency and the concern of the organisation that hosted Bruner's speech – The International Solid Waste Association (ISWA).

The thesis is located at the intersection of two sets of contrasts: the contrast between solid waste as removal-focused sinking, on the one hand, and optimised valorisation on the other, and the contrast between the outcomes of waste management modernisation processes in high-income North-western Europe and North America cities on the one hand, and in cities in low- and middle-income countries in the other. "Valorisation" here is used to mean the extraction and capture of materials that would otherwise be waste, and their commercialisation within the industrial value chain as recyclables, and within the agricultural value chain as nutrients, in the form of compost or animal feed.

The core claim of this thesis is that modernisation processes in high-income countries are moving the waste management provisioning system into a new paradigm, and in the process two frontiers are being crossed. First, modernisation processes restructure solid waste provisioning systems, and

produce "integrated waste management" in high-income countries. In this process a fundamentally new institution, *municipal recycling*, emerges, that connects local authorities with industrial and agricultural value chains in an institutionalised landscape that has a broader and more diverse focus than pure physical removal. Secondly, while there are important similarities in the solid waste ecological modernisation process in and outside of the high-income countries in Europe and North America, there are key differences in outcomes in middle- and low-income countries that produce less favourable results in these countries, because municipal recycling fails to emerge. Thirdly, in the absence of municipal recycling, a different newly emerging model, *inclusive recycling*, may represent an alternative reform strategy that fits the local context in these countries.

The purpose of this chapter is to situate and contextualise the thesis in both the world of waste management and the scientific literature on waste management, and to develop the main research questions for this thesis. The next section starts by providing an historical overview of waste management and showing how waste removal became first segregated from and then again integrated with recycling and recovery. The third section provides an overview of contemporary urban waste management, including recycling, in cities in developed and developing countries, using a data set of 20 reference cities. Section four provides a systematic overview of the most prominent schools of thought in the environmental social sciences in studying waste management, and positions the ecological modernisation perspective in this literature. Section five presents the research questions that guide this thesis, to be followed by an overview of its structure.

2 A historical perspective on waste management

City cleansing and waste removal has developed partly together with, and partly separate from, urban recycling and the value chains for organic waste and recyclables. I will first provide an overview of the history of how calls for public hygiene and clean cities pushed the development of safe waste removal. I will follow that with reporting on the parallel and history of recycling and valorisation, and then show how integration of these two has only recently occurred. Here I will especially report on the history of waste management in European and American cities; in the next main section we will compare current waste management systems in a more diverse set of cities around the world.

2.1 History of city cleansing and waste removal

The idea that waste requires management is linked with the experiences and ideas of urbanisation. People living in close proximity to each other also live with each other's wastes: industrial, commercial, and agricultural by-products, and their own, and their animals', faeces. In the city there are few places where these materials, or the activities associated with them, can be ignored (De Swaan 1988). But in Europe during the Middle Ages and into the 19th century, management of these materials was considered above all an individual or commercial responsibility, or, in the case of the resource value, an individual or commercial opportunity (Poulussen 1987, Velis, Wilson and Cheeseman 2009). And while resource management continued to be primarily opportunity-based until the late 20th century, waste management as we know it became less and less an individual, and more and more a collective, activity. De Swaan (1988) even considers urban hygiene crises as having been partially responsible for the formation of the city as a modern collectivity.

The city of Antwerp in the period up to 1800 provides a nice example of this. The forerunners of the modern waste management system in Antwerp were "geboden", that is, ordinances requiring individual actions by waste generators or households to keep their part of the city clean. The antecedents of the current recycling sector, feeding the industrial and agricultural value chains, were rights-based monopoly agreements with carters or shippers and other commercial parties bringing goods into the city, that gave them exclusive rights (and obligations) to collect and remove the wastes from the city and valorise them in the countryside (Poulussen, 1987). In North America the rights and privileges for recovery were more closely associated with the retail distribution chain, and

valorisation made extensive use of reverse logistics (Strasser 1999).[1] Strasser (1999) traces the transformations in this process in North America, looking at the relationship between producers, marketers, and households in the 18th and early 19th centuries, when there were often shortages of materials. The residues of society – whether from households or industries – were simply valuable resources. Systems to supply goods, such as peddlers and general stores and railroad depots, also functioned as part of a small-scale reverse logistics chain to collect bones, ashes, fabric, metal, and other remnants for sale to industries, and the sellers might also supply parts and/or repair broken items. (Strasser 1999).

The picture that emerges from these and other socio-historical analyses is that until the middle of the 19th century, activities to maintain public hygiene were dependent on individual initiatives of households or businesses. Where these actions didn't occur frequently or consistently, laws were passed to require the desired individual or industrial behaviour (Poulussen 1987, De Swaan 1988, Gille 2007). Newcomers to the city found an economic niche as "rag-pickers," collecting and using or selling the leftovers of those with a higher material standard of living (Melosi 1981, Chaturvedi 2007). Large numbers of people came to rely on these secondary raw materials for their livelihoods, collecting them from households or dustbins and selling them into the developing value chains.

Waste as we know it – meaning materials that the owner intends to discard into a common management and provisioning system that removes them from populated areas – increased greatly with industrialisation and the division of labour, according to Strasser (1999). People in cities increasingly lost their relationship to a resource base that allowed them to produce their own goods and fill their own needs. Over time, they lost both skills and opportunities to re-make products from discarded household items. The making of things became more centralised and more distant, and so the leftovers were orphaned in the city. Amounts of waste grew, and neither the industrialised production processes nor the increasingly centralised distribution systems were able to serve as the channel to return these materials to industry (Strasser 1999). Industrialists also saw a benefit in this, as it enlarged the market, and the disposable or short-term product emerged (Packard 1960).

Removing waste from cities in Northern Europe and North America emerged as a public health priority during the period of urbanisation in the 19th century. Migration to the city increased both the absolute population and its density. Newcomers to urban life understood neither how to live in the city, nor how to manage their wastes and excreta. Moreover, they seldom had access to enough space to do so in the ways they had been used to in the countryside. (De Swaan 1988).

The density, amount, and unruliness of waste simply began to overwhelm the private channels to reuse it, which formed the backbone of the removal system (Ibid.). Much "dust," street sweepings, and manure still went to the agricultural value chain or to road construction, but the products which did not decompose were increasing, and as industrialisation proceeded, products also became more complex and more difficult to manage at the level of household or business (Velis, Wilson and Cheeseman 2009, Strasser 1999). The response was to remove them, to a steep-sided ravine or swamp at the edge of town that was far enough away to reduce nuisance; it was better still if there was a need for that area to be filled. "The dump" was available for private individuals, businesses, and others to bring their refuse. The actual work of removal from households remained a private-to-private affair, with rag pickers going from house to house to collect whatever was not needed. Burning waste was an acceptable management strategy, even the dump was frequently burned to reduce volumes and keep rats and other vectors under control.

De Swaan (1988) and others identify the UK cholera epidemic of 1834, and the rise of cholera as the urban scourge of the 19th century, as the turning point in the institutional development of the solid waste sector. The threat posed to middle and upper classes of poor hygiene and risk of infection

[1] This is still the case in certain places, and for certain material supply chains, such as ferrous and non-ferrous metals, used clothing, and the almost invisible activity of recovering of frying fat for soap. These materials are diverted before entering the waste stream because there is genuine economic demand that covers the costs of extraction, transport, processing, and sale.

emanating from the densely populated urban centres and slums leveraged, according to De Swaan, the creation of urban governance collectivities and the willingness of the middle and upper classes to finance them. These new institutions took unto themselves the responsibility to organise and provide both waste and sanitation services (Ibid.). Starting in the middle of the 19th century, cities made themselves responsible for a general level of sanitation and welfare. The first institutions for this were, according to De Swaan, the civil police, responsible for managing crime, and the sanitary police, responsible for educating about and enforcing public hygiene. (De Swaan 1988, pp. 130-138 in the 1993 Dutch translation, Velis, Wilson and Cheeseman 2009).

Scientific development was increasingly able to demonstrate that the spread of the dreaded cholera – as well as other infectious diseases like polio – were related to poor sanitation and uncollected solid waste (Scheinberg, Wilson and Rodic 2010). The increasing concern about germs and the growing understanding of the relation between hygiene and disease in the beginning of the 1900s fuelled the growing development of an urban solid waste and sanitation infrastructure (Strasser 1999). Particularly larger cities understood that keeping waste from the streets was both their mission and their obligation. During this time the main emphasis was to remove waste from urban areas, by collecting waste from households and sweeping streets, through a branching network of infrastructure and services, which still persists as the dominant mode for waste management. (De Swaan 1988, Melosi 1981).

But improved collection, combined with increasing waste volumes, needed bigger and better places for disposal. Cities needed a place outside the city to isolate these materials from urban populations. They found and used ravines, cliffs, low-lying areas, swamps, and waterways; these were available and convenient, but not always sufficient. By the middle of the 20th century, large cities like New York and London required that the many high-rise apartment houses had their own waste incinerators, fed by garbage chutes from the upper floors, which filled the urban air with the smell and emissions from burning garbage but indeed reduced its volume and septicity. In coastal, river, and lake cities, dumping waste in the water continued to be a preferred strategy, largely uncriticised, until the 1960s when the so-called environmental protection driver was born (Wilson 2007, Scheinberg, Wilson and Rodic 2010).

Out of further protests and knowledge on the environmental consequences of these waste dumps the modern landfill developed. The key characteristics of a controlled sanitary landfill were, and remain, a system of volume and surface management consisting of a weigh-bridge, perimeter fencing, and daily and final cover, combined with precise technical protection and control mechanisms: clay or geo-textile liners, leachate and gas collection, and, since the 1990s, forced underground decomposition through fast recirculation. This is the paradigm of safe disposal in solid waste management, which focuses on placing waste in safe sinks, precisely as Bruner explained (Bruner 2010, Scheinberg, Wilson and Rodic 2010). In some cases and situations – especially in Europe and Japan – the landfill is supplemented by a waste to energy incinerator, which uses incineration technology to reduce both bio-chemical activity and waste volumes and generate electricity with the heat produced.

2.2 Recycling and recovery: a parallel history

While, disease, inconvenience, smell, and ideas of cleanliness drove the early activities in waste management, the separation, collection or extraction, and valorisation of ashes, rags, broken items, and manures drove the beginnings of materials recovery, providing a livelihood for others than the discarders of the materials. The historical capture and valorisation of materials in waste and their re-direction to beneficial utilisation in the agricultural and industrial value chains is based on the latent or explicit intrinsic economic value of materials and their potential to re-enter production chains. In most developing countries, this is primarily a private sector activity located within the industrial or agricultural value chains. (Dias 2009, Scheinberg, Wilson and Rodic 2010, Scheinberg, Simpson and Gupt 2010).

There is even less historical material on the development of the recycling industry than there is about the origins and development of solid waste management. This is in part because the recycling industry

has a culture of obsessive secrecy. This industry has an organisational culture of family businesses that are on the boundary between formal industry and informal enterprise2. The sector is vulnerable to claims of money laundering, criminal activities, and outright stealing, and distrusts outsiders in search of information3. Gille (2007) and Strasser (1999) go some way to filling the gaps in the historical record.

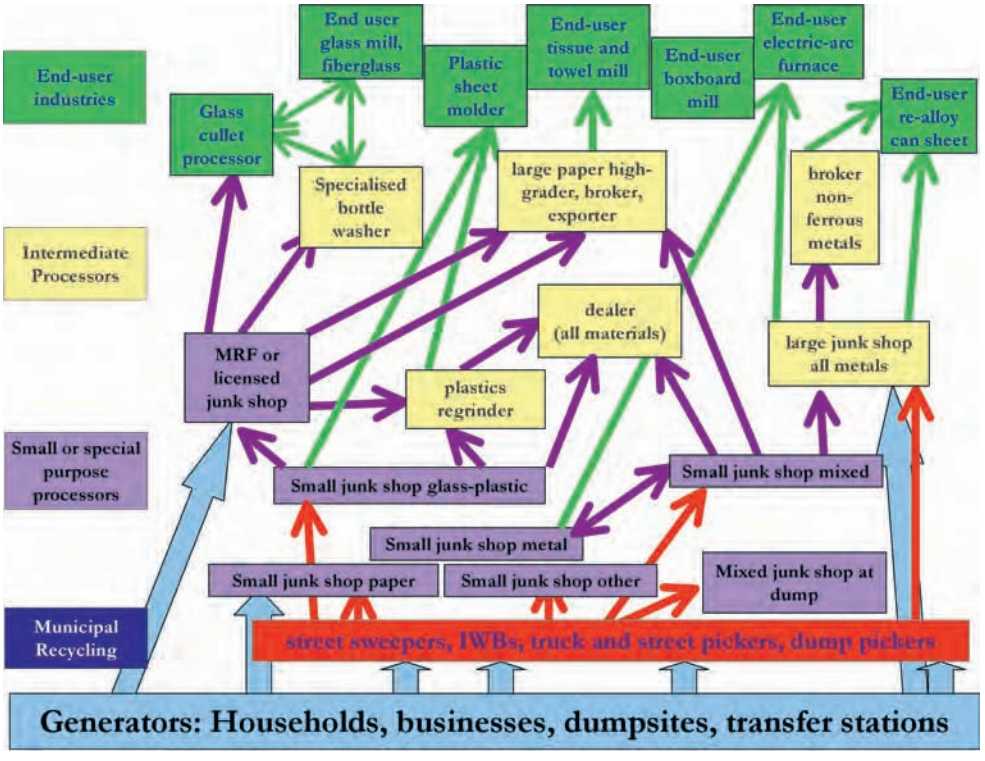

Figure 1. The Recycling Value Chain – A Complex Reality. Source: Anne Scheinberg, WASTE, 2007.

In the previous section it was possible to see that "recycling" or valorisation, that is, the capture, recovery, and commercialisation of materials in the waste stream,[4] essentially the first form of urban waste management, was gradually replaced by the municipal cleansing organisations that emerged in urbanisation in the 19th century. Valorisation continued operating alongside of, but increasingly separated from, the new socio-technical solid waste management provisioning systems. As solid waste became increasingly anchored in the infrastructure of public health and urban cleansing, valorisation remained a private and growing commercial activity. The industrial recycling value chains that absorb secondary materials in the 21st century developed during the late 19th and early 20th century, in the context of the evolution of municipal cleansing.

[2] Representatives of the industry itself explain it differently: first of all, they do not create the waste, they only handle it, and as such they are saddled with the discards of society and the taboos that surround them. Secondly, the valuable materials they have stored are non-count items which cannot easily be inventoried, so there is a high risk of theft, and secrecy and the tradition of family businesses minimises both the risk of theft and the negative consequences of it. (Anne Scheinberg, 1984 conversation with Jack Levin, scrap industry company magnate, North Carolina, USA).

[3] This industry is frequently seen as semi-legal and semi-criminal, a place for laundering money and secreting dead bodies, and the playground of organised crime Weinberg, Schnaiberg and Pellow 2002 is just one example of a work on recycling that blames the industry for these things.

[4] "Valorisation" is the European term for the combination of repair, reuse, recycling, composting, and organic waste management activities that are based on commercialising materials and selling them into the agricultural or industrial value chains.

In North America certain groups of immigrants entered these industries, leaving them today primarily in the hands of descendents of Jewish, Italian, and (in the mid-western US and Canada) Central European immigrants of the mid 19th century. (See chapter 2 in this volume). Strasser (1999) chronicles the activities of small reverse supply chains that worked through itinerant peddlers, and the complex relationships between charitable donations and the commercial secondary materials industries in North America. Wartime shortages and the patriotic collections they encouraged are also part of this history. Velis, Wilson and Cheeseman (2009) look in detail at the history of dust-yards in London in the 19th century, and track their shift from primarily resource-driven processing centres which valorised multiple components of "dust" to public cleansing institutions, a shift that took place between about 1850 and 1900. (Velis, Wilson, and Cheeseman 2009 pp 1287-1288).

Hungarian and other socialist economies had industries in the 1950s that were so hungry for materials that the political system labelled and rewarded recycling as a patriotic activity. Recycling value chains in these countries thus developed as part of the industrial supply system. Their goal was collecting commodities and valorising them, that is, extracting maximum economic value.

The private recycling industry in the OECD countries spent most of the 20th century quietly avoiding public notice, until the 1970s. By the 1980s, when recycling became a topic of interest to waste managers in OECD countries, these industries had become highly developed, and in some cases fully or partially integrated with the virgin materials industries. They need materials, but not too many, because that would depress the price, and although profitable, these commodities-based industries are very vulnerable to price fluctuations. (Scheinberg 2003). Small dealers, or "junk shops," buy from individuals who collect from the streets or businesses. Larger collectors trade with smaller ones, or get materials from charitable paper drives or metal collections. The largest level of traders, "paper stock dealers" or "scrap metal processors", are often partially or wholly owned by the end-user industries they serve. (Scheinberg, Simpson and Gupt 2010).

These industries received the unwelcome attention of waste managers in the 1970s and 1980s. Around the first Earth Day in 1972, the concept of "recycling" as a public-sector activity and environmental policy focus was put forward in the NGO and environmental protection communities in the context of the growing interest in pollution avoidance. Although most did not realise it, these environmental activists and scientists echoed an earlier discourse on waste management in the USA in the 1890s – as to whether to maximise recovery by promoting and maintaining separation of different materials for valorisation, or to optimise technical efficiency and effectiveness by focusing on removal of mixed waste in the most efficient vehicles available. (Strasser 1999, Melosi 1981, see also IJgosse and Scheinberg 2004, and chapter 2 in this volume).

Scientific interest and NGO activism tapped into growing political criticism of the increasing amount of consumption and the waste it "produced". Books like Vance Packard's The Waste Makers (1960) had anticipated this movement by criticising advertising and "planned obsolescence" as creating waste deliberately. Municipal recycling appeared to be the antidote: not only was it seen as an alternative to increasingly expensive disposal, but also as a way of "conserving valuable resources." (Ibid.). Experiments led by NGOs in East and West Coast cities in North America and in the Netherlands, Denmark, and Germany in Western Europe convinced some early adopter municipal waste collection authorities to scale up and create city-wide municipal recycling programmes. In the 1980s in the USA and Canada, the nascent recycling profession succeeded in inventing and institutionalising a new civil service category, the municipal recycling co-ordinator. Municipal recycling was born.

The key trigger for municipal recycling in the modernisation of waste management was pricing of disposal, and associated re-structuring of the financing and budgeting process for waste management. Once disposal was (a) priced, (b) owned and operated by a regional institution rather than owned by the municipality, and (c) farther away, and costing more to reach it, disposal began to be a real and quite alarming cost post for local authorities. Municipal recycling kept the materials out of disposal, and the amounts of money it could save began to be quite significant. This allowed – actually even

pushed – the local authorities to invest in municipal recycling practice and infrastructure.

There were three infrastructure strategies that proved reliable in instituting municipal recycling, and changing the social practices around waste. The first was enacting bylaws or ordinances requiring recycling or preventing the entry of designated recyclables into the disposal chain. This legal infrastructure, called "mandatory recycling" in North America, changed the norm from disposal of mixed waste to separation and valorisation of source-separated materials and disposal of the rest. In the mid-1980s, the first "municipal recycling laws" were put into place in the US and Canada, with New Jersey being the first state to require recycling. (See also chapters 2 and 4 in this volume). Other OECD countries experienced similar policy and legal infrastructures.

The second form of infrastructure was the physical infrastructure associated with separate house-to-house "curbside" (UK: "kerbside") collection of recyclables, combined with providing a specific, identifiable, and specially designed in-house container for municipal recycling, often with the logo of the city on it. It was the Canadian invention of the "Blue Box," or, more generally the "set-out container", a special, easily identifiable box or stack of boxes for storage of recyclables that could also serve to set them out at the curb for collection, that pushed recovery rates in North America beyond 15% of total waste and established the feasibility of municipal recycling in a convincing way. In the Netherlands and Germany curbside collection focused on organic waste; the corresponding Dutch institution to municipal recycling is "GFT" collection, that is, house-to-house collection of kitchen and garden wastes. Other Northern European states started experimenting with separate collection of wet and dry waste to divert the residential organics in the same period, and identified a "green bin" as the official set-out container. (chapter 2 in this volume, van Vliet, Chappels and Shove 2005, Weinberg, Pellow and Schnaiberg 2002, Scheinberg and IJgosse 2004, Huisman 2009, Kreuzberg 1988)

Figure 2. Typical blue-box municipal recycling setouts from the Province of Ontario, Canada. Source: images available at www.google.nl under search for "blue box recycling."

Both kinds of infrastructure – the mandatory recycling laws and the practice of separate house on house collection of recyclables and/or organic waste – relied heavily on a third type of infrastructure: public education, or the structural and repeated social marketing of the desired behaviour to the users of the system. In this sense the responsibility of the new cadre of municipal recycling professionals was similar to that of the environmental police of 19th century Europe: education as a means to improve the functioning of new infrastructure. (De Swaan 1988, see also chapters 2 and 5 in this volume).

The recycling industry and its trade associations in Europe and North America reacted to the public sector interest in recycling with wariness, and indeed in the US with outright hostility. They understood, as the municipalities perhaps did not, that an alliance with public institutions would change their operations, and the market in which they functioned, in a fundamental way. The trade

associations in North America in the 1980s pledged themselves to fight this new development. In OECD countries, the municipalities "won" the conflict, and the recycling industry came (reluctantly) to accept that municipalities were legitimate players in recycling, and that municipal recycling activities formed a sustainable and long-term source of materials. Post (1990) shows this process in micro for the North American paper industry, but it counted also for other sectors in glass, steel, plastics etc..

Municipal recycling is thus an institutional and economic innovation that is the product of the financial reforms that produced priced disposal in the modernisation of solid waste in the past 10-40 years. In Europe, Australia, and North America, the landscape of the waste provisioning system depends on the integration of resource management into public cleansing activities, as a way to offset the costs of environmental protection in technical facilities. This is the essence of an "integrated" waste management system, and echoes in some sense the 16th and 17th century approach to keeping the streets of Antwerp passable (Poulussen 1987). Like its pre-modern antecedent, municipal recycling includes source separation, repair and re-use, collection, processing, composting, transfer, and marketing of materials recovered from waste.

In the process of modernisation and re-structuring, many of the hundreds or thousands of rag pickers, informal recyclers, or "scavengers" in Europe and North America found niches in the formal recycling systems, as sorters, collectors, repairers, or as a rather small group of independent commercial or idealistic community-based suppliers. Some remained on the streets, though, and today in New York City, many people supplement their income by collecting bottles and cans; on the streets of Gouda, in the Netherlands, a shy elderly man with a "bak-fiets" (a cargo bicycle) goes door to door and collects old bicycles, lawn chairs, and other scrap metal to sell. (Chaturvedi 2009; Strasser 1999, see also Chapter 4 in this volume).

3 Waste management in the world's cities today: an orientation

This historical development has not been uniform in time and place. Most importantly, middle- and low-income countries have not experienced a similar development or modernisation path in waste management. To illustrate that I will first report on three very different cities in terms of waste management. Subsequently, I will analyse a dataset of 20 reference cities to explore the diversity of waste management, and more specifically recycling, systems around the world, to conclude with the typical characteristics (and differences) of today's waste management systems in high-income countries and in middle- and low-income countries.

3.1 A tale of three cities

I will use information on three very different cities to illustrate and contextualise the modernisation process of solid waste management. The cities are: Rotterdam, the Netherlands, with a GDP (gross domestic product) of US $46,750 and 528 kilos of waste per person per year; Varna, Bulgaria also a significant port city, with a GDP of US $5,163 and 435 kg per person per year of waste; and Bamako, Mali, with GDP of US $556 and waste generation of 219 kilos of waste per person per year. (Scheinberg, Wilson and Rodic 2010, GDP data from 2009).

Rotterdam with high GDP has a complete, mature, integrated solid waste system with 100% cost recovery and the relatively high cost per household of US$ 364 per year (Rotterdam city report, part of Scheinberg, Wilson and Rodic 2010). Households and businesses in Rotterdam have their mixed waste collected once or more per week at the curb, they can call for pick-up of bulky waste, and they have deposit containers for recyclables and old clothing within easy walking distance5. 100% of waste is captured by the system and disposed of either in incinerators or a controlled landfill; 30% is recovered through targeted recycling and organics management. The key actors operating waste management in the system represent a mix of the large para-statal ROTEB, and other para-statal,

[5] All other Dutch cities also collect compostable *GFT* (vegetable, fruit, and garden waste) from households or depot containers, but Rotterdam does not.

public, and private actors, all of whom are formal, legitimised, and in a transparent relationship to each other.

At the level of municipal institutions, solid waste information management is well organised and complete: each of the 13 sub-municipalities has a separate reported figure for effectiveness, which is used to improve the overall system. Like others of their Dutch waste management colleagues, the Rotterdam waste management professionals see their system as mature, well-functioning, and finished. (Scheinberg and IJgosse 2004). And except for the relatively low rates of recovery, it does appear that both public health and environmental protection are well-managed. Resource management is weak, especially relative to other Dutch municipalities and the EU guidelines, but with its own incinerators, Rotterdam has less incentive to divert materials from disposal, especially since the costs of different treatment methods are cross-subsidised to match the policy goals of the system. New developments and policy initiatives, which made waste management in the Netherlands both turbulent and exciting in the period from 1985 to 2002, have dwindled to a professionalised and minimalist response to new EU initiatives at the margins of Rotterdam's core business of managing the discards from its citizens safely and efficiently. Thus Rotterdam presents us with a picture of a modern waste management system, with few "leaks" into the environment.

Varna is a somewhat different story. Under the influence of the European Union (EU) accession process, Varna has introduced improvements in some areas, but in others not. Bulgaria, like other countries acceding to the European Union, has reformed and modernised the waste infrastructure, institutions and financial structures in its major cities in five to eight years, based on the requirement to re-organise the waste system and fully integrate the environmental and resource management drivers into EU policy and practice. This is a process which took the Netherlands about 30 years. In such a rapid process, almost the only things that can change are physical systems, and there is little chance for institutional development or social anchoring. See also chapter 5 in this volume for a more in depth discussion of Bulgaria and waste modernisation.

While 100% of the citizens in the urban areas of Varna have collection services offered to them at a cost of US$160 per household per year, there are villages in Varna's administrative region that have no or only occasional waste collection, and where residents use horse-drawn carts to dump their waste over a cliff or into a river valley. Varna's waste management is managed at the policy level by one of the city's three Deputy Mayors, with considerable responsibility decentralised to the district mayors of the five sub-municipalities. There is thus a critical split between urbanised and rural areas within the City's official boundaries. While 100% of urban waste is reported to be disposed in the City's recently re-constructed controlled disposal facility, disposal is not priced. In the villages the mainly agricultural wastes are generally discharged into low-lying areas and left to decompose.

In Varna the driving focus at the moment, under EU rules, is on improving environmental management for all wastes, and on the basics of public health-driven collection in villages. Resource management in the pre-modern sense, driven by the value of the materials, operates concurrently with – and fully out-competes – the modern version of recycling as a sink and alternative to disposal. Varna's reported 27 % recovery (not verified) is attributed partly to activities of the informal recycling sector, split between Roma individuals and micro-enterprises who collect cardboard, metal, and paper from the dump and from houses and sell them to small dealers, and pensioners who collect cardboard and other recyclables from the street to sell to supplement their pensions. This system is increasingly under pressure from the national, EU-financed formal recycling (and producer responsibility) organisation, EcoPack Bulgaria, which collects far fewer materials at a much higher cost per ton (Doychinov 2008).

Moving outside of the EU, in Bamako, Mali, which has among the lowest-GDP of the 20 cities, solid waste collection has a budgeted cost of $5 per household per year, but the data management system has so little priority that this and all other numbers are open to question. Only 55% of the city's residents have access to collection, and none of the waste goes to controlled disposal. Households that want to pay for waste collection hire a micro-enterprise called a GIE, an economic interest

group, to collect their waste daily with a donkey cart. The waste is dumped in empty lots that function as formal or informal waste transfer points; sometimes waste is dumped directly into a waiting compactor truck.

Like Varna, the six municipal "communes" are the main waste management institutions, but the waste division of the regional municipality, the District of Bamako (the "voirie"), is responsible for disposal and transfer. The main dumpsite is in the middle of one of the six sub-municipalities, extending into the river. Most organic waste has gone elsewhere, but this dump is waist deep in plastics, rubber, and many kinds or partially decomposed materials.

Small amounts of recycling occur and focus on metals and plastics, in a system that is largely informal. Value chains in West Africa are weak, and little is recycled. But in different conversations, stakeholders interviewed to compile the data have different opinions about the percent of Bamako's waste that is being recovered as "terreau," decomposed organic waste. Estimates of 14%, 65%, 85%, or even 0% can be explained by the fact that both collected and uncollected waste is "stored" in small, unmanaged "transit centres" or illegal dumps. Depending on the time of year, these are informal dumpsites, temporary storage, or a kind of semi-managed composting site where waste loses volume through decomposition, is eaten by livestock, or is lost through evaporation or run-off. Cows graze at these centres and eat, in addition to organic waste, paper and plastics, so that operations to extract kilos of plastic bags from the stomachs of cows have become a key service of veterinarians in Bamako. (Scheinberg, Wilson and Rodic 2010, see also the You-tube film "La Vache qui ne Rit Pas," 2007). The percent recovery then appears differently depending on which of the informal recovery operations are actually "counted" by the municipality.

"Disposal" comes later and whatever does not go to the dumpsite is sold directly to the agricultural value chain. About once per year accumulated, picked-over and partially decomposed mixed waste is removed from the heaps in the city by the district of Bamako trucks or private vehicles and sold to the maraîchers, market gardeners in the flood plain of the River Niger. So even though there is partial collection and no formal disposal, the informal systems operating capture most waste and ultimately use it to feed the agricultural value chain. (Anschütz 2004).

The Bamako waste management system is open-ended and full of leaks, the formal authorities don't have much of a role in waste management and even less in monitoring or documenting it, and slightly less than half of citizens lack a formal removal service. But the intrinsic value of the material is enough so that the value chain "pulls" most of it for recovery. This system is driven by a combination of public health and resource management, and resembles to a rather surprising extent the waste management system described by Poulussen for the Belgian city of Antwerp in the 1700s, as was discussed above.

3.2 Understanding solid waste modernisation through benchmark indicators

These three cities formed part of a 20-city database created in the writing of Solid Waste Management in the World's Cities. (Scheinberg, Wilson and Rodic 2010). This database will be further explored to understand the contemporary variations in the modernisation process in urban solid waste management around the world.

Table 1 shows how the basic ingredient of waste management, the composition or characterisation of the waste itself, differs by country and income level. Higher-GDP cities have more of certain materials in their waste streams and less of others. Paper and plastic tend to follow GDP: the higher the GDP, the more of these materials are in the waste stream. Thus Rotterdam has the highest GDP, the highest percentage of plastic and is among the top 5 for percentages of paper in the waste stream. The highest amount of paper in the waste stream is Tompkins County, New York, USA, with the third highest GDP. Zero Waste city Adelaide, Australia, bucks this trend: with the fourth highest GDP we would expect more materials, but their percentages are comparable to those of some of the poorer cities in the group. Organic waste, with some notable exceptions, has the reverse relationship, with lower-GDP cities having relatively more waste from kitchen, garden, orchard, and in the case of

African cities, sweeping of dirt floors and compounds (although in the case of Bamako and Lusaka, for example this is reported as "other").

Table 1. Income levels, municipal solid waste generation and composition in the 20 reference cities

City & Country	GDP per capita[6], country, in (US$)	Population	Kg Per Capita/ Year	Kg Per Capita/ Day	Paper	Plastic	Glass	Metal	Organic	Other	Total
Rotterdam, Netherlands	46,750	582,949	528	1.4	27%	17%	8%	3%	26%	19%	100%
San Francisco, USA	45,592	835,364	609	1.7	24%	11%	3%	4%	34%	21%	100%
Tompkins County, USA	45,592	101,136	577	1.6	36%	11%	6%	8%	29%	11%	100%
Adelaide, Australia	39,066	1,089,728	490	1.3	7%	5%	5%	5%	26%	52%	100%
Belo Horizonte, Brazil	6,855	2,452,617	529	1.4	10%	11%	3%	2%	66%	9%	100%
Curepipe, Mauritius	5,383	83,750	284	0.8	23%	16%	2%	4%	48%	7%	100%
Varna, Bulgaria	5,163	313,983	435	1.2	13%	15%	15%	10%	24%	24%	100%
Canete, Peru	3,846	48,892	246	0.7	6%	9%	2%	2%	70%	11%	100%
Sousse, Tunisia	3,425	173,047	394	1.1	9%	9%	3%	2%	65%	13%	100%
Kunming, China	2,432	3,500,000	286	0.8	4%	7%	2%	1%	58%	26%	98%
Quezon City, Philippines	1,639	2,861,091	257	0.7	13%	16%	4%	4%	50%	12%	100%
Bengaluru, India	1,046	7,800,000	236	0.6	8%	7%	2%	0%	72%	10%	100%
Delhi, India	1,046	13,850,507	184	0.5	7%	10%	1%	0%	81%	0%	100%
Managua, Nicaragua	1,022	1,002,882	420	1.1	9%	8%	1%	1%	74%	6%	100%
Lusaka, Zambia	953	1,500,000	201	0.6	3%	7%	2%	1%	39%	48%	100%
Nairobi, Kenya	645	4,000,000	219	0.6	6%	12%	2%	1%	65%	15%	100%
Bamako, Mali	556	1,809,106	256	0.7	4%	2%	1%	4%	21%	52%	83%
Dhaka, Bangladesh	431	7,000,000	167	0.5	9%	4%	0%	0%	74%	13%	99%
Moshi, Tanzania	400	183,520	338	0.9	9%	9%	3%	2%	65%	12%	100%
Ghorahi, Nepal	367	59,156	167	0.5	6%	5%	2%	0%	79%	7%	99%
Average		2,462,386	343	0.9	12%	10%	3%	3%	53%	18%	
Median		1,046,305	285	0.8	9%	9%	2%	2%	61%	12%	
Source: Scheinberg, Wilson and Rodic 2010 and data collected to produce it											

Not only is there a big difference in waste generation and composition, but the overall configuration of waste systems differs in a number of factors, which relate both to the stage of development of the cities and their location. A set of indicators and benchmarks has been developed, shown below in Table 2, to analyze and compare the performance of urban waste systems in a consistent and useful way, related to the drivers in and the governance of solid waste management. (IJgosse et al 2004, Wilson 2007, Scheinberg, Wilson and Rodic 2010). A "driver" is a concept that Wilson (2007) introduces to describe a combination of the way that waste is problematised, the domain or policy landscape in which the problematisation is located, and the prevailing ideas about how to solve the problem. Wilson identifies three policy drivers, or areas of main activity in waste management:

- *Public health*. Public health problems have historically been the first driver for better waste management. The problem here is short-hand for cholera: too much waste leads to disease. The drive is to develop policy that succeeds in maintaining healthy conditions in cities. Solutions are to be found in (re-) organising the provisioning of waste collection and street sweeping in cities, with a focus on improving the technical and logistical organisation, extending collection service beyond the city centre or affluent neighbourhoods, introducing newer and more efficient vehicles, and reducing hand labour and contact with the waste.

[6] The reader will notice that GDP per capita is presented here for Quezon City ($1639) and Lusaka (953) and also in Table 9 on page 57, where the respective figures are respectively are quite a lot higher: $3536 for the Philippines and 1554 for Zambia. The Table 9 figures are from the International Monetary Fund and are quoted as being from 2009, and the Table 1 figures from UNDP in 2007, but are likely to be data from some years earlier. Also country figures for cities in Peru and India in Table 9 are also different from other cities in the same countries in Table 1.

- *Environmental protection*. The rise of the environmental driver leads to a focus on the environmental footprint of disposal. The problem is that burying waste in the ground or burning it (often considered to reduce volume and control risks of disease) causes pollution of air, soil, and water. The domain for solutions are improving the completeness and availability of a safe sink, usually by creating a landfill where a cap or cover prevents rainwater from mixing with waste, combined with a liner of plastic or natural clay which prevents permeation of waste to the ground-water.

- *Resource management*. The rise of the resource management driver leads to policymaking activities both outside of and within the solid waste provisioning system, and ultimately challenges the idea that the goal of modern waste management is removal to safe sinks. The problem is that many materials and items that end up as waste do not have to be disposed, because they have original or residual value. "Pure" or commodities-based recycling is driven by the economic value of the materials, and consists of extracting and trading secondary resources to the value chains in industry and agriculture. "Municipal recycling" focuses on using the value chains as a destination for materials that would otherwise be waste. This second service-based kind of recycling creates benefits by minimising disposal, that is, keeping materials in circulation for as long as possible.

The governance of solid waste management systems has been characterised along three dimensions: inclusivity (relating to the degree to which users and providers are included in solid waste management), financial sustainability of the solid waste management systems, and institutional coherence. The six/seven key benchmark indicators, that operationalise these drivers and governance dimensions, are designed to show, at a glance, how well a solid waste system functions. This section uses these indicators for the set of 20 cities to show both common features and differences between high-income countries on the one hand, and low- and middle-income countries on the other, as shown in Table 2 and the other tables that follow.

The percentage of households that receive a removal service is a classic and widely accepted indicator for the physical performance of solid waste systems associated with public health. All of the 20 reference cities score quite well on this indicator, with the lowest value in Ghorahi, Nepal, at 45% coverage, and quite a lot of cities scoring 100%.

The second indicator, the percentage of waste going to controlled disposal, represents some degree of environmental protection and associated technical improvements. The concept of controlled disposal implies fencing, gate control, inspection, but not necessarily the degree of physical infrastructure that would be typical of a sanitary or state-of-the-art landfill in OECD countries. Simply controlling disposal has important environmental benefits (Ball 1998), but does not require broad ecological re-structuring or ecological modernisation; when cities begin to modernise and control disposal, it is possible to talk of the onset of modernisation of waste management, but not necessarily of full ecological modernisation. The data suggests that most cities have begun this process, with Bamako being the clear exception. All other cities send 65% or more of their collected waste to controlled disposal with some form of environmental protection.

Indicator 3 in Table 2 serves to benchmark the degree to which resource management drives waste management policy, and as such it can also flag the presence or absence of municipal recycling. Experience with recovery rates in developed countries suggests that that the level of recovery will not exceed 25% unless there is priced disposal. in combination with municipal recycling driven by an official policy commitment to divert materials from disposal. In poorer cities, recycling and organics valorisation represent private sector activity with or without some policy goals, but generally without financing from local authorities. The next section goes further and deeper into recycling.

Table 2. Benchmark indicators in 20 reference cities

CITY	Drivers for solid waste management			Indicators of Governance			
	Public health	Environmental protection	Resource management	Inclusivity		Financial sustainability	Institutional coherence
	1	2	3	4A	4B	5	6
	Percent collection / sweeping coverage	Percent controlled disposal / incinerated of total disposed / incinerated	Percent materials prevented or recovered	Degree of user-inclusivity	Degree of provider-inclusivity	Population using and paying for collection as percent of total population	Degree of institutional coherence
Adelaide	100%	100%	54%	HIGH	HIGH	100%	HIGH
Bamako	57%	0%	85%	MEDIUM	MEDIUM	95%	LOW
Bengaluru	70%	78%	25%	MEDIUM	MEDIUM	40%	MEDIUM
Belo Horizonte	95%	100%	1%	HIGH	HIGH	85%	HIGH
Canete	73%	81%	12%	MEDIUM	HIGH	40%	HIGH
Curepipe	100%	100%	NA	LOW	LOW	0%	HIGH
Delhi	90%	100%	33%	HIGH	MEDIUM	0%	LOW
Dhaka	55%	90%	18%	MEDIUM	MEDIUM	80%	HIGH
Ghorahi	46%	100%	11%	MEDIUM	LOW	0%	MEDIUM
Kunming	100%	100%	NA	MEDIUM	MEDIUM	50%	HIGH
Lusaka	45%	100%	6%	MEDIUM	MEDIUM	100%	MEDIUM
Managua	82%	100%	19%	MEDIUM	LOW	10%	MEDIUM
Moshi	61%	78%	18%	MEDIUM	LOW	35%	MEDIUM
Nairobi	65%	65%	24%	MEDIUM	HIGH	45%	LOW
Quezon City	99%	100%	39%	MEDIUM	MEDIUM	20%	HIGH
Rotterdam	100%	100%	30%	HIGH	LOW	100%	HIGH
San Francisco	100%	100%	72%	HIGH	LOW	100%	HIGH
Sousse	99%	100%	6%	LOW	LOW	50%	MEDIUM
Tompkins County	100%	100%	61%	HIGH	MEDIUM	95%	HIGH
Varna	100%	100%	27%	LOW	LOW	100%	HIGH
Average	82%	90%	30%			57%	
Median	93%	100%	25%			50%	

Source: Scheinberg, Wilson and Rodic 2010 and data collected to produce it.
NA=Reported as not being applicable to this city

User inclusivity (indicator 4) is translated into practice in many cities, as users are seen as clients of the system that should have something to say about it. The relation to municipal recycling is indirect: often it is users or civil society organisations that push the municipal recycling agenda. What jumps out is that the three cities with "low" on this value are all in middle-income countries. Middle-income countries have some tendency to develop their physical infrastructure systems rapidly at the cost of the time needed for democratic processes.

Provider inclusivity – maintaining institutional and commercial access to the business of waste management for community, private, and informal entrepreneurs – indicates the extent to which the cities invite or accept the participation of micro, small, medium, community, non-governmental, and value chain actors and enterprises. A "high" means that such involvement is encouraged and institutionalised, a "low" means that there is likely to be conflict around claims for materials and service niches.

There are many ways of measuring financial sustainability. The one chosen in Table 2, "Population using and paying for collection as percent of total population," is related to the international ideal of full cost recovery. The picture that emerges is mixed: while collection coverage is high in many cities, meaning that most households can and do use the service, the percent of the population that both uses and pays for the service is much less consistent. This reflects a more general tendency: while the physical systems are working in a wide variety of cities, the institutional and financial support and governance systems are in a state of disorganisation.

Finally, institutional coherence – a composite indicator looking at the complexity of the organogram and its relation to solid waste budgeting and management – is primarily useful to understand institutional restructuring as a result of waste management modernisation, and the extent to which solid waste in the city is seen – and financed -- as an environmental service.

This brief comparison of waste management in a range of countries and cities around the world suggests that the physical systems are more evenly developed than the governance structure of these systems.

3.3 Recycling and valorisation in 20 cities

Most countries and larger cities in the world have some form of recovery and valorisation of materials, under the general term of "recycling," but under widely different physical, economic, and institutional conditions. Before the modernisation of waste management, recycling is often a private sector activity (the current situation in many low-income countries), located in the industrial and agricultural value chains. Putting a price on waste disposal institutionalises environmental protection and creates a new set of incentives and policy drivers towards municipal recycling in high-income countries as well as in some low- and middle-income ones. Where disposal does not become priced, recycling rates may rise for other reasons, and understanding those is quite important. Table 3 gives some additional insight on the nature of recycling in low-, middle- and higher-income countries.

Table 3. Formal and informal recycling and valorisation in 20 reference cities

	"Recycling Rate" = Waste Recovered From Total Generated	Landfill Tipping/ Gate Fee - Per Tonne	Diversion /Recovery Goal	Tonnes valorised by the formal sector	% valorised by formal sector of total generated	% valorised by formal sector of total valorised	Tonnes valorised by the informal sector	% valorised by informal sector of total generated	% valorised by informal sector of total valorised
Bamako	85%	NR	0%	0	0%	NA	392,893	85%	NA
San Francisco	72%	$117	75%	366,762	72%	100%	0	0%	0%
Tompkins County	61%	$80	50%	35,625	61%	99%	0	0%	0%
Adelaide	54%	$22	25%	401,116	54%	15%	0	0%	0%
Quezon City[7]	39%	Y	25%	58,130	8%	20%	229,842	31%	80%
Delhi	33%	NR	33%	165,565	7%	20%	675,505	27%	80%
Rotterdam	30%	NR	43%	90,897	30%	100%	0	0%	0%
Varna	27%	NR	50%	2,207	2%	6%	35,207	26%	94%
Nairobi	24%	NR	0%	NA	NA	NA	NA	NA	NA
Managua	19%	$2	0%	70,445	17%	89%	8,395	2%	11%
Dhaka	18%	NR	0%	0	0%	0%	210,240	18%	100%
Moshi	18%	NR	0%	0	0%	0%	11,169	18%	100%
Bengaluru	14%	$5	50%	277,025	13%	150%	25,185	1%	14%
Canete	12%	NR	20%	142	1%	10%	1,270	11%	90%
Belo Horizonte	11%	$20	16%	134,400	10%	93%	9,900	1%	7%
Ghorahi	11%	None	0%	65	2%	18%	300	9%	82%
Lusaka	6%	$6	0%	12,027	4%	69%	5,419	2%	31%
Sousse	6%	$3	0%	168	0%	4%	4,000	6%	96%
Curepipe	0%	NA	48%		0%	NA	NR	0%	NA
Kunming	NA	$13	0%	NA	NA	NA	NA	NA	NA

Source: Scheinberg, Wilson and Rodic 2010 and data collected to produce it. NR=Not reported for this city; NA=Reported as not being applicable to this city; Y=yes, phenomenon is present but there is no further information

In Table 3 cities are sorted on the amount of waste recovered as percentage of total waste generated. The table explores in detail the way recycling is organised and whether the city most likely has a version of municipal recycling or some other model of (informal) recycling. For Bamako, with the top

[7] The recycling rate shown here is for 2009, and is quite a lot higher than that shown in Chapter 4 in Figure 4. Partly as a result of the study reported in Chapter 4, the Philippines passed a national policy on informal sector integration, which appears to have affected both the real increase in recycling performance, and the way that recycling performance is reported.

reported recovery rate, it is clear that neither modernisation nor municipal recycling is present. For the next four, San Francisco, Tompkins County, Adelaide, and Quezon City, the combination of priced disposal, high recovery rates, high recovery goals, and no (reported) informal valorisation suggests indeed that municipal recycling operates here. Recycling rates in these cities are pushed by priced disposal, and are exceeding their formal recycling goals by a considerable margin.

In contrast, Rotterdam does not have priced disposal *per se*, and also has an unexpectedly low recycling rate. Looking more closely, Rotterdam has the highest costs per household for waste management reported among the 20 cities, and the highest reported cost per tonne, but disposal is not explicitly priced. The relatively low recovery performance, at 30% very low for the Netherlands, is then not surprising.

Table 4. Performance of formal and informal recycling in 20 reference cities

City	"Recycling Rate" = Waste Recovered From Total Generated	Landfill Tipping/ Gate Fee - Per Tonne	Tonnes recovered, all sectors	Percentage recovered by formal sector	Percentage recovered by informal sector	Type of recycling indicated
Bamako	85%	NR	392,893	0%	85%	ag value chain
San Francisco	72%	$117	366,762	72%	0%	municipal recycling
Tompkins County	61%	$80	36,495	61%	0%	municipal recycling
Adelaide	54%	$22	2,611,214	70%	0%	municipal recycling
Quezon City	39%	Y	287,972	8%	31%	semi-formal recycling
Delhi	33%	NR	841,070	7%	27%	semi-formal/ industrial value chain
Rotterdam	30%	Y[8]	90,897	30%	0%	municipal recycling
Varna	27%	NR	37,414	2%	26%	industrial value chain
Nairobi	24%	NR	210,240	NA	NA	information not clear
Managua	19%	$2	78,840	3%	15%	semi-formal recycling
Dhaka	18%	NR	210,240	0%	18%	semi-formal recycling
Moshi	18%	NR	11,169	0%	18%	ag value chain
Belo Horizonte	14%	$5	145,134	6%	0%	semi-formal recycling
Canete	12%	NR	1,412	1%	11%	semi-formal recycling
Bengaluru	11%	$20	524,688	10%	15%	mixed municipal and semi-formal
Ghorahi	11%	None	365	2%	9%	industrial value chain
Lusaka	6%	$6	17,446	4%	2%	mixed municipal and semi-formal
Sousse	6%	$3	4,168	0%	6%	ag value chain
Curepipe	0%	NA	NA	NA	NA	industrial value chain
Kunming	NA	$13	NA	NA	NA	industrial value chain

Source: Scheinberg, Wilson and Rodic 2010 and data collected to produce it. NR=Not reported for this city; NA=Reported as not being applicable to this city; Y=yes, phenomenon is present but there is no further information

The upper middle-income countries in Table 3 have the lowest recovery rates: an average of only 15% of materials are recovered. The private valorisation activities appear to have been interrupted, but the city authorities don't yet understand how to valorise materials well enough to capture or market them. A German Technical Co-operation (GTZ, now German International Co-operation, or GIZ)-financed study of the informal sector in valorisation and waste management confirms that the formal recovery activities in low- and middle-income countries capture small volumes of materials at relatively high costs (Scheinberg Simpson and Gupt 2010, see also chapter 4). Another way of seeing this is that in these countries the material well-being reaches a level where the amount of products in use has increased, but reverse supply chains to return used or discarded items to the production processes have been broken or interrupted. (See, for example, Strasser 1999 on this process in the US, or Gille 2007 on state socialist Hungary).

[8] In Rotterdam disposal is partially priced but the prices are manipulated for policy reasons, so the real price is hardly known.

Table 4 provides another way to understand the relationship between waste modernisation, by looking at interactions between priced disposal and the rate of recycling. By splitting up the total recovery into formal and informal, we can see the influence of priced disposal on the destination to which the materials are flowing.

Here it is quite clear: where the cost of disposal is US $20 per ton or less, informal sector operations dominate – sometimes animal feeding, sometimes recycling, but it is all in the value chain. In some cases there are policies supporting informal recycling in the context of modernisation, we call this "semi-formal" because there is some degree of recognition but it is not complete. In other cases the term "value chain" is used to imply that the operation collecting the most is selling to the agricultural or industrial value chain in a way that appears not to have been (much) affected by the modernisation process. (Scheinberg, Wilson and Rodic 2010, Velis, Wilson and Cheeseman 2009).

Table 5 looks at the relationship between priced disposal and system costs in the modernisation of waste management and recycling. While it might seem logical to think that municipal recycling is related to rising costs, this table suggests that pricing of disposal is more important than the costs in determining recycling rates. The highest recycling rates are associated with the highest prices, but this relationship doesn't hold for costs per household or costs per ton overall. Rotterdam has both the highest costs per ton and the highest costs per household, but is seventh in recovery rate and has no clearly priced disposal. Quezon City has low costs but priced disposal, and enjoys the highest non-OECD recycling rate. Belo Horizonte, in contrast, has priced disposal and high costs per household but low recovery rates – suggesting that it is operating in a different model. And indeed, Belo Horizonte was one of the first cities globally to experiment with different models of accepting and partially formalising the activities of waste pickers.

Table 5. Use of funds, priced disposal and municipal recycling in 20 reference cities

City	Landfill Price Based on Tipping/ Gate Fee - Per Tonne	Percent materials prevented or recovered	Annual City / Municipal budget for swm per household	Municipal / City costs per tonne handled by formal sector	Annual Municipal budget for swm per capita / GDP per capita	% of Family Income Used For SW Services
San Francisco	$117	72%	$31	$21.91	0.03%	1%
Tompkins County	$80	61%	$135	$100.47	0.13%	0%
Adelaide	$22	54%	$95	$58.27	0.10%	0%
Belo Horizonte	$20	1%	$146	$55.95	0.69%	4%
Kunming	$13	NA	NR	NR	NR	1%
Lusaka	$6	6%	$0	$0.01	0.00%	NR
Bengaluru	$5	25%	$26	$243.75	0.71%	0%
Sousse	$3	6%	$55	$36.89	0.40%	NR
Managua	$2	19%	$65	$35.81	1.22%	0%
Bamako	NR	85%	$5	NA/NR	0.14%	2%
Quezon City	$3-$9 per truck	39%	$37	$43.32	0.45%	0%
Delhi	NR	33%	$37	$59.46	0.69%	0%
Rotterdam	Y	30%	$364	$353.54	0.40%	0%
Varna	NR	27%	$61	$72.74	0.46%	1%
Nairobi	NR	24%	NR	NR	NR	0%
Dhaka	NR	18%	$10	$15.48	0.52%	2%
Moshi	NR	18%	NR	NR	NR	0%
Canete	NR	12%	$24	$31.27	0.14%	1%
Ghorahi	None	11%	$5	$29.13	0.31%	0%
Curepipe	NA	NA	$60	$52.72	0.28%	0%

Source: Scheinberg, Wilson and Rodic 2010 and data collected to produce it. NR=Not reported for this city; NA=Reported as not being applicable to this city; Y=yes, phenomenon is present but there is no further information;

In summary, the research done on the 20 cities gives some insight into the structure of the waste management modernisation process, and shows patterns of relationship between the physical modernisation process and financial reforms, which in turn re-constitute the relationship between collection, disposal and recovery. Municipal recycling emerges in high- and middle-income countries

when disposal is priced in the waste management modernisation process. Where waste management modernisation does not result in pricing of disposal, but there is a policy commitment to recycling or to support informal entrepreneurs, cities and other stakeholders may "semi-formalise" the informal sector, to protect them or to be able to claim the recycling rate attributable to them. Where neither of these models appears, the dominant mode of recycling is a kind of pre-modern variant that feeds the agricultural or industrial value chains and has little or no relationship to the solid waste system.

3.4 Conclusion: typical features of urban waste systems in different countries

Hence we can summarize the typical characteristics of a waste system in high-income and in low- and middle-income countries. The physical features of a modernised waste system in high-income countries consist of:

- **Modern engineered disposal.** A regional "sanitary landfill" located on a geologically appropriate site 15-100 km from the city centre. The landfill is designed to receive mixed domestic, commercial and industrial non-hazardous wastes, as defined in national or sub-national legislation or in the environmental standards of the financing institution with advanced technological groundwater protection, serving a population base of 200,000 or more.
- **Reduced frequency curbside collection of household waste.** Household domestic waste is collected from the household or from collective containers with a frequency between once and three times per week, generally more often in cities than in rural areas.
- **Municipal recycling.** Household and commercial recyclables and/or organic waste are collected in a municipal recycling system directly from households, or removed from depots on a regular basis.
- **Public-sector valorisation infrastructure.** A materials recovery facility (MRF), a composting facility, and/or other form of recycling or organic waste processing infrastructure financed or owned by the local authority operates from a location in an industrial or agricultural area.

This process of physical system modernisation creates a need for new financial and administrative arrangements to organise the system, which are likely to include:

- **Priced disposal.** The cost of developing, operating, and closing the landfill is recovered in a "tipping fee," which is paid by the private or public waste collection provider and included in the service fee that they charge to waste generators.
- **Administrative and financial regionalisation of disposal and marketing of recyclables.** The landfill is owned and operated by a regional institution, which may be a public body (such as a county or a province), a private company, or a hybrid of public and private. In North America the processing and marketing components of municipal recycling are often organised and assigned to regional institutions. In Europe this component is frequently brought under collective agreements for extended producer responsibility and is paid for by the producers via arrangements within the value chain.
- **Municipal or private-to-private organisation of waste and recycling collection.** A key governance reform resulting from the modernisation process is to split municipal management of collection and street sweeping from regional management of disposal. The connection is via a new technical level of waste concentration, the transfer station. This is a modest-sized, medium-technology facility where small vehicles dump waste that is then loaded into larger vehicles and pressed to give it higher density. Transfer stations – sometimes on the site of closed municipal dumpsites – make long-distance transport technically more efficient and therefore economically feasible.
- **Bureaucratic and budgetary consolidation in environmental or provisioning organisations**. Within municipal organisations, the waste removal and city cleansing functions, together with new activities in municipal recycling, usually are consolidated in a new "solid waste department" that has clear budget lines and – often but not always – activity-based costing.
- **Parallel consolidation occurs at regional level for organising disposal**, and sometimes for organising and operating municipal recycling. At national level a shift in ministerial level responsibility takes place from the health ministry to a newly formed or young environmental ministry. (Scheinberg, Wilson and Rodic 2010, see also IJgosse 2005).

There is considerable global pressure in cities in low- and middle-income countries to have a system with all of these features – but especially the technical ones (Scheinberg, Wilson and Rodic 2010, see also chapters 4 and 5 in this volume). But that is not typically the case. Physical system features of waste management in low- and middle-income countries usually include:

- **A mix of controlled an uncontrolled disposal.** Each city usually has its own uncontrolled dumpsite and sometimes the regional capital may have a controlled or partially controlled dumpsite/landfill with perimeter fencing and gate control, possibly with a weighbridge, but without a groundwater protection liner or leachate collection system.
- **Daily curbside collection of household waste in the city centre**, infrequent or no service in the perimeter, with a mixture of motorised and non-motorised collection. It is usually the local authority that collects waste (sometimes with second-hand vehicles donated by a city in a rich country). Collection operates reliably in the city centre (in many parts of South Asia in the whole city), supplemented in the outlying areas and informal settlements by activities of a variety of micro, small, medium-sized collection enterprises and organisations using baskets, wheelbarrows, donkey or horse carts or small open trucks. These micro and small private enterprises (MSEs), non-governmental organisations (NGOs) and community-based organisation (CBOs) collect their money directly from clients and together serve somewhere between 45% and 90% of households in the official urban zone but outside the central business district. Household domestic waste is collected from the household or from collective containers in the city centre or industrial areas every day, while housing estates, peri-urban settlements and rural areas have scattered containers emptied sporadically. (Scheinberg, Wilson and Rodic 2010, Scheinberg 2004, Spaargaren et al. 2005).
- **Direct haul to the dumpsite or to semi-legal or truck-to-truck secondary collection points in the city.** Transfer stations hardly exist: the collection vehicles, if large, travel directly to the disposal site. If they are small or are drawn by human or animal muscle power, this is not possible, and so they usually dump their waste into a larger truck that goes directly to the dumpsite. An alternative is direct dumping in semi-legal dumpsites in empty lots or unbuilt areas within the city limits.
- **Little or no formal recycling at municipal level.** In countries like Romania there is state-financed recycling to comply with global norms or requirements for extended producer responsibility (EPR) but the amounts recovered are insignificant, and even when collected separately, the poorly sorted and often contaminated "recyclables" may end up in the dump, rather than the value chain.
- **Informal recycling.** Dumps, containers, and street set-outs are regularly picked by private informal waste pickers looking for edible food, reusable household goods and textiles, and recyclable metals, plastics, cardboard, paper, and, depending on the location and value chains, glass and other materials. Animals also forage on dumpsites and kitchen and garden waste thus enters the agricultural value chain in this way. In Asia and Latin America (but seldom in Africa or south-eastern Europe) there is private household separate collection by itinerant waste buyers who follow a route and pay households for specific materials. Kitchen and garden waste may be fed to animals or sold to swine feeding operations.
- **Junk shops**. Privately collected or extracted recyclables are sold by the kilo to private processing businesses. The smallest of these, small junk shops, do no more than sorting out the contaminants and baling the materials; medium and large junk shops may have sorting lines and cutting, flaking, crushing equipment, in addition to a baler. Junk shops are often located on the access road(s) to the dumpsite(s), and in residential areas of the city, rather than in industrial areas.
- **No municipal valorisation infrastructure.** If there is processing of organic waste or recyclables, or active recycling shops, these are in the private value chains, or occasionally NGO sponsored.

Low- and middle-income countries have a rather different administrative and financial landscape, which generally (but of course not always) includes:

- **Unpriced disposal, partially priced collection.** There is no charge and no gate control for town dumps. A controlled dumpsite/landfill by definition has controlled access, but there are often gaps in staffing and access to dumping is possible outside of official working hours. If there is a

payment it is small and symbolic, and covers neither the cost of operating disposal, nor the cost of environmental protection infrastructure, which is missing. Payments for collection services are common but are often based on what is seen as politically acceptable for a household fee, and not on what the collection actually costs. (Scheinberg 2002).

- **Municipal-level generalist institutions.** The city owns its own dumpsite and collection trucks, but these are seldom organised in a separate administrative division for solid waste. In Africa they fall under the City Council, in Asia and Latin America under a generalised division of public works, and in South-Eastern Europe under the public infrastructure "company" that also manages parks, nurseries, and sport facilities. Separate divisions own and maintain the trucks and the buildings, and personnel are usually in the human resources division. As a result there are no clear activities-based budgets and it is not possible to say what solid waste management actually costs the city or the taxpayer. (Scheinberg, Wilson and Rodic 2010).
- **No administrative or formal recycling institutions or operations.** Official relationships between local authorities and waste pickers, junk shops, and informal recyclers are limited to the social services departments and, in the worst cases, the police.
- **Little or no supra-municipal institutional development.** Few if any functions are regionalised. At the supra-municipal level the only operational institutions are the national health ministries (Latin America and Asia) or the interior or finance ministries (South-Eastern Europe) or the local authorities ministry (Africa). (Scheinberg, Wilson and Rodic 2010, see also IJgosse et al 2004)

Photo image 1. Screening municipal waste compost in Tajikistan. Photo: Peter Engel.

4 "Where you stand depends on where you sit." Schools of thought on recycling in waste management

Disciplines as different as engineering, philosophy, public administration, hydrology, archaeology, economics, business, and anthropology have all reflected upon and interpreted the developments in solid waste and solid waste management in relation to wider economic and societal developments. In this section I review five schools of thought on the relationship between modernisation processes and recycling and valorisation. For each of these schools of thought, a few points of entry guide the review, specifically:

- How is waste analysed and problematised in this school of thought?
- Is this analysis based on experience and evidence (only) in high-income countries, or does the analysis cover also low- and middle-income countries? Do the impacts of globalisation figure in

the analysis?

- What is it that drives modernisation and what are its key impacts in terms of ecological re-structuring in the waste and recycling sectors?
- Is modernisation seen as generally helpful or harmful in solving problems of waste?

4.1 Waste Manager's approach to waste management

The first school of thought to be considered is that of the professional technical waste manager. The level of analysis for the waste manager is operational, and focused on the current and future physical system, or hardware, for managing waste, and the policy and legal framework, institutions, knowledge base, and other software that allow a waste manager to do his or her job.

Waste is analysed as material out of place or at the end of its usefulness, and the problem is to get it to its right, safe, place. The literature of the waste manager is normative and technical, with a focus on improving (engineering) practice. There is a clear (if often unstated) assumption that low- and middle-income countries have the same problems but are at a developmentally earlier stage in the modernisation process than rich countries. Professionals in EU countries, the US, Canada, Japan, and Australia tend to assume that the modernisation process is completed in their countries and the project of environmental improvement requires sharing their experiences and introducing their technologies in the rest of the world. There is something like a globally accepted model of good practice in modern waste management, and the International Solid Waste Association (ISWA) and its national affiliates see it as their task to apply it in all circumstances. (Chalmin and Gaillochet 2009).

The waste manager treats waste as inherently dangerous or dirty, qualities that imply that it has to be managed to protect the environment, the economy, and public health. There are two relevant variants of the waste manager's approach, which distinguish the "progressive wing" which promote the "3-Rs" (reduce, reuse, recycle) ideas of integrated waste management from the "engineered disposal wing" which focus on technology development in service to optimising safe removal and disposal. The common basis underlying these two aspects of the problematisation is that the waste manager has an end-of-pipe task, that of finding something to do with the waste. Management is possible as long as we are able to control the nature and volume of waste on the one hand, and solve the problems of technology and sinks on the other.

For the progressives, the essential problem is in the waste itself; if it were "designed for recycling" there would be less of a problem. There is too much waste, which is too varied, and it is of the wrong kind to be recycled. A variant of this is that there are too many people making too much waste per person, because there is too much consumption and too little recycling, or, a step further, that the resource cycles are broken. This is generally the standpoint of the European municipalities that are members of the Association of Cities and Regions for Recycling and Sustainable Resource Management (ACR+) and the more progressive regional entities like the Canadian provinces of Ontario and British Columbia or the US states of California, Minnesota, New Jersey, Washington, and New York in North America. (ACR+ 2009, Dimino et al 2010). The global NGO movement "Zero Waste International Alliance" also focuses in on the nature of the waste as the problem. Stating that 70% of waste is now recyclable, it joins the European Union's "end of waste" system in saying that if it is recyclable, it should no longer be called waste. Recycling is key to solving the problem of ever increasing portions of waste for the progressives. Rather than "zero waste," this movement actually is advocating for "zero residual waste at the end of the management pipe". (ACR+ p. 8, Zero waste website).

Modernisation for the progressives is built around the idea of municipal recycling, the shifting of the emphasis from sinking the materials in nature to using them again and again, and moving towards life cycle management of products. (ACR+ p. 29). This view is held widely by recycling advocates and promoted in recycling-focused policies. It forms the basis for Dutch recycling policy (Scheinberg and IJgosse 2004, Huisman 2010) and the ambitions of New York State's "Beyond Waste" (Dimino et al. 2010). A more fundamental version of this life-cycle championed by the bestseller Cradle to Cradle is in fact the same message, but with a stronger extrinsic focus on the designing of products and items,

and to a certain extent processes. Interestingly, this concept of design re-enters the discussion when we discuss the socio-political school of thought. (McDonough and Braungart 2002).

For the "engineering wing," it is not waste that is a problem. In contrast to the progressives waste is simply a fact, and the problem lies in our ability to manage the waste. The science and technology of waste is too primitive, and the management of waste requires improvement, and there is too little safe space for managing the waste in sinks that will be stable over a longer period of time. There are other problems behind these operational-level problems, such as the public health or environmental impacts of not managing waste, and they do play a role in the overall characterisation of waste as being a problem. But for the daily work of the waste manager, they are somewhere in the background.

Modernisation for this group means better technology and more efficient operations, specifically, collecting the waste more efficiently, keeping the streets cleaner, and processing or disposing of the waste in a state of the art landfill or incinerator. These facilities are designed to avoid or limit the environmental impacts of waste in contact with water, air, or soil, and to derive economic benefits from energy from (mixed) waste via incineration or gas extraction. The private waste management sector, a quite globalised service industry, supports privatisation and profit generation as an additional element of modernisation of waste management. In general it is the case that collection in private hands is more profitable than disposal, so many private companies would like the "waste market" to offer them more opportunities to collect and fewer to operate disposal facilities. (Chalmin 2011).

Recycling for the engineering wing depends a great deal on the relationship between public and private responsibility, and the pricing mechanisms both for collection and disposal. Chalmin (2011) talks eagerly about the "waste market of €3 billion" for recycling services, by which he appears to mean the economic potential for private marketing of energy from waste. Where disposal is priced and municipal recycling is well established, as in the EU and the USA and Canada, private waste service firms and their municipal clients consider recycling simply business as usual (ACR+ 2010). In the absence of priced disposal (which leads to institutionalised municipal recycling) there is either a call for pricing disposal or a kind of bagatellisation of all forms of valorisation as not being part of the real work of the waste manager (ACR+ 2010).

In summary, and perhaps not surprisingly, the waste management school of thought reasons tautologically from within its institutional mission: waste is a problem when it is not managed, so the goal is to make it more manageable. Modernisation involves "improving" the waste itself by re-engineering or design, finding more sinks and engineering the sink so that they function more completely. The role of recycling in this vision is to provide reliable sinks with better environmental performance in the agricultural and industrial value chain.

4.2 Political economy approach (Schnaiberg cum suis)

The second major school of thought is put forward by (Marxist) scholars of political economy, whose ideas about waste are closely related to their critique of (global) capitalism. While there is a wealth of political economy writing, the group of scholars around Allan Schnaiberg makes a special focus on waste management, which makes it particularly useful to focus in on their 2002 work, *Urban Recycling and the Search for Sustainable Community Development.* (Weinberg, Pellow and Schnaiberg 2002).

Political economists analyse waste as a negative by-product of (global) capitalism. The waste management system feeds large economic interests, which control capitalist economies and can serve to bring them both power and economic benefits (Weinberg et al. 2002, pp. 30 *et seq*). This school of thought analyses the production of waste and the use of resources in relation to industrial cycles within capitalist economies. Capitalist economies create a "treadmill of production," a vicious circle of resource withdrawals to feed the growing industrial production sector, which in turn produces products that are toxic additions to the natural world in the form of pollution. Natural resource use is characterised as an *ecological withdrawal* and pollution as its mirror image, an *ecological addition* (Ibid., emphasis added). The treadmill thus creates ecological imbalances, and a vicious circle of resource

scarcity and resulting conflicts between industrial use of natural resources for production, and the protection of nature for recreation, tourism, and ecosystem regeneration. Managing this scarcity – in part through the mechanisms of environmental protection – then becomes a central task of governments (Ibid., pp 42-44). Globalisation elevates the problem of additions and withdrawals to a critical level (Mol and Spaargaren 2006).

Treadmill of production theory treats waste as a primary product of production, rather than of consumption, an important difference with some other schools of thought. After the Second World War, innovation in mechanisation and engineering fed post-war economic recovery. The two main consequences, which affect on the amount and nature of waste, are higher material inputs (more material intensity) and an increased use of toxic or potentially toxic chemicals (more material complexity and less degradability).

While stopping short of analysing waste as a constitutive element of social life, the authors see both the symbolic and the practical value of working with waste via recycling. On the one hand real physical waste has a real economic value. The widespread availability of waste – especially in inner-city settings – means it can serve as a resource for local economic development, thereby mobilising resistance to the treadmill and mitigating treadmill impact on marginalised persons. Modernisation through recycling offers some hope. In the Chicago and other US case studies explored by the authors, the growing urban resource pools created by the accumulation of urban wastes inside the city become a kind of new commons, an urban space where the material basis for livelihoods is freely available, even to the most marginalised city residents. Basing economic development on this pooled waste looks like an alternative to resource withdrawals from nature, and has a potential to de-rail the treadmill and create something better, fairer, and more accessible in its place. "Mining" the urban resource heap does not require large companies or high-technology factories, it is something that poor people can do in their own communities. Recycling to these authors represents an alternative modernisation path that nurtures urban economic development, and a source of freely available resources that can form the basis for livelihoods for the urban poor (Ibid., p. 5).

This form of "recycling" is actually neither municipal recycling, nor the workings of the private value chain. It is a form of social entrepreneurship that provides livelihoods for the poor, and in fact resembles the activities of Community Based Organisation (CBO) models in low-income countries. (See also chapter 3 in this volume). It is unhooked from the solid waste system – a fact that the authors see as a benefit, but which probably dooms it to failure in the long term.

The proponents of the treadmill of production theory ultimately conclude that community-development recycling fails to fulfillits potential of breaking the vicious circle of the treadmill. The hegemony of global capitalism moves inevitably and implacably to absorb and undercut the renewing value of any social initiatives. Capitalism will defeat change, so the only path to sustainable development is one that aims to defeat capitalism and the treadmill of production. Modernisation of the waste sector itself is no use, and recycling – in spite of its apparent potential to clear a path to sustainable modernisation if kept in community hands – has so far failed to change anything.

4.3 Socio-political approach (Gille)

Zsuzsa Gille's 2007 monograph "From the Cult of Waste to the Trash Heap of History" (Gille 2007) as well as her other work on theorising waste in the context of global environmental change (Gille 2006), connects the work of Schnaiberg, Weinberg, and Pellow, with those of ecological modernisation theorists Mol and Spaargaren (2006, see also chapter 2, and the rest of this section). Gille faults both ethnographers and social constructionists in that they become so involved in the symbolic function of waste in society that its physical presence in the world escapes both analysis and theorisation. For Gille, analysing waste requires that the analyst recognise and work with issues that have "a material existence". (Ibid., p. 13).

While citing Schnaiberg twice in her bibliography, she theorises the relationship of waste, economic activity, and resource withdrawals rather differently than via the "treadmill of production" (Gille

2007). Gille frames her analysis as going beyond simply looking at waste, to understanding where it comes from, how it is made, and, ultimately, how it comes to be classified as waste, with all the negative characteristics that go with that label.

> "However, if we ask why it [waste] is toxic, useless, stinky, and too voluminous, we ought to admit that the answer is because we, humans and society, made it so, that is, materials are not "born" to be waste; they are transformed into waste by identifiable material and social processes. Therefore the focus must shift from waste as a certain kind of material, to the activities from which waste emerges. As I will later qualify, this does not undermine the material agency of waste"(Ibid., p. 18).

Waste consists of real physical materials that are the result of industrial (or agricultural) processes, but they do not bother us until they have been classified as waste through a process of social classification as being used up, defective, without any usefulness or demand in the first place, or out of place in the culture and situation in which they occur. The process of wasting, according to Gille, is that of classifying something as waste. (Gille 2007, p. 19).

Waste is an indicator of socio-cognitive dissonance, and when it is present in excessive quantities or in the wrong place, we are to infer that there are imbalances and incongruities between how the socio-economic system portrays itself and how it actually functions. Mis-classification creates mental maps that are out of sync with the physical and spatial reality of waste located in physical space and time. The result is social blindness, which in turn leads to poor decision-making, pollution, and contamination. The real physical dangers of certain kinds of wastes are thus misunderstood, leading to improper decisions about management and disposal. This has real-world consequences, such as poisoning the ground in the village of Garé, in Hungary, which forms the core of Gille's case study.

Unlike Schnaiberg's group, the problem here is not the conspiracy of (global) capitalism, but a social failure of identification and interpretation. The first element of a modernist solution for Gille would therefore appear to be analysis and deconstruction, modelled on her own analysis of socialist and post-socialist Hungary in general, and the impact of waste policies on the town of Garé in particular. Breaking taboos, questioning social classifications, and scrutinising the distributional impacts of waste and the political decision-making around waste are tools of modernisation she herself mobilises in her monograph, and by implication advises us to use as well. The solution to the waste problems – and there are more and different problems for different societies – lies in modernisation of the analytic frame. Improvement follows when the processes and background assumptions mobilised for decision-making enter the discursive consciousness of key stakeholders and decision-makers. Theorisation, in short, serves the goals of improvement.

There are benefits of "reuse and recycling" for Gille, both at the meta-solution level as part of theorising and analysis, and at the operational and material level. At the meta-level, recycling and reuse require a level of information intensity and analysis that contribute to the better understanding of the social processes of wasting (sic). Particularly in the domain of waste prevention, sister-strategy to municipal recycling and a key ingredient of EU and North American policy (and one whose physical impacts are under-developed and under-theorised), there is opportunity to understand waste-making dynamics and to influence them. Secondly, in their ability to turn the clock back, recycling and reuse offer, for Gille, potential to reverse or mitigate negative impacts of mis-spatialising, mis-temporalising, and mis-classifying waste. Looking at the impact of municipal recycling programs and policies in terms of their intrinsic impacts on the waste system, most of the work of recycling is about re-casting social classifications, re-defining what is waste in a new recycling-rich system; and using socialisation and social marketing to re-embed the new classification system. Modernising definitions, and re-defining certain types of materials previously considered waste as non-waste, is a process that changes physical outcomes. Here is the real power of municipal recycling, and its progressive political variants like zero waste.

4.4 Socio-cultural approach (Douglas and Bauman)

In the literature at the crossing of social science and waste management, two names are completely unavoidable: Mary Douglas and Zygmunt Bauman. Together they cover a vast territory looking at the socio-cultural place of waste, pollution, and dirt, in, respectively, non-industrialised "primitive" and post-war "modern" society and culture. By definition this is a more abstract but also much wider point of view than that of the waste manager or even the waste theorist. Since Bauman begins his analysis based in some sense on the insights of Douglas, it seems appropriate to consider them together.

Mary Douglas's classic work, *Purity and Danger* (1966) can help us understand and frame the fundamental axes of the discourse within and around waste management, and the positions of their adherents. Douglas (ibid., page 2) analyses waste (in her words, dirt) as the antithesis of order.

> "As we know, dirt is essentially disorder. There is no such thing as absolute dirt; it exists in the eye of the beholder...Dirt offends against order. Eliminating is not a negative movement, but a positive effort to organise the environment."

If we take waste as the institutionalisation of dirt, then Douglas makes a convincing case that waste has no objective existence – it is always defined in the process of creating order, cleanliness, and progress. Cultural definitions, taboos, and values define what is dirt or waste, in two ways. There is usually a dichotomy of what is valued and what is not, and dirt or waste locates itself on the side of disvalue, and it defines value by placing itself in opposition to value. But also, together with Gille, Douglas notices that danger and the qualities of waste attach as well to that which is ambiguous or impossible to classify, what Gille refers to as "liminal" (Gille 2007). Dirt is not a by-product of socio-economic processes for Douglas. Rather, classification and production of waste represent core constituting processes that identify value in society. (Douglas 1966/2002, p.2).

Zygmunt Bauman is another social theorist writing on waste. Bauman analyses waste-making, or more specifically "the social production of outcasts" (Bauman and Tester p. 53), as a special case of the role of waste in the creation of order, which goes back to Douglas (1966/2002). According to Bauman, the waste managers and Zero Waste advocates would be wrong in analysing waste as a by-product of industrialisation and modernisation. Theirs is an approach that is built on denial, because in some very real sense waste is a *main* product of industrialisation and modernisation. In order to modernise and improve economic and social life, which Bauman sees as an opportunity for "us", the minority of the lucky ones, modernisation processes rely on large-scale marginalisation and exclusion of "them", the unlucky majority who are of the wrong race, religion, age, ethnicity. The process of modernisation creates both human and material waste as a central result of the drive to improve, because improvement implies distinction between the good and the ungood.

Bauman considers waste as a product of both consumption and production, in contrast to the waste managers who "blame" it on consumption, and the "treadmill of production" theorists and Gille who link it to patterns of industrial production. With a nod to the 1960 work of Vance Packard which first identified "planned obsolescence" as a design parameter for modernised consumer products (Packard 1960), Bauman joins the chorus of those holding the system of consumer culture responsible for the fact that highly materialised products are bought for large sums of money and discarded almost immediately. The mountains of waste are not, as the waste managers (would have us) believe, used-up or broken items, but more in line with the OECD's definition of waste as that for which the owner no longer has a use. Put together all those owners for whom there is – so to say – hardly a nanosecond of time that elapses between the attraction of purchase and the classification of no longer useful leading to discarding, and you have a modern socio-economic system whose main product is indeed waste.

What can change this is a radical re-definition of (global) modernity, which for Bauman, as for Schnaiberg and his group, is associated with (global) capitalism. The nature of modern waste management is inseparable from the modern character of waste. The dark side of the increasing

material welfare and technological progress, even of globalisation, is that it depends on the rapidly escalating production of waste, both in terms of absolute amount and in terms of complexity.

The interactions between order and disorder form the core of the discussion of the waste products of modernisation in Bauman's Wasted Lives (2004). The book moves progressively further away from an initial position seemingly close to that of Schnaiberg, that "blames" capitalism for waste and its consequences. Here the core claim is both deeper and broader. Modernisation, for Bauman, is pushed by the imperative for improvement, and anything which cannot be improved lands in a space of rejection and disvalue which he literally and figuratively calls "the rubbish tip."

Bauman sketches a bleak series of vicious circles around the project of modernisation in the context of globalisation, with a core claim that modernisation as a process creates more and more waste and has fewer and fewer spaces for non-waste. Bauman's main interest is wasted people ("human waste") and how processes of modernisation, which create physical waste in the economic sphere, also create more exclusive social systems, where the available space for a normal life is smaller and smaller.

Like Giddens (1994), Bauman sees that, in the context of globalisation, modernisation also reduces options for using distance and separation to mitigate the effects of too much waste too close by. There are no close-by sinks that can relieve the pressure and absorb the excess – both the wasted humans and the toxic waste. And this changes many things, because there is no longer the option to go somewhere else (for people) or become diluted in nature (for materials).

When Bauman focuses on informal recycling in the context of globalisation, he shows the weakness of his analysis. In recycling Bauman himself sees only a shameful failure of both governance and the consumer economy.

> "In Guiyu, a Chinese village converted into an electronic junkyard, as in numerous other places in India, Vietnam, Singapore or Pakistan populated by former peasants who have fallen (or been thrown) overboard from the vehicle of economic progress, the electronic waste of the West is "recycled." (Bauman 2004, pp 59-60).

Guiyu is to Bauman, as to many other environmental campaigners, the proof of a system dedicated to making waste. But Zhang and Lai (2006) show that the "wasted humans" there turned out to be well organised, working in household-based industries which are organised by the home villages of the families. Many were actively engaged in buying waste that they saw as a cheap resource and potential for entrepreneurship. Although the conditions are not ideal, the choice to work in recycling in Guiyu appears to be based on personal and family enterprise strategies, rather than on Bauman's characterisation that such people "cannot be choosers. (Bauman 2004 p. 59)." Far from considering themselves to be rejects or economic slaves, these people were seeking to participate as producers, not as consumers, in a global economic opportunity that they felt to be in reach.

Bauman's framing of waste and recycling blinds him to nuances. In the interstices of globalisation, there are spaces for re-creation of economic life, even for holding village social structures together. (Zhang and Lai 2006).

4.5 Ecological Modernisation Theory (EMT)

Ecological modernisation theory (EMT) is a political sciences- and sociology-based theory of changes in environmental conditions and the institutions and systems to manage them. The essential claim of the early exponents of EMT is that environmental re-structuring in the context of globalisation has positive as well as the better known negative consequences for the environment. In addition to the daily increasing mountains of waste picked over by wasted people in Bauman's apocalyptic vision, or the waste manager's dilemma of shrinking and ever more expensive sinks, EMT theorists observe that ecological re-structuring produces more consumer autonomy and choice, reduces the hegemony of monopolies, creates spaces for global and local NGO activism and entrepreneurship, and changes the relationships between production companies and natural resource chains. (Mol 2001, Mol and

Sonnenfeld 2000a).

In short, EMT analyses modernisation in the context of global modernity, noticing that environmental concerns are entering decision-making in more and more areas, with significant and observable institutionalisation of the environment into key economic, political and social sectors. Environmental re-structuring thus has potential to create virtuous circles where some of the worst problems are actually mitigated, not only in the Northern European social democracies where EMT was born, but also in rapidly modernising economies like China or countries modifying their institutions in order to join the European Union. (Spaargaren, Mol and Buttel 2006).
EMT thus challenges the idea that modernisation and globalisation (in the context of global capitalism) can only bring about destruction and environmental apocalypse, an implicit claim that underlies the work of Schnaiberg, Gille, and Bauman. (Spaargaren, Mol and Buttel 2006). The process of institutional re-structuring that results from modernisation, for example, includes the fragmentation of "natural monopolies," that is, monopoly grid-based utility systems. (Van Vliet 2002, Spaargaren and van Vliet 2000)). This has positive effects on the resource footprint and environmental governance of socio-technical systems.

One consequence of modernisation is that single-purpose "natural monopolies" that characterised socio-technical systems like waste and water in earlier stages of simple modernisation are changing their structure. There are more resource-service relationships, and a provisioning system now offers service options that are produced by a range of actors at a variety of scales. System users have more choice and more space to participate, not only as consumers but also as (co-)producers motivated by and acting in the context of both local and global environmental ideas.

Ecological modernisation theory analyses waste as an "environmental bad" and waste management as a grid-based management system in the line of socio-technical provisioning infrastructures for sanitation, water, and energy systems. (van Vliet, Chappels and Shove 2005). Environmental restructuring and reform are seen to have explicitly positive effects on the waste management system, in terms of inclusion of greener alternatives in the package of services and products that are offered. There are increasing spaces for consumer activism and co-production of waste services on the one hand, and an increased influence of civil society and a global NGO vision of sustainable waste management on the other. These structural impacts– if correctly analysed and understood – offer a platform for further environmentally positive interventions. (Ibid., Hegger 2007, Spaargaren et al. 2005).

Recycling is brought into the picture as a green alternative that re-structures and ecologises classical waste management, just as renewable energy and solar panels on roofs of social housing in the Netherlands provide a green alternative to grid-based resource intensive electric generation utilities. (Spaargaren and van Vliet 2000, van Vliet 2002, van Vliet, Chappels and Shove 2005). The growth of recycling, like the increasing interest in ecological sanitation (Hegger 2007), is seen as both product and constituting element of increasing institutional space for environmental reform.

5 Research questions

The research questions are built around the hypothesis that while we can witness some similarities in processes of modernisation of waste management in very different parts of the globe, the results are quite different in OECD countries as compared to low- and middle-income countries. Whereas modernisation of the waste management sector generally results in improving the environmental footprint of waste management in the EU and North America, the same cannot be said for the results in many low- and middle-income countries. The modernisation of the solid waste sector in Canada or South Australia produces substantial and lasting improvements, and a virtuous circle of cleaner cities, more efficient logistics, and increasing ambitions and experience in diverting materials from disposal and valorising them.

In contrast, more or less similar modernisation processes occur in Nairobi or Delhi or Managua, but generally (but not always) fail to produce similar improvements, despite the best efforts of local authorities and experts and the mobilisation of large sums of money from donor organisations. In cities in low- and middle-income countries, modernisation functions all too often as exclusion, so that (a) the richer parts of the city get cleaner and the poor areas get dumps, (b) more and more waste requires disposal, (c) cities lose control of their waste systems, and (d) hundreds of private-sector recyclers lose their livelihoods. (Ibid, Bauman 1987, Weinberg, Schnaiberg and Pellow 2000. See also chapters 3 and 4, Furedy and Lardinois 2002, Coffey and Coad 2011, Chaturvedi 2009, Dias 2009, Lardinois and van de Klundert 2005).

The question at the core of this thesis is whether and how adaptations of the path, policies, and institutions of modern, integrated solid waste management that emerged in Northern Europe and North America in the 1980s can be put to work for improving waste management in countries with lower gross domestic product (GDP). While there are many examples of perverse impacts and countless failures of uncritical transplantation of solid waste modernisation technologies, practices and institutions from developed to low- and middle-income countries, the starting point of this thesis is that the lessons from rich countries can indeed contribute to improving outcomes in poor countries, although probably not via a simple one-to-one transfer of technology. Hence, the thesis aims to articulate models for solid waste management modernisation in low- and middle income countries, which make use of the experiences and practices of the developed countries to deliver environmental improvements but are at the same time sufficiently adapted to their specific context. In doing so we will use an ecological modernisation theoretical framework, but in a reflexive way.

A secondary objective of this thesis is to contribute to the development of more context specific variants of ecological modernisation theory, a rather recent phenomenon in the literature on ecological modernisation. (Mol, 2006).

The four main chapters in this thesis each have their own more specific research questions. Still, for the work as a whole, it is possible to articulate two over-arching questions that connect the chapters.

1. Why does modernisation in low- and middle-income countries fail to improve the recycling elements of the solid waste system, as it has done in high-income countries?
2. Is it possible to articulate an alternative path or model emerging in low- and middle-income countries that has the potential to divert large amounts of materials from disposal, facilitate sustainable modernisation, and improve environmental performance of solid waste management?

6 Structure of this thesis

Following this introductory chapter, this thesis consists of five other chapters.

Chapter 2 offers an analysis of the transformation of recycling in the processes of ecological modernisation of waste management, and the role of valorisation in improving the environmental footprint of waste management. Chapter 2 uses the USA in the 1980s as its focus, with supplemental information from other sources. The chapter shows how municipal recycling emerges as a key element in a modernised, integrated waste management system, which is interpreted as a process of ecological modernisation.

Chapters 3 and 4 look through rather different lenses at drivers, dynamics, and results of the solid waste modernisation processes in low- and middle-income countries, with a specific focus on the informal (private) recycling and valorisation sector. Chapter 3 is about international efforts to counteract the social impacts of children who live on the dumpsites. From the point of view of this sector, modernisation is more of a threat than a promise, and its results can mean disaster not only for the value chains, but also for local authorities whose best efforts result in failed interventions and expensive facilities that never operate. Chapter 4 takes this theme further, and investigates recycling

as part of the waste management system in low- and middle-income countries, with a specific focus on the interplay between informal and formal elements in it.

Chapter 5 is built around questioning the kinds of process interventions are likely to produce better results in middle-income countries, in the specific context of EU accession. The chapter analyses the impact of specific projects in recycling and waste management in the pre-accession period in Bulgaria, as a means of shedding light on the dynamics of environmental reform.

The concluding chapter 6 answers the over-arching research questions, focusing in on the frequent failures of solid waste modernisation to produce good outcomes in low- and middle-income countries, and feeds back into theory. It concludes with some recommendations.

Photo image 2. A variety of generated waste materials as they are placed in the collection vehicle. Photo: Jeroen IJgosse.

Chapter 2: The Proof of the Pudding: Urban Recycling in North America as a Process of Ecological Modernisation[9]

Abstract:
This article analyses the history of the development of municipal recycling in the United States between 1970 and 1996 as a case of Ecological Modernisation. Using the framework of Ecological Modernisation Theory (EMT), the article examines the predecessor institutions to modern recycling, showing how environmental policy and politics in the US in the 1970s stimulated a process that altered the technologies, institutions, and environmental impacts of waste management; affected the industrial use of resources; and created many policy and socio-technical innovations. The resulting discipline, integrated waste management, shows a modernised structure, new technology, and an almost completely new discourse, representing a clear break with pre-modernised systems. The article begins by contesting conclusions from the work of Allen Schnaiberg, David Pellow and Adam Weinberg, and concludes with proposed feedback to EMT on the nature and locus of environmental change outside of EMT's core geographic areas of North-western Europe.

1 Ecological Modernisation and North American Urban Recycling.

1.1 Ecological Modernisation Theory: Emergence And Debates

The German political scientist Martin Jänicke is credited with launching the concept of Ecological Modernisation. While serving as a representative in the Berlin Municipal Council in the late 1970s, he argued for the ecological modernisation of Berlin's development path. Although it took some time before the concepts invaded the academic social sciences (see Mol and Sonnenfeld 2000 and 2000a for a historic analysis), the ideas seeded by Jänicke now occupy a solid position in the environmental social sciences, under the name Ecological Modernisation Theory (EMT). With the emergence and maturation of the ideas and concepts of ecological modernisation in the 1990s, we witness a growing diversity in approaches, and a strong debate about the usefulness of the theory.

Recent literature on EMT demonstrates a great richness and variety of approaches and interpretations, some based in system theory (e.g. Huber 1995, 1991a); discourse analyses (e.g. Weale 1992; Hajer, 1995); others from institutional analysis (e.g. Mol 1995; Smink, 2002). The processes of change under scrutiny also differ considerably, in parallel with the various theoretical approaches: policy-making (Jänicke et al. 1992; Andersen, 1994; Lundqvist, 2000); economic production (e.g. Orssatto 2001); Smink 2003); lifestyles and consumption (Spaargaren and van Vliet 2000; Cohen 2000); new social movements and their ideas and ideologies (Rinckevicius 1998; Mol 2000); and international arrangements (Mol 2001).

National and continental orientations and unity of vision can be seen among scholars from Germany, the Netherlands and Scandinavian countries, and in limited measure from the UK. Themes are also identifiable in groupings of American scholars including Fred Buttel, Bill Freudenbrug and Dana Fisher; Australians including John Dryzek and Peter Christoff; and Asian researchers. (Zhang 2002; Sonnenfeld 2000; Phung Thuy Phuong 2002). Mol and Spaargaren (2000) make the case that these geographically dispersed contributions share important underpinnings and form a single, coherent school of thought.

At the same time, several, predominantly theoretical critiques of EMT focus on its limited geographical reach; its technological optimism; its reformist (versus radical) outlook; its blindness to power relations and social inequalities; and its realist (versus social constructivist) perspective (see

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Blowers 1997; Blühdorn 2000; Wehling 1992; Buttel 2002; Dryzek 1997; also Mol and Spaargaren 2000). Pellow, Schnaiberg and Weinberg (2000) and Weinberg et al. (2000) are among the few scholars who challenge the value of ecological modernisation based on empirical examples. In celebrating a Treadmill of Production (ToP) perspective in analysing the failure of recycling in Chicago they have especially criticised Mol and Spaargaren's interpretation of EMT.

While disagreeing certain of the theoretical claims presented in several works of Allen Schnaiberg, David Pellow and Adam Weinberg, this paper accepts their viewpoint that the development of recycling in North America in the 1980s and 1990s represents an interesting opportunity to apply EMT in practice. This paper seeks to enrich our understanding of environmentally-focused social change, and of Ecological Modernisation theory as a heuristic and a normative theoretical basis for understanding that change.

1.2 Recycling and Ecological Modernisation

In a number of articles, but especially in their article "Putting the Ecological Modernisation Theory to the Test: The Promises and Performances of Urban Recycling," Pellow, Schnaiberg and Weinberg assert that recycling development *as represented by the Chicago case* represents a failure of policy, modernisation, and in fact, a failure of change. These claims can be summarised as follows.

Claim 1. The recycling development process is (1) a failure to change, (2) a failure of modernisation and therefore (3) a failure of reform. Reality fails to validate the idea that ecological modernisation produces fundamental and irreversible change in a reformist direction.

Claim 2. Recycling development represents, not ecological gains, but rather environmental losses,. In Chicago, the "blue bag" system was less ecologically sound than the forms of recycling, as represented by the community-based recycling system of the Resource Centre, that preceded it. The development of recycling is therefore not only a failure of modernisation, but a failure of ecologisation. EMT which would expect forward and progressive movement in the direction of improved environmental performance; the Chicago case shows just the opposite.

2 Overview of the Development of Modern Recycling in North America

The modernisation of North American waste management practice and institutions occurred between 1970 to 1996. We divide this into four periods:

1. the baseline period, in the era before earth-day in 1970;
2. the pre-modern period, 1970 to 1980, a period in which the conditions for modernisation were put into place;
3. the transition period, 1980 to 1984-5-6[10], a somewhat truncated period of simple modernisation; and
4. the modernisation period, 1984 to 1996, a period of reflexive modernisation and rapid social and technical change.

Beginning in about 1996, it is possible to look at the institutional and technical basis of urban waste management in North America and call it a modernised system.[11]

2.1 The Baseline Era Pre-1970, Parent Institutions to Modern Recycling.

The entire recycling development process can perhaps be most elegantly characterised as a coming-together of a number of parent institutions to form the modern waste management system. Prior to the onset of this process, these organisations would not have recognised that they had anything to do

[10] While certain events as early as 1984 (discussed below) ushered in the period of modernisation, the characteristics of the modernised waste management did not become fully clear until around 1986.

[11] The author of this paper participated in the development of recycling as a technical and policy consultant and practitioner between 1979 and 1992, when she left the US. She participated in many of the developments presented here as a protagonist. Sections which are not footnoted reflect this direct experience.

with each other; by the end of it, they mostly acknowledged that they could not do without each other.

Prior to 1970, the date of the first "earth day", and, not coincidentally, the date of the passage of the Clean Water Act, there were two institutional forms of recycling in North America, one industrial: the scrap metal and paper recycling industry; and the other from civil society: the volunteer civic association recycling drive.

These two forms of recycling formed two parts of the foundation on which the modernisation process was based. In the developments leading up to 1970, the activist impulse created a third type, the activist-community development recycling centre, of which the Resource Centre (founded in 1968) represents a typical form.

Other "stones" in the foundation include urban cleansing departments and the urban waste sector on the one hand, and the institutions and organisations created by national environmental policy- and law-making, on the other.

2.2 The Pre-Modern Period, 1970 to 1980, the Beginning of Simple Modernisation

We use the term "simple modernisation", to refer to the primarily "technocratic development path" (Mol and Sonnenfeld, 2000 (d) that characterised the first line of responses to the growing perception of the pollution problems in the 1970s and 1980s. This period recalls Huber's definition of modernisation as follows:

> "Modernisation is a social process, which mainly relies on science (what is called nowadays science and technology), on market economy, on money and credit economy, on modern state building (or state administration), on modern law (public and private) and on an ethic of individualism." (Huber 1991b, p. 1).

Prior to 1980 *the private scrap industry* in North America consisted largely of three sub-branches: the ferrous metal processors, who focused on scrap automobiles and other iron and steel scrap; the non-ferrous or "coloured metal" industry, which handled everything from molybdenum to gold; and the secondary or waste paper industry.

In the industrialising cities of the East and West coasts, and great lakes are as of North America, largely family-owned[12], low-profile, high-risk scrap yards, founded in the 1880s, were overwhelmingly in the hands of Italian, Eastern European, or Ashkenazi Jewish families. Prior to 1980, most recyclable materials came from industries, from urban scavengers, and in relatively small quantities from civic organisations. The significant attribute of these recycling businesses is that *they were completely isolated from the urban waste management system*, although both had their origins with the rag-pickers and ash collectors of the 1890s. (Melosi 1981, pp 1-15).

Civic organisations included boy- and girl-scout troops, and garden clubs who held an annual or semi-annual paper drive, a kind of social remnant of wartime metal or paper collections. Both of these types of organisations had social, rather than political goals, can be contrasted with "activist" organisations discussed below. Importantly, for our analysis, the civic organisations were also free of any institutional or commercial connection to urban waste management as a business, an institution, or a form of governance. Their connection to the private recycling industry was episodic and unreflective and consisted of brief transactions for selling paper. Later in the pre-modern period, they began to make alliances with progressive public works directors or with the activist recycling centres.

The publication of Rachel Carson's The Silent Spring, and the developments in environmental thinking, created the first Earth Day in 1970, a defining moment for the North American

[12] Family ownership was a defence against employee theft. By their very nature, scrap businesses have an undefined, and indefinable, inventory which is vulnerable to theft. Theft within the family is at least minimised (Jack Levin, personal communication, 1984).

environmental movement. (Carson 1960, re-issued 2002). The public in the US responded rapidly and in force to this information (which reached the organs of government much later) directing its energy into environmental activist organisations, lobbying, citizen monitoring, and direct action. One important form of direct action, the *community recycling centre*, was distinguished from the scrap dealers and civic organisations in being new, non-traditional, and highly politicised, with a clear activist agenda seeking to create broad socio-political changes which challenged to the dominant capitalist paradigm. The Chicago-based Resource Centre (cited by Pellow et al) represented a typical combination of community activism and recycling also found in several widely dispersed organisations elsewhere in the US. Each of these was closely associated with an activist-founder.[13]

Pre-modern activist recycling organisations were the fore-runners of eco-modernist developments in that they relied upon innovation to address the waste management crisis. They succeeded in changing the discourse about waste management to include more issues, and a different emphasis, and an acceptance of a mixed system as a solution, creating reflexivity where there had been none before. This is consistent with Hajer:

> "The strength of the eco-modernist story lines is that they bring to life a new way of seeing, with new constraints and new opportunities, that is then recognised and interpreted by various actors within the environmental domain, which leads subsequently to all sorts of adjustments in institutional practices…" (Hajer, 1995, p. 262).

Community recycling initiatives mostly matured around 1980, usually including (1) depots where people could drop recyclables paper, aluminium cans, and glass; (2) urban buy-back centres, buying recyclables for cash; (3) collection routes, collecting from households or businesses using vans or small trucks; and (4) some financial relationship with the municipality, such as in-kind use of a premises and/or vehicles; some operating subsidy or grant; or a contract for certain kinds of services, such as public education programmes or information campaigns. As "full-grown" programmes, they collected substantial volumes of recyclables on a regular basis, and then prepared and sold them to industrial end-user clients. The maturation of these programmes to professionalised collection and marketing entities marked what we will call the transitional phase of urban recycling.

The scrap industry experienced this post-earth-day interest in recycling as dangerous interference in their private business, since better collection systems meant increases in supply of waste metals and paper, which threaten to depress prices. Scrap businesses straddle the boundary between the formal and informal commercial-industrial sector, and neither their environmental record, nor their health practices, nor their devotion to tax and zoning laws can bear very close scrutiny. They responded to these new developments with hostility mixed with attempts to undermine development through price manipulation, but nevertheless beginning in the early 1980s, they joined and actively participated in stakeholder forums like the New Jersey Recycling Forum.

Together, these three pre-modern types programs were responsible for many of the innovations that came to be hallmarks of modern integrated recycling systems, and which support the claim that recycling development is in fact a case of ecological modernisation. The first *mandatory recycling ordinances* (= local laws) in the US were passed by one of these programmes, and this represented an important legal and institutional innovation that further stimulated modernisation. Another experimented with *differentiated fee systems* at a landfill, and this work laid the basis for volume-based fees for waste collection. The Institute for Local Self-Reliance, in Washington, DC was responsible

[13] For example: Michael Anderson's Santa Rosa (California) Garbage Reincarnation, Nancy Wolf's New York City Environmental Action Coalition, Dan Knapp and Mary Lou van Deventer's Berkeley Urban Ore, Neil Seldman's Washington DC Institute for Local Self-Reliance, Pete Grogan's Boulder Colorado Ecocycle; Derek Stephenson's Resource Integration Systems (RIS) in Toronto, and David Muchnick's Bronx 2000/R2B2 in the Bronx (New York City). There were in fact other organisations in other states, probably as many as 25. This list is just a sample, but it shows the dispersion of these developments to East-Coast, West-Coast and Midwestern organisations, those from large urban and medium-sized rural municipalities, as well as at least one in Canada.

for some of the earliest *community buy-back centres*; Resource Integration Systems in Toronto made a major technical breakthrough when they pioneered the "blue box" *set-out containers*.

From an EMT perspective, these are all examples of technical solutions playing a role in environmental problem-solving. Secondly, all were social movements moving beyond lobbying to practical operations, many with an increasing economic stake in these operations. In all cases, the discourse changed relative to the role of recycling in waste management, towards integration into mainstream waste management, in a process of de- and re-institutionalisation:

> "After all, the success of ecological modernisation did not mean that the institutions of society suddenly collectively decided to take the very same ecological turn and are now marching together in the direction of a green society. It is much more appropriate to see the significance of eco-modernist discourse as generating a process of de- and re-institutionalisation, of dis-embedding and re-embedding…"(Hajer 1995, p. 263).

2.2.1 Political Modernisation of Environmental Policy in the US

The 1970s saw a political modernisation of environmental policy at the national level which occurred in parallel with the largely localised process of innovating recycling. This influenced the development of recycling indirectly, but powerfully. The Clean Water Act of 1972, the Clean Air Act of 1972, and, later, the Resource Conservation and Recovery Act (RCRA, 1976) significantly changed the boundary conditions surrounding waste management. These developments reflected the early stages of the ecological modernisation of the US political systems:

> "The achievement of political modernisation requires the development of new relationships between state-industry and state-non governmental actors, with a more decentralised, flexible, and consensus-oriented governance style. The emergence of economic and communicative approaches in environmental policy-making is an indication of this changing role of the state and state policy."(Phung Thuy Phuong, p. 120).

These water and air protection laws contained provisions which allowed citizens to monitor and report emissions, to initiate legal action, to participate in public hearings, to serve on advisory committees, raising the status of citizens (and civil society and activist organisations) to active stakeholders in environmental planning and management processes. The term "intervener status" was taken up in laws on environmental impact analysis to describe the legal niche created for citizen-activists in this era (Enck, 1994, personal communication), amplifying the effect of the laws themselves. This fed the modernisation processes by legitimising the activist discourse and inviting activists into the policy-making community, a process which also stimulated many activists either to shift to becoming professional insiders, or to take a more accomodationist stance. (Mol 2000).

2.3 The Period of Transition, 1980 to 1986, a Period of Simple Modernisation

The generation of laws passed in the early 1970s became operational only in the period 1980 to 1986, after the states passed their own laws and developed regulations. These began to shift the boundary conditions surrounding municipal waste disposal and signalled the beginning of the period of transition.

Behind these laws was an increasing scientific appreciation of the difficulties with non-point source pollution (from landfills). Landfill owners were pressured install liners and leachate collection and treatment technology, or to close and shift to regional disposal. Regionalisation stimulated new institutional forms like multi-county authorities. But larger landfills increased political resistance to landfill siting, since now the "host community" or "abutters" would be next door to a large, fenced, noisy, landfill, presumed to be taking waste from a large area, not merely from their town..

The transition period created a crucible for change in the direction of simple, or technology-based, modernisation. If civic organisations, activist recyclers, and the scrap industry were inside the

crucible, it was the political modernisation of environmental policy in North America which fuelled and fired it. The economic effect of the landfill crisis was the introduction of tipping fees, an example of the economisation of the environmental impulse to protect groundwater. Environmental protection measures, new transport requirements, and legal strategies to overcome resistance drove up costs, and accelerated the internalising of the environmental externalities of disposal. Disposal, which had been municipal, informal, un-priced, and un-noticed, became highly organised, privatised or regional, very expensive, and the subject of intense political and economic dispute, in effect a classic eco-modernist discourse on the nature of economic and environmental realities. The rising cost of landfilling and the closing of local landfills drove increasing numbers of municipalities towards alternative approaches; stimulating the creation of modern recycling systems; and setting the stage for the large-scale (ecological) modernisation of waste management in the US and Canada.

The three pre-modern institutions, the civic organisations, the activist recyclers, and the scrap industry, entered the transition period as marginal actors, but emerged in the mid-1980s as central to the modernisation process. They had opportunities to see their ideas and goals taken up by the mainstream, to see their projects adequately funded, and to test the implementation of their ideas on a larger scale. They also saw clear threats: they could no longer remain simply activists, civic organisations, or scrap industry. The choice to stay the same simply did not exist any more, and any attempt to do so spelled marginalisation.

The scrap industry, for example, learned that resistance was not useful. In 1984, a representative of the American Paper Institute stood up at the National Recycling Congress in Ohio and told the audience that municipal paper recycling had to stop, because there was no capacity to take it, and "*none* of the mills planned for construction in North America will take waste paper". In 1990, Charles Post's MSc thesis (Post 1990) was able to show that *all* of the planned capacity for new paper mills in North America was designed to take waste paper (Ibid.). By 1990, it is fair to say that the *scrap* industry in the US was dead, and in its place, the *recycling* industry was flourishing, yet another example of the shifting discourse.

The leadership of both the activist and the civic organisations were likewise confronted with a situation in which they had the choice to institutionalise their programmes and integrate them with the changing formal waste management system, or risk becoming marginalised. In ecological modernisation terms, they needed to emancipate themselves from the political or civic agendas of their founders, and integrate – EMT would say "re-embed" – into the prevailing urban service system. The ones that did emerged changed, and in the process profoundly changed their host solid waste management systems. They became agents of ecological modernisation, and their aims – often explicitly articulated – were to change the way resources were used and materials were managed. (Schall and Scheinberg, 1986). The ones that held to the principals of resistance isolated themselves from the modernisation process, and ended up at odds with it.

2.4 The Period of Modernisation and Integration, 1984[14] to 1996, a Period of Reflexive Modernisation

The year 1984 witnessed passage of the first state-level recycling strategy, the New Jersey Recycling Act, ushering in the era of modern recycling. "Bottle Bills" in New York and Massachusetts and recycling laws in California and Oregon were passed at around the same time. By 1984, Massachusetts had the first State Recycling Director and regional recycling strategy; by 1986, Rhode Island had passed the nation's first "state-wide mandatory recycling law."

The modernisation period was characterised by rapid technological innovation; by development of the institutions of recycling; and by the transformation and professionalisation of the existing recycling actors – the scrap industry, the activists; and the civic organisations, which together matured

[14] There was a certain overlap between the end of the transition period, around 1986 (and even later in some places), and the beginning of the modernisation period, which began in 1984, with the passage of both the New Jersey Recycling Act and the Oregon Recycling Opportunity Act.

into a professionalised, integrated urban waste management sector. Curb-side recycling initiatives – a modernised approach to capture of materials – elevated *participation rates* from 15% to 80%, and achieved *diversion rates* (the percent of wastes *diverted* from disposal and directed to recycling) of 15% and above.

This period shows many characteristics of reflexive modernisation (Giddens 1994, pp. 2-7) or ecological modernisation. (Mol and Sonnenfeld, 2000). Curb-side recycling fits the eco-modernist model of reflexive modernity by demanding of households that they engage reflexively with their own waste-related behaviour, avoiding habitual responses and choosing to comply with policies and programmes. Secondly, it uses an innovation and technology-based approach to handle the technological waste problems, in a situation where a counter-productivity or de-industrialisation stance would work on preventing or inhibiting consumption.

Recycling is seen as eco-modernist precisely because it undercuts the debate on lowering consumption or dematerialising society, showing that it is possible, through increased recycling activity, to de-couple the rate of consumption from environmental effects of disposal and resource withdrawals. During the period described, consumption levels increased, and so did the rate of waste generation in the US and Canada. (USEPA/Franklin Associates, 1994; 1996). In this recycling conforms to the view of ecological modernisation that it is generally optimistic, reformist rather than revolutionary, and that it prefers to use technology to mitigate the effects of technology on the environment. (Mol and Sonnenfeld 2000).

Ecological modernisation changed the relationship of local government to waste management and the private sector. Towns, cities, and counties seeking to lower their reliance on landfilling adopted recycling ordinances, passed local laws, bought recycling vehicles, and instituted collection programmes.i

The private sector innovated the development of divided collection vehicles, represented by the Eager Beaver trailer, LoDal recyclers, and LaBrie trucks, which were designed both for separate collection of recyclables, or in some cases for integrated collection of recyclables and mixed waste. By the late 1980's competition between several firms sharpened the market response to tenders for public procurements, and the technical developments created new institutional challenges. Municipalities with better collection systems had to work harder to sell materials to industrial *recycling markets*. This triggered another round of technical innovation, the *Materials Recovery Facility,* or MRF.

A MRF is a small industrial facility which takes in mixed whole recyclables -- glass containers, steel and aluminium cans ("tins"), newspaper, other kinds of paper, and, more recently, a wide variety of rigid and flexible plastics. On the US East Coast, two competing models for MRFs were developed and tested in the mid-1980s, one , in Groton, Connecticut (Resource Recycling Systems, RRS), working from the civic organisation side, and the other in Oxford, Massachusetts (Recycling Enterprises Inc.), working from the scrap industry side. Together, these technical approaches contributed to the *rates of recovery,* that is, the ability to meet the end-user industries' demand standards through producing materials of reliable quality.

New communication approaches – in combination with the set-out containers, were increasingly understood to be essential to achieving high *rates of participation*, that is, reliably increasing the numbers of households who follow the rules for recycling. Monitoring to meet legislative goals required refined measurement instruments to characterise the waste stream and predict the amounts of recyclables that could be captured and recovered. It was in this era that the USEPA began to issue their publication, "*Characterization of Municipal Waste Management in the United States",* working with Franklin Associates to track waste characterisation, composition, and recovery statistics incidentally probably the only evidence of a change in State-industry relations.

A key public management innovation, consistent with EMT theory, was the *municipal recycling co-ordinator*, which brought young professionals into public works and public cleansing departments,

where they could facilitate information exchange and act as insider change agents. Many recycling co-ordinators came into local government from the activist sector, shifting human resources from civil society into local government, also consistent with the changing role of activist organisations in a modernisation process. (Mol 2000). The term "municipal recycling co-ordinator" points to the shifting discourse: recycling was already an activity requiring co-ordination in the sphere of local governance. The function and role of the state were changing – only here, this means local government, since the Federal government is not the relevant authority.

This period was one of unprecedented consultations, a rapidly changing discourse on recycling and municipal waste management, and the formation of remarkable alliances between activists. Government, and industry. Under the leadership of Garden State Paper's CEO Fred Schmidt, the New Jersey Recycling Forum represented one of the earliest attempts to create a stakeholders' forum, bringing together recycling activists, civic recyclers, leaders from the paper, glass, and metal industry, waste collection companies, municipalities, and state regulators. The National Recycling Coalition held its first National congress in 1982. These platforms provided a forum for the new discourse about recycling as a discipline, as a form of public-private co-operation, and as an activity of government. In these meetings, a whole new terminology of recycling emerged, was discussed, and finally became institutionalised in publications, reports, and articles in *Resource Recycling* and *Biocycle*. *Integrated solid waste management*, a new discipline with a new name, a new jargon, and an almost unrecognisably changed discourse, replaced urban cleansing as the umbrella for solid waste activities.

This "modernised" integrated solid waste management (ISWM) paradigm had by 1996 largely stabilised in North America, although this approach was (and remains) unevenly distributed, being concentrated in the highly populated and urbanised Northeast states, on the West coast (Canada: in Ontario and British Columbia), across the industrialised Northern mid-west (Canadian provinces of Manitoba and Alberta); but present only in progressive pockets in the largely agricultural states of the central mid-west, deep South, and South-western US (Canadian Maritimes, Saskatchewan). Thus it is possible to speak of trends which affected most of the major population and urbanisation centres of the US (and Canada), but not all states in equal measure. (Brewer 2002, personal communication).

2.4.1 Epilogue: Developments Since 1996: a case of anomie?

Before closing the discussion of the modernisation period, it is perhaps useful to mention what has happened in the intervening years (Ibid.) While recycling remains widespread and institutionalised, it has in effect become re-integrated into the overall economic system. In particular, decisions made in response to recycling development in the steel and paper industries in North America are now being modified in response to the influence of globalisation, threatening some of the ecological gains. (Kinsella, 2002, personal communication). The integration of recycling into the more general economy has also resulted in a spate of mergers and acquisitions, in the course of which some of the landmark innovations have been submerged into larger commercial strategies. While these are consistent with the "economisation of ecology" , they may seem to be motion in reverse. As a result, Chicago (presented by Pellow et al as the proof that recycling failed) is among several large cities where integrated municipal waste management has failed. Weinberg (1998) provides a useful framework for seeing these as characteristics of the process of maturation of change:

> "The tension between growing and staying green is a good point for analysis, because it captures struggles over anomie (Durkheim 1951) … how people come to act when the normal means of achieving accepted goals conflict with reality. This is precisely the tension driving green businesses (and the recycling sector). The accepted ecological goals of the green business community inevitably conflict with the social reality of achieving growth in a market system. Firms are trying to meet a goal (of being green) with a means (of economic growth) that is not well suited to realising that goal." (Weinberg 1998, pp. 242-243).

2.5 The Environmental Effects of Modernisation

This section looks at seven indicators of change, which are chosen to illustrate the breadth, depth, nature, and irreversibility of change. The first two, tons recycled and numbers of curb-side recycling programmes, are used by Pellow *et al* in their paper. The number of MRFs is an indication of depth of change, since these are major pieces of urban infrastructure. The number of materials targeted by recycling programmes is an indicator of breadth, as it shows that the recycling development process, has continued to innovate and expand its reach.

Participation and diversion rates are indicators of effectiveness, and relate to resource impacts of recycling and, ultimately, to ecological gains. The growth of *pay-as-you-throw* payment systems is an indicator showing degree of re-embedding or integration of recycling into the host waste management system, as well as a measure of the integration of ecological change into the economic system.

2.5.1 Tons Recycled.

Table 1 interprets statistics offered by Pellow *et al* about tons recycled.

Table 6. Materials recycled, incinerated and landfilled from the municipal solid waste steam in the US (in thousands of tons) and percent total generation, 1960-1996

	YEAR				
	1960	1970	1980	1990	1996
Recycled (1,000 tons)	5,610	8,020	14,520	29,650	46,610
percent	(6.4%)	(6.6%)	(9.6%)	(15%)	(21.9%)
Incinerated (1,000 tons)	27,000	25,100	13,700	31,900	36,090
percent	(30.6%)	(20.7%)	(9%)	(16,2%)	(17.2%)
Landfilled (1,000 tons)	55,510	87,940	123,420	131,550	116,240
percent	(63%)	(72.6%)	(81.4%)	(66.7%)	(55.4%)
Modernisation period	pre-modern	pre-modern	transition	modern	modern
source: Franklin Associates, Ltd. as quoted in Pellow *et al* 1997. pp 115-116.					

Prior to 1980, recycling by the civic and scrap sectors captured a small but consistent percentage of the waste. The rise to nearly 10% in 1980 reflects the incremental effects of the entry of the post-Earth-Day activist organisations.

The impact of the early municipally sponsored recycling systems begins to show its effect in the 1990 figures, and by 1996 has exceeded 20%.

2.5.2 Number of Curb-side Recycling Programmes in the US

By 1996, there were 8,817 municipal recycling curb-side collection programmes, as opposed to 2,700 in 1980 (Pellow *et al,* Table 2), representing the impacts of a basic a change in the system of waste management to include recycling.

2.5.3 Number of Materials Recovery Facilities (MRFs)

Berenyi (1999) shows that the overall number of materials recovery facilities (MRFs) –capital facilities which indicate a change in investment patterns -- grew from 104 in 1991 to 468 by the beginning of 1999, without counting the "dirty MRFs" or mixed waste processing facilities. The percent of these "dirty MRFs has remained at 14% of total, or 66 facilities nation-wide. (Berenyi 1999, p. 12).

2.5.4 Materials Targeted

According to Folz (1998), the number of materials targeted for recycling also increased. In 1989, relatively early in the modernisation period, most programmes collected newspaper, aluminium, and glass bottles. By 1999, when modernisation had fully matured, as Table 2 shows, each of the listed materials was included in at least 60% of recycling programmes. (Folz 1998, p. 28).

Table 7. Materials included in percent of US recycling programs

Material	percent of programs including this material in 1989	percent of programs including this material in 1996
Newspaper	97%	99%
Aluminium	97%	99%
Glass bottles	94%	98%
Tin/other metals	46%	92%
Old corrugated containers	58%	90%
Plastics	64%	83%
High-grade paper	41%	78%
Mixed paper	30%	75%
Yard and garden wastes	50%	66%
Used crankcase oil	44%	61%
Source: Folz 1998.		

Significantly, this suggests that the industrial recycling infrastructure – was changing, since in order for these materials to be collected, there had to be markets for them.

2.5.5 Participation and Diversion Rates

The *participation rate* is the percent of total households which participate in recycling – that is, which separate the designated materials and set them out for separate collection. According to Folz (ibid.), the mean participation rate for the 158 cities in 25 states in his survey was 54% in 1989 and 73% in 1996. This means that changing the collection system in the cities surveyed had successfully modified the behaviour in the target populations.

The *diversion rate* is the percent of total waste generated which has been diverted from disposal and directed to recycling. Changes in diversion rate represent effects that are felt in the modes of provision (Spaargaren and van Vliet, 2000), that is, the formal system provided by the municipality to serve households. When this diversion reaches the point that the waste disposal routes can be consolidated and re-oriented because of the shrinking volumes, the change has been felt in the mode of production. (Ibid.). The diversion rate in 1989 was 16% in the 25 cities and had more than doubled, to 33%, by 1996. Both of these rates are indicators that recycling is far more than window dressing, and has significantly changed the management of waste materials.

2.5.6 Solid Waste Payment and Fee Systems

Variable rates, or pay-as-you-throw fee systems,[15] are used when a municipality wants to support or institutionalise a shift of emphasis from mixed waste collection and disposal to separate collection and recycling. A waste fee is charged for the mixed waste, and collection of source separated recyclables is usually free of charge. Variable rate programmes are one of the best indicators of the integration of recycling into mainstream solid waste management, or its emancipation from its activist political origins on the one hand, and its civic or scrap industry forebears on the other, and its re-embedding in an integrated waste management system. They are also consistent with what Ecological Modernisation Theory (EMT) labels "the economisation (sic) of ecology and the ecologisation (sic) of the economy." (Mol, 1995).

The first variable rate systems were introduced in the Pacific Northwest in the early 1980s. By 1997, Skumatz, Truitt and Green (1997) report a total of 4,400 communities in the US and Canada with variable rate programmes, and a growth rate calculated at 10% per year. (Skumatz *et al* 1997, p. 31-32). The state of Illinois, where Chicago is located, had 132 municipalities with variable rate programmes in 1996. (Ibid., p. 32).

[15] In urban areas, variable rate programmes usually assess a fee per waste can, per bag, or per some other measure. Residents buy a sticker or tag and have to identify their own waste. Waste which is not stickered or in a pre-labelled container is left behind. In rural areas, variable rates are often associated with weighing the waste, although some rural transfer stations also use a truck volume or bag/tag system.

3 An EMT Analysis of Recycling Development in North America

Ecological Modernisation and Environmentally-Driven Change

For a summary of EMT as a theory of change, we quote at length Mol and Sonnenfeld (2000, pp 6-7) for each of the following characteristics of ecological modernisation

"Changing role of science and technology, …(which come to be) valued for their role in curing or preventing (environmental problems). … Traditional curative and repair options are replaced by preventative socio-technical approaches incorporating environmental considerations from the design stage…"

Six specific socio-technical approaches, generally innovated between 1984 and 1986, can be identied in the development of recycling.

1. refinements and improvements in processing (MRF) technology, mostly initiated by the recycling industry;
2. development of new separate collection vehicles, initiated mostly by local experts working with private collectors;
3. development of the new technology of household separation, a joint project of the activists, the local experts, and the municipalities;
4. refinement of the legal instruments, including landfill bans and recycling ordinances;
5. refinement of the whole area of municipal composting, especially turning machines, initiated by municipalities; and
6. development of new marketing arrangements and forms, a joint effort of municipalities, the recycling industry, and the stakeholders' forums like the New Jersey Recycling Forum.

"Increasing importance of market dynamics and economic agents… as carriers of ecological reform (in addition to the more conventional categories of state agencies and new social movements that prevail in almost all social theories of the environment)."(Ibid.).

Beginning already in 1984, state policymakers, and their municipalities, realised that they could not collect materials if there were no markets. One of the motivations behind the formation of key stakeholder platforms -- the National Recycling Coalition (NRC), the New Jersey Recycling Forum, the Northeast Recycling Council (NERC), to name just a few -- was the perceived need to open a dialogue between public and private sector over the demand for recyclable materials. Many recycling markets experienced, and responded to, policy pressure to change their practices to support public sector recycling initiatives.

Recycling became "emancipated" from the market (Mol 1995) in the period between 1980 and 1986 to the extent that it became an activity having a logic and expertise of its own: it distanced itself from its activist and political origins, and integrated with municipal waste systems. The state laws passed in the period 1984 to 1988 acknowledged this emancipation through numerical recycling goals and recycling requirements which were valid in their own terms, not in relation to economy or environment. The discourse recognised this emancipation by labelling a body of technical knowledge as municipal recycling; this coincides with the early modernisation period, and the most important innovations: divided collection vehicles, "blue box" set-out containers, state recycling laws, and MRFs.

After 1988, recycling increasingly "re-embedded" (Mol 1995, pp. 29-30) into the larger socio-technical sphere of integrated waste management, a term that was coined to describe the results of this re-integration, and the related evolution in the host urban waste management system. In this process in both the host system and the innovations themselves are changed.

"To restore the balance between nature and modern society a kind of "re-embedding" should take place... But modern social relations and practices cannot be re-embedded in traditional and local structures and contexts…(EMT) states that re-embedding contemporary economic practices with the aim of respecting ecological limits cannot be a reversal of the historical dis-embedding process.

Contemporary economic practices are firmly rooted in modernity, characterised by a high level of time-space distanciation and a relatively independent economic rationality and connected with modern scientific-technical and state institutions. … Consequently the ecological modernisation theory only sees possibilities for – and contributes to – a process of a "re-embedding" of economic practices – in view of their ecological dimension – within the institutions of) modernity."(Mol 1995, emphasis in the original).

Re-integration on the public sector side took the form of long-term alterations in local governance and city cleansing practice, stimulated and supported by changes in state law and enforcement of, and high profile attention to, state recycling goals, by the return of cost-benefit criteria to solid waste decision-making, and by corporation mergers and acquisitions, so that entrepreneurial firms end up as part of the larger firms which today dominate the field. (Berenyi 1999).

"Transformations in the role of the nation-state…more opportunities for non-state actors to assume traditional administrative, regulatory, managerial, corporate, and mediating functions…"(Ibid.).

In the US and Canada, these shifts took a different form than in the Northern European model. The policy, legal and institutional role attributed by EMT to the nation-state in was largely assigned to states and provinces, whose roles changed after 1984. New Jersey, California and Oregon transformed their roles dramatically in this period, passing legislation and taking significant control of the process of disposal of waste. Cities and towns relinquished their role in providing disposal, giving this authority to counties, multi-region authorities, or in some cases to the private sector, while at the same time assuming new enforcement functions. Municipalities took on roles in relation to the collection and marketing of recyclables which had, prior to 1980, been the exclusive charge of the private recycling sector. The private recycling sector also began to take on roles in relation to collection and processing of recyclables which had previously not existed. The new stakeholder platforms and a growing cadre of recycling professionals took on new mediating and information functions. In all of this shifting, there were a wide variety of institutional and legal innovations, which, as a body, combined to support recycling and increase its viability.

"Modifications in the position, role, and ideology of social movements, (which become) involved in public and private decision-making institutions regarding environmental reforms, in contrast to having (previously) been limited to the periphery…"(Ibid.).

The activist organisations retained their role as advocates, but increased their legitimacy and access, and by 1990 were insiders and collaborators in the making of local, national and state policy. Some community recycling organisations moved to new economic and operations niches, professionalising their recycling operations and becoming community-based businesses. Others retained their social mission, combining it where possible with practical activities. A few simply refused to change, and became marginalised, losing their niches to other organisations or the private sector.

"Changing discursive practices and emerging new ideologies (in which the formerly radical positions are broadly accepted as legitimate, that is, a shift of the centre)." (Mol and Sonnenfeld 2000, pp 6-7, emphasis in the original).

One change in discursive practices was signalled by the rise of the city or county or provincial "Recycling Plan" or the "Integrated Solid Waste Plan". The simple fact that, after 1986, it became possible to speak of -- and to hire consultants to prepare -- a "recycling plan" indicates how rapidly the discourse around recycling changed. The idea of "integrated solid waste management" represented a key new ideology that emerged around 1988, marking the point at which the discourse had already shifted to define solid waste management as an entire system including recycling, composting, public education, fee structures, and the like.

In recycling development, there was a period of increased reflexivity, in which the discourse itself came to rely on a high level of engagement; this ushered in a period in which technical innovation or

hyper-modernisation was applied in the effort to transform the waste and packaging problem, which is seen as a product of modernisation. This corresponds nicely to Giddens' interpretation of *reflexivity* as meaning the end of tradition. (Giddens 1994, p. 6).

Reference to Buttel (2000) strengthens the case that the development recycling is typical of a process of reflexive modernisation:

> "… most sociological proponents of ecological modernisation strongly concur with the … constituent notions of reflexive modernisation: …the solutions to environmental problems will lie in a progressive modernisation of societies (rather than the de-modernisation or counter-modernisation that is advocated within radical environmentalism)." (Buttel 2000, p. 29).

The introduction and dissemination of recycling can be seen as discourse-intensive initiatives, where stakeholders relied on disrupting habitual patterns of thinking (a characteristic of reflexivity) to trigger the discursive attention of households and businesses. Public communication differs from the discourse and rhetoric of environmental activism, in that it stimulates households and individuals to adjust their behaviour to be compatible with the new technical innovations; this contrasts with environmental activism, (following Pellow et al, and others) a de-industrialisation or counter-productivity political impulse, which asks people to consume fewer products and less packaging, in effect, to de-modernise. Thus although many integrated waste management programmes come to the point of convincing consumers to purchase less, recycling professionals focused consistently on new technological and institutional "end of life" strategies to minimise disposal. Giving households a set-out container is nothing like telling them not to consume. Recycling seen this way follows core eco-modernist concepts, finding solutions to the problems of modernisation in yet more innovation and modernisation.

3.1 EMT and the Locus and Nature of Change

EMT's European theoreticians relate eco-modernist trends to the change in relations between industry and the nation-state, but this does not work in the North American case. Christoff (1996) finds the focus of EMT on the nation-state also too narrow, although he focuses "up" to its failure to look at international institutions; in North America, this failure is "down" from the level of the nation-state to that of state, province, county, and municipality.

> "…Given this predominantly nation-statist view of EM, discussion of the emergent international institutions for environmental regulation and protection, and of environmental trends, remains underdeveloped where it occurs in the EMT literature." (Christoff 1996, p. 487).

Eco-modernist theories suggest that that political modernisation at the level of the nation-state might have – in Europe – resulted in the nation-state relinquishing its management role, and instead working on the boundary conditions. But federal governments in the US and Canadian already worked on boundary conditions, and did not have responsibility for operational functions at all. The EMT analyst in North America thus needs to seek his or her evidence for changes in governance at the level of the state or province and below, and indeed, to develop a theoretical perspective on how to "see" this type of institutional change in the North American context.

Typical of the North American version of EMT's changing state-industrial relations was the large-scale exit of local authorities from managing landfills. Municipalities simply chose to give up the disposal business, first closing landfills, then privatising collection. Under many of the new state solid waste laws, counties were newly required to take increased responsibility for planning and siting of disposal facilities, becoming a third stakeholder on the waste management scene. Private waste management companies, who were interested in developing private landfills or incinerators, could achieve the larger economies of scale of the new landfills through privatised regionalisation, this implicating new market actors.

EMT also could benefit from seeking aggregate, rather than individual case-based, evidence of changing regulatory and legal environments. The fact that recycling in Chicago failed (or that Berkeley went much farther than other cities) influences but does not change the overall trend towards modernisation of solid waste systems; it only shows that there can be special cases. Documentary evidence cited in Section 2 shows collective and aggregated changes in the practice and norms of municipalities in relation to solid waste management over the period 1980 to 1996: numbers of recycling programmes, tons recycled, cities with variable rate systems; states in this period with recycling targets of 25% and above. (Post 1990). While the details of ground-breaking experimentation, action, and in some cases deliberate inaction are technically interesting, the overall trends do more to show how municipal waste management was changing, and it is these trends that provide the evidence of an eco-modernist process. The extent of the change can not really be captured by case studies of large cities like Seattle or San Francisco (or Chicago), because each individual case was the product of its own particular history, and also because the largest cities were often the most deviant examples.

In a country as large and diverse as the US or Canada (or Russia or China or Brazil or India), this is an especially important point for EMT. When the USEPA or other institutions measure the effects of change, they do it by aggregating tonnages, or counting MRFs and variable rate programs, or surveying municipalities or waste collection companies. It is the aggregation of all the small- and medium-scale efforts that gives the picture of ecological modernisation North American style. The locus of change is the municipality, and the evidence is dispersed. Thus the evidence-gathering for changes associated with ecological modernisation is fundamentally a different project in North America (or in other large countries) than it is in the relatively smaller, more homogeneous nation-states of Northern Europe, something which EMT would do well to acknowledge.

4 Epilogue: Recycling in North America and the Claims of Pellow, Schnaiberg, and Weinberg

Pellow *et al* offer three fundamental critiques to EMT, based on this history. In this paper, we focus on critiques 1 and 2, which relate more to the case of recycling. We leave aside critique 3, whose focus is that recycling had negative social consequences, and that a modernisation theory which does not "incorporate issues of social equity and political-economic power (p. 111)" is not an adequate social theory, as falling outside the scope of this article. Moreover, Mol and Sonnenfeld (2000, pp 6-8), state that a response to this critique has been incorporated in the more recent formulations of ecological modernisation.

Critique number 1

> "There is no compelling evidence that the ecological sphere has been emancipated from the economic sphere in decision-making criteria. In this case, it appears that prior social and ecological spheres have been suppressed under a narrow economic agenda. We note the robust character of capitalism has shaped (sic) the modernising recycling industry in at least two respects: 1) the ability of market criteria to dominate the agenda, even in the face of strong public support for ecological protection, and (2) the inability of ecological interests to penetrate the organisational logics (sic) even when market opportunities exist." (Pellow *et al* 1997 p. 125).

According to the authors, critique 1 asserts *a failure of modernisation*, since market criteria emerged as dominant in the field of urban waste management in Chicago. The main response to critique number 1 is that Pellow and his fellow authors *have the phasing wrong in their analysis: the reintroduction of economic criteria occur in Chicago at precisely the moment that EMT would suggest that re-integration should occur.*

EMT suggests that re-integration of the ecological domain into the larger economy – already well under way by 1990 – can be expected to re-subordinate processes to economic criteria of the dominant system. In Chicago, once the ecological modernisation process was mature, market criteria

re-intervened in the process, just at the point where one would expect a process of re-integration, an ecologisation of the economy and an economisation of the environment.

The historical record does not agree with critique number 1, but suggests, in contrast, that an important process of ecological modernisation did take place.

Critique number 2

Critique number 2 claims, not a failure of modernisation, but a failure of *ecologisation*; that is, that the modernisation processes failed to solve the environmental problems or to solve them in any significant way.

> "The modernisation of recycling appears to lead only minimally to a very narrow set of ecological gains. Many reviewers of our work have commented that, despite our critique, there *are* ecological gains none the less associated with municipal recycling practices, like Waste Management's blue bag. This is true, but such gains are minimal." (Ibid., p. 127, emphasis in the original).

Resource conservation is not the only – or perhaps even the major – potential source of ecological gain. Critique number two can be challenged in two principal areas: ecological (largely but not completely resource) gains in the recycling process, and ecological and efficiency (not especially resource) gains in the environmental performance of municipal waste management systems.

Gains in relation to the environmental effects of the use of recycled materials occur predominantly in savings of energy, and secondarily in savings of materials. Secondary manufacturing processes use far less energy than those using primary (virgin) materials. In the case of glass, for example, the energy use in container manufacturing is 90% less when using secondary cullet (New Jersey Recycling Act publicity materials, 1985-88). Reduced energy use is also characteristic of the use of ferrous scrap as compared to virgin ores; of secondary fibre in comparison to trees; and of secondary textile fibre compared to virgin wool or cotton. There are also energy gains from separate collection of yard waste and other compostables when the rest of the non-compostable waste goes to an incinerator, since the rest-fraction burns better and makes more energy, if the compostables, which have a high moisture content, are no longer present.

Secondly, many manufacturing processes based on secondary production can use cleaner production technologies than those using primary resources. Paper mills using secondary fibre avoid chemically intense and hazardous use of corrosive black liquors and chlorine bleaches, some of the heaviest environmental pollutants from paper-making. And there is an important "doppler effect"*:* any policy stimulus to use more secondary materials also triggers discursive attention in manufacturing enterprises, so that they may identify additional gains (and savings) as a result of altering their systems.

The modernisation process triggers cumulative changes in the investment and resource use patterns of industry to more efficient, more ecological processes based on primary use of secondary, not primary, resources. The American paper industry's investment strategy shifted from wood-based mills to recycling mills between 1984 and 1990, due largely to the large and reliable supply of secondary fibre that was being made available from new municipal recycling initiatives. (Post 1990). The steel industry shifted to more energy-efficient mini-mills in the same period (Michael Simpson, personal communication). The environmental impacts of recycling need to be evaluated here, where the host industrial system modifies its fundamental relation to resource withdrawals.

On the solid waste management side, recycling system development offers additional small gains in energy efficiency and pollution avoidance. The introduction or expansion of separate collection programmes often provides municipalities with a reflexive opportunity to optimise their routing and capture efficiency and scale gains, which can contribute to rationalised routing of all forms of waste collection in the system. Such gains reduce energy and decrease vehicle deterioration.

Moreover, separate collection routes usually go to a MRF or composting site located in the city centre, or in a nearby industrial zone, rather than to the landfill or incinerator which are further away. There are thus energy gains in transport as well.

5 Conclusions

First, the development of recycling is sufficiently consistent with the context, framework, and descriptive predictions of ecological modernisation theory to be characterised as a process of ecological modernisation. The general direction of change, the phasing, and the practical experiences provide strong empirical support to EMT's theoretical claims.

Secondly, while the changes appear solidly institutionalised and therefore irreversible, there is still some dynamism in the system. The "proof of the pudding" is not in the emancipation of recycling, but rather in its re-integration. If changes are ephemeral, they simply disappear, and re-integration is not necessary. The fact that re-integration occurs suggests strong validation of the claim for change.

Third, we can conclude that specific indicators of change and benchmarks for identifying new situations differ between EMT's "cradle" in North-western Europe and other *loci* of change. In the North-American context it is not industry-nation-state relationships that are changed, but the relationships between industry and *government*, which, in the US context, means state, county, and local government.

Chapter 3: Slim pickin's: Supporting waste pickers in the ecological modernization of urban waste management systems[16]

Abstract

Informal sector scavengers or waste pickers have been unrecognized stakeholders on the fringes of the urban waste landscape since the nineteenth century. Although solid waste systems of both rich and poor countries continue to change radically in the process of (ecological) modernization, the living conditions and position of waste pickers have changed little, and then usually for the worse. Development approaches focusing on pickers' welfare, capacities and rights consistently fail to 'help'. A systems approach that instead focuses on the opportunities provided by the modernization process provides a stronger framework for legitimizing the role of pickers and strengthening their livelihoods.

1 Introduction

Informal sector scavengers or waste pickers have been scratching out a living on the fringes of the urban waste landscape since long before the cities in Europe and North America first began collecting waste in the 1880s. (Melosi 1981). In modern times, scavengers recover and sell materials and sell them in cities like New York, Paris, Melbourne, Bangkok, Tegucigalpa and Harare, among others. Their work feeds global industries that produce autos, computers, newspapers, books, building materials, clothing, and many other products.

Many development projects designed to 'help' or 'rescue' waste pickers treat picking as a disembedded phenomenon, separate from the local and global economy that produces waste. This isolates researchers and development workers from the conceptual framework or tools that would help them understand the roles and functions of waste pickers; the result is that pickers become objectified, and treated as a problem rather than as protagonists who can and do make choices and act strategically.

In counteracting this, the authors of this paper draw on two separate lines of conceptual work: the framework of integrated sustainable waste management (ISWM), to provide an overall way of understanding solid waste systems and the role of waste pickers in it; and ecological modernization theory (EMT), to better understand the process of environmentally driven change.

The authors analyze the main processes and results of modernization in waste management and the changing niches available to waste pickers within it. They also look critically at the kinds of projects used by development organizations to 'improve' the conditions in which waste pickers work, and draw conclusions about the kinds of approaches that are sustainable.

2 EMT and the ISWM framework

2.1 EMT: Understanding the modernization of urban waste systems[17]

Waste management systems worldwide are changing as part and parcel of environmentally driven changes. OECD countries have mature or partially modernized systems of waste management, while many developing countries are just beginning the process. EMT contextualizes these changes and provides a framework for understanding them.

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[16] First published as: Scheinberg, Anne and Justine Anschütz (2006): "Slim Pickins' Supporting waste pickers in the ecological modernisation of urban waste management systems." *International Journal of Technology Management and Sustainable Development* volume 5, number 3, pp. 257-270. In this version some typographical and numbering errors have been corrected, and some of the figures have been modified.

[17] This section owes some of its content to the contributions of Professor Arthur Mol to an earlier paper on waste management.

The German political scientist Martin Jänicke is credited with launching the concept of 'ecological modernization'. While serving as a representative in the Municipal Council in the late 1970s, he argued for the environmentally driven – ecological – modernization of Berlin's development path. Although it took some time before the concepts he used found a home in the formal academic social sciences, the ideas seeded by Jänicke now occupy a solid position in the environmental social sciences, under the name EMT. EMT isolates the following five primary processes. (Mol and Sonnenfeld 2000: 1–7).

> "Changing role of science and technology, [through which] traditional curative and repair options are replaced by preventative socio-technical approaches incorporating environmental considerations from the design stage.'(ibid.: 6–7, emphasis in the original). In the modernization of solid waste systems, this phenomenon can be seen in the progression of policy focus from protecting ground water to safe land-filling, to decreasing the amount of waste being land-filled and increasing the amount recycled, and to preventing the generation of waste and changing product policy. (Scheinberg 2003; Scheinberg and IJgosse 2004).
>
> "Increasing importance of market dynamics and economic agents… as carriers of ecological reform.'(ibid.) The process described above greatly increases costs of land-filling, stimulating increased attention to cost recovery and cost-effectiveness, resulting in systems which focus on profit margins in addition to environmental performance. The focus on recycling opens a second 'front' for market dynamics in terms of collecting and marketing recyclables and compost.
>
> "Transformations in the role of the nation-state…more opportunities for non-state actors to assume traditional administrative, regulatory, managerial, corporate, and mediating functions…'(ibid.). Both in the North and the South, the modernization process stimulates the transition of focus of state, regional and local authorities from the business of providing solid waste services to the tasks of regulation, inspection, control and financing. The actual implementing agencies increasingly involve the private sector and community-based organizations (CBOs) and non-governmental organizations (NGOs).
>
> "Modifications in the position, role, and ideology of social movements, (which become) involved in public and private decision-making institutions regarding environmental reforms, in contrast to having (previously) been limited to the periphery…'(ibid., Mol and Sonnenfeld, 2000: 1–7)). This political modernization opens up decision-making, sometimes voluntarily, and sometimes under political or social pressure. Civil society organizations are increasingly involved in siting of solid waste facilities, but also as partners in planning, where they are key to mobilizing stakeholders. Moreover, many also operate recycling and solid waste collection.
>
> "Changing discursive practices and emerging new ideologies (in which the formerly radical positions are broadly accepted as legitimate, that is, a shift of the centre).'(ibid.). In modernization, the 'problematization' of waste management becomes a driving force for change, shifting focus from 'how to get the waste out of the city' to 'how to reduce the impact of waste on the environment', and finally to 'the problem is that the global economy creates waste and expects to be able to continue creating waste' (Bauman 2004)."

EMT makes a convincing case that the modernization process involves more than simply updating technology. The system that was static for many years becomes dynamic, with technical elements changing in response to new scientific paradigms. The result is a system with more internal complexity and variety, comprised of many subsystems and sub-technologies. Operating these can provide micro-niches that were not available before.

Modernization has a similar impact on the institutional landscape: the role of the state (and local)

authorities shifts from operations to control; civil society is invited to sit at the table; economic actors can take new and innovative roles. In this context, existing actors like waste pickers can lose their stake to stronger players, but they also have access to a range of new options and possibilities.

2.2 Integrated sustainable waste management

While EMT can help understand environmentally driven changes in a general way, the ISWM framework focuses on waste management as a multi-actor, multi-layer socio-technical system of provision (IJgosse, Anschütz and Scheinberg 2004; Spaargaren and van Vliet 2000). ISWM applies the principles of PRA (participatory rural appraisal) (Chambers 1997) to solid waste, in support of poor and disenfranchised stakeholders seeking to improve their lives and livelihoods.

ISWM situates waste pickers and informal waste service providers in the overall socio-technical system of provision for waste management. The ISWM framework, shown in Figure 3, recognizes three important dimensions in waste management: stakeholders, waste system elements and sustainability aspects.

Figure 3: The Integrated Sustainable Waste Management (ISWM) Framework. Source: IJgosse, Anschütz and Scheinberg 2004

Stakeholders, the first ISWM dimension, are persons or organizations with a stake, or interest, in waste management. In pre-modern urban waste systems (such as exist today in Nairobi, Tegucigalpa or Dhaka), legitimately recognized stakeholders include only the local authority, the national environment or local government ministry, and one or two private companies working under contract to the municipality. Unrecognized stakeholders in this system include street sweepers (usually females), workers on collection trucks or at the dumpsite (usually males), and family-based informal sector waste pickers and small recycling businesses (usually called 'junk shops') that buy materials.

In the process of modernization, households and businesses generating waste, together with NGOs and CBOs, also acquire legitimacy (Scheinberg 2003). The priority of these stakeholders is located somewhere between the need to have their waste removed, the desire to participate in some kind of

recycling, and an interest to claim and earn money from waste materials. Other stakeholders gaining legitimacy in the modernization process include: recycling businesses, residents in the neighbourhood of dumpsites, industrial users of recyclable materials, farmers interested in the organic waste fraction and schools with an advocacy position. They all differ in their interests, influence and relation to the solid waste and recycling system.

The second dimension is the waste system elements. These are the technical components of waste management. In a pre-modern system, the technical waste management system is built entirely around the logic of disposal. The presence of waste in households and on the street is seen as the main problem, so the primary solution is normally removal to a dumpsite outside the city.

The modernization process changes the 'problematization' of waste to a focus on the existence, character and environmental impacts of waste. Acceptable approaches must go beyond providing dumping-space, to protecting the environment and ultimately reducing both the quantity of waste and its dangerous character. Prevention, recycling and composting gain status as legitimate complementary activities in an expanding discourse on waste management. The result is an 'integrated' system including source separation, repair and reuse, collection, processing, composting, transfer, marketing, of materials from waste, and land or thermal disposal of the residues. This becomes institutionalized in a management 'hierarchy', giving priority to waste prevention and recovery, shifting the destination of materials away from land disposal to formal and informal reuse, recycling and composting (Scheinberg 2003). The entire provisioning system thus becomes diversified and moves to rely on a mix of technologies and institutions – a modernized mixture (Spaargaren and van Vliet 2002).

The third ISWM dimension consists of six sustainability aspects used in the assessment of the existing waste system and in the planning of new or modernized approaches. Decision-making focuses on more than cost and technical feasibility, with choices based on political–legal, social–cultural, institutional–organizational, technical-performance, environmental-health and financial-economic criteria. A technically feasible landfill may prove financially or politically impossible because no clients will pay to use it, or because citizens refuse to allow it a site.

3 Waste pickers in the urban waste context in the South

Waste pickers play an important, albeit often unrecognized, role in not-yet-modernized solid waste management systems,[18] where they represent the foundation of most recycling activity and the bottom layer of the so-called secondary materials pyramid (Lardinois and Furedy 1999). Cairo has almost 70,000 semi-formal waste pickers and collectors; Kolkata in India, 50,000; Quezon City in the Philippines, 13,000 (ILO 2004b).[19]

Pickers recover recyclable materials from mixed waste in street bins, containers, communal collection sites, vacant lots, and final (or closed) disposal sites. They recover secondary resources directly from disposal – that is, from the first point at which they become common property resources – and redirect them to local and global industries that use recycled resources.

Waste pickers sell to specialized small-scale materials dealers ('junk shops') at or near the landfill. The junk shops aggregate and sell materials to intermediaries who process and pack them in industrial quantities for export or domestic manufacturing uses. Dealers may employ waste pickers, or may offer them loans, equipment or shelter (Furedy 1997). Prices paid are low, partly as a result of the low bargaining power of dump pickers and partly due to pickers' limited ability to aggregate materials and

[18] Solid waste modernization is an indicator of general level of development (David Wilson, undated). Most urban solid waste systems in North-western Europe, North America and Japan have been modernized; those in Australia, CEE, the 'Asian tigers', Costa Rica and India appear to be modernizing rapidly, and this is also occurring in many 'developing and transitional countries'.

[19] The ILO has done research on waste picking in twelve countries, but data is thin and difficult to verify, so these numbers are indicative, rather than exact. A study financed by GTZ (German Technical Co-operation), in which both authors of this paper are involved, is due to be published in 2007 and has updated and more detailed data.

transport them to industrial users who would pay higher prices.

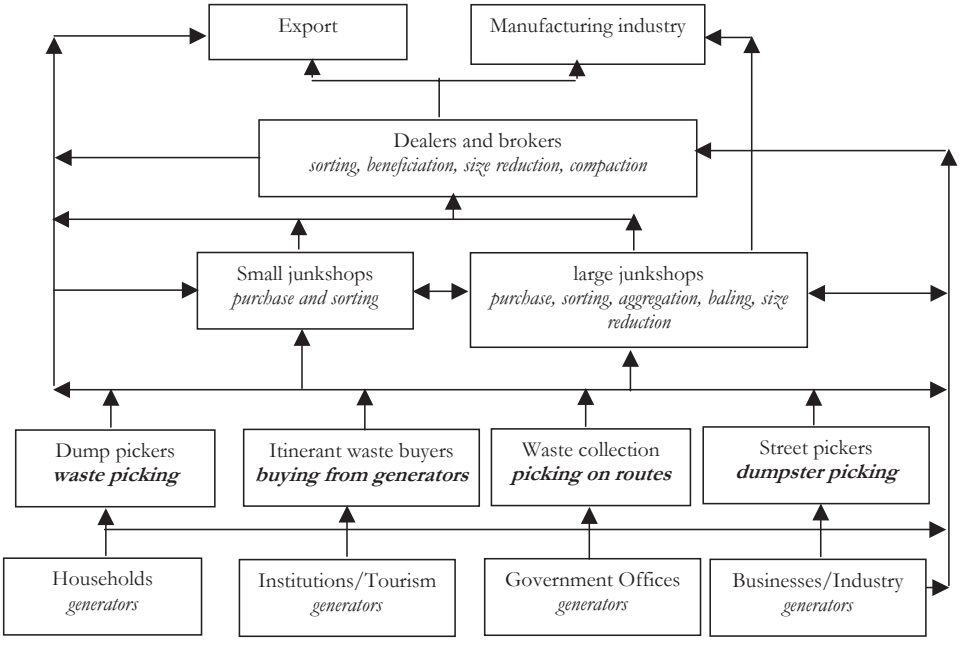

Figure 4. The Recycling Value Chain, Idealised view. Source: Adapted by the Author from Marchand 1998.

In pre-modern waste systems, waste pickers suffer from chronically poor labour and living conditions, especially when they work and/or live on landfills and dumpsites. They face injuries from dogs, rats, and other vectors, combined with chemical and biological health risks due to contact with toxic substances, health care wastes, faecal matter, body parts, used syringes and other materials in the waste stream. In the best of situations, pickers report ergonomic problems due to the physically taxing nature of the work, and psychological and social disadvantages stemming from their low social status (van Eerd 1996; Simpson-Hebert et al. 2005). They are reviled because handling waste materials is considered dirty, or is associated with violating religious or class taboos (UWEP Plus 2005).

Waste pickers may be internal or cross-border migrants, or may belong to religious, social, or ethnic minorities with a tradition of engagement in waste-related activities, as in the case of the Coptic Christians in Egypt, who make up the majority of the 'Zabballeen' waste collectors and waste pickers, or the Muslim minority in Kolkata, India (Furedy 1997). Throughout India the 'dalit' (casteless, formerly 'untouchable') people are involved in picking waste and emptying latrines. In Romania and most of Eastern Europe, Roma gypsies (cigani[20]) are associated with activities such as street sweeping, gutter clean-out, or working at the dump. In Lebanon, many waste pickers are Syrians and Palestinians. In Delhi (India), it is Bangladeshis and members of the Muslim minority; and in Pakistan, it is the Afghan refugees (ibid.). The 'dirtiness' of the work generally results in society everywhere despising waste pickers (Furedy 1997; Dias 2000). Consequently, modernization of solid waste management is often used as an excuse to exclude pickers or criminalize waste picking. These are political actions which do not account for the significance of pickers for the operation of the formal solid waste management system and their potential to divert substantial quantities of materials to recovery.

[20] A word meaning 'do not touch' (Simpson-Hebert et al. 2005).

Without legitimacy, waste pickers may also be manipulated or exploited by the municipality or the businesses to whom they sell materials. In Mexico City, authorities and waste pickers' leaders collude in an intricate system of political clientelism, including payment of bribes to government officials, for ignoring abuses of power by waste pickers' leaders, collectors demanding tips from small industries to pick up their waste, and the 'sale' of waste collection routes in wealthy neighbourhoods (Medina 1997). In the Batangas Bay area of the Philippines, prior to modernization, small recyclers were consistently the victims of harassment and physical threats by larger junk shops and dealers (UWEP Plus 2005).

Photo image 3. Women waste pickers scavenging plastics at a formal dumpsite in India, 2003. Copyright WASTE.

3.1 Waste picking during modernization of waste management

Some of the most important changes to the condition and position of waste pickers occur when a waste management system actively enters the modernization process. Modernization may make their way of working obsolete, 'dis-embedding' pickers from their customs, leaving them seriously out of sync with modernization and putting them at risk. Or they may change in parallel with the modernization process, strengthening their positions and/or seizing the opportunity to take advantage of new circumstances.

Waste pickers become losers in the modernization process when their access to waste is denied as a result of modernization of the landfill, restricted gate access, or competition from formal recycling activities. When the modernization process ignores pickers it risks depriving them of their common property use of the waste stream and disrupting their livelihoods, especially as the legal status and formal ownership of the waste changes and formal participants gain privileged claims to materials. For example, a company managing one of the landfills in Bangkok, Thailand, 'officially' denied access to waste pickers, but allowed them in to continue picking under the condition that they sell only to that company, at even lower prices (Barkhop 2004). In Romania in 2002, an initiative for

modernization and landfill gas recovery at eight landfills resulted in forbidding access by the local Roma, enforced by armed guards at the periphery of the landfills (Hordijk, Aad (2002) Project Manager, Environmental Resources Management Netherlands, personal communications and field notes). In Dar es Salaam, Tanzania, a large private waste collector holding concession to collect waste from downtown hotels threatened a women's group that wanted to collect plastic bottles from one hotel, thereby causing the group to withdraw (Ishengoma, Alodia 2003, Staff, ILO Tanzania, personal communications and field notes). In Cairo, a national government commitment to privatize the city's waste management deprived the traditional waste collectors and recyclers (the Coptic Christian Zabbaleen) of their traditional livelihoods collecting and valorizing solid waste in a range of semi-formalized economic activities, including raising swine from collected food waste (ILO 2004b; Aziz 2004).

There are some cases where waste pickers have been winners in the modernization process, and where they have achieved legitimacy and status as important stakeholders in the solid waste system. In Belo Horizonte, Brazil, the municipal authorities created a separate status for waste pickers as the managers of recycling depots, designating them as formal participants, and giving them improved access to materials. This created a high-profile recycling system that saved the city considerable amounts of money (ILO 2004a; Dias 2000).

In Bangalore, India, an NGO (Mythri) has worked with a number of large commercial waste generators to create a system of contracts with women waste pickers. Each business generator contracts with one specific waste picker, giving her a service relationship and service fee (for cleaning and sweeping) and guaranteeing her a stream of high-value recyclables. In return, the business avoids costs that would otherwise be associated with the modernization process (UWEP Programme Progress Reports 2003). The relatively well-organized Hungarian Roma community has been able to negotiate for continued access to waste materials after modernization: Roma entrepreneurs (many of them women) in at least two cities, Gyor and Debrecen, pay a concession fee for the right to scavenge the landfill (Scheinberg 1999). The above mentioned small recyclers in Batangas Bay were supported to form a marketing co-operative, which gave them a base of operations, a collectivity capable of purchasing a truck, and, through these, access to more markets for more materials (UWEP programme progress reports 2001).

4 Development approaches to improve the condition and position of waste pickers

Development approaches to alleviate poverty and eradicate scavenging tend to treat waste pickers as a social problem rather than seeing them as economic actors in (or at the fringes of) the socio-technical solid waste and recycling system. Waste pickers thus become the 'targets' of development approaches focused on improving the conditions of scavengers and eradicating child labour (ILO 2004; Furedy 1997). The three most common approaches are (1) the welfare-based approach, (2) the development-oriented approach and (3) the rights-based approach.

4.1 The welfare-based approach

This approach seeks to directly improve the living conditions of waste pickers by focusing on daily needs and welfare problems. It assumes that it is possible to introduce improvements in pickers' condition without addressing the political and social forces that influence their position. Waste pickers and their children are seen as passive victims of society, not as entrepreneurs involved in a livelihood activity. In ISWM terms, the waste pickers have only a social identity, not a professional one.

4.2 The development-oriented approach

This approach sees waste pickers and their children as poor people who lack (other) opportunities, and focuses on strengthening capacities to facilitate an exit from picking. The development approach is concerned with social and economic interventions such as education, credit and income generation. It supports empowerment and gender and facilitates access to schools or other social institutions, but

continues to ignore the content of waste picking and its contribution to family livelihood. The development approach shares the social framework and vision with the welfare approach, and thus gives little attention to pickers' status as informal sector recyclers working on solid waste. Also, it lacks recognition that an exit will deprive the family of the quite considerable income being generated in the existing situation[21].

4.3 The rights-based approach

This approach aims at creating more political room for changing and strengthening pickers' position as a group in society, giving them a voice, making them visible, and stimulating their political participation. The rights-based approach addresses social, political and institutional aspects of waste picking and the reasons for entering it. Typical approaches include supporting pickers to form organizations and lobby for rights and social status, still without acknowledging the economic importance of picking. While the rights approach acknowledges waste pickers as political (in addition to social) actors, it falls short of understanding their role in the solid waste management system.

Reference to EMT theory and the ISWM framework provide clear insight into why these approaches have not been effective (ILO 2004b). First of all, none of these three approaches treats waste pickers as stakeholders in the waste management system (or even in their own lives). Most development interventions neither consult waste pickers regarding questions of priority, nor engage them in solving their problems (Furedy 1997; Simpson-Hebert et al. 2005). In Romania, this lack of consultation has consistently led to Roma waste pickers ignoring projects that would give them housing and schooling opportunities, and in the process creating much resentment in the non-Roma organizations doing the 'helping' (Stanev, Veraart and Popovici 2004).

Secondly, none of these approaches contextualizes pickers as economic and institutional actors already within the waste management system. This leads to an assumption that exit from this system will help, something the pickers themselves may or may not agree with.

Third, and perhaps most importantly, none of these three traditional approaches appreciates the dynamism of the modernization process, with the result that they focus on changing the pickers and their family or social circumstances. In contrast, the EMT approach suggests that the probable effect of the modernization process is to open up the system to a variety of technical, economic and institutional innovations, each of which can either threaten the niches pickers already occupy or open new possibilities.

The general failure of the first three approaches suggests the need for a fundamentally different approach to supporting waste pickers, one located within the solid waste rather than the social sphere. With the insights about modernization, which come from EMT, it is possible to formulate a systems approach, which conceptualizes the modernization process as opening new niches for waste pickers as important economic stakeholders. Such an approach analyzes waste picking (and informal recycling and waste collection) as legitimate economic activity taking place within the overall solid waste management system.

5 Legitimizing waste pickers in a changing system: The system approach

If development projects are to succeed in supporting pickers, there is a need for a fundamentally different, systems approach that is sustainable, fair and effective. Looking at the insights from EMT and the ISWM framework, it is possible to identify the key attributes of such an approach as being based on:

- consultative, participatory engagement with pickers as leaders in the process;

[21] Research in the 1990s in Latin America, Africa and Asia by WASTE in the UWEP programme indicates, on the contrary, that waste picking consistently provides income that is approximately three times the minimum wage or the wage for an equivalent of skills and experiences (Price, Rivas and Lardinois 1998).

- contextualization of pickers as solid waste system stakeholders, both in terms of helping them understand their own economic relationship to the solid waste system, and in legitimizing and valuating their activities to the formal solid waste and political authorities;
- an understanding of the specific effects of ecological modernization of waste systems, especially in terms of anticipating new institutional and economic niches, and helping pickers to enter them in a sustainable way; and/or
- a commitment to sustainable improvement in the lives and livelihoods of pickers.

Table 8 presents a modest number of projects in Latin America and elsewhere, to illustrate how a systems approach works (ILO 2004a).

Table 8. Actions based on the systems-oriented approach

Effects of modernisation	Corresponding actions with pickers	Selected practical examples
The modernisation process prioritizes recycling and introduces source separation and separate collection	Design the source separation, separate collection, and sorting systems for recyclables so that waste pickers can have the contracts for doing this	Bangalore, India Coopamare, Colombia
The modernisation process has a line of activities supporting separate collection of recyclables and organic waste	Designate street pickers or informal recyclers as the official agents for operating these systems, supply them with ID cards, uniforms, equipment and protective gear;	Linis Ganda project in Manila; Dar es Salaam, Tanzania Coopamare, Colombia
Shifting institutional relations between the public and private sector, with new roles open to secondary materials MSEs	Strengthen the relationship between waste pickers and recycling markets through marketing co-operatives or the formation of multi-actor alliances like recycling platforms	Batangas Bay, Philippines; various projects in Colombia
Closing of informal dumps, upgrading dumps to be modern landfills; opening new regional landfills; restricting recyclable materials and organic waste from being dumped in landfills; prohibiting waste picking at modern landfills	Include a separate sorting 'receiving area' at landfills, so that the pickers work on a clean, dry, surface while diminishing the risks to their health and safety from disease or accidents involving waste vehicles. Regularize the status of landfill-based pickers by giving them a franchise or contract to extract and process materials	Gyor and Debrecen, Hungary, Colombia,
Civic pressure to modernize the waste system and clean up scavengers	Facilitate communication and bridge the gap between the formal waste management sector and waste pickers and informal waste service workers, using stakeholder platforms	Blagoevgrad, Bulgaria, Swabhimana Platform, Bangalore, India; COPIDUC and COGEVAD, Bamako, Mali.
Planning processes to plan for managing solid waste in a modernized system	Invite scavengers or their representatives to participate as stakeholders in planning processes, as well as in the formulation of municipal and national SWM policies	Dar es Salaam, Tanzania; Bamako, Mali
Source: ILO 2004(a) and (b); UWEP Programme 2001-2004, further elaborated by the authors.		

Systems-oriented approaches increase the bargaining power and legitimacy of waste pickers by focusing on the status and social value of the waste management activity. In the process, harassment decreases and family income and marginal profits often stabilize, creating better conditions for sending children to school. This seems indirect but has a relatively more powerful effect on the welfare, development and rights of pickers.

When the modernization system treats waste pickers as legitimate technical and economic actors, it opens the way for them to achieve a new status as recognized stakeholders involved in professional recycling. Their expertise is valued and their economic contribution to the system is – at least in theory – available for quantification and valuation. Such legitimacy can create a virtuous circle of more attention, less harassment and formal projects to optimize recycling, which in turn improve the situation and position of pickers.

6 Conclusion

'Developing' countries and post-socialist 'transitional' countries are involved in the same ecological modernization processes as the wealthier, 'more developed' countries in Northern Europe, North

America and Asia. They experience increasing pressure on cities to clean up dirty areas, provide services to the poor, improve the business and investment climate, protect groundwater, prevent pollution and diminish or alleviate poverty. Solving the 'solid waste problem' has become a key priority for city mayors throughout the world, and solid waste systems and the discourse surrounding them are changing rapidly in response to these pressures.

The modernization process is the source of both threats and opportunities to solid waste and recycling informal sector, specifically waste pickers. As a wider range of actors becomes involved, they may claim the resources in the waste stream and exclude or displace pickers. This is compensated by the new institutional and economic niches allowing pickers to become designated recyclers or sign contracts for collection, sorting or cleaning operations.

There are risks for all parties – both the pickers and the waste management authorities – in the modernization process. But there is a still greater risk in denying that modernization is taking place, or worse, in trying to hold it back. The path to sustainability lies in understanding the process, accepting changes in good practice and supporting waste pickers and local authorities to engage with the processes of change. As pickers move to occupy key new roles and niches, they can better capitalize on their experience and knowledge of recycling and the various materials chains.

Participation by the pickers themselves is key to any approach to integrate picking into a modernized solid waste system in a structured and sustainable way. This can only work when there is a political and institutional commitment to consult and engage the pickers as legitimate solid waste and recycling stakeholders and professionals.

Chapter 4. Assessing Urban Recycling in Low- and Middle-income Countries: Building on Modernised Mixtures[22]

Abstract
Recycling and valorisation of waste in urban centres in low- and middle-income countries is often misunderstood. Recycling in these countries represents neither the service of removal, nor an activity of "greening" related to ecological modernisation. Recycling is first of all an economic activity of commodities extraction, upgrading, and trading, and as such it provides a livelihood for millions of persons worldwide. Based on evidence of waste management and recycling activities in six urban centres in low and middle-income countries, this paper explores the contribution of informal sector recycling to recycling and solid waste management. It interprets the variety of urban recycling systems as "modernised mixtures": the mixing of formal municipal waste removal systems with informal private sector recycling activities. Context-dependent factors determine how this mixture of formal and informal systems looks, and how effective informal recycling in these urban centres is. This approach to analysing existing recycling can contribute to improvement of solid waste management systems through sustainable and fair recycling.

1 Historical perspective on recycling and waste management

In most developed countries the origin of the recycling industry is to some extent related to the origins of solid waste management (see, for example, Melosi 1981). Urbanisation in the 19th century provided livelihoods for rag-pickers, night soil and ash collectors, and other urban gleaners, who could remove unhealthy waste materials and commercialise them by selling them into the growing industrial and agricultural value chains. In the late 1800s (ibid.), this activity became increasingly focused on maintaining sanitary conditions, and solid waste management gained the public works focus which it maintains to this day.

This increasing professionalisation of solid waste management in the 20th century resulted in separating the development of solid waste management systems from recycling activities (Strasser 1999, Wilson 2007). Environmental insights stimulated engineers in large European and North American cities to refine a range of new technical approaches to disposal which moved the two disciplines even further apart (Wilson 2007; Scheinberg, Wilson and Rodic 2010). While for most of the 20th century recycling systems operated as part of the industrial supply chain, they moved further and further away from the public service of waste management. This status applied regardless whether the industrial system primarily consisted of private economic activities as in the Americas, or of state-organized activities as in socialist-era Hungary, or of a hybrid of these (Scheinberg 2003, Gille 2007, Weinberg, Pellow, and Schnaiberg 2007).

The post-Earth Day discipline of environmental management and resource conservation stimulated a new solid waste modernisation process which began to bring the two disciplines back together. Ecological modernisation currents focused not only on impacts of waste discharged to water, air and soil, but also on declining fossil fuels and the need to conserve natural resources. Resource conservation in particular served to turn the attention of waste managers in the direction of recycling.

Thus it can be said that modernisation of waste management represents a return to an improved – and updated – version of an older paradigm. The waste systems which had evolved to have a single technical idea—remove waste from populated areas and dump it on or bury it in some unused or far-away ground – are shifting towards deconstructing waste streams and looking for appropriate intermediate or final destinations for all the different components, according to their sources, value,

[22] First published as Scheinberg, Anne, Sandra Spies, Michael H. Simpson, and Arthur P.J. Mol (2011): "Assessing urban recycling in low- and middle-income countries: Building on modernised mixtures." *Habitat International* volume 35, pp. 188-198. For this thesis minor corrections have been made, and a figure and a photo have been added.

and physical nature (Scheinberg 2003, Scheinberg, Wilson and Rodic 2010, Saarikoski 2006). In developed countries the main public sector motivation for a renewed interest in recycling is its value for environmental protection and resource conservation. This distinguishes modern municipal recycling from its commodity-focused rag-picking forebears, and is a basis for calling it a process of ecological modernisation (Mol 2000, Mol and Spaargaren 2000, Mol and Sonnenfeld 2000). The further integration of recycling into municipal solid waste management—often referred to as 'Integrated Solid Waste Management'—significantly raises the importance of keeping materials out of disposal and directing them to valorisation, that is, to diversion from disposal into the industrial value chain for reuse and recycling, and the agricultural value chain for composting and related uses. In high-income countries, recycling increasingly has become not only a practical strategy in response to rising disposal costs and growing waste streams of increasing toxicity and complexity, but also a symbolic antidote to 'over-consumption' and the throw-away society (Pellow, Schnaiberg and Weinberg 2000).

In low- and middle-income countries recycling can be distinguished from solid waste management in that it is not a service of cleaning or removal, but a largely private economic activity based on valorisation and trading, with strong direct links to the industrial sector and hundreds of years of history (Scheinberg 2003a, Gille 2007, Melosi 1981, Strasser 1999). Specifically, private recycling has little or no relationship to the primary activity in waste management (and sanitation), which is removing waste (or excreta, both 'economic bads') and minimising their nuisance, environmental or health impacts (Cointreau 1989; Scheinberg, Wilson and Rodic 2010). In contrast, recycling in not-yet-modernised solid waste systems has the opposite goal: to extract any remaining economic or use value from the 'economic goods' that end up in the waste stream, to prevent their removal and disposal, and to 'valorise' or commercialise them through aggregating quantities, removing contamination, sorting by grade or type, storage, transport, and marketing. Recent research for UN-Habitat (Scheinberg, Wilson and Rodic 2010) suggests that informal recycling may already be recovering 15-35 percent of generated waste in cities in low-and middle-income countries (Scheinberg, Wilson and Rodic 2010)[23]. In these cities, recycling forms the livelihood of hundreds, sometimes thousands of individual and family-based entrepreneurs, who form the base of the recycling supply chain pyramid (Chaturvedi 2007, IFC 2008, Simpson-Hebert, Mitrovic and Grajic 2005).

Over the past two decades we see a modernisation process entering urban centres in low- and middle-income countries, where Northern practices and systems of integrated solid waste management are introduced as global best practice. To what extent do these modernisation processes interfere with and change the largely informal recycling systems in the urban centres in low and middle-income countries? Do these formal modern systems and the informal recycling systems mix? And what are the consequences for the people for which informal recycling forms a major livelihood asset? We will explore these questions through information gained in a 2006-2007 study of formal and informal recycling and solid waste management in six urban centres in low- and middle income countries. Before reporting on these cities and their (mixed) formal and informal systems of managing waste, we will first elaborate a perspective of modernised mixtures.

2 Modernising recycling infrastructures: the concept of 'modernised mixtures'

Modernisation is a heavily contested concept in the social sciences, with a variety of interpretations and normative connotations. It ranges from 'modernisation as westernisation'[24] to reflexive

[23] Based on research in 20 high-, middle, and low-income countries for UN-Habitat in 2010, and the six cities reported on in this study. The range is large and depends, among other things, on how cities divide the waste stream between household (hh) waste, commercial and industrial waste; construction and demolition waste; agricultural waste, and other streams. Moreover, cities measure amounts of waste at different points and in different ways; these percents follow the cities' own claims and ways of measuring.

[24] This connotation was also the subject of much of the literature criticising modernisation, such as the work of Bauman (e.g. 2004) and of many anti- or de-modernisation scholars such as Jacques Ellul, Otto Ullrich, and Lewis Mumford

modernisation, where the side-effects of simple 'western modernisation' have become the key subject for furthering (modern) change (Beck et al., 1994). Modernisation in the literature debate and praxis of urban infrastructures often resembles the first connotation of 'modernisation as westernisation': the further development/modernisation of socio-material infrastructures along lines of centralisation, advanced technologies, larger scales, more market involvement and stronger relying on expert systems. But during the last decade a much more reflexive notion of modernising urban infrastructure has been developing, which focuses on the relations of socio-technical systems and their users.

Scholars of reflexive modernisation, who have been studying developments in public utilities that provide energy, sanitation, and water services in North-western Europe, suggest that a fundamentally new model of modernisation is emerging, which can be formulated as 'modernised mixtures' (Spaargaren et al, 2005; Hegger, 2007; Scheinberg and Mol, 2010). 'Modernised mixtures' refer to socio-technical complexes of infrastructures, institutions, and payment systems which combine large-scale, centralized, high-technological, low citizen-consumer participation models, with small-scale, decentralized, less technologically advanced and more participative models. The mixing of elements and characteristics from contrasting models provides socio-technical infrastructure adapted to specific circumstances and needs and with a range of client choices and payment options. In Europe, it appears that these systems represent a reflexive and deliberate response to the challenge of a changing social, economic and environmental context and a more varied demand for different levels, types, and intensities of service (Hegger, 2007:48). Pluralistic combinations of economic actors offering a variety of technical solutions respond to growing demands for improved environmental performance, higher levels of client participation, increased competition associated with de-regulation and liberalist politics, and new insight on economies of scale.

In the electricity sector, for example, highly centralized, large technological power plants exist alongside the growing number of medium-scale co-generation and wind energy installations, housing-estate level solar installations, and household-level self-provisioning initiatives for solar, wind, and micro hydro power. Institutional and economic diversity follows this technological mixing, and results in changing ownership and financing systems, an increasingly varied resource base, varied systems of participation, new consumer roles, and differentiation in levels and types of services (van Vliet 2002: 110-116). In Northern countries the processes that produce modernised mixtures are closely associated with deliberately and reflexively re-configured ideals and processes of "greening." (Hegger 2007: 48). The message is that "modern" does not necessarily mean large, centralized, high technological, and hidden from consumers and clients. Advanced modern systems can achieve effectiveness through innovative institutional arrangements, financing mechanisms, participation, resilient technologies and decentralised structures.

The early research pointing to the mixed modernity products has been concentrated in North-western Europe (e.g. van Vliet 2002, Hegger 2007, Scheinberg and Mol 2010). But such modernised mixtures also appear to have value as a development model in low- and middle-income countries (Spaargaren et al, 2005). There, large scale, high-technology, formal, centralized infrastructure, often imported from developed countries, fails to perform in the short term. Over the longer-term, lack of sources of spare parts, equipment, and qualified personnel creates structural patterns of over-capitalisation and under-performance (Wilson 2007, Scheinberg, Wilson and Rodic 2010).

Where delivery systems for sanitation, water, energy, and cleansing services in Africa, Asia, and Latin America function well, they often consist of a kind of patchwork set of initiatives of public, private and NGO actors which look surprisingly like the modernised mixtures now emerging in Europe. This suggests that advancing the project of modernising and upgrading these systems in a sustainable way involves adapting socio-material infrastructures to the specific local situation, rather than copying the large-scale systems that have dominated western service provision during the former century.[25]

[25] 'Parallelism' means that competing options or paths in both formal and informal sectors exist for materials at the same place in the chain. In contrast, 'mixing' refers to situations where formal and informal waste and recycling processes are integrated or complement each other. Both parallelism and mixing contribute to what we have labelled 'modernised mixtures.'

Pluralistic structures based on parallelism and mixtures of providers and technical approaches appear to be critical to sustainability, resilience, and affordability.

Multi-provider and multi-model systems are increasingly advocated in solid waste collection services in developing countries in much of Africa, Asia and Latin America, often under the heading of 'pro-poor Public-Private Partnerships (PPPs)', micro-franchising, and the like (Ishengoma and Toole 2003, Slater, R., et al 2007). Recycling, resource management, and valorisation of waste materials and items found in the waste stream, represent a more confusing picture in low- and middle-income countries. Unlike collection service, the business model for recycling relies on income from trading materials. In developing countries, the informal sector is a principle source of materials for the recycling supply chain.

While the literature and experience on high-performance recycling in Europe and North America has blossomed since the 1980s, relatively little is known about the recycling systems and their relationship to solid waste management in low- and middle-income country cities. This paper seeks to contribute to the knowledge base, by focusing on four research questions.

1. What can a focus on informal recycling tell us about present and future recycling in low- and middle-income countries?
2. Is informal recycling integrated in solid waste service delivery?
3. Do informal waste recycling activities form a separate system from formal, municipal and private sector recycling initiatives?
4. Or, to put it in our conceptual model: do we see a modernised mixture emerging in urban recycling in low- and middle-income countries, and how does that new model look?

3 Methodology: analysis of city level waste flows

Six urban centres in different continents form the empirical focus of this paper. They were selected as part of the tendering process for the 2006 study entitled "Economic Aspects of the Informal Sector in Solid Waste, which was co-financed by GTZ (German Technical co-operation, Deutsche Gesellschaft für Technische Zusammenarbeit GmbH) and the the CWG (the Collaborative Working Group on Solid waste Management in low- and middle income countries)[26]. GTZ in particular designed the tender for the study based on the need of its engineers, working all over the world in developed and transitional countries, to understand this informal sector better, and to know how to respond to it in the face of their combined technical improvement and poverty alleviation mission.

The methodology combined secondary data collection, literature search, scientific extrapolations, and approximations and modelling.[27] So little was known about the sector that it was necessary to define it before the study could begin. 'Informal' was defined as private sector activity which is neither sponsored, paid, nor recognised by the formal waste management authorities as being part of the waste management system. This differs from the economic definition of informal, which is unregistered, and not paying taxes. Some of the 'informal' recycling businesses are registered, for example, as transport or construction companies, but they do not have the permits or recognition necessary for operating within the waste system.

The selection of the cities was subordinated to the selection of local partners who had good relations to both the local authority and the community of people earning livelihoods in informal waste services and recycling. While not strictly representative in statistical terms, the cities do differ in size, continent, and economic level, as shown in Table 9. The partner-based approach was designed to ensure that insights gained from this study would have an institutional home in the cities themselves, enabling and facilitating improvements of recycling in each city.

[26] The tender called for selection of three cities, but the team selected was able to co-finance three more.

[27] The field work and primary data analysis were done in 2006 and 2007 and reported in the draft research report referenced here as GTZ/CWG, 2007. After a delay of three years, measures are being taken to publish that report in late 2010 or early 2011.

Process flows and materials balance modelling were used to analyse city level waste management and recycling, with a special emphasis on quantifying the activities and economic impacts of the informal sector. In each city the collection of field data involved a city stakeholder organisation, with deep knowledge and experience of, and access to both formal and informal solid waste system actors and data.

Table 9. Cities and local partners

City	Population	National GDP/capita (in $ per person per year) (2009)	City partner name	Type of organisation
Cairo – Egypt	17,620,580	6,147	CID Consulting	Private consultant with NGO daughter, specialised in social development, Public Relations (PR), education, and advocacy
Cluj-Napoca - Romania	380,000	11,755	Green Partners	Small private consultancy specialised on economics, carbon financing, solid waste
Lima – Peru	7,765,151	8,723	IPES	NGO institute with strong economic and technical focus on entrepreneurship
Lusaka – Zambia	1,238,227	1,544	Riverine Associates	Small private consultancy focused on solid waste, sustainability, governance
Pune – India	3,000,000	2,932	KKPKP	Union of waste pickers representing 10,000 waste pickers in the informal sector, primarily women
Quezon City (Manila)-Philippines	2,487,098	3,536	Solid Waste Association of the Philippines (SWAPP)	National solid waste association, municipal and private sector members, deep formal sector knowledge & connections
Source: Scheinberg, Simpson and Gupt 2007. Data on gross domestic product (GDP) from the website of the International Monetary Fund (IMF)				

Solid waste and recycling systems—including formal and informal elements and operations—were modelled in a process flow diagram (PFD) as shown in Figure 5 and Figure 6. A combination of process flow and material balance was used to understand the relationship between formal and informal sectors. A process flow requires a clear setting of system boundaries, to be systematic in inclusion and exclusion of activities and material flows. Starting at the household, materials 'enter' specific process steps. There are three possibilities for inputs to each process step:

1. materials are processed, in mechanical, thermal or other ways, and value is added or removed, and the largest percent of them leave the step as output and go into transport or another process step.
2. some percentage of the processed materials leave as residue destined for disposal which can be recorded or estimated at the point of exit and documented at the point of disposal, and/or
3. an additional materials needed for the materials balance simply disappear or are untraceable. The study treats this as a "loss."

Losses mostly consist of unrecorded discharge to air, land or water, by burning, evaporation, eating by animals, or dumping in ravines or in water, but methodologically the term simply means that their destination is uncertain and cannot be drawn in the process flow diagram.
Steps where materials are 'lost' are sources of potential environmental impact, and points where they are recovered and directed to recycling are sources of environmental benefit, either because of avoided energy or extraction costs, or avoided emissions that would have occurred during disposal or discharge to land or water.

The process flow approach used identifies process steps as 'belonging' either to formal or informal waste management or recycling. Using a process flow to understand the informal and formal recycling systems serves to map interactions, transactions, and linkages between formal and informal activities, actors, and steps in the chain of removal, processing, valorisation, or disposal. The mapping gives a visual representation which becomes the basis for a background input/output and pro-forma financial analysis of all the major identified steps in the system. Following the flow of materials also allows mapping of transactions, interactions, and the probable flow of money, but the basis is the

movement of materials, modelled in tons. A PFD models transactions as well, making it possible to understand points of intersection between formal and informal sector and the degree of parallelism and mixing in the systems.

Adding a mass balance to the PFD adds the capability of using these tons as the basis for environmental impact analysis. In the study, a carbon footprint analysis for formal and informal sectors approximates the global environmental impacts, while local impacts are unfortunately neither measured nor analysed. More importantly for purposes of this paper, the movement of tons provides a convenient and convincing medium for analysing the degrees of mixing and parallelism in the system.

In order to compare costs and efficiencies between different operations, and for the system as a whole, costs were added as a third dimension to the PFD and materials balance analysis. A pro-forma economic model for each process step was made, using standard business model parameters: labour, capital and operating costs of equipment, maintenance, fuel, water and electricity use, and the like. The economic analysis of costs of process steps was based on a 'typical cost of one' approach. In each city, process steps were analysed as business units, and the system analysis was based on how many typical versions of that step exist, usually based on size and scale. For example, in Pune three types of junk shops were identified: small, medium, and large. For each type we calculated an adapted pro-forma costs and an input - output model, to arrive at the 'typical cost of one'.

Typical tonnages were used to produce a cost per ton for each 'process step'. This cost per tonne was then a key input into the overall cost model for the city.[28] The aggregation process then involved modelling the 'passage' of materials through each process step, and 'directing' them to their possible outputs, multiplied by the total number of such process units.

This PFD approach is useful for distinguishing between parallelism and mixing. For example in Lusaka, shown in Figure 5, formal collectors compete with informal collection service providers to collect waste from households; in the same way in Lima informal waste collectors on tricycles compete with formal collection systems for service fees, at the same 'step' in the process flow.

4 Recycling and organics management in low- and middle-income countries: insights from the study and what they tell us.

In investigating recycling systems in low- and middle-income countries, we analysed a number of key characteristics of recycling and recovery systems in the six case study cities.

4.1 Composition and quantities

The environmentally-driven ecological modernisation of solid waste in the EU and North America frequently serves policy goals for "municipal recycling" for diversion of 50% of waste and above (Scheinberg, Wilson and Rodic 2010). This is increasingly being presented as a requirement or necessity in cities in low- and middle-income countries. Table 10 suggests that the waste stream in the six low- and middle-income cities would support goals as high as 80%.

The quantity and composition of domestic waste makes improved recycling ('valorisation') highly attractive. The on average 2.3 kg domestic solid waste generated per household per day in the six cities contains relatively high percentages of both organic wastes and non-organic recyclables, which are suitable for valorisation. Table 10 presents the percentages of these key materials. The organic fraction averages 50%, and is above 45% (by weight) in all six cities. Recyclable non-organic types of

[28] Because of the crossing of materials between formal and informal sector, and the iterative nature of the informal recycling process, this cost per tonne per process step was the only one which appeared to be reliable. The systems are iterative because some materials pass a stage in processing more than one time. A PET bottle that ends up at the landfill may they be extracted, and then washed, and reused. This means that while it is possible to understand tonnes entering the system, as well as tonnes passing through each step, it is not possible to understand how many times each of those tonnes 'goes around.' This is actually a key problem with the process flow methodology.

waste represent at least 20% of waste, on average 32%, and in Quezon as much as 39%. The category 'other' is likely to also include recoverable materials, specifically sand and grit from floor and yard sweeping that are valuable inputs for urban farming (Lusaka), and construction and demolition waste in all cities.

Table 10. Recyclable materials and organics in the six case study cities.

City	Paper	Plastic	Glass	Metal	Recyclables	Organics	Other	Total
Cairo	18%	8%	3%	4%	33%	55%	12%	100%
Cluj	20%	8%	5%	3%	36%	50%	14%	100%
Lima	13%	11%	2%	2%	28%	52%	20%	100%
Lusaka	9%	7%	2%	2%	20%	40%	40%	100%
Pune	15%	13%	1%	9%	38%	55%	7%	100%
Quezon City	17%	16%	3%	3%	39%	48%	13%	100%
Average	15%	11%	3%	4%	32%	50%	18%	100%
Source: Scheinberg, Simpson and Gupt 2007.								

The insight from this is that when cities face policy-driven recycling goals, they can often go a long way to meeting these goals simply by including informal private sector recycling in their tallies. This is important because informal recyclers, operating purely on their own, are more likely to recover household waste than formal private recyclers, whose focus is on higher-value commercial streams.

High average numbers of persons per household and high densities of households per km2 (see Table 3) provide good opportunities for waste recycling and recovery. The high incidence of private buying activities of itinerant waste buyers (IWBs) confirms latent demand, and the ability of the value chain to absorb and pay for more materials. This is the basis for economic feasibility of source separation and separate collection. The final column in Table 11 confirms the presence of substantial recycling activity in these cities, which exist prior to the growth of city ambitions for intensified resource management and a 'greening' agenda for solid waste. The economic power of the recycling supply chains are largest in Lima, Cairo, and Pune. Lusaka has less than a million Euros in recycling sales per year[29], and Cluj—a much smaller city—just over two million.

Table 11. City-wide activity in recycling and solid waste

City	Tonnes/ year	Waste generation rate (kg/ capita/ day)	Waste generation rate (kg/ household/ day)	Persons per household	Households per km2	Total annual sales to recycling value chain (€1000 /year)
Cairo	3,454,996	0.7	3.3	5.0	560	26,337
Cluj	194,458	0.7	2.3	3.3	649	2,462
Lima	2,725,424	0.7	3.1	4.3	643	55,678
Lusaka	301,840	0.5	2.6	4.9	702	471
Pune	544,215	0.3	1.5	4.6	4605	15,831
Quezon City	623,380	0.3	1.1	4.5	3418	7,077
Average	1,307,386	0.5	2.3	4.4	1763	17,976
Source: Scheinberg, Simpson and Gupt 2010, and supporting data and excel baseline workbooks						

[29] This column includes both formal and informal sales into the recycling value chain, but data doesn't provide a basis for distinguishing them. So this is not a measure of informal recycling activity, but of how active the recycling sector in the city is.

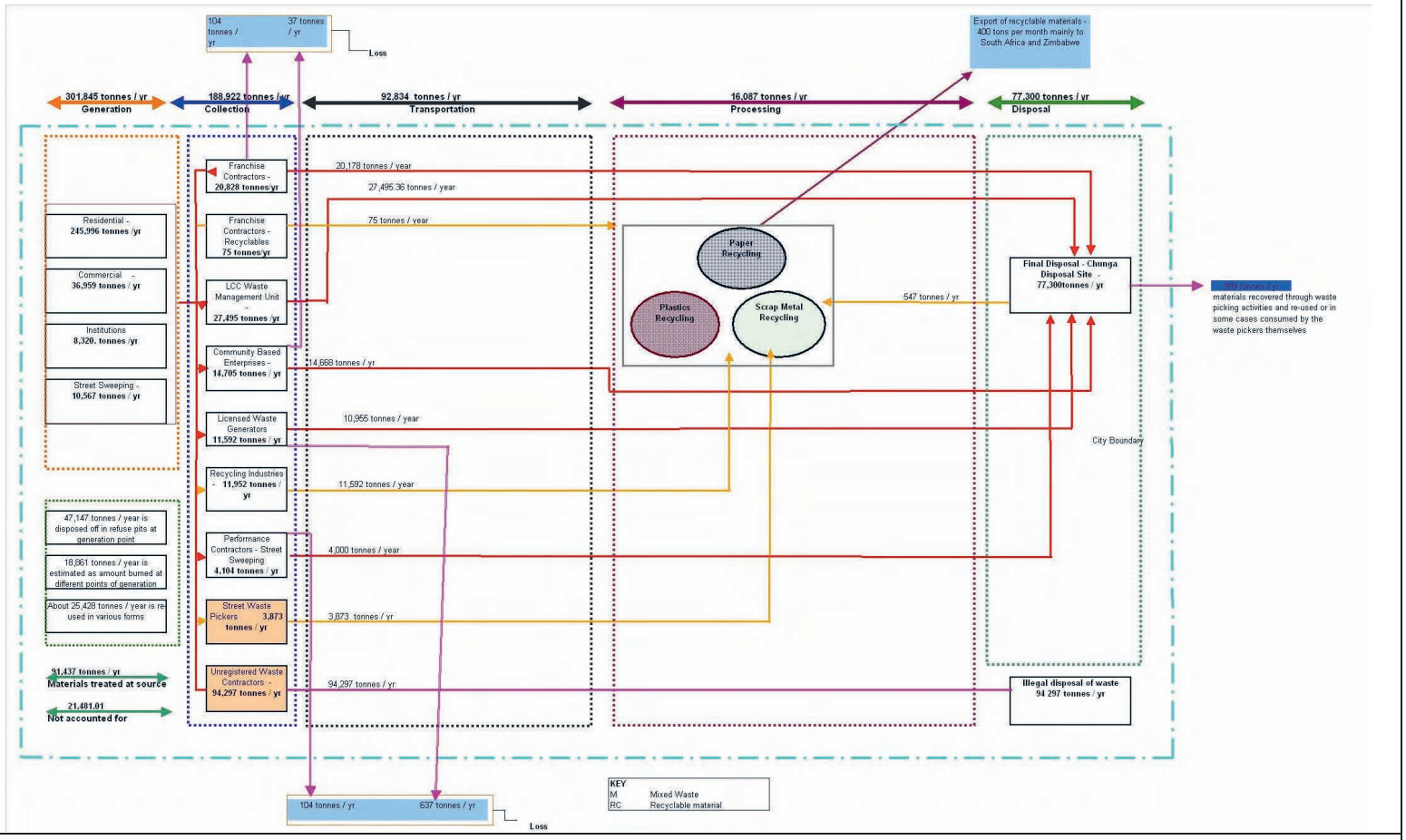

Figure 5. Process Flow Diagram for Lusaka, Zambia. Source: Riverine Associates, Scheinberg, Simpson and Gupt 2007, Annex 6.

4.2 Informal sector in urban recycling

Most recycling in the six cities occurs on a commercial basis and is organised by private entrepreneurs, some of them in the formal sector others in the informal sector. Table 12 shows that in five of the six case study cities (with the exception of Lusaka), private informal recycling is responsible for more than half of the valorisation activities; in Pune for 100%. This is explained by the fact that private informal recycling actors collect only the materials that they (expect that they can) valorise, to earn income from them. In contrast, formal system actors are mostly paid for removal services. Recycling rates above 20% can be credited to the informal sector, except in Cluj, where informal recycling is a part-time seasonal informal activity and formal recycling is growing rapidly in relation to requirements of the EU. The other exception is Lusaka, where – as in much of Eastern and Southern Africa – recycling market opportunities outside of the metal sector are weak[30]. In Cairo and Quezon, informal swine feeding competes with formal organics management via composting[31].

Table 12. Material recovered by the formal and informal sector, as percent of waste entering the system

City	Formal		Informal		Combined		
	Entering formal system via household (hh) primary collection or containers	% recovery	Entering informal system via IWBS, waste picking	% recovery	Total entering both systems	% recovery overall	% recovery by informal sector
Cairo* **	810,677	45%	2,567,142	84%	3,377,819	75%	64%
Cluj*	145,779	6%	14,575	100%	160,354	15%	9%
Lima	1,839,711	1%	848,364	62%	2,688,075	20%	20%
Lusaka	90,720	13%	98,170	6%	188,890	9%	3%
Pune**	394,200	0%	132,130	89%	526,330	22%	22%
Quezon City	489,606	3%	141,831	100%	631,437	25%	22%

Source: Scheinberg, Simpson and Gupt 2010. *Based on part-time informal sector activity of 50 days/year. **Formal recovery in Pune is zero. ***Cairo is a special case, since the informal waste collection service is actually geared to recovery, but via a mixed waste collection system operated by the Zabbaleen.

Informal recycling activity in the cities is dominated by family and micro private enterprises who have entered the sector because it provides reasonable levels of income, in spite of having low status. The six cities, with a combined population of 32.5 million in 2006, count about 74,000 informal waste sector workers, mostly working in recycling, without including the family members who work on processing materials at home. On average this is about 0.23% of the population, as shown in Table 13. The recycling system in Lusaka consists of around 500 informal individual and family enterprises, plus an additional number of formalised or recognised micro and small enterprises, community-based organisations, and NGO initiatives. In Lima 17,000 people live from informal recycling, of which about one third are involved in swine feeding. In Cairo as many as 40.000 Zabbaleen collectors and recyclers collect, sort, process, and sell recyclables and – in 2006 when the research was done – were producing pork from organic waste. These informal sector recyclers earn livelihoods comparable to or above the national minimum wage, even in situations where recycling is not yet an interesting greening activity for public authorities.

[30] Lusaka is representative of many cities in Western Eastern, and Southern Africa outside of South Africa, in having a weak value industrial chain with few intermediate steps. The result is limited demand for materials via private-to-private transactions in the region; this limited demand translates into a relatively small informal recycling sector, something that is also to be also seen in Dar es Salaam, Bamako, Dakar, Lilongwe, and other cities. South Africa, Nigeria, Ghana, and Zimbabwe are notable exceptions.

[31] Swine feeding in Cairo was widely present in 2006, but ceased by government order in 2009 when the government ordered all pigs slaughtered due to their fears of an epidemic of 'swine' flu. At the time of this writing, the Zabbaleen are looking at other options for valorising organic waste.

Table 13. Numbers of individuals working in the informal sector in recycling and solid waste

City	Population (2)	Number of informal sector workers (1)	Percent of population	Average individual earnings (€) / day reported for persons active in informal sector (1)
Cairo	17,620,580	40,000	0.23%	€ 4.30
Cluj (50 days)	380,000	3,226	0.85%	€ 6.28
Lima	7,765,151	17,643 (6460)	0.23%	€ 5.40
Lusaka	1,238,227	480 (100)	0.04%	€ 2.03
Pune	3,000,000	8,850	0.30%	€ 3.29
Quezon	2,487,098	10,105	0.41%	€ 6.26
Source: Scheinberg, Simpson, and Gupt 2007. Socio-economic workbooks				
(1) This information comes from the process flow/materials balance modelling. The number of informals in Lima includes 6460 piggery workers in the agricultural value chain. The number in Lusaka includes 100 informal service providers (ISPs), paid directly by the households they serve, to collect waste and dump it				
(2) This information was reported in the surveys done for the socio-economic workbooks.				

Photo image 4. Landfill picking in Romania. Photo: Ciprian Popoviçi. Copyright WASTE and Green Partners.

These informal recycling sector entrepreneurs are working in six main types of activities, and at different points of the recycling supply chain:

- Itinerant waste buyers (IWBs) move along a route, and collect recyclables from households (or businesses). In the five "southern" cities there is a payment made or something bartered for these materials, while in Cluj households donate waste materials.
- Street pickers collect materials that have already been discarded by households. In some cases street pickers extract materials from household waste set-outs and/or picking up reusables or materials waiting for formal collection. In other cases street pickers remove materials from dumpsters or community containers or secondary collection sites.
- Dump pickers work and often also live on the landfill or dumpsite, and sort the disposed to capture materials not diverted by the formal sector, nor collected by IWBs or street collectors.
- Truck pickers as an occupation are informal members of formal sector waste collection crews, and ride with the trucks. They inspect the waste as it is loaded onto the truck, and separate out valuable items for sale. Truck picking as an activity is also done by formal crew members, see discussion below.
- Junk shops: small, medium or large traders of recyclables, usually for specific materials. Junk shop workers span the informal and formal sectors, and most likely there are many more junk shop workers in each city than found or reported in our research.

- ISPs (informal service providers). who also recycle. These are collection businesses that are paid directly by households for a removal service. They are included in this list of informal recycling occupations because some ISPs also skim materials for recycling. While ISPs exist in all cities, in Lusaka and Cluj they do not engage in any recycling activities and the materials they collect are not recycled nor used for animal feed, so there is no recovery percent associated with that activity.

Informal service providers (ISPs) are the other part of the informal sector – they perform the service of removal, and do not focus on recycling. Most ISPs are street sweepers or waste collectors. Although as service providers ISPs are not the focus of this paper, they are included here because in several cities, ISPs have started to recycle as part of an integration initiative to improve informal livelihoods. Lima follows a model initiated in Belo Horizonte, Brazil, of creating hybrid ISP-Recyclers, supplying vehicles and equipment to informal recyclers, and giving them access to fixed collection routes, where they have official roles that allow them to collect waste and extract and sell recyclables, but do not receive any wages for the services (Dias, 2000). This model is increasing in popularity in India, and was being introduced in Pune at the time of the research.

Table 14. Informal sector collection of recovered material in the cities, by type

City	Total tonnes recovered by the informal sector	"Skimmed" from collected waste by ISPs (informal collection service providers)**	By IWBs	By street collectors	By dump pickers	By other informal occupations, including truck pickers and hybrid ISP-recyclers
Cairo *	2,161,534	100%	-	-	-	-
Cluj	14,575	-	2%	40%	58%	-
Lima	529,370	7%	27%	30%	6%	30%
Lusaka	5,419	-	-	71%	29%	
Pune	117,895	32%	34%	-	10%	24%
Quezon	141,831	-	72%	16%	8%	4%

Source: Scheinberg, Simpson, and Gupt 2007, supporting data and excel baseline workbooks. Information is based on secondary sources, experience, and observation in the cities. *Cairo is a special case, since the entire informal waste management system is actually geared to recovery, but via a mixed waste collection system operated by the Zabbaleen.

4.3 Modernised mixtures: parallelism and mixing of formal and informal sectors

The process flow methodology assists us to understand and analyse parallelism and 'mixing' of formal sector and informal sector processing of 'waste'. Different forms of parallelism and mixing can be observed for different materials at different points in the flow of materials in the six cities. For organic waste and paper there are competing ('parallel') paths; that is, the point of origin is the same but both transport and use are different, sometimes also in time. In all cities, organic waste goes through a mixed system. In Cairo and Quezon City, for instance, formal composting competes with informal swine feeding. In all cities some households also use kitchen waste to feed animals in their homes or villages, and this waste never enters the formal collection system. In Cluj households burn paper and other combustibles in small wood stoves in the winter, but 'donate' them to informal recyclers in the summer, mixing of end use that is time-related. This suggests that mixing and parallelism thus occur also within the informal (and formal) sectors, and not only between them.

Analysing the paths of materials reveals transactions and relations between different stakeholders, and relations between formal and informal systems. Information on mixing

and parallelism are important entry points for improvements. The Lusaka PFD in Figure 5 shows that what appears to be a 30% loss of Lusaka's waste (to be seen at the lower left part of the PFD) does not in fact leak into the environment, but is collected by informal service providers – most of whom bring it to the formal dumpsite at Chunga.

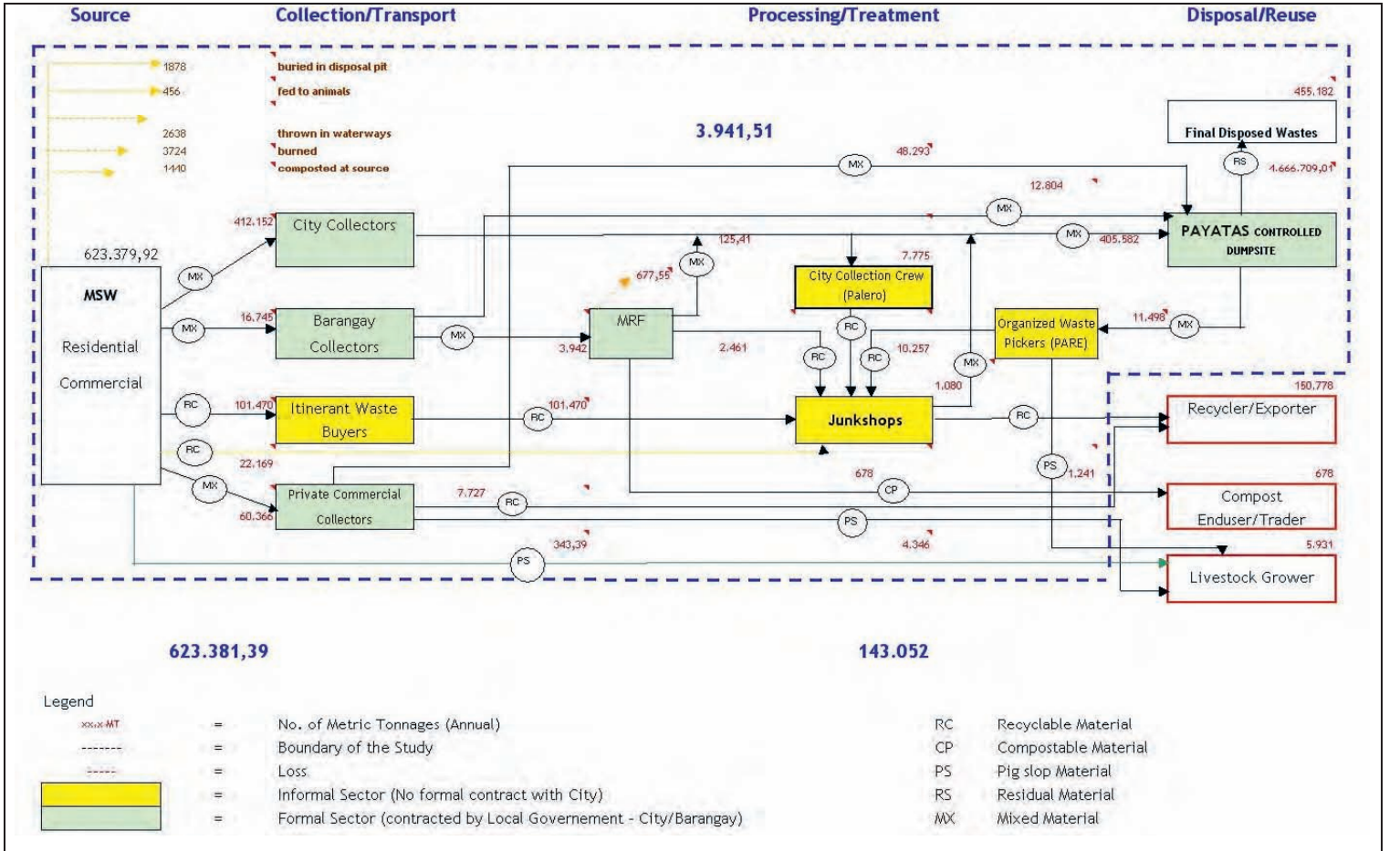

Figure 6. Process Flow Diagram for Quezon City, part of Metro Manila, Philippines.Source: Scheinberg, Simpson and Gupt 2007, Annex 6.

Understanding this fact was a by-product of Lusaka's participation in the study, and influenced the city's attitude towards – and recognition of – the Lusaka ISPs[32].

The process flow for Cluj-Napoca, Romania indicates that households are highly selective in what they do with their materials, choosing informal paths for organics, clothing and recyclables, and formal paths for mixed waste. Supplemental interviews provided an explanation: residents feel a direct social connection with the itinerant waste collectors taking clothing, metal, and reusables, while they feel no connection with the informal waste pickers extracting 'their' metal and cardboard from the containers placed by formal authorities (Stanev, Verart and Popovici 2004). This signals that the system for metal and cardboard could be improved by moving separation upstream, building on existing household experience in source separation.

The process flow diagram for Quezon City, shown in Figure 6, highlights the role of the Materials Recovery Facility (MRF) as the only formal recycling institution inside the city boundaries, and the point where many formal and informal recovery activities converge. Materials from both formal collectors and itinerant waste buyers come together at the MRF. Informal junk shops buy materials both from the MRF and from organised waste pickers from the Payatas dumpsite. The MRF also sorts for organic materials which go to composting. MRFs with composting have a far lower cost per tonne of waste than MRF's without composting.

In Quezon City, parallelism within the formal sector means that there are three separate formal sector paths for non-separated materials to move from households and businesses into the waste system: via city collectors, via Barangay collectors, and via private commercial collectors. And there are two informal/semi-formal parallel paths for source separated recyclables to move to junk shops: via itinerant waste buyers on the one hand, and by households and businesses selling their own materials ('self-haul' or 'buy-back'). Introduction of source separation in these three formal sector paths would be following the precedent set by the informal sector. Not only would it likely produce more and better recycled materials, but there is an opportunity for building an integrated source separation approach operated by informal collectors and facilitated and supported by formal recognition, monitoring and documentation.

Empirical data on waste flows in the six cities shows that the handling of materials involves extensive and structural cross-over between formal and informal handling, so that the two sectors can not be truly considered to be separate systems, but rather intertwined sub-parts of one large citywide waste and materials recovery system. One example of this is 'truck picking,' which occurs when formal waste collectors employed by the city or its waste contractor, 'skim' materials during formal waste collection, a process step clearly 'belonging' to the formal waste system. The collectors then have a range of both formal and informal paths for valorising the material. This is an example, then, of informal activity which occurs 'inside' a formal process step, and which can then lead to materials continuing in either a formal or informal circuit.

4.4 Costs, efficiency and fairness

Cost modelling of informal and formal sector waste collection and recycling provides insights into economic efficiencies and distributional issues. It helps cities to understand existing rationales, economic interests, and the livelihoods that depend on them. This represents a challenge to the claim that all cities need to 'develop' recycling towards a modernised municipal monopoly, which assumes – usually incorrectly – that no recycling is happening already[33]. Recycling planning can begin by analysis, and then focus on activities to improve the existing 'modernised mixture' structures and activities.

[32] Words and labels can be important in governmental perceptions. For example, the PFD for Lusaka shifted the perception of key stakeholders. They changed from calling the ISPs in that city "illegal collectors" to "unregistered informal collectors". This was reported to have played a role in shifting perceptions, and stimulating informal recognition and more favourable policies (Scheinberg, Simpson and Gupt 2007 Annex 6, Lusaka City Report, and the Addition Scenario Workbook).

[33] Whether this is the case or not is heavily dependent on the size and location of the city. In Eastern and Western Africa, for example, there is little end-use industry and so opportunities to valorise materials are limited Scheinberg, Wilson and Rodic 2010, . Smaller cities often generate too little waste (and what there is has too little value) to attract informal recycling activity.

Municipal monopoly interest in collection and recycling is often reported to result in criminalisation of waste picking, police harassment, or thug-like abuse of waste pickers and their families (Chaturvedi 2007 and 2009). The strong point of modelling costs in relation to the use of PFDs and materials balances is that it focuses the debate not on poverty, criminality or morality, but on the economic and environmental impacts of informal activities in the city waste management system and the win-win opportunities of mixed formal-informal waste recycling models.

Photo image 5. Semi-formal service provider collecting waste in the Maldives, 2009. Photo: Anne Scheinberg

While cost modelling results of the six-city study come with significant uncertainties and sometimes arbitrary figures, the overall picture provides clear indications of the size of economic benefits generated by informal recycling sector activities. These indications support earlier claims of the importance of informal sector recycling for urban livelihoods of a substantial group of citizens (Scheinberg and Anschütz 2007, Medina 1997, Chaturvedi 2007 and 2009).

Efficiency of recycling relates to value for the amount spent, but in the case of municipalities specifically to value to the local authority. While cost comparisons between formal and informal sector are difficult to make and more difficult to validate, there are a few specific observations and a very few formal-informal sector cost comparisons per tonne of waste handled that seem relevant (Scheinberg, Simpson and Gupt 2007, Annex 6).

Comparing ranges of costs in Lima, for example, shows formal sector recycling costs around €30 per ton, while informal activities costs range from less than €2 per tonne for dump picking to a high of €31 for transfer station extraction. Similarly in Cluj, formal recycling operations range from €5 to €40, and informal from less than €1 to up to €24. Looking back to Table 12, it becomes clear that in cities in low- and middle-income countries with a large informal sector, formal municipal recycling initiatives generally recover very moderate amounts of material[34]. When formal diversion of materials

[34] 'New' municipal recycling activities often look for the easy win, which is often metals. But metal recovery is also a quite developed and mature informal activity. So in order to claim the materials, the local authority often has to establish its claim. In the US in the 1980s, 'anti-scavenging ordinances' did just that: new laws criminalised traditional activity, making it a criminal violation for informal waste pickers to take recyclables that were set out for municipal collection (Scheinberg 2003, personal experience of the authors of this paper).

is low, even with moderate investments and operating costs produce very high costs per ton. The above examples suggest that with more data and more analysis it would be possible to say that informal operations generally cost less than formal ones.

4.5 Economic and environmental costs and benefits

There is also a significant degree of complexity in the allocation of costs and benefits from recycling in low- and middle-income countries, again a 'modernised mixture' in terms of who pays, and who benefits, from formal and informal recovery activities.

In formal recycling initiatives, the municipal authorities are paying (or indirectly subsidising) formal sector recycling costs, which are in their own budgets or paid via contracts, franchises, and the like[35]. Environmental costs of formal recycling, such as re-disposal of residues and pollution control at recycling facilities, are paid by the local authority (LA); some are also paid by neighbours and abutters to recycling facility sites. The authorities receive environmental benefits, and they may also claim the revenues. The formal sector is forced to compensate these environmental costs through payment of permitting fees, taxes, licenses, insurances, and clean-up costs of environmental disasters.

Informal recycling is 'pure' private activity, as is also the case with the formal private sector businesses 'higher up' in the industrial value chain. The waste pickers, junk shops, and IWBs pay their own costs, much of it with their muscles, and get (and live from) the economic benefits. In the same way paper packers and plastics molders pay their suppliers, process materials, and sell their products, and get the economic benefit – otherwise they wouldn't do it. Municipal authorities neither pay the direct costs, nor do they receive the direct benefits, as the materials revenues go to the private collectors and processors. They are, however, paying some indirect costs, for example reduced efficiency of formal collection when the collection crews devote time and energy to truck picking.

There is some discussion about whether recycling is a net environmental cost or benefit to the local authority (see, for example, Weinberg, Pellow and Schnaiberg 2000), but when the carbon impacts of avoiding disposal and the energy impacts of conserving resources are included, the balance is positive, which is why many countries and cities require recycling and diversion as part of their 'greening' initiative. The carbon modelling in the study shows that the highest carbon benefit is in avoided disposal, with significant benefits also accruing from the lower energy consumption of informal activities on the one hand, and the energy savings in the life cycle of materials and products on the other (Scheinberg, Simpson and Gupt 2007, chapter 7).

The environmental costs and benefits of informal recycling present a more complex and nuanced picture, because informal recycling generates both positive and negative externalities. While the financial rewards of private sector recycling go to the entrepreneurs, municipal authorities and their citizens receive significant environmental benefits from informal and formal private collection and recycling activities, primarily in terms of conserved resources, avoided disposal, and improved (global) carbon footprint. Informal recycling generates significant positive environmental externalities. Municipal authorities may lose environmental and economic benefits when private formal or informal recycling cease to function, either for market reasons or because municipal administrations in low- and middle-income countries prohibit them or claim rights to the materials. The materials revenues earned by the local authority seldom cover the costs associated with managing increased volumes of materials with a net result that direct municipal costs and/or environmental impacts increase.

[35] Extended Producer Responsibility (EPR) laws and policies change this, so that it is the producers of products or packages who pay the costs of recovery and can claim the environmental benefits. Thus in the European Union, a global leader in EPR policies and laws, the private sector co-organises recycling with the local authorities, and shares responsibilities, costs, and benefits. The introduction of EPR adds to the 'mixtures' in still another way. This has affected the situation in Cluj since the study was completed.

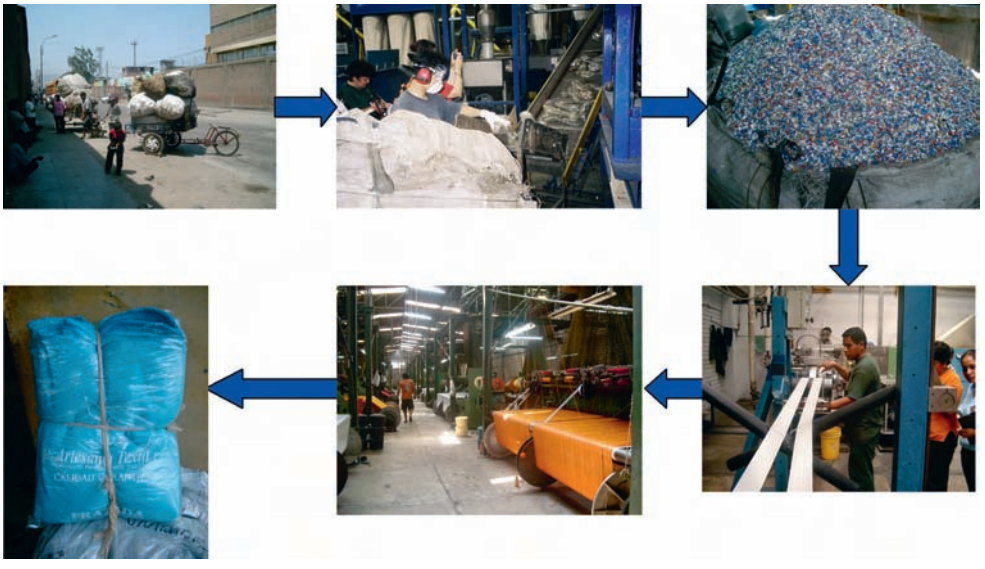

Photo image 6. PET bottles recovered and sold by the informal sector to the weaving industry that incorporates the recycled material into the weaving process for making textile products in Lima, Peru. Photo series: Jeroen IJgosse

But there are also environmental costs and negative environmental externalities of recycling activities, and the municipality and the citizens also pay for these – both directly and indirectly. First are operational costs: re-collection of residues from recycling, and the potential for diminished efficiency or loss of benefits of economies of scale in collection. That these exist are clear, but up to now it has been difficult if not impossible to measure them, also in the informal sector study. So they can be named, but not enumerated, in this paper. Secondly, there are negative environmental externalities relating to discharge of residues to land or water; air pollution and cardio-pulmonary diseases caused by burning as part of processing or extraction of metals; and pollution from sorting or processing in homes or informal areas. The municipality and the citizens share the costs of both of these with the informal entrepreneurs, who have the highest levels of exposure and personal impact. Here again, the study results allow them to be identified, but quantification and monetisation are key priorities for further research.

5 Conclusions

In relation to the main research questions in this chapter, we can conclude the following.

5.1 What can a focus on informal recycling tell us about present and future recycling in low- and middle-income countries?

A focus on the informal recycling sector, and use of a systems approach, tells us a great deal about recycling in low- and middle-income countries, because this sector is responsible for most of the recycling in those countries. Yet by definition the informal sector is left out of formal statistics, and out of official waste studies, so new methods of investigation are necessary. In terms of the amount of materials recycled, total net costs, and subsisting livelihoods of 'waste' workers the informal sector seems to outperform the formal waste management and recycling sector. The process flow/materials balance form of analysis is not perfect, but it shows well the relationships between the sectors, and the degree to which they are inter-linked. The six city study (Scheinberg, Simpson and Gupt 2007) has illustrated the value of the informal sector in current urban recycling in low- and middle income countries.

5.2 Is informal recycling integrated in solid waste service delivery?

The informal sector is partially separated from, but partly mixed with and integrated in the formal waste management system, a model we can label modernised mixtures. The informal sector is deeply connected at many points with the physical and technical elements of the formal waste management system. Informal actors are integrated in the flow of materials, and is a great deal of mixing of informal recovery activities with formal activities focused on removal; they complement each other in unexpected ways. Certain formal service activities have recycling sidelines, and informal valorisation has both positive and negative impacts on the solid waste service sector. Several forms of parallelism and mixing could be traced in the six cities, both between formal and informal sectors as well as between different material routes within each of the sectors. Regretfully, political and institutional integration does not automatically follow the physical integration, which puts well-functioning informal recovery systems at risk, but also provides interesting opportunities for improvement. Particularly hybrid activities, such as combining services of solid waste and recovery of recyclables, have important development potential.

5.3 Do informal waste recycling activities form a separate system from formal, municipal and private sector recycling initiatives?

Informal waste recycling activities are an essential and integrated part of private recycling in the industrial value chain, even when they are not connected to formal municipal recycling initiatives. The informal recycling sector fills a variety of unoccupied economic niches, recovering materials which are found in the waste stream – and therefore not already being recovered. Analysis of the six cities suggests that a substantial number of informal recycling activities exist primarily to feed the industrial value chain. They are in fact major suppliers of the lowest level of private formal processing institutions, the medium-sized junk shops. In this sense the informal recycling activities are fully integrated in the private industrial value chainIn most of the cities, the informal valorisation portfolio does include some uniquely informal commercialisation activities, such as valorisation of organic waste via swine feeding, or small-scale reuse and re-manufacturing.

5.4 Or, to put it in our conceptual model: do we see a modernised mixture emerging in urban recycling in low- and middle-income countries, and how does that new model look?

In low- and middle-income countries, there are significant parallel or competing activities within the informal and formal private recycling sectors, between informal and formal waste management sectors, and between formal and informal private, and public municipal recycling sector as. The vision of modernised mixtures provides a strong conceptual basis for designing integration initiatives that build modern, high--recovery recycling and organics management on productive, well-functioning informal recycling systems. Inclusive modernisation, building a modernised mixture, is a promising model for developing municipal recycling in low- and middle-income countries, where there are large numbers of experienced informals, and the room for improvement of processing and marketing is large.

In conclusion, we note that a strategy of building on modernised mixtures takes advantage of differences in experience, effectiveness, and efficiency between informal and formal recycling operations in seeking to upgrade and modernise waste management and recycling in urban centres of low- and middle income countries. In these countries, the relatively small margins for cost recovery from waste services means that municipalities have neither the knowledge nor resources to duplicate the monopolistic municipal recycling strategy used in developed countries in the 1980s to eliminate this sector and reduce their access to materials. Building on this model of modernised mixtures would be much more profitable—both economically and environmentally—than copying the experience in Europe and the Americas. The strategy for doing this requires careful analysis of the functioning systems in each city: the clear economic, geo-political, and cultural differences between our six case study cities confirm that it is the unique local circumstances that supply the specific elements of the 'right' mixture.

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- KKPKP, Pune, India
- IPES, Lima, Peru
- Green Partners, Cluj-Napoca, Romania
- Riverine Associates, Lusaka Zambia
- SWAPP, Quezon City, Philippines
- CID, Cairo, Egypt

Chapter 5: Multiple modernities: transitional Bulgaria and the ecological modernisation of solid waste management[36]

Abstract

In 1996, Bulgarian municipalities were facing practical impacts of the transition from socialism affecting their solid waste systems. Existing waste infrastructure and practices had to accommodate both increased quantities and types of waste and new EU performance norms. New demands, in combination with rising fuel prices, made ordinary operations unaffordable. Municipal managers searching for solutions joined with environmental NGOs and consultants in exploring alternative modes of modernising their solid waste systems, using models that deviated as much from Socialist-era traditions as from emerging EU waste management doctrine. This paper presents and analyses a selection of 17 small-scale, leading-edge solid waste modernisation projects, implemented between 1996 and 2008 in two regions in Bulgaria. Results and insights from these projects suggest that ecological modernisation in Bulgaria is a richer and more complex process than pure compliance with EU norms, having its own dynamics in relation to adaptation of EU blueprints.

1 EU accession and modernising waste management

From the mid-1990s onwards, the Bulgarian solid waste management system and infrastructure sector came under increasing pressure. By 1996, existing solid waste infrastructure and practices were proving ill-equipped to handle new materials entering the waste stream[37], the increased quantities of waste being generated, the new performance norms and standards for landfills and waste collection, and the financial consequences of the transition from socialism to a market economy (Donker, Scheinberg and van Neste, 2005: Skovgaard and Villanueva 2007).

This represented a complex problem for the publicly owned municipal waste companies, or "Chistotas,[38]" who were out of the line of environmental innovation, under-funded, and working with old equipment and assumptions. While socialist-era provisioning systems were very effective, covering almost all households and effectively removing waste from city centres, efficiency was never an operational value (Donker, Scheinberg and van Neste 2005, Hadjieva-Zaharieva et al 2003). The solid waste vehicles and systems from the pre-1989 period had low fuel and operational efficiencies and in an era of rising energy prices, this made ordinary solid waste management prohibitively expensive[39]. The hyper-inflation of the mid-1990s in Bulgaria exacerbated these problems (Watson 2000).

Changing ideas about service and the role of the "consumer" in the system, and the beginnings of a demand for municipal financial reform and effective cost recovery for municipal services created equally urgent pressure for change. The rhetoric of "customer service," "participation", transparency, and public involvement challenged governance and institutions, and threatened the legitimacy of traditional waste management approaches.

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[37] New materials came from new products entering the local consumer market for the first time; ferrous metal scrap and concrete and stone products in demolition waste from industrial and urban infrastructure that was being abandoned or retired; new domestic packaging such as product-specific packaging for meat, dairy, soft drinks, yogurt; changes in service, for example, the growing use of plastic cups for single-service coffee at coffee bars and cafés; ash from home heating stoves ("pechkas") to prevent increasing electricity and central heating tariffs; more glass due to the collapse of neighbourhood glass container buy-back for reuse kiosks.

[38] The term *Chistota* is used by many but not all municipalities for the municipal waste and public works and cleansing company. In this paper we use it to cover all variations of municipal companies.

[39] Particularly the chain-lift trucks for the 4 m3 containers were extremely costly to run, more than four times the cost per ton of the Rotring rotary compactors (field notes of the authors from 1997).

Finally, the first wave of preparations for Bulgaria's accession to the EU, which finally occurred on 1 January 2007, created extra pressure to modernise the solid waste management system and infrastructure. European and international standards of practice for environmental control and hygiene meant that municipal managers and politicians faced new norms for solid waste system performance, a new vocabulary of waste management, and an entirely new way of analysing the situation and setting priorities. The dumpsite should become a landfill with a liner and leachate collection to protect groundwater; it should have perimeter fencing and gate controls to restrict dumping of hazardous materials and a weighbridge for registering the loads and recovering costs of dumping. Open burning in dumpsters and at the dumpsite was now a source of air pollution and no longer welcome as volume reduction. Protective clothing, restrictions on lifting, controlled exposure to dangerous substances, and ergonomically improved tools were increasingly required to protect the health and safety of workers (Watson 2000, Wilson 2007).

The changing circumstances and increasing pressures confronted Chistota directors, deputy mayors, and city councillors sharing responsibility for financing and managing the waste management portfolio with the need to modernise the waste system[40]. The 'logical path for change' and the dominant discourse on the future of solid waste management looked to EU and US models for an advanced, professionalized, large scale, high-technology system of solid waste collection and state of the art landfill disposal (Scheinberg 2003). But officials also acknowledged that this model, although seductive, was beyond realistic reach in the short term. As an alternative, a small number of municipal managers opted to co-operate with NGOs and academics in an experimental approach to modernisation, moving in the direction of international good practices by experimenting with recycling, composting, micro-privatisation, and landfill upgrading. These NGO projects were funded by EU and US small-scale grant programmes and by the municipalities themselves; grants were written and implemented by a small group of inter-connected institutions, NGOs, and consultancy organisations. The projects generally had costs under US$50,000; affected a village or neighbourhood of several hundred to a few thousand households; and were designed to demonstrate feasibility, build capacity, and establish a modest base of experience with modernised waste management techniques.

What happened with these experiments and how important is it to understand them, now that Bulgaria has joined the EU? In investigating the viability of alternative practices and trajectories in Bulgarian solid waste management, we have analysed and evaluated 17 of these experimental solid waste management projects implemented between 1996 and 2008 in two regions in Bulgaria. But first, we present an analytical perspective on the ecological modernisation of solid waste systems.

2 Modes of ecological modernisation

In studying and analyzing processes of environmental reform, the ecological modernisation school of thought has emerged as one of a small group of dominant perspectives in the environmental social sciences. Ecological modernisation refers to 'modernising modernity,' along ecological lines, using ecological principles and perspectives. According to the ecological modernisation theorists, environmental reform processes take place through and with the assistance of modern institutions, including: science and technology; state and governance institutions; markets and economic actors; and modern belief systems and ideologies. In contrast to certain other perspectives on environmental reform, ecological modernisation theorists consider modern institutions to be key elements in the solution of ecological problems, rather than parts of the problem.

The idea of ecological modernisation initially developed in the 1980s in North-Western Europe (Mol, Sonnenfeld and Spaargaren, 2009); many of its conceptual formulations take on the characteristics of this specific time-space constellation. This Western European orientation came under increasing criticism during the second half of the 1990s, in line with many of the globalisation debates, as limiting the applicability and value of its concepts to non-West-European countries with

[40] The relationship between these municipal governance institutions is further explained in section 3

fundamentally different institutional dynamics of environmental reform (Mol, 1995; Blowers, 1997; Mol and Sonnenfeld, 2000).

Under conditions of globalisation, growing interdependencies and time-space compressions reduce the logic of studying national processes of (ecological) modernisation and social-environmental change in isolation. Fortunately, more recent studies have taken up the challenge to adapt ecological modernisation ideas to the study of processes of ecological modernisation outside of the North-western European context (e.g. Andersen, 2002; Mol and Sonnenfeld, 2000; Wilson, 2007; Lang, 2002; Barrett, 2005). This need for tools to understand ecological modernisation dynamics and processes in non-European regions and countries stimulated the articulation of the idea of modes of ecological modernisation that reflect a variety of cultural and national contexts (Mol, 2006). Analysing change processes as belonging to differing modes of ecological modernisation allows scholars to create a uniform perspective for understanding differentiated processes of environmental reform, even though they may differ in their specifics, in the pace of change, and in the mechanisms that bring it about. A wide variety of modernisation processes can then be understood as including ecological interests, perspectives and 'rationalities' in their development.

Most ecological modernisation studies outside Western Europe have focused on other OECD countries and a limited number of rapidly industrialising nations in (South-)East Asia and Latin America (Jepson et al., 2005; Mol, 2006; Sonnenfeld and Mol, 2006; Zhang et al., 2007; Oelofse et al., 2007, Scheinberg 2003). More recently the relevance of ecological modernisation for countries and regions with low or negative growth rates and thin and fragmented connections with the world network society been taken up as a pressing and theoretically challenging theme, resulting in a further elaboration of the idea of modes of ecological modernisation.

Research on the ecological modernisation of urban infrastructures, including sanitation, water, solid waste, and energy, in rapidly urbanising sub-Saharan Africa (Spaargaren et al., 2005), as well as on alternatives for centralised sanitation systems in western Europe (Hegger, 2007, Hegger and van Vliet, 2007), has been organised around the key concept of modernised mixtures. Modernised mixtures refer to socio-technical configurations of infrastructures in which a variety of features of (modernising) systems have been deliberately and reflexively reconstructed in response to the challenge of a changing social, economic and environmental context (Hegger, 2007: 48). Ecological modernisation as modernised mixtures relates to intelligent combinations or mixtures of simple and advanced technologies; small and large scale systems; centralised and decentralised control; public, private, formal and informal actors; citizen participation and professional management; and uniformity and diversity of systems. In the developmental context of African countries, modernised mixtures in solid waste management refer to an ecological modernisation strategy which is sensitive to and adapted for the specific circumstances of societies with fragmented urban infrastructures and ill-functioning health and sanitary practices and institutions (Ibid., Spaargaren et al., 2005).

Frames and ideas of modes of modernisation and modernised mixtures appear relevant to our investigation of the ecological modernisation of waste management in transitional Bulgaria, as a way of relating processes of ecological modernisation to the specific local (time / space) context in which they occur. This corrects the conceptualisation of ecological modernisation as a single process, inspired by north-western European developments and leading to a single set of outcomes.

3 Analysing Bulgarian solid waste modernisation

3.1 Context

Beginning in the mid-1990s, a number of small-scale experiments focusing on "greening" solid waste strategies and approaches were implemented in Bulgaria. These projects filled the gap between the disintegrating 'old' solid waste management system in socialist Bulgaria, and the perceived need to modernise all municipal operations. In transitional Bulgaria the ambition to join the EU, which

inspired interest in a modernised, EU-style solid waste management system, combined with growing recognition of environmental problems and imperatives. Both contributed to the recognition of the need to ecologically modernise solid waste management, and replace land burial with composting, recycling, and prevention. Activists and professionals working within non-governmental institutions of various types[41] formed "the edge of the wedge" of this recognition, and initiated a number of small projects to demonstrate techniques and benefits of modernisation. The initiators included:

1. activist or advocacy NGOs with a regional focus, a charismatic leader, and a core group of about 15-20 active members. These included EcoSouthwest in Blagoevgrad, and PECSD in Varna. The main implementing organisation, Environmental Youth Club Terra, located at the American University in Bulgaria (AUBG), was also registered as an NGO but consisted of a more diffuse leadership and a larger core group of students who organised and managed practical recycling operations at AUBG.
2. social development and Roma interest NGOs in Blagoevgrad and Sofia. These included EuRoma, a family-based NGO registered in Simitli (South of Blagoevgrad), and Kupate and Sega based in Sofia
3. NGO and private-sector consulting and project organisations in Sofia and Varna, including the Institute for Environmental Strategies (IES) in Sofia, a two-person post-donor consultancy registered as an NGO; the environmental firm CCSD Geopont-intercom in Varna, with a small staff and large network; and, after 2000, Geopont's associated NGO, the Institute for Ecological Modernisation (IEM).
4. The American University in Bulgaria, in Blagoevgrad, which played a relatively large role in co-financing most of the projects, through subsidizing student salaries for project work in its "work-study" programme; supporting faculty initiatives and involvement in the projects; and providing University office space, meeting rooms, and other infrastructure.[42]

The main focus of these projects was solid waste and recycling, and more specifically: micro-privatisation; village, community, and home composting; source separation and separate collection; strengthening of markets for recyclables; extended producer responsibility; strategic planning; waste prevention; household and community self-provisioning; and stakeholder mobilisation.

3.2 Setting for the Projects[43]

All of the projects investigated were sited in and co-financed by one or more host municipalities, whose municipal solid waste management institutions played an active role. To understand the projects, it is useful to sketch the way that solid waste is organised in Bulgaria, at the time of the projects and since.

Responsibility for solid waste was, and *de facto* still is, split between a number of main local governance entities in Bulgaria. The elected mayor, who heads the municipal administration, the executive arm of local government, delegates responsibility for solid waste to one specific deputy mayor. The deputy mayor supervises the Chistota, and manages the budget and operations, as the executor of policy set by the Council. When the municipal administration is under a mayor from a different political party than the Municipal Council, a common occurrence since the 1990s, there can be considerable friction when Municipal Council members with the waste portfolio involve themselves in executive functions.

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[41] The projects presented in this paper involved, with a few exceptions, Bulgarian environmental activists and young professionals studying or working at the American University in Blagoevgrad, Bulgaria (AUBG), and their networks in SouthWest Bulgaria, Sofia, the Balkans, and elsewhere. They were supported by faculty members, American NGOs, Dutch NGOs, and two environmental consulting firms, one in Sofia and one in Varna, Bulgaria. Most financing was via either the EcoLinks Programme of USAID (EcoLinks Programme of USAID 2000, EcoLinks Programme of USAID 1998), or the PHARE Programme of the European Union (PHARE Programme of the European Union 2004).

[42] This model of a university supporting a student NGO and faculty to participate in projects was not common in Bulgaria at the time, so it also had an important example function.

[43] Information in this section combines information drawn from project notes and a 2009 conversation with Mr. Lyudmil Ikonomov of CCSD Geopont-Intercom in Varna, Bulgaria.

The Municipal Council sets policy, collects fees and taxes, makes the annual budget, allocates resources to the Chistota, makes and executes contracts with private companies and the Chistota for services to residential and small commercial users. Businesses may make their own contractual arrangements for the service. There is often a Council Standing Committee specifically charged with solid waste policy and financing.

The Chistota, a municipally owned company, is the operational entity for solid waste. It does implementation, supervision, and daily control. Beginning in the mid-1990s, private companies entered the picture and shared or took over this function. The institutional mechanism for this is sometimes a contract with the Municipal Council, sometimes the purchase by private companies of shares in the Chistota.

The Planning Department makes master plans, multi-year plans, and is in charge of land-use planning, zoning, facility siting or closure, and related issues.

Each Bulgarian municipality has an environmental department, with at least one technical specialist usually called the "Chief Ecologist," who advises the Council in changing policy and practice (for example, designing and implementing recycling) and supports decision-making processes. The environmental department also has inspectors who inspect the work of the Chistota (or private contractors), and issue fines for inadequate performance.

Since the 1990s international donor programmes, exchanges, and grants have some influence on municipal waste decision-making. Perhaps for this reason the English-speaking International Projects Co-ordinator also has significant influence, particularly at the level of the Municipal Council and Deputy Mayor. Figure 7 gives a sketch of Bulgarian waste governance.

Bulgarian Waste Governance circa 2001

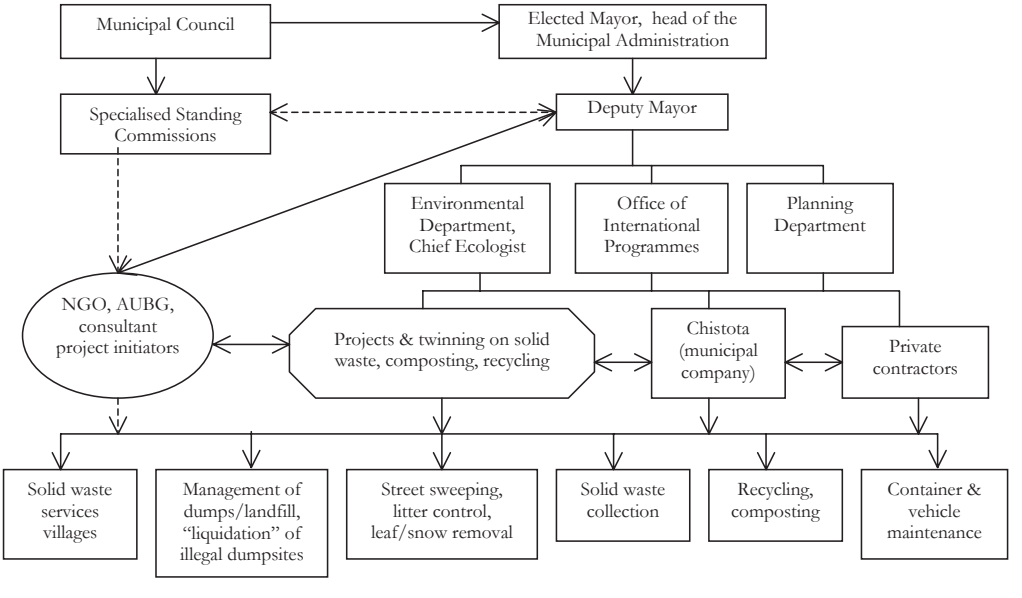

Figure 7. Bulgarian Waste Governance. (Source: assembled by the authors from project notes, and interviews. See footnote 43).

Solid waste is financed by the "*taxa smet*[44]", which is one of a number of local revenue sources paid directly by households and businesses to the Municipal Council. The Municipal Council decides both the cost pro mille, that is per BGN 1000 (leva) value of real estate, and the allocation of revenues to the Chistota budget, inspection, and other uses[45].

The specific organisation of operations differs somewhat between villages, municipal regions, and small an large cities. Villages in all types of municipalities are consistently under-served, relying on one or more "unofficial" dumpsite[46], and irregular visits of a collection vehicle to pick up heaped waste or empty an over-filled container.

The smallest setting for one of these projects was the municipality of Byala in Varna County, at that time a sleepy Black Sea fishing town with a number of low-key summer resorts and small hotels, five extremely rural villages, and a winter population of less than 2,500. There the mayor himself was directly involved in the project, together with the small but effective public Chistota.

Blagoevgrad, where the largest number of projects were sited, is a medium-sized university municipality of about 100.000 population, about a fifth of which are students at the large SouthWest University and the much smaller American University in Bulgaria. It is divided into a number of neighbourhoods – which function as waste collection zones – and includes four villages in its administrative region, one of which hosts the dumpsite.

Varna, the largest host in this group, with a population of about 360.000, is Bulgaria's third largest city and most important (Black Sea) port, and an industrial, maritime, and tourism centre. Varna consists of a main municipality with a mayor, several deputy mayors, a Municipal Council and five municipal regions, plus five semi-autonomous villages.[47] The landfill is across the border in a neighbouring municipality. Varna's sub-municipalities are served by private collection contractors contracted by the Municipal Council of Varna. These semi-independent solid waste operations operate under Varna's solid waste policy and plan, and use its landfill.

3.3 Methodology

This paper analyses solid waste management system as a system of provision, in parallel with (*inter alia*) energy, water, sanitation and transportation systems. Systems of provision are socio-material systems that provide citizen-consumers with services and goods. Solid waste management systems basically provide two services: the removal of waste to prevent health hazards, nuisance or environmental threats; and the recovery of materials and organic wastes, associated with separate collection, valorisation, composting and recycling.

In analysing environmental developments and changes in systems of provision, Spaargaren has developed a useful analytical model: the so-called social practices model (Spaargaren 2003; Spaargaren and van Vliet, 2000). The core idea behind this model is that changes in social practices – and in this case waste management practices, as shown in Figure 8 – can best be understood by analysing both the institutional system characteristics and the behaviour of actors. Social practices around solid waste – like other social practices – belong neither exclusively to the social structure and its provisioning system, nor solely to the social actors and their customs, perceptions and behavioural routines. Social practices should be placed – and thus understood – at the intersection between household (and commercial) users, and public and private-sector providers. Hence, to understand the logic of solid waste management, and especially to analyse changes in solid waste management practices and routines, we have to concentrate on relations between the systems of provision on the one hand, and

[44] *Taxa smet* is used here as a stand-in for several Bulgarian terms for solid waste fees and tariffs.

[45] During the period of most of these projects, up until 2004, the *taxa smet* was the only local revenue source over which municipalities have full taxation authority. Since 2004, it is required that funds raised from the *taxa smet* go into a dedicated fund for solid waste purposes

[46] Unofficial dumpsites are nevertheless recognised and regularly visited by health and environmental inspectors.

[47] The governance structure for regions and villages has changed several times since the mid-1990s, with regional and village mayors being sometimes elected, sometimes appointed by the party in power; some but not all have a staff and/or a mini-Council.

the users of the system on the other. This analytic frame provides the methodology for our analysis of the Bulgarian projects.

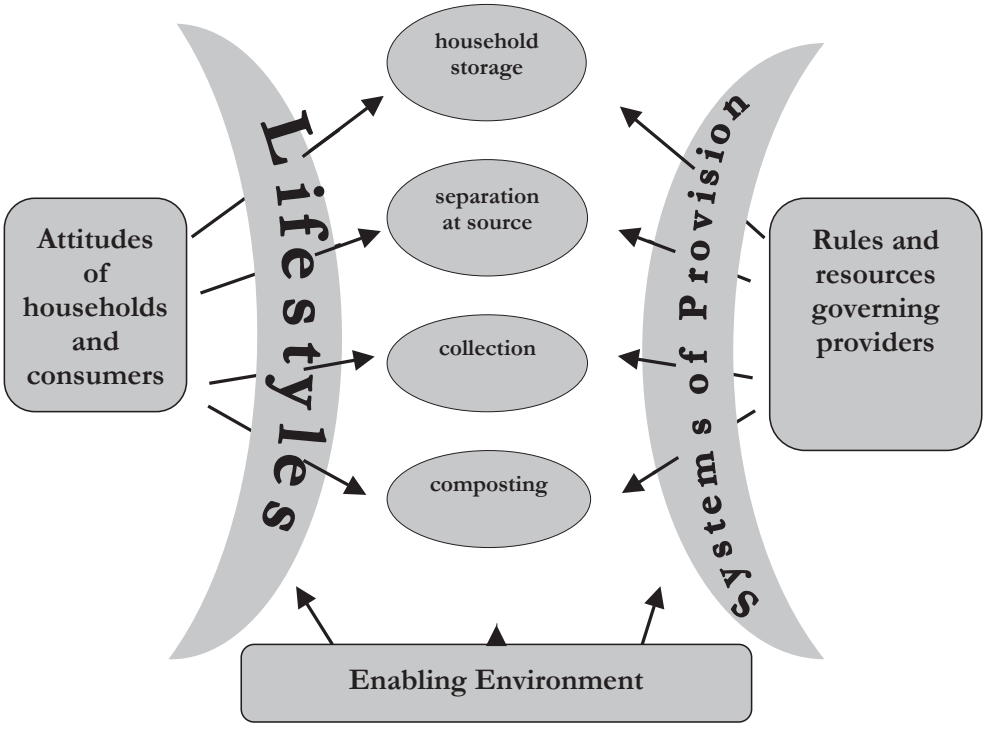

Figure 8. Social practices model for solid waste management (Source: adapted from Spaargaren 2003; Spaargaren and van Vliet 2000).

In analysing solid waste projects, we aim first to understand what mode of ecological modernisation is (successfully) at work in solid waste management in transitional Bulgaria – in terms of the kind of actors and institutions involved, and the processes through which change is sustainably established (Mol 2006, p. 34-35). Secondly, we are interested in the lessons that these projects offer for a 'one-size-fits-all' EU modernisation process, which is actively introducing large-scale, high technology, centralised, market managed socio-material infrastructures in Bulgaria.

For our analysis we selected 17 of these solid waste innovation projects, located especially in two regions: in and around Blagoevgrad, Southwest Bulgaria, and in and around the city and region of Varna, on the Black Sea Coast. The projects were investigated through project documents and interviews with project participants, supplemented by feedback from staff and clients of the provisioning organisations. The distinguishing feature of these projects as a group is that they borrowed principles of integrated solid waste management from Western Europe and North America, adapted these to the local situation, and tried them out in practice, actively searching for Bulgarian approaches and solutions. Hence they could be interpreted as fitting the framework of modernised mixtures. As such, the projects offer a direct contrast to the large-scale, top-down investment programmes which promote an EU standard modernisation approach to solid waste management, introduce international norms, technologies and financial schemes, and pay little attention to local conditions, opinions, or realities.

The main criteria for identifying the projects as successful include: the extent to which they continue beyond the time period of the project, the ways in which they influenced user behaviour and/or

provider systems during and after the project; and the degree to which they changed existing models of solid waste management. A few of these 17 projects succeeded and are still continuing; about half succeeded during the active project period but then stopped functioning or disintegrated afterwards; a very small number failed during the project period. Both the successes and the failures are interesting and provide useful experiences and insights in the search for a modernised mixture path to improved environmental performance and ecological modernisation of the solid waste sector in Bulgaria.

Photo image 7. Children picking cardboard from the street in Blagoevgrad, Bulgaria, 1999. Photo: Rogier Marchand.

4 Solid waste management projects in Bulgaria

The 17 projects – the actors involved, the stated goals and their results – are briefly presented in Table 15. The earliest projects consisted of practical and strategic projects on waste prevention, paper and plastic recycling, source separation of ash, glass, and organics, small-scale and village composting, and micro-privatisation of street sweeping. Later initiatives moved more into planning, and the most recent projects had a focus on supporting household and community self-provisioning and influencing the governance and policy context. Specific projects operated at a variety of institutional levels:

- municipal level: affected operations for the whole municipality, or for a facility (like a dumpsite) serving the entire municipality
- sub-municipality level: operated in one named official sub-municipality or village belonging to a main municipality's administrative responsibility
- community, housing estate, neighbourhood: operated in one named or un-named zone, neighbourhood, area, or housing estate, which is commonly recognised but has no official administrative or governance status

Based on the methodoligical distinction between providers and users in Figure 8, the projects were classified for analysis into four categories, according to their primary focus on:

1. both users and providers;
2. providers;
3. users;
4. institutional capital and the 'enabling environment.'

4.1 Group 1: source separation through providers and users

Group 1 projects shared a goal to change solid waste practices, with an emphasis placed equally on both user and provider sides. Projects in this group had their primary focus on approximating EU and international norms for modernising solid waste management, interpreted as following the solid waste hierarchy that places waste prevention as preferred approach at the top, and disposal as least desirable at the bottom. The international models that were available served both as the inspiration and the technical basis for new approaches, but instead of copying the details and physical infrastructure, project teams actively explored what was feasible in the Bulgarian context, working with users and providers on changing actual practices. The projects introduced consultations and stakeholder engagement on both "sides" of the practices model in Figure 8, engaging providers in a discussion on the costs and benefits of changing the provisioning system, and using student availability for intensive consultation and communication with users.

The providers included public and a few private waste management companies, municipal authorities, and municipal cleaning and greening companies;[48] counterparts in the source separation projects also included private (and privatised) recycling industries. Providers organized meetings and field visits to the municipal companies, set up measurement programs, collected photo-documentation, and external experts worked together with Chistota staff to calculate efficiencies and benchmark costs.

The "target" user groups varied: residents of an established housing estate, university students, residents of villages, small businesses in residential areas, and "users" of street sweeping in a housing area under (re)-construction. On the user side, projects offered convenient and attractive alternatives for management of waste at home, making new environmentally friendly waste behaviour easy and affordable. The users could benefit from the convenience and status of "European" practices without an immediate tariff increase.

Group 1 projects changed solid waste practices in a sustainable way, and most of the innovations are still operating. Moreover, they demonstrated also that change in practices and systems is possible with very modest financial inputs[49]. Against expectations, users in these projects proved themselves to be more flexible about changing practices than providers. Participation levels were universally higher than anticipated, creating long-term success for ash separation in projects 1 and 5. This high response was, ironically, the main reason for the failure of project 4: the provider was convinced that users would resist, and when they did not, was technically unprepared to operate the collection of so much material. In fact, the provider side of the system could not change rapidly enough to accommodate the energetic, pragmatic, and enthusiastic response of the users.

Group 1 projects addressed and solved locally recognised problems by bringing new actors, resources, knowledge, and ideas from the global discourse on solid waste modernisation, such as:

- communication campaigns and community meetings, organised and implemented by local NGOs;
- assessments of international consultants with new methodologies and technical information;
- input of international professionals and (university) experts.

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[48] In South-eastern Europe under socialism, the *Chistota* had a range of responsibilities, including waste collection, cleaning of streets, leaf and snow removal, management of parks, street trees, boulevards, monuments, grounds of public buildings, swimming pools, sport facilities and other green spaces, and, frequently, owning and managing a plant nursery that provided flowers, plants, seedlings and saplings for all of these uses.

[49] The largest amount of external financing in any of the projects was US $25,000 to the municipality of Blagoevgrad, which was split between projects 3, 4, 5, 10, 11, and 12.

The involvement of the internationally-oriented American University in Bulgaria was a clear factor in some projects. The legitimacy and local power of the university conferred a special status and symbolic value to the projects. Participation of the university community both challenged the municipal providers to innovate and offered a kind of protection from the consequences of potential failure. The results of the Group 1 projects suggest that changing practices depends on participation of users and non-state actors in stimulating providers to innovate, and maintaining their interest in longer-term change.

4.2 Group 2: provider-driven change

Group 2 projects had a deliberate focus on stimulating innovation in systems of provision and communicating the new service aspects to users. Design of these projects was based on a hypothesis that an experience of innovation in a protected project environment would increase provider readiness to innovate in ordinary operations, and to continue to modernise solid waste management in conformity with global norms. The mechanism for information transfer on innovations in these projects was usually technical support from a "peer" or specialist in a similar provider organisation from the EU or the US,[50] not so much "supra-national" as "external to Bulgaria," and their design focused in introducing new planning and efficiency approaches into existing municipal provider plans and operations.

The Group 2 successes, including projects 6, 8, 9, relate primarily to planning initiatives, where international input offered alternative approaches to technical planning, so that a wider variety of stakeholders were invited into the process. This meant, at the same time, that the goals of planning were broadened to give more emphasis to new solid waste management elements, including composting, recycling, small-scale village initiatives alongside standard city collection, and realising efficiencies through more precise management of tourist-season highs and off-season lows in the flow and variety of waste. All three of the planning projects were positively received by the provider organisation "clients" and accepted by formal authorities. In all three cases, recommendations became policy for the provisioning system, and in one case the Chistota anticipated acceptance of the plans by immediately introducing new efficiency measures. Even considering that not all plans are fully implemented, the planning projects do appear to have been successful.

A second subset of projects (7, 10, 11, and 12) succeeded, during their specific project periods, because they offered simple, affordable solutions to legitimate, recognised, "locally owned" problems. The approach helped providers innovate and make changes in the system of provision using their own staff, knowledge, and resources, and changing practice only at the margins. The improvements proposed in these projects were welcomed because they reduced costs and increased efficiency.

Project 10, for example, produced an immediate and visible impact on operations and increased the reputation and status of the municipal organisation, but in practice cost nothing. Project 11 re-introduced composting at the Chistota vehicle park, which had been used up to 1989 as a nursery for municipal green spaces, and so was compatible with staff knowledge, equipment, and space resources. Like project 10, it had little direct impact on users, but unlike project 10, it failed for reasons completely external to the project itself.

The highest-profile project in the group was the micro-privatisation of street sweeping in Project 12. It was controversial because it introduced privatisation, but also because the main beneficiaries were Roma street sweepers. Success was recorded by inspectors at municipal and regional level, and celebrated in press and media articles, convincing even the sceptical deputy mayor that this was a good way to modernise municipal cleaning, and make space for other actors in the mix. The readiness

[50] This mechanism was implicit in the two grant programs that financed Group 2 projects. The EcoLinks project of USAID was based on the concept of "peer matching," pairing Bulgarian with US businesses or experts. The EU PHARE programme had a similar structure but relied more on experts and consultants than peer matching. (Programme documents of EcoLinks in 1999 and PHARE in 1998-2000).

of both municipality and micro-enterprise to continue were prevented by circumstances external to the project, and had to do with a lack of support for privatisation in national tax policies.

Table 15. Overview of the projects

No.	Years	Project name	Actors and institutions involved	Main goal	Short-term Result, Long-term changes
Group 1		**Users and providers**			
1	1996-2001	Ash separation Blagoevgrad	Chistota (municipal waste company), local authorities, students, faculty, EcoSouthwest NGO (ESW), Zapad households	Demonstrate feasibility of changing household attitudes; reduce burning / air pollution	Feasibility established, continued for five years, then expanded in project number 5. New operations continue
2	1996-2002	Plastic /paper recycling AUBG	Students, faculty, staff of AUBG, Phoenix Recycling Company	Demonstrate recycling, reduce waste and raise student / university awareness	Mixed success due to diminishing interest of recycling company; stopped when the University stopped direct and indirect support
3	2001-2002	Source separation organic waste in Zapad, Blagoevgrad	Chistota, local authorities, students, faculty of AUBG, Ecoclub Terra, EcoSouthwest NGO (ESW), Zapad households	Demonstrate that Bulgarian households are willing to and capable of changing household practices	Demonstrated high rates of user participation and feasibility to change user behaviour; Provider discontinued collection when project ended
4	2001-2002	Blagoevgrad separate organics collection	Households, Chistota, organics supplier, Deputy Mayor, press	Demonstrate feasibility of a change in Chistota practices, build capacity for modern separate collection	Demonstrated that household behaviour was easier to change than provider operations; Chistota was unprepared for success. Abandoned at next election
5	2001-2003 (to present)	Blagoevgrad ash separation upscaling	Chistota, local authorities, students, faculty of AUBG, Ecoclub Terra, EcoSouthwest NGO (ESW), Zapad households	Institutionalise and anchor change in household practices to support long-term change in provisioning system	Success in changing user behaviour proved dependent on intensity of education and type of housing stock. Ash separation system covers the entire city. Project initiated without significant external funding; survived a change of party, administration. However, now needs some external investment
Group 2		**Provider-driven change**			
6	1998	Beloslav Solid Waste Plan	Local authority, Chistota, representatives of hospital and other large waste generators	Demonstrate sustainable modernisation of rural waste management, plan according to the new 1997 law	Stakeholders participation in solid waste planning; plan adopted, created readiness for a follow-up project on village composting
7	1999-2000	Beloslav Village Composting	Local authority, Chistota, mayors and residents of two villages, Roma waste pickers at village dumps	Demonstrate simple composting in 1 town /2 villages, extend capacity of Chistota;	High participation, high satisfaction, well-functioning systems in 2 places; stopped at new election and change of personnel
8	2001	Varna recycling and composting plan	Varna deputy mayor, environmental staff and consultants, waste management companies	Demonstrate modern planning for recycling, and approach to reach EU recycling goals	Plan was accepted but not implemented; important long-term impact was the capacity gained by the two consulting organisations, city staff in data collection/ analysis
9	2001	Solid waste plan Byala	Mayor, city council of Byala, environmental staff, 4 village mayors, Chistota, local tourism/ industrial actors, and residents	Improve plans and operations of SWM system, lower costs, test efficient / sustain-able models for villages	Chistota introduced many small changes and included villages; improvements still ongoing, also new ones introduced

No.	Years	Project name	Actors and institutions involved	Main goal	Short-term Result, Long-term changes
10	2001-2002	Blagoevgrad landfill modernisation	Chistota, deputy mayor's office, representatives of Auburn Alabama, NGOs, universities, Roma organisations	Demonstrate feasibility of upgrading dumpsite to avoid new landfill with high capital/ operating costs	Filling pattern and management approach modernised; improvements still ongoing; project suffered from change of administration
11	2001-2002	Blagoevgrad composting	Chistota, deputy mayor's office, health inspectors, residents of Zapad housing estate	Establish feasibility and capacity for sustainable organic wastes recovery	Composting worked; Chistota discontinued activity when administration changed
12	2001-2002	Blagoevgrad micro-privatisation	Chistota inspectors, deputy mayor's office, ecologist, residents of Zapad, Roma firm, women street sweepers	Change image of Roma, explore micro-privatisation	Inspectors con-firmed excellent results; continuation desired by both municipality and private provider, but blocked by the way VAT is levied in Bulgaria; stopped at election
Group 3		**User-driven change**			
13	2002	China cups at AUBG snack bar	University kitchen staff, University administrators, students, faculty, plastics industry	Establish feasibility of changing student / university staff behaviour to reduce consumption of plastic	Small but enthusiastic participation among students and faculty for a limited period of time (1-2 school years). No succession of staff or student groups, and stopped when students graduated
14	2002-present	List po list (leaf by leaf) office paper recycling initiative PECSD	Public Environmental Centre for Sustainable Development (PECSD), Foundation MayDay, private waste collection company, Students, parents, staff from more than 170 schools, kindergartens, NGOs, press, radio and TV	Establish feasibility of recycling office paper at schools	In the project period 75 tonnes of recycled paper were collected. NGO was able to organise succession by co-operating with private waste collection company. PECSD currently collects waste paper weekly from the 60 organisations.
Group 4		**Focus on institutional capital and the enabling environment**			
15	1997	Terra recycling seminar	Government and private recycling companies and primary producer factories, NGOs, representatives of national and local government, other stakeholders and providers in recycling	Create a recycling platform and constituency; two-day workshop, discussions, interchange of information and experience gave some modest local impetus to local recycling	Was well-received at the time but did not result in new institutions or associations. The event was not repeated until after EU accession, perhaps due to dismantling of the state recycling infrastructure and changes in the policy and legal environment (cf. Gille 2007 for a description of this process in Hungary).
16	2002-2004	Preparation of hazardous waste plans for both municipalities, Varna and Blagoevgrad	Government ministries, City mayors and councils from Blagoevgrad and Varna, producers, importers, wholesalers and retailers	Use multi-stakeholder approach to assess implementation policies for new treatment/ purchasing patterns for household hazardous materials	Positive response from industry and ministries. The plans at local level leveraged a large-scale investment plan by the Ministry of Environment (MoEW). In 2004 a site and EU funding was secured. The initiative received opposition from local people and NGOs; 3 years later no treatment plant implemented.
17	2004-2007	Models of village sanitation / waste management	Environmental NGOs, village residents, village mayors and committees, Dutch NGOs	Explore technical and social dimensions of composting as forms of collective self-provision-ing for Bulgarian rural areas	The rainwater harvesting system and master composter support appear to be robust and sustainable. Collective and community self-provisioning are more sustainable than household self-provisioning
Source: prepared by the authors based on project documents					

Project 7 deserves some special mention, because the combination of strong buy-in of the Chistota director, and the specific external circumstances, and the spontaneous innovations of users and providers, meant that the innovation level exceeded the project design.

Group 2 projects demonstrated the room for provider innovation with very modest financial inputs51. The main contribution of these projects to solid waste modernization was knowledge, expertise, and introducing a fresh approach to management and evaluation of existing systems. In plain language, the changes brought about by these projects seemed to be simply "common-sense good ideas", and so became fully "owned" by the municipal authorities, who felt they maintained control and could replicate what they learned. Both the successes and the failures carry the same message: modernisation and the introduction of new elements in the existing provisioning system is possible as long as the problems are recognised, the local experts agree that they will work; the changes are modest, and the financial impact is small. At the same time, it appears that operational changes are more vulnerable to external circumstances than planning, especially when the "counterweight" of direct involvement of users is missing.

4.3 Group 3: user-driven change

Group 3 projects, numbers 13 and 14, mirror Group 2, in that they had a focus on attitudes and behaviour of users, and were based on implicit assumptions that users can leverage change in systems of provision. Providers were either excluded entirely from the NGO-based project team, or included at the margins or late in the process. These two projects represent the type of citizen-consumer projects discussed by Hegger (2007), in which "citizens' groups and NGOs collaborate to realise pilot projects in which their ideals about what sustainable development entails are made manifest." (Hegger 2007, p. 153). Methodologically, Group 3 projects relied on user-driven innovation by agents external to the formal provisioning system.[52] Initiators assumed, implicitly or explicitly, that providers would accept and respond to innovations introduced by activists from civil society, representing the interests of users.

The decision to innovate outside of the provisioning system allowed freedom to do something quickly and effectively, which gave these projects energy and contributed to their success. This choice, however, proved risky in terms of sustainability and longer-term continuation. In Project 13, for example, the co-operation of the University catering staff can best be described as reluctant, highly conditional, and laden with resistance. The only ownership was with student activists themselves; there was no succession organised within the formal provider organisation and the project stopped at the graduation of the student initiators.

Project 14 began the same way, but succeeded and continues. The risk of working outside the solid waste provisioning system was balanced by involving the recycling industry, another economic actor, in buying the paper, so that the project generated real income. The NGO sponsor was able to use that income to leverage succession through the formal provider for solid waste, and activities continue at the time of writing. The lesson of these user-focused projects is that there is a role for green initiatives from outside the provider structure, but that a connection is necessary to ensure sustainability. Where embedding is hindered by active resistance and or lack of succession, such initiatives are short-lived, no matter how reasonable they appear to initiators.

4.4 Group 4: working on the enabling environment

The group of 17 projects also includes three projects that aimed to introduce change at a higher level, either through policy, producer responsibility, working with market actors, or shifting the ideas about what is good solid waste management practice. The approach and the activities were in some ways similar to those used in Group 2, and relied on extensive stakeholder mobilisation. But the goal was to set in motion a different way of conceptualising waste management and recycling, and a

[51] The largest amount of external financing in any of the projects was US $25,000 to the municipality of Blagoevgrad, which was split between six projects (3, 4, 5, 10, 11, and 12).
[52] The main implementers were student activists in the Project13 and staff of the PECSD staff in project 14.

modernisation of institutional relations and responsibilities of providers and users, also generally a characteristic of modernised mixtures (Spaargaren et al. 2005).

Photo image 8. Preparing Rasdelna composting site in Project 7. Photo: Anne Scheinberg

Both projects 15 and 16 involved encounters which were designed to open up channels of communication between key stakeholders, and to create a forum for them to work co-operatively with state institutions to modernise the policy context and enabling environment. The differences in result have as much to do with timing as with project design. In 1996, while the stakeholders were willing to meet for three days and discuss issues, they did not see much potential for or benefit in taking action. Partly this is because at that stage of the transition, the imperatives for change affecting national institutions and "private" stakeholders were less clear than they were for municipal provider organisations. Moreover their institutions or "companies" were at that time highly unstable, in the process of being privatised or reorganised, and many of the individuals involved moved on to other positions. No further initiative for a national platform occurred for nearly 10 years, when the EU packaging directive stimulated the formation of EcoPack Bulgaria (Doychinov 2008).

In 2004 (eight years later) project 16, using the same methods and approaches, filled a recognised need for industry to respond to national legislation harmonised with EU directives. Project 16 appeared to participants to be relevant, timely, and a response to a recognised problem. Project 16 was designed by a national authority on waste management law, whose Black Sea municipal constituency remains, in large measure, beneficiary and owner of the information, contacts, and ideas of how to approach household hazardous waste management under EU law. Like the Group 2 planning projects, it succeeded in that it helped the government formulate a strategy. For similar reasons, many aspects of practical implementation have been delayed by wider political and economic developments. The most important institutionalisation in project 16 appears to be that it significantly improved permanent communication channels between government and industry (UWEP Plus Programme Reports, 2005).

Project 17 also had ambitions to affect the enabling environment, this time in relation to rural sanitation and solid waste. The strategy was based on organising "user-led" green provisioning demonstration projects in three villages, similar to those described in Hegger (2007). The project

included "pure" household sanitation self-provisioning with ecosan toilets[53], and "pure" community water provisioning through rainwater harvesting at a school, and "mixed" community-household provisioning in the form of Master Composter. The strategy was to use the projects to demonstrate the feasibility of community and household self-provisioning approaches in remote villages, and to stimulate adjustments in policy and the enabling environment. Project experiences were shared with national institutions in two national-level meetings, but there are questions as to whether they had the desired impact on the enabling environment.

Yet this initiative was successful in terms of showing the larger potential for modernised self-provisioning as a mode for ecological modernisation of village environmental services. The "pure" household self-provisioning appeared to fail because of its reliance on individual capital investment, and because provision of sanitation is something Bulgarians expect from providers. In contrast, both master composter and school rainwater harvesting garnered significant support and are still functioning. These two provisioning interventions build on community cohesion and the experience of villagers that they have to do for themselves (as a group) what the central municipality will not organise for them. Like the spontaneous collection of organic waste in Konstantinovo in project 7, both master composter programme and rainwater harvesting at schools and other institutions seems to "fit" in a village context, where pure household provisioning does not. This puts project 17 more in line with the Group 3 projects, suggesting that user-led additions to the modernised mixture in Bulgaria may offer real options in villages with some degree of community identification and social cohesion. The spontaneous response of the villages in project 7, and the small town in project 9, support the insight that community provisioning may indeed offer a mixed modernisation mode that is useful in transitional Bulgaria.

5 Conclusions

What can we learn and conclude from these experimental cases in solid waste management in transitional Bulgaria? The analysis of these 17 projects shows that small-scale experimental solid waste management works in transitional and EU Bulgaria. A number of factors appears to contribute to the success in starting and continuing such forms of ecological modernization:

- involvement of international actors, alongside Bulgarian experts and specialists;
- participation of actors outside the solid waste provisioning system, specifically users, external consultants, academics, NGOs, and students;
- ownership of the solid waste problem and intuitive reasonableness of the proposed actions, especially by the local stakeholders; and
- incrementalism in all aspects of the process: small changes taken in small steps, involving small sums of money, with low levels of both risk and benefit.

Decentralised, flexible, and consensual forms of solid waste management follow local ownership of the problem, and construct solutions that fit within the existing frame of reference of key actors. In the same way, non-state providers allow for experimentation with less risk and lower costs than direct involvement of the local authorities or the Chistota. And international involvement through consultants, NGOs or academics provides legitimacy, opens inflexible bureaucracies, brings in new ideas, and increases provider willingness to innovate. While international linkages and visions of modern environmental infrastructure and services do stimulate processes of change, the local embedding of solutions make them feasible, sustainable, and ultimately acceptable both to users and providers.

These results challenge the dominant EU discourse on modernisation and Europeanisation of the solid waste systems in Bulgaria – and by extension in other transitional economies. The EU – as shown by the patterns of financing in the two pre- and post-accession structural programs, ISPA and SAPHARD – pushes Bulgaria firmly towards global best practice "blueprints", designed by external consultants and consisting of rapid 'forced' regionalisation of disposal with a strong reliance on extensive capital

[53] Ecosan toilets are a modern form of dry toilets where urine and faeces are kept separate and urine, in particular, is recovered for agricultural uses.

investments (Whiteman 2008, Soos and Popovici 2008). The results of our analysis suggest that such a global best-practice model of ecological modernisation in insufficiently rooted in the local setting of transitional Bulgaria. Euro-blueprint technical solutions have limited sensitivity for the local context, and may fail to match the experience and intuitions of the domestic professionals and experts charged with picking up the garbage every day, as well as the more environmentally concerned users/clients.

A second problem of an EU format of solid waste modernisation is that is gives especially national authorities and external consultants responsibility for defining new uniform systems of provision, and municipal authorities for introducing them. The project results suggest that these actors operating alone are especially vulnerable to political changes and failures at institutional and policy levels, to lack of momentum, and to other unanticipated events, such as drought or emergencies. The *Chistota*, economic actors, recycling companies, producers, user/clients, and NGOs are missing from the ISPA-SAPHARD equation, which assigns the dominant role to ministries and national authorities and external consultants. This alienates local experts, removes checks and balances, disturbs transparency and accountability, removes problem ownership from user/clients and leads to frustration, cynicism, and a lack of faith in positive outcomes.

The ecological modernisation of solid waste management in transitional Bulgaria is a more complex and rich process than EU models appear to assume, relying on a much wider mix of motivations, actors, and interventions. It appears to be key to match ecological modernisation strategies to local specificities, user preferences, institutionally comfortable interventions, mixed provisioning strategies, and a plurality of actors and motivations. Current EU interventions in solid waste management fail to take this into account and seem to move Bulgaria towards large, central, technically advanced, solid waste management systems. Such an EU approach tends to dominate all decision-making, while the space for innovation, experimentation, user engagement, participation, and critical evaluation diminishes. The large investments, operational risks, and uncertain local benefits of the EU strategy may (and to some extent already does) attract negative attention and confrontations from local and national NGOs (sometimes with support from trans-national NGO movements like the global anti-incinerator movement and Zero Waste), precisely those things that create resistance and reluctance to change with the municipal officials in the projects.

An ecological modernisation mode that fits the situation in contemporary Bulgaria offers municipal innovations at a moderate, municipal scale. Such an approach features, incremental change, managed by local officials and experts, but with support from users, NGOs, supra-national institutions, and a variety of economic and non-state actors. The project results suggest support for a modernised mixtures vision of the future of solid waste management in Bulgaria, and a pluralistic process of change, with space for experimentation, new roles for NGOs and the private sector, consultations with industry and producers, and a mix of city, village, and community-scale activities. These solid waste modernisation characteristics in Bulgaria appear rather consistent with trends and experimentation in Western Europe with modernised mixtures, where large monopolistic provisioning structures are complemented by tailor-made modernised mixtures, as Hegger (2007) has illustrated. In these experiments, providers offer a variety of solutions tailored to consumer and community users with specific ideas and practices of a comfortable, clean, and convenient management of solid waste. Bulgaria seems to be set to leapfrog into such a mixed-mode, ecologically modernised future.

6 Acknowledgement

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Photo image 9. Sorted ferrous and non-ferrous cans loaded onto truck for transportation in Brasil. Photo series: Jeroen IJgosse

Chapter 6. Conclusions

1 Introduction

Solid waste management in developed countries started very much from a public health perspective. Throughout the second half of the twentieth century solid waste management systems in developed countries started to include environmental objectives in their physical-material and their institutional design. This modernisation of solid waste management changed the private sector recycling practices whose history parallels that of the solid waste management system up until that time. By the 1990s this had resulted in a new institutionalised mode of reuse and recycling, often labelled *municipal recycling*. We do not (yet) see such an institutionalised system of municipal recycling in most urban centres in low- and middle-income countries. Against that background this thesis has developed its research questions.

The question at the core of this thesis is whether, and how, the adaptations of the path, policies, and institutions of modern, integrated solid waste management that emerged in Northern Europe and North America from the 1980s onwards can be put to work for improving waste management in low- and middle-income countries beginning modernisation processes 30-40 years later. Because there are so many examples of perverse impacts and failures of technology-focused transplantation of solid waste modernisation practices and institutions from developed to developing countries, one needs to be very careful in applying lessons and approaches from rich countries to improve outcomes in poor countries. Hence, the thesis aims at articulating models for solid waste management modernisation in low- and middle income countries which apply experiences and practices of the developed countries, but are sufficiently adapted to the specific context of low- and middle income countries.

In arriving at the conclusions presented in this chapter I have used an ecological modernisation theoretical framework, but in a reflexive way. Hence a secondary objective of this thesis has been to contribute to the development of more context-specific variants of ecological modernisation theory, a rather recent phenomenon in the literature on ecological modernisation.

The thesis articulates two over-arching questions that connect the four core chapters that are at the heart of this thesis:

1. Why does modernisation in low- and middle-income countries fail to improve the recycling elements of the solid waste system, as it has done in high-income countries?
2. Is it possible to articulate an alternative path or model emerging in low- and middle-income countries that has the potential to divert large amounts of materials from disposal and facilitate sustainable modernisation and improved environmental performance of solid waste management?

This final chapter aims to answer these general research questions and to reflect upon the findings of the four core chapters. The next section summarizes the key (idealised) characteristics of the (ecological) modernisation of recycling and its integration into solid waste management as it occurred in many developed countries. Section 3 looks at the main differences that characterise solid waste management – and especially recycling – in urban centres in low- and middle-income countries, and as such it answers and reflects upon research question 1. Section 4 addresses research question 2 by abstracting from the four core thesis chapters above an emerging model of more environmentally sound solid waste management *cum* recycling in developing country urban centres. Section 5 summarizes the conclusions to be drawn from this study. Section 6 provides final recommendations, both for further research on recycling in low- and middle income urban centres and for practitioners and policy makers working in the field of urban recycling in such cities.

2 The ecological modernisation of waste management and the introduction of municipal recycling

In modernisation, valorisation (organic waste recovery and recycling) changes from being a purely private commercial (or charitable) activity to becoming a part of a modern urban environmental service.

Chapter 2 introduces, via a historical view of waste management in North America to recycling's post-modern institutional form, municipal recycling. Modernisation of waste management begins in the policy and politicial sphere, but proceeds and becomes institutionalised due to key financial reforms, laws, practical experience, changing of habits of practice, and development of human and organisational capacity within the public organisations. Municipal recycling, the third "R" in the catchphrase "3-R[54]", emerges in this process as a new hybrid form, that combines a much older urban industrial activity dating back to the 16th century with the more recently evolved activity of municipal solid waste management. The "ecologising" of the municipal waste management function occurs not only by improving waste collection and disposal, but by "adding" a recycling and organic waste valorisation component financed as part of the total system. The definition of municipal recycling is that it is part of a total provisioning system, and financially integrated into it. Municipal recycling emerges only as a result of a financial reform that results in attaching a price to disposal, thereby incorporating the legal and technical reform in the financing of the solid waste system.

Priced disposal and associated financial reform are key because they change recycling, considered from the viewpoint of the local authority, from a net system cost to a net financial benefit. Local authorities introduce and pay for municipal recycling as a secondary sink, even if there are no "real" value chain revenues (Scheinberg 2008)[55]. The development of a technological, financial, institutional, and socio-cultural knowledge base, and the creation of separate bureaucratic entities with budget lines for recycling, represent some of the measures that serve to re-embed and institutionalise municipal recycling. At this point we can speak of an ecologically modernised waste management system.

As the modernisation process proceeds, we see progressively deeper reforms and re-structuring. Local authorities gain experience, as they progressively divert more and more materials from disposal, reduce costs, and report successes to users. This creates a virtuous cycle of avoiding disposal costs, generating increased "revenues," and using them for new investments in municipal recycling and organic waste diversion, which in turn diverts more materials and allows financing of new diversion activities.

Progressive and ecologically reflexive local authorities and regions actively push this process until they have exhausted the potential of the value chains to serve as sinks. When they encounter insufficient demand, the innovation of producer responsibility serves to force this – by creating pressure from within the value chain to close materials cycles and provide incentives to producers to re-design products for better end-of-life management.

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[54] "3-R" is widely used to refer to "Reduce-Reuse-Recycle," an English-based way of referring to municipal recycling as covering, beyond recycling, the other two top levels of the hierarchy described in chapter 2. While it is not certain, "3-R" appears to be a take-off of the American English joke about what children learn in the first years of school: **R**eading, W**R**iting, and a**R**ithmetic. It's a joke because while the "R" is pronounced, only one of these three key words actually begins with an "R".

[55] By this it is meant that the inherent value of the materials in the value chain is high enough to cover the costs of extraction, before, during, and after modernisation. Ferrous and non-ferrous metals generally meet this criteria in almost all countries, because there is an extensive global value chain that reaches into most local places. Waste paper and secondary fibre meet this criteria in Asia, where the global value chain enterprises are concentrated, and for many countries high-grade sorted papers will usually pay for themselves everywhere except in sub-Saharan Africa, where the combination of distance to markets, poor infrastructure, relatively little paper in the waste stream, but most of what there is coming from inported sources, and few value chain end-users creates a situation where the price seldom covers costs of extraction, processing, and transport. Polyolefine plastics, specifically HDPE, PP, and PET, increasingly pay for themselves and the infrastructure of medium-scale processors is growing – driven primarily by Chinese demand. Glass containers pay for themselves when there is an end-user within 500 km of the point of generation, but this value chain is shrinking and seldom works without some form of producer responsibility subsidy, which is why it works in Europe.

In later stages of modernisation, such market development initiatives produce policies and laws that require producers of materials and packages to take responsibility for the end of life of their products, a post-modern institution referred to as "extended producer responsibility." Without starting with priced disposal, there is no drive to require producers to be responsible, that is, to shift the economic benefits of production from shorter- to longer use phases of the life cycle.

High recycling rates that are stable, or grow over time with deep involvement of the production sector, such as those institutionalised in Dutch or EU policies, are thus linked closely to the presence of this financial reform in the ecological modernisation of waste management. The development of municipal recycling and its embedding in the new discipline of integrated solid/sustainable waste management results in a new hybrid form, which changes the dynamics of the whole solid waste system in a profound way.

3 Failing emergence of municipal recycling in low and middle-income countries

While the current modernisation process in urban solid waste management in cities in low- and middle-income countries is quite similar to what we have seen in developed countries, the results are quite different. Before discussing differences in outcome, we need to acknowledge some basic similarities in the solid waste modernisation process, which have also been highlighted in all of the chapters.

Low- and middle-income countries are responding currently to solid waste system failures that partially resemble the crises OECD countries in Europe and North America faced in the 1970s and 1980s. The process of modernisation of solid waste management in low-income countries is similarly triggered by failures of the removal-based system to adequately manage waste in the city.

The first similarity is insufficient collection and widespread presence of heaps of waste in the city, as well as nuisances and pollution from dumpsites and burning waste. A second similarity is that at the time the crisis or political impulse hits, there is usually an undifferentiated public health or public works department with no specialised expertise, budget, or institutions. In Africa, solid waste usually falls directly under the city council.

Like the OECD countries in the 1980s, low-income countries have partially functioning removal systems, and middle-income countries have more complete removal of solid waste. Collection is done with relatively unspecialised equipment like dump trucks, and waste is removed to a low-lying swamp or ravine or lagoon at the edge of the city, where the private landowner is willing to have the land "filled" to make it suitable for other uses. Valorisation of recyclables and organic waste is occurring in private-to-private value chain transactions, which are separate from the waste management system and seldom recognised by it, or seen as a nuisance to be eliminated in modernisation.

The national ministry involved is often the health ministry, which also lacks specialised (environmental) capacity. The financing of solid waste is from the general fund of the city or from locally administered real-estate taxes, and if there is a fee charged for removal services, it usually returns revenues to the general fund.

There is sharp differentiation between rich and poor areas within cities in low- and middle-income countries in terms of in population densities, public infrastructure, housing stock and the reach of water, transport, and energy utilities. De Swaan's (1987) analysis is valid here too: poor waste management translates to disease and public health risks in poor areas, which will affect rich enclaves if no form of collective solution is installed.

But despite the similarities, there are certain key differences between the (ecological) modernization processes of OECD countries in developing their municipal recycling model, and the modernisation processes that we can identify, at the present time, in the urban centres in low- and middle income countries. The next sections discuss these differences.

3.1 Modernisation of collection: but is it "ecological"?

While the drive to modernise waste management in cities in low- and middle-income countries has important environmental dimensions, its specific focus and problematisation is different from such factors currently present in high-income OECD countries.

The focus of solid waste management modernisation in low- and middle-income countries is very much on collection. Concerns about groundwater protection and pollution avoidance are less important than the need to clean up central commercial and middle- and high-income residential areas, provide waste removal services to markets, public squares and poorer neighbourhoods, improve the appearance and functioning of cities to stimulate tourism, improve the business and investment climate, and provide livelihoods that diminish or alleviate poverty. These predominantly social and economic drivers dilute the "ecological" character of modernisation. As long as collection remains the focus, modernisation in solid waste management is signalled by the proliferation of new institutional and economic niches offering waste pickers, recovering drug addicts, unemployed school leavers, and women's groups (to name a few) new and expanded opportunities to hold franchises or sign contracts for collection, sorting or cleaning operations. Also here the main motive is rather economic or social, and to a lesser extent ecological.

These individuals and community based organisations/enterprises (CBOs) and micro and small enterprises (MSEs) sometimes seek to combine their cleaning and collection activities with recycling, organic waste valorisation, or some combination of special services[56]. But this is not really municipal recycling, because there is no ownership, initiation, or cross-subsidisation from solid waste revenues; these activities only continue as long as the value of the materials exceeds the cost of extracting the materials.

3.2 Modernisation of disposal: global ideas, global financing, no local ownership

In contrast to the prevalence of locally anchored socio-economic drivers for modernising *collection*, the motivation and driver for modernising *disposal* in low- and middle-income countries is environmental; but it is often not driven by local developments.

In OECD countries like the USA or the Netherlands, ecological modernisation processes of disposal were ushered in by domestic and local crises of contamination – and the crisis narratives that they produced. The associated reform is related to upgrading the disposal technology and institutions, codified in improved national, local and EU laws and policies. The push to modernise waste disposal in cities in low- and middle-income countries, in contrast, is driven by global ideas of good practices, the possibility to attract global flows of investment capital, the anti-incineration and environmental justice activities of globalised NGOs, and the consequences of globally-driven changes in waste stream. These motivations have global origins and are not anchored in local conditions or politics. As a result modernisation of disposal, when it occurs in low- and middle-income countries, is only weakly related to local conditions.

Global financing of capital investment for modern landfills via the World Bank, donor organisations or bilateral Official Development Assistance (ODA) are essential in environmental improvements, and without them far fewer landfills would get built in low- and middle-income countries. External financing "plants" the facility in the local landscape, but this does not lead to institutionalisation, ownership, or embedding, and it is even less likely to stimulate financial reforms. Priced disposal does not emerge, and so the incentive structure of a modernised system is stillborn. The fact that such facilities are frequently abandoned, stop working after a few months, or operate far below their design specifications suggests that these global interventions are not sufficiently locally institutionalised. When the financial reform is missing, long periods of time elapse between building

[56] This variant of municipal recycling is also found in North America, where it forms the focus of Weinberg, Pellow and Schnaiberg 2002). Their main complaint about Chicago's lack of support for recycling as a part of community development can in part be understood as criticising the lack of financial reform that would have institutionalised the activities of the Resource Center by making available financial support related to avoided disposal costs.

and opening the landfill and introducing consistent and effective pricing for using it. And so the emergence of municipal recycling is delayed, distorted, or prevented.

3.3 Technological and awareness focus to modernising waste management

Cities in low- and middle-income countries often modernise in response to externally driven pressures or opportunities to improve waste provisioning systems in a short time. The mechanism is usually to give or lend large infusions of capital. This focuses the intervention on modernising technology-intensive parts of the provisioning system, such as collection and landfilling. This is often complemented by an exaggerated emphasis on the role of public communication and "awareness", based on the idea that this will change practices and result in correct use of the system.

The combination of compressed timeframe, money- and technology-led reforms, and lack of understanding of local dynamics, create a tendency to overlook those parts of the system which depend on reforming and re-constituting social practices between users and providers. In these countries the result is an incomplete modernisation process that misses locally necessary adaptation and institutional innovation to embed municipal recycling into a modernised provisioning system. What is often neglected is the need for (a) organisational and institutional modernisation for the providers, (b) pricing of disposal, (c) financial reform, and (d) the need to re-invent the social practices through changing more than the physical infrastructures in the provisioning system for solid waste.

3.4 GDP differences, real demand and financial reform

Differences in economic conditions contribute to the differing outcomes. Household income in low- and middle-income countries simply is not (seen as) sufficient to cover costs of modern environmentally sound disposal, even where there is widespread ability and willingness to pay for waste collection and removal and street sweeping. City councils are unwilling to impose the higher disposal fees on their citizens, because while every household understands how it benefits from removal, disposal has diffuse benefits and is far away. There is in fact no strong local *economic* demand for a sanitary landfill, and this translates to little or no financial reform, and no structural financing for municipal recycling[57].

Without the financial reform, the system is too expensive for the local economy. Local authorities operating the new infrastructure are confronted with the task of operating a system they cannot afford, even when the capital costs have been paid by donors. The infrastructure is modernised, but there is no modernisation of finances, institutions, or governance. The response to this incomplete modernisation is a kind of fever to either reduce costs of the system or to find other sources of revenue to finance it.

3.5 Failed recycling, declining disposal standards, and lost livelihoods

The result is a vicious circle, that works as follows. Municipalities seek to take organic waste and recyclables away from waste pickers, organics collectors, swine feeders and the smaller recycling enterprises, and criminalise private value chain activities. Not only informal recycling, but also swine feeding may be labelled as illegal – although the official reasons given relate to morals, hygiene and dignity. With negative attention, fines, police harassment and outright municipal hostility, the informal sectors at the bottom of the value chain extract and valorise fewer materials, lose livelihoods, and may stop altogether. Value chain recycling is interrupted, so more materials require disposal.

Also public sector recycling fails. Without priced disposal, there is no incentive to invest in knowledge, equipment, or re-design of provisioning systems. The city authorities or their private contractors may introduce separate collection schemes, but they are seldom able to get the materials into the value chain; they simply don't know how to valorise materials, don't understand the value

[57] For this particular insight on the lack of economic demand for disposal, I am grateful to Reka Soos.

chains, and lack commercial contacts or experienced traders to help them. This is equally true of waste collection companies whose origins are in public utilities functions or private construction businesses. In Southeastern Europe, this same lack of knowledge hampers the ability of producer responsibility organisations like EcoRom (Romania), Sekopak (Serbia), and Ekopak Bulgaria to capture significant volumes of materials and keep them from disposal.

Declining private value chain activity, bungled experiments of inexperienced local authorities, and overcapitalised ineffective producer responsibility in low- and middle-income countries act to increase the amount of materials going to disposal. The disposal site is often already present and functioning, but the need to receive more materials means higher operations costs. Pressure to reduce these costs is expressed in a lowering of operations standards: the scalehouse isn't used, the gate rusts, and within short time the landfill develops into a dumpsite – only now the informal valorisation systems have been broken, and so even more waste goes to disposal. The whole modernisation experiment is at risk of becoming a failed import from the North.

3.6 Inclusive recycling as alternative to municipal recycling

In low- and middle-income countries, municipal recycling does not emerge from the current ecological modernisation process. When a failure to price disposal inhibits the development of municipal recycling, and there are legal or environmental recycling goals, other mechanisms are necessary to achieve high-performance recycling in low- and middle-income countries.

And in fact an alternative to municipal recycling is already emerging, as can be seen with a careful reading of Chapters 3 and 4. *Inclusive recycling* is a shared risks and benefits model, in which the main responsibility for valorisation remains in the private value chain. (see also Scheinberg, Wilson and Rodic 2010, Chaturvedi 2009, and the information on *inclusive cities* at www.wiego.org and www.inclusivecities.org). Inclusive recycling, like municipal recycling in the mid-1980s, has at the time of this writing a kind of experimental and in-between status. There are a number of project-based experiments, but these are not yet anchored in full-scale city waste systems, and there remains a lack both of documentation and experience with institutionalising inclusive recycling in the modernised provisioning systems to be found in low- and middle-income countries.

4 Three inclusive recycling models

Three emerging inclusive recycling models can be distinguished in current practices in low- and middle-income countries.

The first inclusive recycling model can be labelled a *service model*, as informal recyclers are paid for a service and as such become part of the provisioning system of solid waste management. The service model for valorisation comes close to municipal recycling, because the activity of recycling is designed to reduce waste going to disposal and is therefore paid out of solid waste system revenues. It is quite rare in low- and middle-income countries, where services usually relate to removal and valorisation is not seen as a service. What perhaps comes closest is the model of "truck pickers" in Quezon City, but it can also be seen in Cairo, where the Zabbaleen are paid for collecting waste and, incidentally, recycling it (see chapter 4). Community-based organisations in Lusaka and Lima, and the authorised waste pickers in Pune come close to a service model because they are paid for collecting and recycling (Ibid.). Some of the projects in chapter 5 are also experiments with this approach.

Photo image 10. Licensed waste pickers operating a hybrid model of separate recyclables collection in Lima, Péru, 2006. Photos: Jeroen IJgosse

The second inclusive recycling model can be labelled a *commodities model*. Here value chain actors collect materials and valorise them, and keep the revenues; the municipality recognises, allows, accepts, and in some cases co-finances this activity, and counts the materials in their diversion or recycling rates. Commodities models leave the value chain in charge of valorisation, and encourage local authorities to share the risks and claim both credit and key benefits. Middle-income countries, specifically India and Brazil, and large Latin American cities like Lima and Bogotá, have done some experiments with this model. The local authorities in Belo Horizonte, Brazil, and many of the sub-municipalities in Lima, Péru, have this relationship with informal recyclers of construction and demolition wastes, and household wastes, respectively. Quezon City, Philippines, authorises private sector junk shops as receiving points for recyclables as part of their ward ("barangay")- based work packages. In leading OECD countries a strategy that looks very much like this is used to measure diversion that falls outside of the range of recognised municipal recycling, for example, the activities of clothing collection charities in Rotterdam, the Netherlands or San Francisco, California, USA or the activities of re-use and repair businesses in Ithaca, New York or San Francisco. (Scheinberg, Wilson and Rodic 2010). Sometimes the authorities also co-finance these activities by paying a diversion credit to the recycling organisations or businesses, based on an estimate of the avoided cost of disposal, but this is rare outside of EU Europe. (Scheinberg and IJgosse 2005).

Table 16. Examples of inclusive recycling

City / Country	Project or intervention in line with the ideas of inclusive recycling
Brazil Philippines	Municipalities give informal recyclers /junk shops concessions to collect or receive materials /to operate recycling centres (ASMARE and Quezon City MRFs)
Mali (W. Africa)	Communes give local platforms concessions to operate recycling transfer and community disposal and sell the decomposed soil to farmers (COGEVAD, Mali) (Anschütz 2005)
Egypt Columbia	Informal recyclers use city land for post-collection sorting, tip areas (Colombia, Cairo). Mostly they don't pay but they have no rights to stay there if the city changes its mind.
Bangalore, India	An NGO introduces waste pickers to large business generators. Each waste picker gets a service fee for cleaning, and guaranteed access to that business' materials (Bangalore, India)
Tanzania Bulgaria micro-franchise	Cities and municipal districts allow micro-and small enterprises to tender to have exclusive rights to waste collection and in some cases recyclables (Dar, Tz), sweeping (Bulgaria). But the MSEs and CBOs have to collect money from households.
New York USA, South Africa	Private companies hire waste pickers to work while they excavate, sieve, and reconstruct the old landfill, shift to cell pattern, add recycling and composting areas
Bangladesh, India, Malawi, Kenya PPPs	CBOs and MSEs pay market managers for the right to collect market waste, separate and wash plastics, compost organics from markets
Brazil China PPPPPs	State and city governments organise collection privatisation tenders that require working with the informal sector
Costa Rica, Honduras, India	NGOs work on PPPs with bank sector & finance ministry & cities to make loan guarantees which require longer contracts to MSEs / CBOs.
USA, Canada, Netherlands PPPs	Cities collect organic waste and bring it to private compost producers to process for a fee. Same cities agree to use a certain volume of compost for parks, road berms, cemeteries, public spaces, pay a lower fee for composting.
Sri Lanka, Belgium PPPs	The agriculture ministry provides subsidies and technical assistance to farmers to accept source separated organics and make and use compost from municipal collection
Netherlands	NGO second-hand shops and clothing collectors also function as a workplace for former collectors. The shops can claim an output-based payment per tonne from the municipality, for the tons that they have recycled or repaired and sold.
India, Brazil, Mali, Columbia, & globally :	Global organisations pay local organisers to support informal recyclers to form, unions, NGOs, co-operatives; platforms; associations, and get health care from the city.
PPP Philippines, USA, Canada, Costa Rica	Recycling co-operatives rent warehouses so they can store material, and share transport to better markets. They get a subsidy from the muncipality, the port authority, or other public entities, as part of economic development. The official diversion rate includes these materials.
Philippines; Colombia; USA	Recycling co-operatives and associations organise collective transport, storage, and/or marketing co-operatives; municipalities authorise the co-operatives and may give them land or a building in which to operate.
Indonesia, Canada & California USA, Bangladesh	Community development officials support and pre-finance recyclers to develop hybrid or new businesses combining services with valorising the materials. respectively: composting, deposit return, carbon financing
Costa Rica, Netherlands, Canada	National governments make laws requiring producers to take their products back and recycle them (EPR). In Costa Rica, the producers hire informal recyclers to dismantle the computers in a workshop with good working conditions.
Costa Rica, Brazil, Cairo, India	NGOs get funds from the municipality to train waste pickers and value chain actors; give them income support; keep children in school; teach parents to read; pay health insurance
New York (NY Times); Brazil, Peru, Manila	Informal recyclers organise themselves to manage waste at sorting events, outdoor concerts, fairs, and markets. They get a fee from the organisers but get to keep the recyclables.
Peru, India, Brazil, Philippines	The city authorities provide waste pickers and value chain actors with uniforms, shoes, gloves, eye protection, and ergonomically correct carts. They provide insurance and give them ID cards which allow them to enter residential areas and collect recyclables without being harassed. Or to manage municipal depots to which the private informal recyclers have a key. The collectors keep the recyclables and sell them; do not receive any salary. The City claims the diversion as part of their reporting to the environmental authorities.
Source: Elaborated for this thesis based on WASTE 2010.	

Thirdly there are *hybrid models*, where the municipality and collectors share responsibilities and also share benefits and revenues in recycling and solid waste management. In hybrid models, the local authority goes beyond recognition and tolerance of value chain activities, towards active support of these activities. This is usually accompanied by the local authority claiming credit for the diversion rate, as well as for managing and benefitting from recycling activities fully or partly located in the private informal or formal value chain.

The form of such support ranges from de-criminalisation and official authorisation to the granting of concessions or franchises or district monopolies, to providing city land, buildings, or equipment to value chain actors to reduce their costs and increase their efficiency. Other hybrid forms lie more clearly in the social sphere, where waste picker families who send their children to school receive some kind of payment in recognition of lost revenue, or the Pune Municipal Corporation recognises the status of authorised waste picker and pays for their health insurance (see also chapter 3, 4 and 5). Some examples of inclusive recycling practices from these global experiments are presented in Table 16..

5 Final conclusions

The main conclusion from this thesis is that while elements of the ecological modernisation process in the solid waste sector in low- and middle-income countries are to some extent similar to those in high-income countries in the 1970s and 1980s, they produce different results because of key differences in circumstances, and the balance of global and local influences. The differences in results are significant: priced disposal, the key to the emergence of municipal recycling and associated high recycling rates, is currently not considered feasible in low- and middle-income countries. Instead of a virtuous circle of increasing costs of disposal, driving ever higher levels of valorisation, through new structural relations between local authorities and value chain markets, the modernisation process in low- and middle-income countries produces a vicious circle of competing claims for rights to valorise materials, disenfranchisement of the least powerful value chain actors, and disruption of materials cycles. Working value chain cycles are interrupted and the recycling rates go down, making disposal more and more of an economic and environmental burden.

Instead of municipal recycling, low- and middle-income countries do show a promising emerging model for institutionalising private value chain valorisation activities in a modernised solid waste provisioning system, which is being labelled *inclusive recycling*. Inclusive recycling maintains private value chain control over valorisation of recyclables and organic wastes, but involves municipalities as facilitators of the activity. Municipalities recognise, appreciate, authorise, and take credit for the performance of the private value chain and in return get the continued and increasing benefit of reduced materials to manage in the formal provisioning system and increased positive environmental and economic externalities of private valorisation. In some cases there may be explicit risk- and revenue-sharing.

In municipal recycling, the public sector accepts responsibility for the *negative* externalities created by waste entering the environment. Pricing disposal is in effect requiring polluters to pay for the costs of internalising the negative environmental externality of disposal within the solid waste system. Transferring resources to pay for municipal recycling reduces the externalities by shifting from the sink of a disposal facility, with both pollution and resource consequences, to the sink of the value chain, which has some negative pollution consequences but where the resource consequences are positive.

Inclusive recycling reverses the relationship of public authorities to environmental externalities. Inclusive recycling relies on private actors being able to earn private benefits that have *positive* environmental externalities for the municipal waste provisioning system. These positive externalities are the basis for creating a relationship of shared risks and responsibilities, but the emphasis remains on the private sector actors, who in some sense – in the absence of priced disposal – continue to finance most if not all valorisation activities.

The contribution of this thesis to the theorising of recycling in modernised waste management can be summarised in the following points.

1. In the ecological modernisation process in high-GDP OECD countries, the ecological re-structuring process has produced a genuinely new institutional innovation, *municipal recycling*. The

key factor in the emergence of municipal recycling is pricing of disposal.
2. While the process of modernisation looks similar in high-, middle- and low-income countries, there are key differences in the final ecologisation process, attributable to different economic, social, and political dynamics. In low- and middle-income countries disposal is seldom priced, and so municipal recycling does not come into being. The environmental benefits associated with it are thus lost. Also the informal and formal value chain actors responsible for most if not all recycling in these countries are at risk for losing their livelihoods.
3. The drive to re-capture those environmental benefits and preserve the livelihoods is resulting in the piecemeal emergence of an alternative variant of formally organised recycling, provisionally labelled *inclusive recycling*, in low- and middle-income countries.
4. Analysing, crystallising and stabilising this model can benefit from the same kinds of process and planning interventions that crystallised and stabilised municipal recycling in the 1980s; improvements in outcomes and a shift from vicious to virtuous circles are the expected results of such analysis and interventions.
5. Recognising and institutionalising inclusive recycling – and re-theorising recycling within the social practice of waste management – is thus a key research priority.

6 Recommendations

The recommendations are divided into inclusive recycling recommendations for practitioners working on improving and upgrading waste management outcomes, and recommendations for future research and analysis in recycling as part of the system of solid waste management.

6.1 Inclusive Recycling Recommendations

From the process of researching this thesis (and the body of work behind it), it is possible to arrive at some recommendations about how to improve outcomes and support the emergence of inclusive recycling in low- and middle-income countries.

1. Shift the definition of recycling goals and the focus of public authority recycling interventions. First, define these goals as being additional to measured levels of existing value chain activity. Municipal annexation of private recycling should not be counted as a net valorisation gain. Secondly, shift the obligation of public authorities from "introducing" recycling (assuming that new actions are needed to make it happen) to facilitating, officially recognising, and "counting" the activities of existing value chain actors.
2. Support professionalisation of value chain actors – including informal actors. The "price" of recognition can and should be that informal actors improve their working conditions, capacities, business models, and willingness and ability to monitor and report on their own activities.
3. Re-define integrated solid waste management in low- and middle-income countries as a mixed system of co-production. This is about changing the *ideal vision* of a modern waste system, to create space for sustainable involvement of non-state actors and the private and informal value chains. Maintain ownership and place interventions, to the greatest possible extent, within the value chain itself. This means, among other things, that public sector monitoring needs to have access to private sector information on what is being recovered and were it is going.
4. Split valorisation off from the waste management package that is given for privatisation or concessionisation. Waste management companies – and especially globally operating ones – are experts in the businesses of efficient removal and construction and operation of safe sink facilities like landfills and incinerators, but have little knowledge, interest, or incentive in re-directing the lower-grade materials not already being valorised. A key element in dividing removal from valorisation is for local authorities to *stop paying waste service companies by the ton*, but instead to pay them by the number of households they adequately serve.
5. Experiment with models of shared risks and revenues, where the facilitation activities of the public sector are balanced and compensated by reduced need for disposal capacity and/or a direct revenue-sharing arrangement.

6. Expand and test a new metrics for analysing costs and benefits within the current system. The analysis of the performance of the existing system – both in social and physical performance terms – can also identify specific current practices that are creating economic, social, or health problems – or under-analysed benefits. Unlike the globalised approach to eliminating child labour in scavenging which is the focus of Chapter 3 (and which is shown there to largely have failed), this produces a locally-based and highly focused platform on which to introduce improvements in the local systems of private-sector valorisation.
7. Support local experts to adapt global ideas, technologies, and interventions to local circumstances. In order to domesticate global practices in local spaces, the significant involvement of local experts is critical. Current models of expatriate- and expert-led, technology-based interventions have a high risk of becoming expensive failures if localities do not participate in making choices and decisions about their own solid waste systems.
8. Pay attention to the social practices, not (only) to providers and users. Ecological modernisation does not occur only in provisioning systems, nor only in the awareness of users. Installation of technology and changing of trucks or routes or containers does not necessarily result in a change in how the users (or even the providers) use the system. Nor does "increased awareness" among users guarantee that they will change their habits, practices, and ideas about what is comfortable, clean, and convenient. The real change happens at the level of social practices, and only when new practices pass into habit can there be a claim that ecological modernisation has occurred.

6.2 Recommendations for additional research and theoretical reflection

A main recommendation is that there is a need for additional research, to adequately theorise the ecological modernisation of valorisation in low- and middle-income countries. First, social theories of the environment that address recycling need to take its long history and economic relation to global agricultural and industrial value chains into account, in addition to seeing it as a kind of adjunct or green variant within the local solid waste social provisioning system.

Secondly, the role and impact of municipal recycling in modernisation, specifically as it relates to re-constitution of both public and private sectors during modernisation, deserves further attention. We could ask both how the involvement of public authorities in significant levels of valorisation re-constitutes not only the urban policy landscape, but the value chains themselves, and how engagement with the value chains re-shapes and re-constitutes the local authorities' views of themselves and their missions, a point which is key when shifting the focus "up" the hierarchy from recycling to waste prevention. Chapter 2 gives some indications that this is a plausible direction for future investigation in leading OECD countries and high-GDP countries in general.

Finally, the emergence of inclusive recycling brings a whole new set of questions into both the practice and theory of ecological re-structuring in low- and middle-income countries. Some examples of new research questions include the following:

- Are there precedents in, for example, environmental economics, for shifting from an analysis based on internalising negative externalities to one based on rights and benefits related to claiming positive externalities?
- What are the changes in power relations within the value chains following the process of ecological modernisation of solid waste management?
- Should transnational environmental NGOs shift from an advocacy based on avoiding pollution in specific places, to one which focus on protecting rights to materials of informal recyclers?

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Summary

For many centuries urban waste management in Europe and Northern America consisted of private – to – private arrangements to remove waste from the city centre and so restrain the spread of cholera and other diseases, odour and nuisances. The agricultural and industrial value chains provided a destination and a motivation to extract and valorise rags, ashes, dust, excreta, metals, food scraps, and many other forms of secondary resources which had some value to someone. The business of recycling developed alongside of municipal waste management, and absorbed many discarded materials, but remained a separate sector with its own practices, institutions, and economic rationality. The management of solid waste management became primarily focused on dumping waste outside the city boundaries.

The 'discovery' of the relationship between open dumping and groundwater contamination in the 1960s set the stage for a round of modernisation of waste management practices and institutions in high-income countries. The widely recognised and celebrated result was the shift from open dumping and open burning of waste to the engineered "regional sanitary landfill" as a large technical facility that concentrates waste, isolates it from population centres, protects ground-water and thus allows for safe modern disposal of increasingly complex materials.

This proved to be a costly affair though, and triggered a process of ecological modernisation in solid waste management characterised by institutional and financial reforms, which elevated the cost of removal. Disposal became costly, and as cities expanded, land to dump became a scarce resource. This set the stage for incorporating valorisation into the modernised waste management landscape as an alternative to modernised disposal. The ecological modernisation process that took place in Northern Europe and North America in the 1980s and early 1990s changed the policies and practices of waste management in fundamental but seldom understood ways. Pricing of disposal in high-income countries represents a core financial reform which in turn stimulates local authorities to invest in their own recycling (composting, reuse) infrastructure as a lower-cost and environmentally attractive alternative. *Municipal recycling* emerges as a key modernised institution in the landscape of integrated waste management, where investment in recycling produces higher and higher recovery rates and a virtuous circle of more investment, more recovery, less waste, co-operation with the value chains which have been re-constituted as "recycling markets," and lower system costs. In municipal recycling, the agricultural and industrial value chains function as alternative and lower-cost sinks, complementing the landfill and lowering costs for the whole waste management system.

In low- and middle-income countries, in contrast, the ecological modernisation of solid waste is problematic and incomplete, and 'recycling' becomes a key new area of global conflict. Priced disposal does not come about, either because of low levels of disposable income or unwillingness of elected officials to impose a burden on tax- and rate-payers, or because the motivation to modernise disposal comes from global institutions and is insufficiently embedded in genuinely local policymaking. Without it the system-internal benefits of diverting materials from disposal to valorisation are missing. Municipal recycling does not emerge, and the virtuous cycle of increasing recovery ambitions and performance is replaced by a vicious cycle of interrupted private value chain transactions, declining valorisation rates, and increasing volumes of materials requiring expensive disposal.

City authorities in low- and middle-income countries seeking to gain the financial benefits of selling materials compete with private (informal) waste pickers, recyclers, and livestock feeding operations, claim monopoly rights to materials, and criminalise value chain activities. But they are unable to organise effective valorisation themselves, as they lack knowledge and commercial channels to reach the value chains. The value chain actors are blamed for not buying materials, but also for exploiting poor workers in miserable working conditions. Valorisation businesses are unwilling to do business with municipalities who supply low-quality materials, so the value chain transactions fail, and both avoided costs of disposal and offsetting revenues from valorisation remain elusive.

Municipalities, waste system users, and the environment lose in this situation when local authorities are unable to pay landfill operating costs, and the expensive sanitary landfill infrastructure reverts to the status of a pre-modern dumpsite, which has to handle more and more waste. Agricultural and industrial value chains also suffer, because the thousands of individual and family enterprises in waste picking, recycling, and animal feeding are at risk to lose their livelihoods, or see reduced returns on their efforts due to monopoly behaviour, criminalisation, or harassment from the formal waste system actors. Mid-level value chain enterprises get fewer materials, and increasing volumes of potentially recoverable resources end up in the dump.

But there are already some examples of how changing the model can produce improved results. In a small number of cities in low- and middle-income countries, the ecological modernisation of the waste management system appears to be leading to the emergence of a new model for institutionalised valorisation, provisionally called *inclusive recycling*. Inclusive recycling is a model for public sector acceptance of private value chain activities of valorisation. It is a model of shared ownership, risks, and benefits, where each set of actors does what they are best at. While it builds upon the techniques for participatory planning and stakeholder engagement, as well as on technical innovations for separate collection, processing, and environmental education that characterised the development of municipal recycling in the 1980s in OECD countries, inclusive recycling does not rely on the institutional reform of priced disposal. Rather, it maintains the centre of gravity of valorisation activities in the industrial or agricultural value chains, where the knowledge and infrastructure exists to receive, process, and market materials. Instead of re-inventing recycling as a part of the municipal solid waste department's responsibilities, inclusive recycling looks to intermediary institutions such as labour unions or recycling co-operatives to facilitate shared risks and responsibilities between local authorities and value chain actors.

Inclusive recycling can be seen in some of its emerging forms in Asia and Latin America, particularly in situations where there is a tradition of co-operation between civil society and local authorities, large numbers of waste pickers at the base of the value chain pyramid, and where the paper and metal value chains are long, healthy, and deeply rooted. In place of a single municipal recycling system, inclusive recycling is a mixed system where there are many different types of actors, economic niches, and business models. The results may be high levels of recovery and diversion from disposal, making it comparable to municipal recycling as a modernised institution. Like municipal recycling, inclusive recycling contributes to the pluralism of the modernised system, with a proliferation of actors, activities, and economic niches, which qualify it as what ecological modernization scholars have called a 'modernised mixture'.

However, inclusive recycling is not municipal recycling, and in the absence of priced disposal, the risks for both local authorities and value chain actors remain high. Combining global knowledge with local control of ecological modernisation processes is one approach to keeping the risks limited and enlarging the space for the virtuous circle of inclusive recycling to take root and flourish.

Samenvatting

Het proces van ecologische modernisering in Noordwest Europa en Noord Amerika in de jaren tachtig en negentig van de vorige eeuw heeft aanzienlijke, maar weinig begrepen, veranderingen gebracht in het afvalbeheer. Sinds de 16de eeuw bestond het beheer van stedelijk afval voornamelijk uit privatearrangementen voor het verwijderen van vuil vanuit de stadskern, met als doel de verspreiding van cholera en andere besmettelijke ziektes terug te dringen en de bijkomende stank- en hinder te vermijden. Het eindpunt van de verwijderingketen bestond uit het lozen van ongewenste materialen in rivieren, grachten, afgronden, of het storten op ongebruikte gebieden, bij voorkeur buiten de bebouwde kom. De landbouw en industriële sectoren vormden een (eind) bestemming voor de waardevolle materialen, alsmede een reden en motivatie om o.a. as, grind, stoffen, doeken, menselijke en dierlijke uitwerpselen, keukenrestanten, metalen en vezels te scheiden en schoon aan te leveren. De secondaire grondstoffenindustrie ontwikkelde zich in parallel met de instituties van stadsreiniging, maar bleef (en blijft) een aparte sector met eigen praktijken, instituties, en een eigen (economische) rationaliteit.

Het "ontdekken" van de milieu-effecten van ongecontroleerd storten op het grondwater in de jaren zestig van de vorige eeuw heeft een impuls gegeven aan het moderniseren van afvalpraktijken in de rijke landen, wat tevens ook een institutionele ontwikkeling in de afvalsector teweeg heeft gebracht. De resulterende moderne regionale stortplaats is een grote technische afvalverwerkinginrichting die als functie heeft het afval weg te houden uit dichtbevolkte gebieden, te concentreren, te bedekken met aarde, het grondwater te beschermen, en zodoende het verwerken van steeds meer complexe afvalstromen mogelijk en veilig te maken.

Met de uitbreiding van steden en het bouwen van nieuwe woonwijken werd beschikbare grond voor stortplaatsen een schaars goed. Tevens bleek het implementeren van de benodigde milieubeschermingsmaatregelen van een moderne stortplaats een kostbare aangelegenheid. Torenhoge kosten leidden tot de invoering van kosten voor het storten van afvalstoffen. Dit fenomeen -- het plakken van een prijs op storten -- vormde de voornaamste stimulans voor de verdere intensivering van het ecologisch moderniseringsproces van het afvalstelsel, gekenmerkt door institutionele en financiële hervormingen. Ecologische modernisering heeft, als dusdanig, de voorwaarden geschapen voor het toevoegen van "valorisatie" (hergebruik en nuttige toepassing van bioafval en herbruikbare spullen en afvalstoffen) aan het huidige (moderne) afvalbeheer, voornamelijk vanwege haar lagere kosten in vergelijking met het storten van ongesorteerd afval. In Nederland is dit geïnstitutionaliseerd door middel van de "Ladder van Lansink".

De tarifering van storten in rijke landen vormt de kern voor de financiële herstructurering, die een stimulans geeft aan gemeenten en nationale overheden om te investeren het "nuttig toepassen van afval" en aanverwante doelstellingen te hanteren, juist om tot een totale systeemaanpak te komen die milieu- en economische voordelen opleveren in vergelijking met modern storten. Nuttige toepassingen van afval op gemeentelijk niveau (product- en materiaalhergebruik, verbranden, compostering, kringloop) ontpopt zich daardoor als een belangrijk onderdeel van het gemoderniseerde institutionele landschap van afvalbeheer. Het stimuleert zowel landelijke als lokale overheden om in een virtueuse cirkel te treden, waar beleid tot investering leidt, waardoor toenemende hoeveelheden materialen in het hergebruik circuit komen, wat verder investeringen rechtvaardigt, minder afval genereert, een vermindering van storten met zich meebrengt, en uit eindelijk resulteert in een duurzamere en goedkopere levenscyclus van producten en materialen. Vraag en aanbod van secondaire grondstoffen nemen toe en er is minder winning van nieuwe grondstoffen en natuurlijke hulpbronnen nodig. Door vermindering van de vraag naar duur en modern storten worden stortinstallaties langer in gebruik gehouden, wat tot een vermindering in de totale kosten van het afvalsysteem leidt en een geringere belasting voor het milieu met zich meebrengt. Dit hele systeem wordt wel municipal recycling genoemd.

Het tegenovergestelde kan worden waargenomen in landen met een laage of middelmatig inkomen.

Daar is het proces van ecologische modernisering enigszins verstoord, en "hergebruik" is verwikkeld in een nieuw conflict. Tarieven voor storten worden niet toegepast: of omdat de politiek daar toe niet bereid is omdat de huishoudens te weinig inkomsten hebben; of omdat de motivatie voor modernisering veelal van buitenaf komt in de vorm van mondiale normen en standaarden, en niet wordt ingebed in de lokale beleidsvorming. Zonder storttarief ontstaan er geen of te weinig prikkels voor gemeenten om zich aan hergebruik te committeren en daarin te investeren. Als eraan gedacht wordt, is dat vaak alleen in termen van een bron van inkomsten op de korte termijn. Nuttige toepassing van afval op gemeentelijk niveau blijft uit, en de virtueuse cirkel wordt vervangen door een vicieuze cirkel van concurrentie voor de "her te gebruiken materialen", verstoorde waardeketens en transacties, dalende hergebruikprestaties, en een toenemende berg afval die gestort moet worden tegen hoge kosten.

Lokale autoriteiten, op zoek naar de financiële baten van hergebruik, gaan concurreren met de privé hergebruiksector, die in landen met lage- en middeninkomens gekenmerkt wordt door vuilnisrapers en kleinschalige opkopers; alsmede door de nuttige toepassing van organisch afval d.m.v. het voeren van varkens met keukenafval, of compostering en toepassing in de landbouw. Op zoek naar economisch gewin verbieden lokale overheden vaak informele hergebruikactiviteiten, of criminaliseren de private- hergebruiksector, en claimen veelal het absoluut recht op materialen uit de afvalstroom.

Helaas zijn gemeenten vaak niet in staat om commerciële relaties met de waardeketens te creëren en te onderhouden, omdat kennis en contacten met opkopers en exporteurs ontbreken. Bovendien zijn private ondernemers in de hergebruiksector veelal terughoudend om met de overheid zaken te doen, in de vrees voor een zwakke onderhandelingspositie gekoppeld met materialen die niet aan de kwaliteitseisen voldoen. Als gevolg hiervan stokken de transacties van de waardeketen; gemeenten ontvangen noch de baten van het voorkómen van storten, noch de inkomsten uit de verkoop van herbruikbare producten en materialen. Bovendien, krijgen de bedrijven die de materialen kopen vaak het verwijt dat ze vuilrapers uitbuiten, alsmede de schuld van het niet zaken willen doen met een gemeente die laagwaardige materialen aanbiedt.

Iedereen lijdt hieronder: gemeenten, gebruikers van het afvalsysteem, en het milieu. Gemeenten kunnen hun financiële verplichtingen niet nakomen voor het beheersen van de stortinstallatie, met als gevolg dat operationele standaarden worden verwaarloosd. Tegelijkertijd, door de verstoring van bestaande private hergebruikactiviteiten, komt er steeds meer afval naar de stortplaats, en lijdt de economie onder het te geringe aanbod van (secondaire) grondstoffen. Tevens kunnen duizenden vuilrapers en dierenvoerverzamelaars hun levensbestaan en werk verliezen.

Maar er zijn ook positieve signalen. In een handvol steden in landen met lage- en middeninkomens leidt de ecologische modernisering van het afvalbeheer naar een nieuwe ontwikkeling, het tot stand komen van een alternatief model voor gemeentelijk hergebruik, het zogenaamd "inclusieve hergebruik". Het gaat om een model waarin de gemeente officieel de baten erkent die zij ontleent aan de hergebruikactiviteiten van de private sector binnen haar grenzen, en deze ondersteunt door verschillende maatregelen. Zo wordt er vastgelegd dat de gemeente de bijdrage van de private sector erkent en meemeent bij het berekenen van de mate, en hoeveelheden en activiteiten van nuttige toepassingen van afval in haar gemeente.

Daarbij hoort o.a. ook dat de gemeente vergunningen aan vuilrapers geeft voor het inzameling van her te gebruiken materialen, hun ziektekostenverzekering betaalt, grond of een gebouw voor hergebruikactiviteiten ter beschikking stelt, of andere ondersteunende of bevorderende acties onderneemt ten behoeve van de activiteiten van de private sector binnen de waardeketens van materialen uit de afvalstroom voor industriële of landbouw toepassingen.

"Inclusief hergebruik" is niet afhankelijk van de invoering van storttarieven of aanverwante institutionele hervormingen, al hoewel haar voorstanders wel gebruik maken van voorlichtingstechnieken en het stimuleren van burgerparticipatie die ook de grondslag vormde van

het ontwikkelen van gemeentelijk hergebruikbeleid in de rijke landen in de jaren tachtig. Dezelfde maatschappelijke processen dragen bij aan de goede afstemming tussen gemeente en actoren uit de private sector, zodat deze laatste de mogelijkheid behouden om hergebruikactiviteiten voort te zetten. Het zwaartepunt van hergebruik blijft bij de private sector, maar in samenspraak en samenwerking met de overheid kunnen de kosten verminderd en de baten verhoogd worden, veelal met inmenging en hulp van bemiddelingsactiviteiten van vakbonden, coöperaties, of stichtingen die de belangen van de informele sector, gemeenten en bedrijven van de waardeketens op elkaar af stemmen.

"Inclusief hergebruik" is nu al te zien in een relatief jonge vorm in Azië en Latijns Amerika, vooral in situaties waar de institutionele ontwikkeling voor langere tijd voor een goede communicatie heeft gezorgd, met name in combinatie met lange, gezonde en diepgewortelde waardeketens van metaal en papier. Op deze plekken resulteert het afvalsysteem niet alleen in schone(re) steden, maar ook in een hoge hergebruikgraad, mede doordat er meerdere actoren, operaties, en firma's bij betrokken zijn, die allemaal met verschillende aanpakken en ondernemersmodellen werken. Net als bij municipal recycling, is er in deze steden een robuust, gemengd gemoderniseerd systeem waar te nemen met meerdere economische niches, wat lijkt op wat milieusociologen een "modernised mixture" noemen.

Niettemin, is "inclusief hergebruik" niet hetzelfde als municipal recycling, want door gebrek aan (vastgelegde) storttarieven blijven de risico´s hoog, zowel voor lokale overheden als voor de hergebruikindustrie. Door het combineren van mondiale kennis en lokale controle over ecologische moderniseringsprocessen kunnen die risico's beheerst worden, waardoor de gewenste virtueuse cirkel een kans krijgt om zich te wortelen en te bloeien.

About the Author

Anne Scheinberg has worked for nearly 35 years in waste management and recycling in North America, Europe, the Balkans, Africa, Latin America, and Asia. She works in five languages, planning and implementing sustainable waste management and valorisation projects. Before starting her own consultancy near Boston in 1984, she worked five years in recycling for government, civil society, and industry in the USA. She specialises in informal and formal recycling; organic waste management; micro-privatisation; and institutional development. Ms. Scheinberg has a BA in Anthropology *cum laude* from Vasssar College in Poughkeepsie, New York, in the USA, an MSc in Sociolinguistics from Georgetown University in Washington DC in the USA, and a Masters in Public Administration from the John F. Kennedy School of Government at Harvard University. She joined the Environmental Policy Group as an external PhD student in 2003, and had a short seconded appointment as researcher there in the Afri-Net project in 2004.

In addition to the UN-Habitat 2010 prizewinning publication, *Solid Waste Management in the World's Cities*, her most recent projects involved preparing for publication the 2006/2007 study *Economic Aspects of the Informal Sector in Solid Wastes*; developing a user pays framework for the North Province of the Maldives, designing a small regional waste management initiative as part of a reconstruction project in Haiti; and supporting Tompkins County, New York State, on writing their "Beyond Waste" plan in 2011. A dual citizen of the Netherlands and the US, Ms. Scheinberg lives with her husband in the Hague, the Netherlands, and works in Gouda at WASTE, Advisers on urban environment and development.

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