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Development drivers for waste management

This paper identifies six broad groups of drivers for development in waste management. Public health led to the emergence of formalized waste collection systems in the nineteenth century, and remains a key driver in developing countries. Environmental protection came to the forefront in the 1970s, with an initial focus on eliminating uncontrolled disposal, followed by the systematic increasing of technical standards. Today, developing countries seem still to be struggling with these first steps; while climate change is also emerging as a key driver. The resource value of waste, which allows people to make a living from discarded materials, was an important driver historically, and remains so in developing countries today. A current trend in developed countries is closing the loop, moving from the concept of 'end-of-pipe' *waste management* towards a more holistic *resource management*. Two underpinning groups of drivers are institutional and responsibility issues, and public awareness. There is no, one single driver for development in waste management: the balance between these six groups of drivers has varied over time, and will vary between countries depending on local circumstances, and between stakeholders depending on their perspective. The next appropriate steps towards developing a sustainable, integrated waste management system will also vary in each local situation.

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Figure 1 appears in colour online: http://wmr.sagepub.com

Introduction

Understanding what has driven developments in waste management in the past, and what the drivers (mechanisms or factors that significantly impact development in solid waste management) are now, is important in understanding how best to move forward in developing sustainable waste management systems around the world.

The paper begins by taking an historical perspective, looking at how the drivers have varied over time. It then takes a global perspective, examining how the perceived drivers vary today, both around the world and between different stakeholder groups. To do this, I sought assistance from some 20 colleagues working around the world, asking what they see as the key drivers for waste management in their particular context(s). The results are presented separately for developed countries and for 'emerging' or 'developing' countries. Finally, the drivers are summarized under six broad groups; these are related to the concepts of sustainable development; and some conclusions are drawn as to how best to move forward towards integrated and sustainable waste management.

Drivers for waste management over the last millennium

From 1000–1800

In the Middle Ages, city streets were covered with foul-smelling mud – composed of soil, household waste, human and animal excrement and stagnant water. Many attempts were made over the centuries to clean up, driven both by a practical concern to keep the streets clear of obstruction, and by the disgusting smell; for example, in England, 'rakers' were periodically employed (or even bought the rights) to remove waste from the streets (Girling 2005) – anything saleable was removed, and the residue either sold to farmers for use as compost or dumped. However, most of these initiatives did not last, both because the poor were more concerned with where their next meal would come from, and because the rich objected to paying to clean up for the poor. There was however one fairly constant driver – resources were relatively scarce, so most 'consumer' items were repaired and reused rather than entering the waste stream, and anything saleable in the waste stream was scavenged to provide a source of income (Woodward 1985).

1800–1850

Most histories of waste management have the previous period continuing through to the middle of the nineteenth century. However, in London a reasonably effective, formal waste management system appears to date back at least to the end of the eighteenth century, when the resource value of the waste began to provide a much more systematic driver. Due to domestic heating and cooking with coal, the ash content of household waste was high. The industrial revolution and rapid urban expansion led to an excess in demand for bricks and 'breeze' for building, for which municipal waste became an important raw material. So the London parishes began to let contracts, effectively granting an exclusive franchise to a private contractor to collect the waste in their area. From the 1790s to about 1850, this trade flourished, with the contractors generally bidding for the right to collect the waste. The waste was taken to a network of dust-yards across London, where a small army of workers were employed to sift through the waste, separating coal, breeze, 'soil' for use as a fertilizer or in brick making, and a whole range of saleable materials. The local London brick-makers were an important market, but this 'soil' does seem also to have been traded internationally, even reaching the rebuilding of Moscow! The trade peaked around the 1830s, and from some time in the 1830s or 1840s the parishes began to have to pay for the annual contract to remove waste, although the dust-yards survived until much later in the century (Velis 2004).

1850–1900

Overlapping with the decline of the dust trade was the rise of an important new driver, public health or the sanitation movement. A Sanitation Commission was appointed in London in 1839, and made the first clear linkages between infectious diseases such as cholera and poor sanitation conditions (based on the erroneous belief that disease is caused by 'miasma', i.e. bad odours from decaying organic matter). This led to the 1848 Public Health Act, and eventually to the 1875 Public Health Act which required householders to keep their waste in a 'movable receptacle' and made local authorities responsible for emptying this receptacle at least once a week (thus creating an important institutional driver). The motivators for the sanitation movement have been described as 'philanthropy, horror, and the recognition that better public health was an essential precursor of improved national prosperity' (Girling 2005). Similar legislation was also implemented in other countries.

1900–1970

Public health (legislation) continued to be a main driver, with the focus on collection – getting the waste 'out from underfoot'. Services were generally provided directly by municipalities. There were also other drivers, such as technological innovation, and resource scarcity driving recycling during the two World Wars. Disposal was largely uncontrolled, either by dumping on land or by burning – energy generation was common in Europe and even in Britain, but air pollution control was not on the agenda. Girling (2005) described Britain's 250 'waste destructors' before the First World War as 'each one a mini volcano deluging its neighbourhood with a sooty lava of ash, dust and charred paper' [I suspect that this 'folk memory' is not unconnected to current 'not in my backyard (NIMBY) opposition to modern waste-to-energy facilities].

Since 1970

Waste disposal finally came onto the political agenda in the developed world in the late 1960s or 1970s with the emergence of environmental protection as a key driver. Figure 1 shows a schematic simplification of the development of waste management policy in Europe since that time, distinguishing four overlapping phases (Wilson 1999). This figure is discussed in the next section, which examines current perspectives in developed countries.

Current perspectives: developed countries

One conclusion from the previous discussion is that *all* countries could have been termed 'environmentally developing' at some time in the recent past (within my lifetime). Indeed,

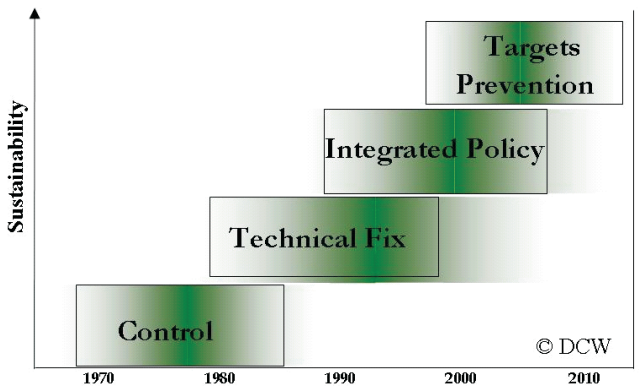

Fig. 1: Phases in the development of modern waste management policy (Wilson 1999).

one could argue that there are some regions and countries within the European Union to which the description could still be applied. Nevertheless, it is useful to divide the discussion of current perspectives into two parts, one for developed countries and the other for 'emerging' and developing countries, while recognizing that in practice there is a 'continuum' rather than just two 'extremes'.

Public health

In most of Europe, public health is largely 'taken for granted' and is no longer a major driver (although it has been used recently in the UK to argue against the introduction of fortnightly collections for residual waste).

Environmental protection

As shown in Figure 1, environmental protection was the initial driver for phasing out uncontrolled disposal, for example, by compaction and daily covering of landfills, and retrofitting incinerators with electrostatic precipitators for dust control [the '*control*' phase (1970s)]. This was followed by an emphasis on (gradually increasing) technical standards, focusing initially on leachate and gas control from landfills, and reducing dioxin and other trace gas levels from incineration, but now also including, for example, odour control for anaerobic digestion and in-vessel composting facilities (the '*technical fix*', which started in the 1980s and continues today, alongside the later phases). The EU currently requires best available techniques, as defined in a series of reference documents (BREFs), to be taken into account by EU member states in the permitting process for waste facilities (EIPPCB 2006).

A more recent environmental driver has been climate change, leading both to a move away from landfill of biodegradable wastes (a major source of methane emissions) and to a renewed focus on energy recovery from waste (Defra and Wrap 2007).

Resource drivers

An important driver in Europe has been the 'waste hierarchy', which was first introduced in 1977 in the EU's Second Environment Action Programme (CEC 1977), and which calls for a move away from disposal towards the more sustainable options of reduction, reuse, recycling and energy recovery. The waste hierarchy links into one of the historical drivers, the resource value of waste: recycling rates in Western Europe had generally dropped from high levels in the nineteenth century to single figures in percentage terms by the 1970s, but have now been rebuilt to levels of 25% or higher (SLR Consulting 2006), often driven by statutory targets rather than by the resource value *per se* (i.e. recycling is practised because it is the right thing to do, not because the value of the recovered materials covers the costs).

The EU Landfill Directive (CEC 1999) can be seen as being driven both by the waste hierarchy and by climate change: it requires all member states to reduce the levels of biodegradable municipal waste landfilled, to 35% of the 1995 levels by 2020 at the latest. Several countries have gone further and introduced a ban on the disposal of specific waste streams; for example, Belgium, Germany and the Netherlands. Germany introduced a ban in June 2005 on the landfilling on non-biostabilized waste (SLR 2006). Taken together, this recent focus is identified in Figure 1 as the last phase, labelled *targets/prevention*.

The waste hierarchy can also be seen as an 'historical' first step towards a current move away from the 'end of pipe' concept of 'waste management', towards the more integrated concept of 'resource management'. This emerging driver is termed here 'closing the loop', and is illustrated by, for example, the concept of 'sustainable consumption and production' (UNEP 2005); a focus on 'decoupling' waste growth from economic growth; 'integrated product policy' (one of seven new environmental Thematic Strategies in the EU); and a shift of emphasis upstream to product design.

Institutional and responsibility issues

Institutional issues featured relatively low in my survey of current key drivers in developed countries. The responsibility on municipalities to collect and dispose of wastes was generally introduced in the nineteenth century, and, like public health as a driver, is now largely 'taken for granted'. In many countries, the private sector has recently become much more involved in delivering the service, but this has not affected the *responsibility* of the municipality to ensure that the service is provided. The change in focus from waste collection to environmentally sound waste management has served as a driver for inter-municipal co-operation, to realize economies of scale.

As shown in Figure 1, the 1990s brought a realization that a one-dimensional regulatory approach, focusing on ever

Box 1: Variations in perceived drivers from different perspectives.

Country/stakeholder group	Perceived drivers/directions
UK local authority	EU Landfill Directive, Landfill Allowances Trading Scheme (LATS)
New EU member states	Transposing the Acquis (EU environmental law) Availability of grant funding for investment in infrastructure
Sweden, Switzerland	Resource management and climate change, leading to (even) more energy recovery
Flanders	No landfill, waste prevention, maximum energy recovery
Non-governmental organizations	No incineration, zero waste

increasing environmental standards, is not enough, rather a more integrated approach is required to waste management policy, looking at the political, institutional, social, economic and financial aspects alongside the technical and environmental (the '*integrated policy*' phase in Figure 1).

A key international driver that emerged at this time is the concept of extended producer responsibility (EPR), which involves producers taking more responsibility for managing the environmental impact of their products throughout their life, and in particular taking (financial) responsibility for the collection, recycling and safe disposal of their products at the end of their working lives. EPR is often seen as a European phenomenon, but it has also been championed by the OECD (2001) and is now being applied widely around the world, including, for example, in Australia and Canada.

EPR is just one example of the use of policy or economic instruments to drive changes in waste management. Other examples include the widespread use of landfill taxes, as a driver towards more sustainable methods of waste management; and a recent upsurge of interest in so-called 'pay as you throw' schemes, whereby householders pay directly according to the amount of residual wastes they put out for collection (with no charge or a much reduced charge for wastes separated for recycling) (Gordon Mackie Associates 2007).

Public awareness

Public awareness is also an important driver. In some countries, environmental issues including climate change, resource and waste management are beginning to appear on the political agenda. The moves towards better resource management, including more repair and reuse, higher recycling, more home composting etc, all require *behaviour change*, which has become an active area for applied research (Sharp 2006). Negative public perceptions of poor practices in the past (burning dumps, polluting incinerators) have led to the almost inevitable NIMBY reaction to proposals for *any* new waste management facility, no matter how clean or sustainable that may be. So, public awareness and education can be seen as a driver in its own right.

Differences in the perceived drivers

However, even in developed countries, there is a considerable variation in what are perceived as the important drivers, between both locations and stakeholder groups (Box 1). Across the EU, for example, a UK local authority would likely see the EU Landfill Directive as the major driver, while an authority in Latvia might cite EU accession (which brought both an obligation to meet EU legislation and the availability of grant funding for the necessary infrastructure to do so). Good resource management and climate change may be seen in some countries (e.g. Scandinavia, Switzerland) as a driver towards (even) high(er) levels of energy from waste, while some stakeholder groups, non-governmental organizations (NGOs) in particular, would see 'no incineration' as a key driver. Similarly 'zero waste' would be seen by some stakeholders, both NGOs and public authorities, as their key driver (Hill *et al.* 2006).

Drivers in the USA

Most of this discussion has focused on Europe, with an occasional reference beyond. What of the United States of America? The predominant driver appears to be the free market (i.e. business interests and the profit motive); the market is dominated by large, low-cost landfills, which import wastes from a number of states. However, there are also environmental drivers, with stringent technical standards both for landfill sites and waste-to-energy plants. Public opinion has driven a recent increase in recycling (now averaging 30%), while local opposition to large new facilities is strong. Recent energy legislation has incentivized electricity generation from landfill gas and waste to energy plants. There are some state-level drivers that resemble EU measures, for example for landfill diversion in California; four states provide (different) incentives for recycling of electronic wastes; and three states promote 'product stewardship', which has some similarities to, but is generally rather weaker than EPR.

Professionalism as a driver

One notable driver has so far not been mentioned, and that is the rapid rise in professionalism in the waste sector over

the last 30 years. For example, the UK ISWA member was founded in 1897 but only gained full official recognition as a professional body (so-called 'Chartered' status) in 2002, while ISWA has recently launched its International Waste Manager qualification scheme.

Current perspectives: 'emerging' and developing countries

Public health

I have been working on waste management in developing countries for 20 years, and have seen much progress in that time. However, in many parts of the world the key priority for cities is still the same as in Europe and North America up to the 1960s, i.e. waste collection or 'getting waste out from under foot'. In tropical climates, this generally means providing daily collection, so it is not surprising that waste collection often consumes 10–20% of a hard-pressed city's budget (Wilson *et al.* 2001). A recent donor-funded project in Lusaka, Zambia, to extend waste collection to the urban poor in an unserved peri-urban community, eliminated cholera in the area. The outbreak of plague in Surat, India in 1994 was attributed (at least in part) to rats breeding on uncollected refuse that was blocking drains and water channels. This led to the successful petitioning of the Indian Supreme Court by citizen groups, seeking to force the major municipalities to tackle their waste management problem. Even so, collection rates are still only around 70% or less in most Indian cities.

Environment

Environmental protection is still relatively low on the public and political agenda in many developing countries, although this is beginning to change. A notable example is China, where the environment has become a major feature of the Government's tenth and eleventh Five-Year Plans, in recognition of the environmental damage that has been done by the previous policy of unconstrained economic growth.

The result is that, as in Europe and North America up to the 1960s, uncontrolled or open dumping is still the norm in many countries, as comes to international prominence for a few days each time there is a major landslip, engulfing whole communities in waste (e.g. Bandung, Indonesia, 21 February 2005; Payatas, Metro Manila, Philippines, 20 July 2000). One of the first priorities is thus to phase out uncontrolled disposal and to introduce either engineered (intermediate) landfills or full sanitary landfills (Rushbrook & Pugh, 1999), as one component of an integrated, sustainable waste management system (WASTE 2006). Legislation is often now in place to require such a phase out (e.g. in India since 2000), but enforcement tends to be weak, so it is unclear whether there are, as yet, strong drivers in many countries, even to achieve this initial step.

South Africa is an example of a country where water shortages are a driver for waste management – 75% of the land area is classified as desert or semi-desert. A key requirement has thus been surface and groundwater protection, which led to the establishment of Minimum Requirements for Waste Disposal by Landfill (1994, now in its third edition: Department of Water Affairs & Forestry 2005).

In the absence of strong legislation, competition between cities, to provide a 'clean city' with good municipal environmental infrastructure, in order to attract (often foreign) investment can be a key driver (this appears to be particularly important in India where competition for foreign information technology investment is strong, but has also been quoted as a driver in China, Egypt and Russia). An extension of this is the prestige of staging an international sporting event; for example, improvement of waste management is a key part of preparations for the Beijing 2008 Olympic Games (Guo *et al.* 2005), and also for the New Delhi 2010 Commonwealth Games. A similar driver is the promotion of tourism – this has been particularly important in the Caribbean.

Resource value of waste

The resource value of waste was critical in the former centralized economies of China, the Soviet Union and Eastern Europe, where the ready availability of recycled raw materials via municipal or state-owned recycling companies was a major driver for industry (Furedy 1993). These impressive systems were one of the first casualties of the free-market system, as they relied on 'state subsidies'; however, they did also reduce waste disposal quantities and costs, which are reputed to have jumped by 50% in Eastern Germany shortly after reunification. Today, fast-growing economies like those of China and India still depend on large inputs of secondary raw materials, but these tend to be imported from developed countries (e.g. plastics from Europe and scrap metal from all around the world).

The ability to make a living by recovering saleable materials from waste is still a key driver for the urban poor (the 'informal sector') in many parts of the world (Wilson *et al.* 2006). This sector is one of the links between solid waste management and the Millennium Development Goals, to reduce world poverty by 50% by 2015 (CWG 2006). Working conditions are often very poor – children working on dumpsites are a major focus of the International Labour Organisation (ILO) programme to eliminate child labour (ILO 2004). However, the informal sector also collects clean, source-separated materials, e.g. via itinerant buyers who go from door-to-door (e.g Bangkok, Philippines, Nigeria) or drop-off centres (e.g. in Russia and South Africa).

Institutional issues

There seems to be general consensus that weak institutions are a major issue in emerging and developing countries (e.g. Asia, Africa, Latin America, Russia), so that institutional strengthening and capacity building becomes a major driver.

In a recent project in Zambia, three regional stakeholder workshops each ranked management commitment and leadership as the most important issue, even ahead of the availability of funding. This suggests that the need to increase professionalism should be another priority. One constraint here can be cultural: if waste is viewed in some way as 'dirty', then waste management will be viewed as 'not an honourable profession', a view which I suspect was once widespread, but still appears to be common, for example, in parts of the Arab world and Latin America.

In the absence of strong local drivers, say through legislation or public opinion, international financial institutions (IFIs) such as the World Bank and the European Bank for Reconstruction and Development (EBRD) can be important drivers, as they address one of the key constraints facing a developing country, namely the lack of finance for investment in new infrastructure. Box 2 explores some of the ways in which the involvement of an IFI can act as a driver, including their strong focus on environmental and social

Box 2: International finance institutions as drivers for waste management in developing countries.

Issue	Discussion
Lack of local drivers	In the absence of strong local drivers, e.g. through legislation or public opinion, international financial institutions (IFIs) can be an important driver.
Availability of finance for investment	IFIs see good municipal environmental infrastructure as necessary to underpin development. Given that lack of availability of funding for investment in waste management facilities is generally a constraint in the cities in developing country, this makes them an important driver.
Environment and social impacts	IFIs generally have strong environmental policies, so their involvement provides an environmental driver. Poverty reduction is central to their agenda, so that social, as well as environmental, impact assessments are generally required for investment projects.
Negative experiences with municipal solid waste management (MSWM) investment projects	In the 1990s, the World Bank had several relatively unsuccessful projects focused on investment in MSWM facilities (e.g. Mexico, Philippines, Sri Lanka). Constraints included weak institutions and governance, and a lack of financial capacity (e.g. to sustain facilities once the investment funds have been spent). After a period focusing on capacity building (see below), lending has now resumed: for example, in Argentina (World Bank 2006) and Nigeria (Okwe, 2006).
Institutional capacity building	Most IFI projects include a strong element of institutional capacity building. A major World Bank regional project in the southern and eastern Mediterranean focused on capacity building: guidelines are available on policy and legal, institutional and planning, finance and cost recovery, private sector participation and community participation (METAP 2005). This builds on earlier World Bank guidance, including their Strategic Planning Guide (Wilson *et al*. 2001) and Landfill Guide (Rushbrook & Pugh 1999).
Private sector participation (PSP)	Private sector participation (PSP) is seen by the IFIs, including the World Bank and European Bank for Reconstruction and Development (EBRD), as a key component of the institutional arrangements if they are to provide finance, and so can also be viewed as a driver. EBRD tends to require waste collection to be tendered to the private sector, while treatment and disposal often stays with the public sector company, which in their regions tend to have more experience in these aspects. The World Bank has set out three key principles that must be met for successful PSP in waste management – *competition, transparency and accountability* (Cointreau 2000). To these I add a fourth – the municipality needs to retain *responsibility* for providing the service, while delegating service *provision* to the private sector (this follows from the public health and environmental consequences if the service fails). GTZ have published a critical review of experiences in PSP in waste management, including 23 case studies (Coad, 2005).
Climate change	The clean development mechanism under the Kyoto convention, whereby developed countries can buy 'carbon credits' from developing countries, is widely seen as a major driver for improving waste management. It is being actively promoted by the World Bank, particularly for landfill gas projects – to achieve a reliable income, a city needs to demonstrate that it has actually saved carbon emissions, providing an incentive to continue operating the new landfill site properly when the initial investment money has dried up.
Affordability	The IFIs are generally lending money (indeed, they are driven by the need to finance projects), and their interests may not always coincide with those of their clients, who may be concerned with the affordability of the projects to their citizens. A particular case arises in the Former Soviet Union: whereas significant grant funding to improve municipal infrastructure has been and is available to EU accession countries, those outside this group are expected to borrow the whole capital costs at normal rates. In addition, the EBRD has a standard rule that all projects have to meet EU environmental standards, which further exacerbates the affordability issue.
Good governance	A common thread underpinning much of this box is the need for good governance. This is clearly a much broader issue than just waste management. However, the UK Department for International Development has made the case for using the state of waste management in a city as an *indicator* to monitor the success of good governance programmes (Whiteman *et al*. 2001) – where waste management is working well, it is likely that the city has also tackled underlying issues relating to management structures, contracting procedures, labour practices, accounting, cost recovery and corruption.

impacts, on institutional capacity building and on good governance.

The IFIs have also underpinned two particular drivers in developing countries, namely private sector participation and the use of the clean development mechanism under the Kyoto convention. The latter provides a financial mechanism to promote environment, climate change and waste as an energy resource as technical drivers for waste management.

Public awareness and cultural issues

In some countries, simple survival is such a predominant concern, that waste management does not feature strongly on the list of public concerns. Where it does, then public health (e.g. the plague in Surat) will tend to feature before environmental issues. However, poor waste management is beginning to come onto the public agenda, for example, in South and East Asia, perhaps led by those communities who live near dump sites. Unfortunately, the poor public perception of existing (or past) disposal practices does mean that locating any new facilities, no matter how much better they are intended to be, is met by almost universal public opposition (NIMBY). The need to improve public awareness of, and community participation in, waste management has been widely recognized; for example, the World Bank has included this aspect in their guidelines for the Mediterranean region (METAP 2005; see Box 2); and UNICEF initiated a national campaign in Brazil in 1999 involving Waste and Citizenship Forums (Dias 2006).

Discussion, conclusions and future directions

Common threads

This analysis has identified six broad groups of drivers (Box 3). Public health led to the emergence of formalized waste col-

Box 3: A categorization of development drivers in waste management.

Groups of drivers	Historical perspectives	Current perspectives	
		Developed countries	'Emerging' and developing countries
(1) Public health	Emerged as a key driver for waste collection in nineteenth century	Now largely 'taken for granted'	Remains a key driver, particularly in hot climates
(2) Environmental protection	Came to the fore in 1970s.	The systematic increasing of environmental standards is continuing	Focus still on initial steps, to phase out uncontrolled disposal
		Energy/climate change emerging as a key driver	Clean development mechanism is extending this to developing countries (promoted by international financial institutions (IFIs)
(3) Resource value of waste	Repair and reuse the norm up to early twentieth century Communities of scavengers in major cities up to nineteenth century	Displaced as a key driver by a more holistic approach to resource management (see (4) below)	Provides a livelihood for large numbers of the urban poor
	Provided the basis for major industrial economies (Nineteenth century London; twentieth century China/Soviet Union, Eastern Europe)		China and India still rely on imports of recycled materials as industrial raw materials
(4) Closing the loop	Waste hierarchy dates from approximately 1977. More holistic approaches to resource management more recent.	Increasingly important. Waste prevention and recycling are key priorities, irrespective of the cost	
		Sustainable production and consumption, integrated product policy, zero waste all emerging as drivers	
(5) Institutional and responsibility issues	Municipalities assigned a duty to collect waste in late nineteenth century.	Such a duty is largely taken for granted	Ability to discharge this function still limited
		Extended producer responsibility in Europe attempts to move the financial burden from the public to the private sector	Capacity building and good governance are key drivers (being promoted by IFIs)
(6) Public awareness	Waste management moves up the hierarchy of people's priorities as living standards increase	Environment, climate change and resource management emerging as key issues in terms of public perception	Focus is still on food, shelter, security and livelihoods – waste becomes an issue when public health or environmental damage impacts on these priorities.

lection systems in the nineteenth century, and remains a key driver in developing countries. Environmental protection came to the forefront in the 1970s, with an initial focus on eliminating uncontrolled disposal, followed by the systematic increasing of technical standards. Today, developing countries seem still to be struggling with these first steps. The resource value of waste, which allows people to make a living from discarded materials, was an important driver historically, and remains so in developing countries today. An emerging driver in developed countries is closing the loop, moving from the concept of 'end-of-pipe' *waste management* towards a more holistic *resource management*. Climate change/energy from waste (which can be related to three of these groups of drivers) is emerging as a key driver worldwide – the clean development mechanism under the Kyoto protocol is seen as providing an important source of income to encourage cities in developing countries to maintain investments in new landfill sites.

These four basic groups of drivers are underpinned by two more. The first is institutional and responsibility issues. Institutional capacity is seen as a particular weakness in developing countries, and is a particular focus of interventions by IFIs. Extended producer responsibility is seen as critical in Europe, as a means of shifting to producers the (*inter alia*, financial) responsibility for managing the environmental impact of their products throughout their life. The other is public awareness, which needs to be increased in both developed and developing countries if major advances in waste management are to be achieved.

Relating the drivers to sustainable development

How do these six groups of drivers relate to current ideas on sustainable development? Each driver may be related to the familiar 'pillars' of sustainable development, i.e. environment and resources, economy, and social acceptance. For a fuller answer, I would refer to the concept of integrated sustainable waste management (ISWM), as formulated by the Collaborative Working Group on waste management in middle- and low-income countries (CWG – Schübeler *et al.* 1996), and elaborated, for example, by WASTE (2006). This recognizes three 'dimensions' of a waste management system.

1. All the *components*, from waste generation through to final disposal.
2. All the *aspects*, including the environmental, social, health, legal, political, institutional and economic, as well as the technical and financial.
3. All of the *stakeholders* involved, including service users, NGOs, national and local government, the private and informal sectors and external support agencies.

The elaborations of the ISWM concept referenced here focus on applications in developing countries, but the principles apply universally. Referring to Figure 1, the initial steps taken in the West in the 1970s and 1980s focused on the technical and environmental aspects; while the later steps recognized the need for a more integrated approach, considering all the aspects enumerated above, in order to achieve a sustainable solution.

Challenges for the future

What do I see as the major challenges ahead? As with the body of the paper, I will divide the answer into two parts. The detailed approach taken so far in developed countries has shown wide variations, notably between the EU and the US, both in terms of the end point sought (e.g. how much use of landfill is acceptable in the long term?), and in the degree of policy intervention. For me, the major challenge going forward is how to 'close the loop'; that is, how can we move from the traditional 'end-of-pipe' concept of 'waste management' to a more holistic concept of 'resource management', which will also form one part of the wider global strategy to reduce carbon emissions and tackle climate change. The current EU approach is a step towards this, but there is still a long way to go. For example, we need to address systematically a series of institutional and governance issues, such as how to change local waste management authorities into resource management authorities (Lisney 2007).

In developing countries, the current baseline is perhaps even more variable. I see the challenge as helping each country to decide on their next steps towards developing an integrated and sustainable waste management system that is appropriate to their particular local situation. If there is one key lesson that I have learned from 30 years in waste management, it is that there are no 'quick fixes'. All developed countries have evolved their current systems in a series of steps; developing countries can benefit from that experience, but to expect to move from uncontrolled dumping to a 'modern' waste management system in one great leap is just not realistic.

Closing remarks

This paper has presented a very personal perspective on development drivers in waste management. I believe that understanding what has driven developments in waste management in the past, and what the drivers are now, is important in understanding how best to move forward in developing sustainable waste management systems around the world. My overall conclusion is that there is no one, single driver that can be seen as 'dominant'; rather, all of the six groups of drivers are important, and the balance between them will vary between countries depending on local circumstances,

and indeed between stakeholder groups depending on their particular perspective.

The next appropriate steps towards developing an integrated and sustainable waste management system will still need to be determined for each local situation. It is here that I see a real opportunity for waste management professionals: let us all rise to the challenge and play a key role in shaping how society tackles waste and resource management in the twenty-first century.

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