

Article

Resolving Governance Issues to Achieve Priority Sustainable Development Goals Related to Solid Waste Management in Developing Countries

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Academic Editor: Christian Zurbrügg

Received: 15 December 2016; Accepted: 1 March 2017; Published: 9 March 2017

Abstract: As a key utility service that more than 2 billion people are currently lacking, solid waste management (SWM) is a crosscutting issue that can be directly linked to 12 out of the 17 UN Sustainable Development Goals (SDGs). Distinguishing between physical components and governance aspects of SWM, this research focuses on governance issues concerning basic solid waste collection services and controlled disposal, thus addressing the ‘How’ and the ‘Who’ dimensions of a SWM system. As a form of transdisciplinary research, the findings from the literature on governance issues in SWM were iteratively subjected to several rounds of commentary by a large group of stakeholders from six continents, within the authors’ work for the United Nations Environment Programme (UNEP)’s 2015 *Global Waste Management Outlook*. The study identifies a combination of complementary instruments required for extending collection to all and bringing disposal under control. While municipalities have a legal responsibility for providing services to their citizens, various service providers can contribute to an effective SWM system. Appropriate forms of funding are essential to secure financial sustainability of the services under the local conditions of affordability and willingness to pay. As new services require behavioural change on the part of citizens and municipal waste departments alike, communication and exchange with other stakeholders function as enabling and supporting factors. The significance of capacity development is highlighted.

Keywords: solid waste management; governance; developing countries; Sustainable Development Goals (SDGs); waste collection; waste disposal

1. Introduction—Direct Links between Solid Waste Management and SDGs

If it functions properly, solid waste management (SWM) is a key utility service that generally goes by unnoticed. However, if it does not function well, SWM keeps drawing public, political, and media attention in the country, e.g., [1–3]. If SWM completely stops functioning, the situation amounts to a crisis and reaches the headlines internationally. The relatively recent case in point is that of Campania, Italy, which filled the media around the world with distressing pictures of streets clogged with piles of uncollected waste, drainage channels along country roads that had become ad hoc dumping grounds, and lorries standing still in long queues, unable to unload waste anywhere [4,5].

As such, SWM is a crosscutting issue that affects and impacts various areas of sustainable development in each of the three sustainability domains: ecology, economy, and society. The affected areas include living conditions, sanitation, public health, marine and terrestrial ecosystems, access to decent jobs, as well as the sustainable use of natural resources. Accordingly, out of 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development, adopted by the 193 UN

Member States in September 2015 [6], at least 12 SDGs and their pertinent targets have a direct link to SWM. Not being a high-level SDG in its own right could potentially threaten to reduce the ‘visibility’ of SWM as a political priority; however, United Nations Environment Programme (UNEP)’s recent *Global Waste Management Outlook* (GWMO) [7] developed the contrary argument, that the crosscutting nature of SWM and its impact on not just one but on 12 SDGs should only emphasise the importance and increase the political priority of SWM. Table 1 presents these 12 SDGs with their pertinent targets and their links to SWM.

In essence, the SDGs have the same driving forces as those that have been driving development of SWM activities over time, namely: public health, environmental concerns, and resource value, with relatively recent additions of climate change and inclusivity [8]. Protection of public health was the main driving force behind the early attempts to introduce some form of solid waste collection in cities around the world hundreds of years ago [9]. While in the past most cities and towns have been able to organise some level of services to their citizens, in recent decades many of them have been struggling to keep up with the amounts of waste generated, particularly in developing countries, e.g., [1–3]. Such an increase in waste amounts is a result of an ever-increasing urban population, largely due to unprecedented rates of rural-urban migration, and of economic development accompanied by changes in consumption patterns and changes in waste material composition. As a consequence, more than 2 billion people still do not have access to basic waste collection services [7].

In developing countries, while people leave their villages for prospects of employment and generally ‘a better life’ for themselves and their families in the cities, they usually start their urban life in slums or similar informal settlements, under very challenging living conditions, lacking basic infrastructure and services. Their specific needs are addressed by Target 11.1: “By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums”. Solid waste collection is one of these basic services, which, together with sanitation, would make a considerable difference to the lives of billions of people worldwide, probably those who need development the most.

The uncollected waste is usually just dumped in watercourses or vacant land or burned in the open air near the residences. Such practices pose health risks to the residents, with children being especially affected. Dumped waste also clogs drains, which exacerbates floods and the damage that floods cause to public health and property [10,11]. However, even in places where waste is collected, it may still end up being dumped in low-lying areas or just anywhere outside the city. This means that open dumping will affect local water sources and adversely affect the environment. More than 3 billion people lack access to controlled disposal for their waste [7]. In recognition of this global problem, SDG Target 11.6 states: “By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management”. Also, SDG 6 on water and sanitation explicitly addresses the problem of waste dumping in its Target 6.3: “By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally”. Consequently, tackling this global waste crisis, by ensuring access to adequate, safe, and affordable solid waste collection services for all and by eliminating uncontrolled dumping and open burning, would constitute a major contribution to sustainable development as defined by the UN SDGs.

In addition to that, the elimination of open dumping is the necessary stepping stone toward environmentally sound waste disposal, which is explicitly addressed by Target 12.4: “By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment”.

When the current modernisation process started in developed countries in the 1970s, ‘modern’ waste management was largely defined in engineering terms—a technical problem with a technical solution. Accordingly, there is a considerable body of scientific and professional literature on technologies necessary for waste collection and waste disposal, e.g., [12–15]. Gradually, however,

as many city authorities will confirm from their own experience, the world community learnt that no technology could on its own solve the problems related to economic and social sustainability of waste management activities; in other words, that the governance aspects of the necessary actions need to be duly considered. In comparison to technical aspects, governance aspects have been less systematically examined, particularly in relation to SDGs. This paper is a contribution toward this body of literature.

The objective of the paper is to identify the appropriate governance instruments necessary for the provision of basic services of waste collection and controlled disposal (i.e., SWM related Goals 1 and 2 in Table 1) as the necessary initial steps in developing an effective solid waste management system. With this focus, the paper is most relevant to developing countries, and in particular to many lower-income countries. Attention here is specifically on SWM, but the principles of good governance discussed here are likely to be applicable also in other areas of sustainable development that are related to human settlements.

The paper is structured in four sections. Section 1 is an introduction into SDGs and their relationships with SWM; Section 2 presents the methods used and the analytical framework adopted for the analysis of policy instruments in the study; Section 3, comprising the research results, is divided into three parts, each addressing one of the three categories of policy instruments, according to the classification adopted. Finally, Section 4 provides the main conclusions as well as a brief summary of the results.

2. Methods and Analytical Framework

2.1. Methods

This study is conducted in continuation of the research done by the authors for the UNEP's 2015 *Global Waste Management Outlook* [7]. For the GWMO, starting from an extensive literature review, an exhaustive list of governance instruments and issues in implementation was compiled. Subsequently, the list and its organisation have been iteratively subjected to several rounds of commentary by a large group of stakeholders from six continents, who had been identified and approached by UNEP. In addition to comments, the reviewers provided numerous examples from their practice, which illustrated particular governance instruments and issues. In this sense, this is a case of transdisciplinary research [16], where a variety of stakeholders contributed to shaping the final document with their contributions drawn from local experiences. In addition to the GWMO, the examples of experiences from cities worldwide draw upon the authors' research for the UN-HABITAT's 2010 *Solid Waste Management in the World's Cities* [17], and its later expansion using the Wasteaware benchmark indicators [18].

2.2. Analytical Framework

While the usage and the exact meaning of the term governance varies across scientific literature, e.g., [19–21], the study adopts the analytical framework developed by the authors and colleagues [11,17,18] based on the concept of Integrated Sustainable Waste Management [22]. The framework distinguishes between the physical components (the 'What' dimension of a SWM system) and the governance (the 'How' and the 'Who' dimensions of a SWM system). Of the physical components of a SWM system, this study addresses waste collection services for all and controlled disposal as the essential initial stepping stones for public health and the environment. This paper focuses on the governance aspects of the efforts needed to achieve such services. It firstly identifies the policy instruments that have been essential to apply to this end. However, enacting legislation or opting for other policy instruments is just an initial step toward effective services. Therefore, due attention is given to their implementation and enforcement in practice, where arguably the most challenges lie. This necessarily broadens the discussion from the 'How' dimension to look also at the 'Who' dimension within our definition of governance, considering in particular the service users and the various potential service providers.

Table 1. Relationship between Sustainable Development Goals and Solid Waste Management.

Driver	Sustainable Development		Solid Waste Management (SWM)	
	Sustainable Development Goal (SDG) ⁱ	Specific Target	SWM Related ‘Virtual SDG’ ⁱⁱ	
Protection of public health	SDG 11: Sustainable cities	11.1 Ensure access for all to adequate, safe, and affordable basic services; upgrading slums	→ Goal 1. Ensure access for all to adequate, safe, and affordable solid waste collection services.	
	SDG 3: Good health and well-being	3.2 End preventable deaths of children under 5 years 3.3 End malaria and combat water-borne diseases 3.9 Reduce illnesses from hazardous chemicals and air, water and soil pollution, and contamination	<i>Uncollected waste is often dumped in waterways or burned in the open air, thus directly causing pollution and contamination. Waste also clogs the drains, which exacerbates floods, keeping stagnant water and contributing to water-borne diseases and malaria. Children are among the most vulnerable, so they are affected the most.</i>	
	SDG 11: Sustainable cities	11.6 Reduce the adverse environmental impact of cities; special attention to waste management		
Protection of the environment	LOCAL	SDG 12: Responsible consumption and production	12.4 Environmentally sound management of chemicals and all wastes in order to minimize their adverse impacts on human health and the environment	→ Goal 2. Eliminate uncontrolled dumping and open burning, as the first stepping-stone to achieving environmentally sound SWM practices.
		SDG 6: Clean water and sanitation	6.3 Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous materials	→ Goal 3. Achieve environmentally sound management of all wastes, particularly hazardous wastes (either chemical or biological hazardous wastes).
		SDG 15: Life on land	15.1 Ensure the conservation of terrestrial and inland freshwater ecosystems and their services	
	GLOBAL	SDG 7: Affordable and clean energy	7.2 Increase the share of renewable energy in the global energy mix	→ Goal 3. SWM technologies can derive renewable energy from (organic) waste.
		SDG 13: Climate action	SDG 13: Take urgent action to combat climate change and its impacts	→ Goal 3. Adequate SWM practices can prevent emissions of large amounts of greenhouse gases. ⁱⁱⁱ
		SDG 14: Life below water	14.1 Prevent marine pollution of all kinds, in particular from land-based activities, including marine debris	→ Goal 1 and Goal 2. Extending waste collection to all and eliminating uncontrolled dumping will prevent waste (particularly plastics) ending up in the oceans.

Table 1. Cont.

Driver	Sustainable Development		Solid Waste Management (SWM)
	Sustainable Development Goal (SDG) ^I	Specific Target	SWM Related ‘Virtual SDG’ ^{II}
Resource value	SDG 12: Responsible consumption and production	12.5 Reduce waste through prevention, reduction, recycling, and reuse	<p>→ Goal 4. Substantially reduce waste generation through prevention and the 3Rs (reduce, reuse, recycle) and thereby create ‘green’ jobs</p> <p><i>Waste prevention is the highest-ranking option in the waste management hierarchy. It is followed by reuse of products or their parts, and then by recycling of component materials.</i></p> <p>→ Goal 5. Halve per capita global food waste at the retail and consumer levels and reduce food losses in the supply chain.^{IV}</p>
		12.3 Halve global food waste and reduce food losses along production and supply chains This SDG also contributes to SDG 2: Zero hunger—End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
Supplementary driver: Inclusivity	SDG 1: No poverty	1.4 Ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources and financial services, including microfinance	<p>→ Goal 4</p> <p><i>Reuse and recycling have a significant potential for creation of jobs.</i></p> <p>→ Goal 1 and Goal 4</p> <p><i>In developing countries, SWM services are often provided by individuals and small and microenterprises. Any measures applied to support them will improve livelihoods and directly contribute to SDGs 1 and 8.</i></p>
	SDG 8: Decent work and economic growth	SDG 8: Promote inclusive and sustainable economic growth, employment and decent work for all	

^I Source of SDGs and targets: [6]. The wording of the targets is shortened. Dotted lines denote overlap. ^{II} Source of SWM related ‘Virtual SDGs’: [7]. Explanations are given in *italics*. ^{III} The potential of improved SWM practices to contribute to climate change mitigation is discussed in Topic Sheet 1 of the *Global Waste Management Outlook* (GWMO) [7] (pp. 12–15). ^{IV} Examples of global good practices of food waste prevention are presented in Topic Sheet 11, Case Study 3, and Box 4.8 of the GWMO [7] (pp. 114–115, pp. 116–119 and p. 140, respectively).

Policy instruments deployed to achieve goals can be divided into a few main groups. In the GWMO, and in this study, we adapted the typology of policy instruments from Taylor et al. [23], who distinguish five types:

- Direct ‘command and control’ regulation,
- Economic instruments,
- Information-based instruments,
- Co-regulation and self-regulation,
- Support mechanisms and capacity building.

In the GWMO, we kept direct regulation (‘command-and-control’ approach) and economic instruments. However, we inserted co-regulation and self-regulation as a subtype of direct regulation. We also combined information-based instruments with support mechanisms and capacity building into one type, here termed ‘social’ instruments, because they include some form of ‘social’ interaction and communication among stakeholders in the system, either with or without direct participation of government. The term ‘social’ instruments also better covers the full range of meanings and contents of interaction and communication, as they take place not only on the intellectual level but also engage emotions and may involve direct experience.

The three categories of policy instruments adopted here are presented in Figure 1 below. It is worth noting that Bemelmans-Vidéc et al. [24] also group policy instruments into three equivalent categories, namely ‘sticks’ (for direct regulation), ‘carrots’ (for economic instruments), and ‘sermons’ (representing communication and information-based instruments). Other authors do not explicitly classify policy instruments [25].

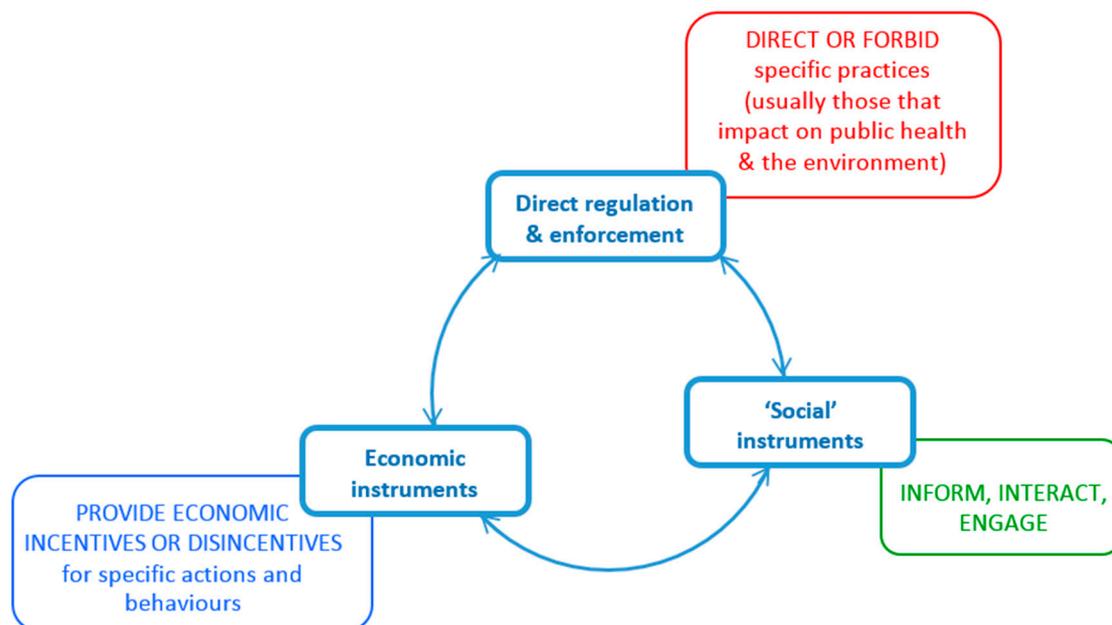


Figure 1. Policy instruments for SWM. Source: [7] (Figure 4.1, p.128).

3. Results—Governance Aspects of Basic SWM Services

In recognition of solid waste collection and sanitation services as essential contributors to public health, authorities have been putting in place and implementing various policy instruments for this purpose in cities around the world for centuries, including many older cities in developing countries. Addressing controlled disposal is a more recent policy goal, which brings into play a whole new set of governance related issues. Beyond controlled disposal as an intermediate goal, the ultimate goal is

protection of the environment through environmentally sound waste treatment and disposal, as well as through environmentally sound resource recovery activities, and the transition from a linear to a circular economy [7]. This is to say that other physical components, such as environmentally sound treatment and disposal and resource recovery from waste, need to be considered from the outset so as to ensure and capitalise on the synergy of actions toward strategic long-term goals of the system. In other words, it is important and beneficial to ensure coherence of policy goals and cohesion among the instruments applied to achieve them [26,27].

3.1. Direct Regulation and Its Implementation

3.1.1. Direct Regulation for Waste Collection Services

Due to the importance of public health as one of the fundamental policy goals, countries all over the world have national legislation in place requiring measures related to sanitation and solid waste management. Regarding SWM, such legislation allocates the legal responsibility to a party, commonly the waste generator, for ensuring that the waste is collected and removed from its point of generation and transported to an appropriate facility. For municipal solid waste this responsibility is placed on municipalities or counties or a similar level of local government. For other types of waste, commercial and industrial generators are responsible for arranging that their waste be adequately taken care of.

While countries have relevant legislation, the implementation in practice is inadequate in many places, with the result that waste collection services are simply not available to all citizens. The reasons for this situation are manifold, ranging from inadequate capacities of the authorities in charge to the lack of political commitment and support, to the lack of willingness and ability to pay of service users, to, in some cases, the lack of enabling local legislation to engage other parties.

National legislation does not necessarily stipulate which actor is to provide the actual services; it is usually up to the municipalities to decide and specify in their local by-laws whether they will provide the service themselves or outsource it to a third party.

In developing countries, municipal waste departments usually lack financial and technical capacities to provide adequate services to the growing city population. As part of the remedy, public-private partnerships (PPPs) have been promoted in development policies as a means of harnessing the expertise, efficiencies, and investment that the private sector can bring to the delivery of public services. The evidence shows however [17,28] that the waste collection coverage and quality of services are not necessarily related to the type of service provider, public or private, including the variants of each. In other words, there are examples of good and bad services for each type and subtype of service provider. Having said that, a number of issues have been identified concerning the successful implementation of public-private partnerships. For diverse models of PPPs to 'work' in practice, municipal authorities need—and often lack—the competencies to fulfil their 'client' role in interaction with private sector service providers. The competences to successfully initiate, develop, negotiate, award, and manage PPPs in SWM—as well as in public services and (urban) infrastructure projects in general [29,30]—are essential to change the status quo and improve the situation. In some cases, such as Malaysia, the central government intervened and took the 'client' role on behalf of municipalities to overcome this critical situation [7] (Box 4.33, p. 188).

For example, large private companies tend to be more interested in providing waste collection services in more affluent areas such as city business districts and affluent residential areas, where the streets allow easy access to larger vehicles and where service users are more likely to pay a higher fee than in other areas of the city. This is the main challenge in terms of the related SDGs—while the city centres are usually clean, access to services is still a serious issue in the rapidly growing peri-urban fringes. For these areas, the solution may be in engaging smaller service providers, including small and microenterprises and their organisations, including the informal sector, to provide primary collection services. Elaboration of various operator models applied in selected cities around the world can be found in [28], while Topic Sheet 14 in [7] (pp. 176–179) presents a discussion of the informal

sector. At the same time, the full support and cooperation from the municipal waste department are indispensable, both for secondary collection and transport to a facility as an essential physical component of the SWM system, and for giving legitimacy and securing acceptance by the service users. Alternatively, if a larger private company (rather than the municipal waste department) provides secondary collection and transport, municipal authorities have an essential role to align the parties involved toward the common goal of better SWM performance. In the same way that municipal waste departments often lack capacity, so do small service providers; for example, the capacity to prepare a business plan or negotiate contracts or obtain small-scale and affordable finance. As they can be very valuable contributors to the effective overall SWM system, in many places it is worthwhile for municipal officials to collaborate with these and other stakeholders to build their capacities and facilitate access to finance, as the examples of Kampala, Uganda [7] (Box 4.27, p. 175) and Lusaka, Zambia [17] (pp. 66–67) illustrate.

The transition to a new way of providing the services may evoke resistance from the municipal waste department, both from higher-ranking officers and the workers. Officers in charge may be reluctant to change their ways and look down at collaboration with small service providers. Such an attitude is more likely to develop in response to initiatives coming from ‘outside’—from central government or foreign development aid organisations. Municipal waste workers may fear for their jobs and actually sabotage the newly introduced services provided by a third party, as the cases in, for example, Nicaragua [31] and Malaysia [7] (Box 4.33, p. 188) testify. Regardless of whether such fears are founded or not, it takes a lot of appropriate communication with a high degree of openness and transparency for them to subside. However, the necessary communication and public relations skills may also be lacking in the municipal waste department, where officers in charge may be engineers. To make matters worse, the pressure of inadequate financial and technical capacities and the ‘fire fighting’ mode of day-to-day operations to meet the citizens’ needs do not leave much time and resources for staff development. There are examples, however, where bilateral cooperation and exchange with colleagues from foreign twin-cities has contributed to capacity development, as in the cases of Cebu City in the Philippines, the city of Bo in Sierra Leone, and their European partners [7] (Box 4.29, p. 183 and Case Study 7, pp. 255–259, respectively).

It is clearly important that the local laws and regulations allow for solutions involving third parties and indeed facilitate the inclusion of various service providers. If, in contrast, the pertinent by-laws are formulated so that municipal waste departments have a duty and the sole access to waste, while other parties do not—thus effectively forbidding the access to waste to any other party but the municipal waste department—areas of the city most in need of development may remain underserved [32]. This touches upon a broader issue of access to valuable materials in waste and the question of who actually owns waste [33]. This issue is certainly relevant for waste collection services in general, but even more so for (separate) collection services for the purpose of recovery of resource value through reuse and recycling. Clearly, having legal authority to access the valuable waste materials provides regulatory certainty for interested parties to invest and engage in related SWM activities.

In some cases where city authorities failed to provide adequate services, other actors took the initiative and organised services in their neighbourhoods themselves, either as an enterprise or a cooperative. Examples include educated but unemployed youth in Mombasa, Kenya, a group of women in Bamako, Mali, and residents of a few wards in Dhaka, Bangladesh [17] (Box 5.26, p. 199; pp. 48–49 and p. 100; and Box 4.6, p. 99, respectively). The first two groups have not only provided the much-needed services in the area but also managed to create jobs and a source of income for themselves. The Dhaka initiative received attention from the rest of the city as well as from other cities and was later on copied in several places across the country.

3.1.2. Direct Regulation for Controlled Waste Disposal

The environmental movement in the 1960s and 1970s was instrumental in adding environmental protection to public health as a driving force for policy formulation. Consequently, environmental legislation has been instituted that requires measures of environmental protection to be applied to waste facilities and services. However, before countries embark on imposing stringent imported standards, the first essential step is getting waste to a controlled facility.

Much like in the case of waste collection, the problem with waste disposal is in the implementation of this legislation. Practices of open dumping and burning are explicitly against the law in most countries, but lack of law enforcement means that such practices continue in many developing countries. In other words, for environmental legislation to be effective and meaningful, it is essential that it be supported by decisive and visible enforcement. Without it, the waste industry as we currently know it in developed countries would not exist—waste would just be dumped at the lowest cost, causing huge damage and ensuing costs to society through adverse health impacts and pollution. However, enforcement is based on information gathered through regular monitoring and inspection, which can be administratively ‘heavy’, requiring considerable institutional capacities and involving high costs to run.

At the same time, there must be a synchronised effort to actually have facilities in place, ready to receive the waste once the regulations are enforced. This has been called the ‘implementation conundrum’—regulations say that waste generators need to use a certain type of facility, but the regulations cannot be enforced until those facilities are available. However, until the regulations are enforced and non-compliant facilities closed down, no one will invest in the higher cost facilities that are needed for regulations to be enforced, as their gate fees will be undercut by the non-compliant facilities. This was very much evidenced with hazardous wastes in the 1980s—for example, there were several high profile cases in the USA, where new facilities went bankrupt within a few months because non-compliant facilities were still available just across the State border [34].

However, getting from a situation with no facilities at all to the state-of-the-art facilities in one ‘leap’ is unrealistic. The ‘answer’ is in gradual implementation, where each step is relatively small and attainable with the resources available. The case of Moshi, Tanzania, mentioned below is a good example. This is also how the development proceeded in Europe and North America from the 1970s, in a series of steps, first focusing on upgrading dumpsites to controlled disposal; then gradually increasing the environmental standards; then turning attention to diversion from disposal [8]. By making each step relatively small, this helped mitigate both the ‘implementation conundrum’, in that each step in facility sophistication (and related incremental cost) was not so huge; and the ‘enforcement conundrum’, in that the increase in needed capacity (and related cost) of the environmental regulator was manageable. The end goal of environmentally sound waste disposal does however need to be borne in mind from the outset. Depending on the size of cities, inter-municipal cooperation may contribute to solve the problem of waste disposal, offering economies of scale for facilities and benefits of centralised operations and environmental controls.

To reinforce the point regarding gradual improvement, it is worth mentioning situations where countries that were just starting to bring their waste disposal under any level of control adopted technical standards for engineered landfills from other countries, which were among the most stringent in the world. In those circumstances it was a rather meaningless exercise in legislation. Such unrealistically stringent standards were actually counterproductive, as the stakeholders affected by them knew that there would be no enforcement, which removed any incentive for efforts to improve disposal practices.

Finally, similarly to the citizens taking action to organise waste collection service, it is sometimes also citizens who precipitate enactment or enforcement of environmental legislation on waste disposal. This was the case in, e.g., the UK where, following the discovery of hazardous waste dumped near residential areas and ensuing public outrage and media coverage, the UK Deposit of Poisonous Waste Act 1972 was drafted and passed by Parliament within just a month. In India, it was the action by

an individual—the case of *Almitra H. Patel v. Union of India*—that accelerated the preparation of the landmark environmental legislation, the Municipal Solid Wastes (Management and Handling) Rules of 2000 [7] (p. 181). In many places, usually with the support of advocacy Non-Governmental Organisations (NGOs), local communities near the dumpsites will at a certain point protest and take action against dumping near their residences. A current global initiative by the International Solid Waste Association (ISWA) to close 50 of the world's most notorious dumpsites gives voice to such local actions [35].

3.2. Economic Instruments

3.2.1. Economic Instruments for Waste Collection Services

Based on the 'polluter pays' principle, various economic instruments have been devised to finance waste management activities or achieve desired behaviour on the part of actors in the system. In most cities, some degree of cost recovery from user charges is in place. However, due to the significance of waste collection for public health, direct cost recovery from paying users, although considered important, is not the central feature of financial management in the cities examined for this study. In addition to the need to protect public health, authorities are concerned that the introduction of direct user charges could be a perverse incentive for some waste generators to continue with indiscriminate dumping and burning. In some cities, the charges are deliberately kept low; in others, no measures are taken to increase low payment rates among residents [17]. If the charges do not entirely cover the costs entailed, the remainder is provided from municipal property or a similar tax or from budgets allocated by the national government.

However, even in high-income countries, there is no uniformity in approach—e.g., in the UK, it is explicitly prohibited for municipalities to impose a direct user charge; instead, people pay via an indirect property tax. In the Netherlands, funding is derived from a combination of user charges and property tax in varying proportions across the municipalities; in some cases there is a cross subsidy, where the majority of residents pay a bit more so that the poorest people pay less or not at all.

Perhaps unsurprisingly, if the city authorities are introducing a direct charge to the users for the first time, citizens will generally resist such a change, using the rationale that either those public services ought to be provided by the city free of charge, or the citizens have already been paying for them via other taxes or charges. Such resistance has been observed in Latin America, Africa, Asia, and Europe alike. As such, the issue has often been highly politicised, as for example, in the UK where the incoming government in 2010 repealed the law that had recently been passed by the previous government, which would have allowed local governments to trial direct user charges.

Interestingly, however, residents of slums and other settlements without services are usually willing to pay for primary collection service if these were to be introduced, as for example, in Maputo, Mozambique [36,37]. The benefits of a good and reliable primary waste collection service—literally getting waste out from under foot—are easy to see for the residents, as it directly contributes to the cleanliness of their immediate living surroundings and better health of their children. Anecdotally, one of the two highest paid jobs in Kibera, the large slum in Nairobi, Kenya, is that of emptying pit latrines—clearly, ridding the neighbourhood of their waste (in this case, human excreta) is as important to slum dwellers as it is to residents of planned areas.

Securing financial sustainability of the service provision is an essential governance aspect that needs to be considered from the outset of any initiatives to introduce waste collection services. This is particularly important in cases where this is done within projects supported by international or bilateral development aid agencies, as financing after the project ends can be problematic even in very successful projects, as was the case in Cochabamba, Bolivia [7] (Box 4.28, p. 180). In this regard it is actually favourable that large—and costly—high tech vehicles and equipment are not appropriate for slum areas with their narrow streets and hanging electricity cables. This means that the costs of appropriate vehicles are lower and thereby more affordable.

3.2.2. Economic Instruments for Controlled Waste Disposal

Unlike the benefits of good waste collection service, the benefits of secondary collection, transport, and environmentally sound waste disposal are not directly visible to service users or obvious to city dwellers in general. Therefore, they are often not willing to pay for these. In addition to the willingness to pay, affordability of charges becomes an issue in low-income countries and expecting people to pay will be problematic. Actually, it is only in high-income countries that user charges are calculated based on the real costs incurred. Therefore, investments in environmentally sound landfill technology and adequate financing of disposal site operations will be difficult in low-income countries. However, bringing disposal under control, getting from open dumping and burning to a basic level of controlled operations, can be done even under severe financial constraints, as the town of Moshi, Tanzania, exemplifies through their 3Cs approach to disposal: Confine, Compact, Cover [17] (p. 110).

Searching for sites with favourable geological, hydrogeological, and geotechnical characteristics may pay off in significant savings on engineered barriers to the migration of contaminants from disposed municipal waste. If combined with ecological criteria that protect the habitats of sensitive species, such disposal sites have a potential to markedly contribute to SDGs. A good example is the town of Ghorahi, Nepal, where a group of thoughtful and committed municipal authorities and local stakeholders managed to develop an environmentally sound waste processing and disposal facility under the conditions of very limited technical and financial capacities, without any financial support from abroad [11].

An important lesson has been learnt from the experiences in both developed and developing countries. In developed countries a lot of effort was put into developing the science and technology of environmental controls and building state-of-the-art landfills, only to realise that the costs are very high, thus seeking to avoid landfilling altogether. Similar problems can occur in developing countries, where, for example, operation of a distant disposal site may entail prohibitively high transportation costs and thus jeopardise the efforts toward environmentally sound waste practices. Here it is particularly important to take the 3Rs into account from the beginning of the planning process, as it can be a win-win situation for all parties. Reuse and recycling not only provides livelihoods for those involved, but can also markedly decrease the amounts of waste destined for disposal, thus both reducing the city's costs and prolonging the use period of the costly disposal facility [7] (Topic Sheet 14, pp. 176–179).

In recognition of the difficulties in securing funding for waste treatment and disposal, alternative financing methods have been devised. Donor funding was used for the capital costs of new landfills (for example, in Lusaka, Zambia) or for major upgrading of the existing dumpsites (for example, in Dhaka, Bangladesh) [17] (p. 109). Funding of landfill operations in various places was provided through the Clean Development Mechanism (CDM) introduced under the Kyoto Protocol. The CDM enabled carbon credits to be obtained based on the evidence of capture and use of landfill gas. This provided an annual 'revolving fund', paid upon presenting the evidence, which then provided funding to the city for the next year's proper operation, and so on. As the payments were directly related to landfill gas capture, this constituted a direct financial incentive for cities to operate their landfills as designed. Currently, the replacement (and potentially more flexible) financing mechanism, Nationally Appropriate Mitigation Actions (NAMAs), is expected to provide similar and indeed wider incentives [38]. In other words, while likely to be problematic if tackled on its own, financing of waste disposal can be achieved if integrated with broader development goals. More details on financing models and their use for municipal SWM can be found in Sections 5.4 through 5.9 of the GWMO [7] (pp. 222–250).

More broadly, the economic instruments of Extended Producer Responsibility (EPR) for products from abroad, such as electrical and electronic (EEE) equipment, in combination with the interests of local recyclers, have proven to be effective in tackling recycling and disposal of e-waste in some African countries [7] (Case Study 1, pp. 99–101). There have also been anecdotal examples where an ad hoc voluntary 'EPR' agreement was made between European donors and African recipients that,

once the donated computers reach the stage beyond repair, European donors will take them back for processing in Europe.

An important—and in the past often overlooked—economic aspect is the need for some form of compensation to the host community if new disposal sites are planned nearby. In general, as notorious LULUs (locally unwanted land uses), waste facilities are an unwelcome neighbour anywhere in the world, e.g., [39]. The prospect of their construction will usually be met by fierce opposition by local residents, businesses, and their organisations. Such a NIMBY (not in my backyard) attitude often comes from a lack of trust in the authorities, originating from their previous failure to protect public interests. In that context, compensation to local communities can be useful in convincing people to accept new waste facilities, from small transfer stations to landfills, near their houses [31]. As such a situation is also linked to the issue of environmental justice, adequate compensation will often be in terms of other public services including paved roads, a school, or a healthcare clinic. However, it is critical that alongside the community benefits, the environmental standards promised for the new waste facility are really delivered. This is discussed further in Section 3.3.2 below.

There are many other economic instruments pertinent to SWM and to the transition from the current linear to a regenerative use of natural resources in a circular economy, but they are not directly applicable for the goals of basic waste collection services for all and controlled disposal. These instruments are discussed in Section 4.5 and Topic Sheet 13 of the GWMO [7] (pp. 155–159, and pp. 160–165, respectively).

3.3. Social Instruments

3.3.1. Social Instruments for Waste Collection Services

Any change in the SWM system that entails changes in waste generators' attitudes and day-to-day habits requires appropriate actions to achieve such a change as it is not likely to happen on its own accord. Putting waste out for collection instead of dumping or burning in the yard or somewhere nearby will involve a significant degree of behavioural change on the part of householders. In fact, it is the 'mirror image' of collection coverage, i.e., the availability of a reliable and affordable waste collection service. This means that, in addition to legal, technical, and economic aspects, the necessary behavioural change is an important aspect that requires focused attention. Some of the models and theories of change are discussed in Section 4.6 and in the literature listed in Annex A of the GWMO [7] (p. 166 and p. 320, respectively).

For this, various social instruments have been devised, primarily based on communication and exchange with the public and other actors in the system. This means that government and public administration agencies depart from their traditional role as legislator and regulator and take a different role, that of frame setting, engaging, communicating, educating, and negotiating. Campaigns to raise environmental awareness and impart new behaviours can take various forms, ranging from conventional ones such as informative posters, to innovative and artistic ones such as educational street theatre, to electronic messaging services through social media. Other successful examples include radio drama in some African countries, traditional chanting in some countries of Central Asia, and promotional events deriving from Carnival in the streets of some South American cities. Clearly, local culture, customs, and habits have been taken as the starting point for selection of the appropriate forms of social instruments. In addition, social instruments for SWM are more likely to be effective if they take into account people's daily realities where other pressing issues compete for their attention and time. Holding meetings with the citizens, their communities, and leaders, in an atmosphere of open dialogue and mutual respect, has worked well in countries as different as, e.g., Sweden, Mali, and Italy. Other social instruments that have been used in SWM include variants of what is popularly known as 'name and fame' campaigns, whereby best performing neighbourhoods, cities, or companies are given publicity in the media, public praise, and prizes. Alternatively, 'name and shame' campaigns are used to expose poor practices.

In addition to raising awareness, providing clear instructions is essential to enable people to develop the appropriate habits and behaviours in handling their waste—an element that surprisingly often gets forgotten when new services are introduced.

While concentrating on waste collection service, segregation at source needs to be considered from the outset so as to promote reuse and 3Rs as policy goals in coherence with those of public health. In many places in developing countries, people are involved to some degree in the recovery of resource value from waste through their interactions with repair and reuse shops and/or with itinerant buyers of discarded products and waste materials. In contrast, people often look down at waste pickers searching for recyclables in street containers as being dirty. The ‘inconvenient’ message is that waste pickers get dirty while picking recyclables from mixed waste *because* these same citizens have not segregated their waste in the first place, as eloquently put by NGOs working with informal recyclers.

Similarly to the issues discussed under ‘Direct regulation’ above, the institutional capacities may not be adequate in municipal waste departments for such tasks. When financial resources are under pressure, any budgets previously allocated to communication with the public would likely be the first to be cut in the face of perceived more urgent tasks. Also here, like above, collaboration with other stakeholders could be beneficial for the overall SWM system. In this case, it would be calling upon the expertise, capacities, and natural role of schools and various advocacy NGOs to organise awareness raising campaigns and help establish and maintain dialogue with the community.

It is not only citizens who need to change their behaviour and habits. This also applies to municipal waste departments, which need to take and implement concrete actions at the level of management. They also need to ensure that their waste collection crews actually take the newly collected waste and transport it to a disposal facility. The crews’ resistance to change has already been discussed in the context of implementation of direct regulation.

3.3.2. Social Instruments for Controlled Waste Disposal

In the case of construction of a new landfill, it takes a lot of open communication to overcome NIMBY attitudes. The only experience that the local community has of waste disposal is what has happened previously, and if that was uncontrolled dumping, then that is what they will expect. It will take a lot of time and effort to establish trust, both that the promises made by the authorities that ‘this time it will be different’ are genuine, and that the higher environmental standards of operation that have been promised are financially sustainable and will be enforced in practice by the environmental regulator. As previously discussed, the ability to offer some compensation to the host community can be helpful. Equally, if trust is not established and nurtured, any compensation offered will raise suspicion and may be perceived as another form of manipulation and lack of respect for the people, their lives, and realities. Operating the new facility to the promised environmental standards is absolutely critical—seeing is believing—and being able to visit a new or existing good facility in a neighbouring city will go a long way in convincing protesters that the promises are genuine.

In the case of a dumpsite upgrade, it is likely that there are waste pickers present at the dumpsite. While opinions differ on the desired course of action, most practitioners agree that some appropriate arrangements need to be made with the pickers for the upgraded disposal site [17] (Key Sheet 8, pp. 111–112), [40]. However, if done in a way that does not take into account the realities and interests of the waste pickers, this may be met with their fierce opposition, resulting in aggravation and prolongation of the dire situation, as was the case in e.g., Karachi, Pakistan [41]. Therefore, any interaction in such a complex situation demands a lot of effort to establish trust and understanding on both sides, in accordance with inclusivity as a characteristic of good governance.

3.3.3. Social Instruments for SWM in General

The chances that citizens will adopt new patterns of behaviour and get involved will be higher if the local authorities lead by example, in other words, if they exemplify the desired behaviour

in government buildings and their vicinity. This plays an equal role in developed and developing countries, as eloquently captured in a UK report with the telling title: *I will if you will* [42].

A common factor in successful waste management, and indeed other development interventions, is often a high degree of interest and commitment from political leaders [43,44]. The towns of Moshi, Tanzania, and Ghorahi, Nepal, introduced above as good examples, demonstrate the importance of political commitment by the local authorities [11]. Similarly, keen interest and leadership by the Mayor have been instrumental in delivering change in SWM of many large cities around the world, including Milan (Italy), Cebu City (Philippines), and Seattle (Washington State, USA) [7] (Case Study 4, pp. 120–124; Box 4.29, p. 183; and Box 4.9, p. 141, respectively). Conversely, SWM has such high local visibility that it can be used for political purposes; for example, services may be intensified in the period preceding elections or they may become a ‘political football’, with the changes made by one administration being immediately reversed by the incoming party. Such a situation should be avoided, for the benefit of the city, citizens, and the policy goals—and indeed the Sustainable Development Goals—of public health and the environment to which SWM contributes.

4. Conclusions

Solid waste management is an integral component of actions for achieving at least 12 out of the 17 UN SDGs. Improvements in SWM and 3Rs will substantially contribute to the better living conditions and better health of more than 2–3 billion people who currently lack services, prevent plastics entering the oceans, significantly contribute to climate change mitigation, and help restore terrestrial ecosystems. In the process, decent jobs will be created, which will support many people and their families on their way out of poverty.

Extending waste collection services to all citizens, eliminating open dumping and burning, and upgrading dumpsites are arguably the essential initial steps that will make the most difference in terms of the SDGs in lower-income developing countries. This paper focuses on governance aspects of the actions necessary to achieve these basic improvements in SWM. For the analysis, the study adopts a three-way categorisation of policy instruments from the GWMO: direct regulation, economic instruments, and social instruments. A strong conclusion is that, rather than relying of any one of these, a combination of complementary and well-coordinated measures from each of these three categories is necessary to implement and sustainably maintain such services, as summarised in Table 2 below.

Due to its importance for public health, the law in every country requires some form of SWM to be in place. While the legal responsibility lies with municipalities to provide or organise services, its implementation in practice is often inadequate in developing countries, mainly due to limited technical and financial capacities within municipal administrations. In such cases, complementing the public sector through collaboration with a range of other, private sector service providers, from large private companies to small and microenterprises, can be effective in ensuring locally appropriate and affordable services. However, for diverse models of PPPs to ‘work’ in practice, municipal authorities need the competencies to fulfil their ‘client’ role, which are often lacking. Here, as in many other governance aspects, capacity development is critical.

For disposal, in parallel with the preparation of legislation and its enforcement, there must be a synchronised effort to actually have facilities in place, ready to receive the waste once the regulations are enforced, and to actually close down non-compliant facilities. Otherwise, waste will continue to go to uncontrolled dumpsites that cost the user very little or nothing at all, as various examples from developed countries in the 1980s testify.

However, getting from a situation with no facilities to modern, state-of-the-art facilities in one ‘leap’ is unrealistic. Gradual implementation has worked much better, where each step is relatively small and attainable with the resources available, both in terms of facilities and in terms of the institutional capacities required for inspection and enforcement. The first step, bringing disposal under control, and getting from open dumping and burning to a basic level of controlled operations, can be done even under severe financial constraints, as the town of Moshi, Tanzania, exemplifies through

their 3Cs approach to disposal: Confine, Compact, Cover. The town of Ghorahi in Nepal provides another example of global good practice, where an environmentally sound landfill was built relying only on local funding.

In order to secure some form of financial sustainability for the municipal SWM service, it is likely that direct charges to the users will need to be supplemented by other, indirect sources of funding. Residents of slum settlements and other areas without services will in principle be willing to pay for a primary waste collection service, as the benefits of a cleaner neighbourhood are easy for them to see. However, the benefits of secondary collection, transport, and environmentally sound waste disposal are not directly visible to service users or obvious to city dwellers in general. Therefore, the willingness to pay—but also the affordability of the charges—will be problematic in low-income countries. Gradual implementation will also help here. International development funding for the capital costs of new facilities is important, but so too are mechanisms such as climate financing which can in principle assist municipalities with the continuing operating costs of modern landfills and other facilities that meet the required environmental standards.

Putting waste out for collection, instead of dumping or burning it in the yard or somewhere nearby, will involve a significant degree of behavioural change on the part of householders. While concentrating on collection, segregation at source needs to be considered from the outset so as to promote reuse and 3Rs as policy goals; this too will require major efforts to change behaviours. Also, collaboration with other service providers will require changes in the way that a municipal waste department functions. There is an array of instruments, based on information, communication, and exchange, available for raising people's awareness about waste and prompting them to adopt the desired changes in their behaviour. While they have been applied with varying degree of success, they always had to take into account peoples' daily concerns and realities. As for establishing new waste facilities, it takes a lot of effort and communication skills to open a dialogue and establish trust with local communities. A key lesson is that the success of SWM interventions is much more likely if there is a high degree of interest and commitment from political leaders.

Table 2. Key governance aspects of extending waste collection to all and securing controlled disposal.

Class of Policy Instruments	Goal 1: Waste Collection to All	Goal 2: Controlled Disposal	Necessary Condition	Enabling/Facilitating Factor
Direct regulation	Legal framework for inclusion of both public and private, and both formal and informal, service providers	Strong regulations requiring controls to protect the environment, <i>and</i> credible and consistent enforcement	Construction of facilities in parallel to the regulations	Institutional capacities to <i>both</i> enforce law <i>and</i> to work with various service providers
Economic instruments	Sustainable financing—securing funding for collection services, including some contribution from direct charges	Sustainable financing—securing funding for facilities, <i>both</i> capital costs <i>and</i> the continuing costs of operation	Affordability for service users	Availability of national and/or international funding, including EPR ¹
Social instruments	Awareness raising for behaviour change and clear instructions on new services, to avoid dumping and be willing to pay	Awareness raising for behaviour change, to avoid dumping	Collaboration with civil society including media	Authorities engaging with the public and leading by example

¹ EPR—Extended Producer Responsibility.

The final conclusion is that efforts to extend waste collection services to all citizens, eliminate open dumping and burning, and upgrade dumpsites depends as much on governance aspects as they do on technology and the infrastructure installed. Improving these basic and essential services will make a significant difference to the lives of billions of people around the world. It will also provide a solid foundation for further improvements to SWM, including the transition from a linear to a circular economy, and contribute to better governance in general.

Acknowledgments: The authors gratefully acknowledge UN-HABITAT (United Nations Human Settlements Programme) and UNEP (United Nations Environment Programme) for their funding of the original research studies.

Author Contributions: The authors closely collaborated during the original research studies over a period of several years. For the paper, the authors jointly developed the outline of the contents and were in discussion throughout the writing process. Ljiljana Rodić wrote the text while David Wilson reviewed it.

Conflicts of Interest: The authors declare no conflict of interest.

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