



Ambitions for Greening Solid Waste Management: Perspectives from Urban(ising) Africa

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Executive summary

African cities are vexed by the triple challenge of rapid population growth, urban expansion and poor waste management. With population growth often outstripping economic growth, the ability of governments and municipalities to provide adequate solid waste management services is severely compromised. The result is pollution and waste that

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severely impact quality of life, ambitions for urban sustainability and green growth. Our oceans have recently been described as the ‘report cards’ of what is happening on land,¹ and if the levels of marine litter and pollution are considered the primary indicator, the grades are not good. The Green Economy and its offshoot, the circular economy, are two paradigm shifts that have shown potential to catalyse shifts away from the traditional modes of production and consumption best described as ‘take-make-dispose’. A number of pioneering examples of these principles in action in African cities show that innovation and entrepreneurialism are important ingredients in mainstreaming such approaches in economic growth and resource management.

Industrialisation, population growth and its limits

The way society consumes resources has undergone a number of fundamental changes or ‘revolutions’ over time. The Industrial Revolution in the early 19th century was arguably the beginning of the transition to our current mode of resource consumption, characterised largely by comparatively frenzied consumerism. Prior to this period, resources were generally scarce, consumption was relatively low and resource management was characterised by high levels of recovery from products and materials, rather than disposal.² This is in stark contrast to contemporary global society, where the abundance of resources

1 Cicin-Sain B et al., *Ocean sat Rio+20: How Well Are We Doing in Meeting the Commitments from the 1992 Earth Summit and the 2002 World Summit on Sustainable Development? Summary for Decision Makers*. Delaware: Global Ocean Forum, 2011.

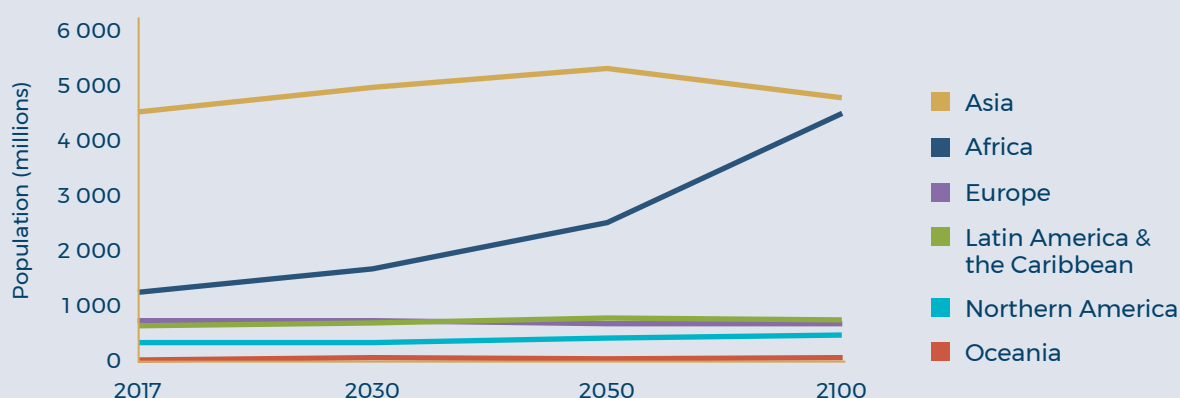
2 Mukhtar EM et al., ‘A tale of two cities: The emergence of urban waste systems in a developed and a developing city’, *Recycling*, 1, 1, 2016, pp. 254–270.

and technological advances in manufacturing have facilitated the production of affordable and easily available products, rendering the recovery of raw materials all but obsolete.³ Perhaps the most significant and concerning consequence of our hyper-consumerism has been the overexploitation of the natural resource base and the increase in the amount of waste generated by human populations. This has had near-catastrophic impacts on the natural environment, particularly in developing countries, which face the triple challenge of rapid population growth, urban expansion and poor waste management. While many developing country economies have grown rapidly during the last century, population growth has outstripped economic growth in most cases, often at the cost of the delivery of basic services such as waste management and sanitation. This situation is particularly pertinent for African cities.

Population and economic growth

Recent estimates show that some 55% of the global population – approximately 4.2 billion people – live in urban areas. This number is projected to grow to almost 70% by 2050.⁴ Nearly 90% of the anticipated growth in urban populations by 2050 is expected to occur in Asia and Africa. Both regions' population growth rates are expected to climb steadily until the mid-21st century.⁵ Beyond 2050, Asia and Africa's projected population trends diverge noticeably – Africa is anticipated to continue its trajectory of rapid growth, while Asia's peaks in 2050 and begins to decline as the 22nd century approaches (Figure 1).

Figure 1 Population of world regions, 2017, 2030, 2050 and 2100, UN medium-variation projection



Source: UN Population Division, *World Urbanisation Prospects: The 2017 Revision – Key Findings and Advance Tables*. Washington DC: UN, 2017

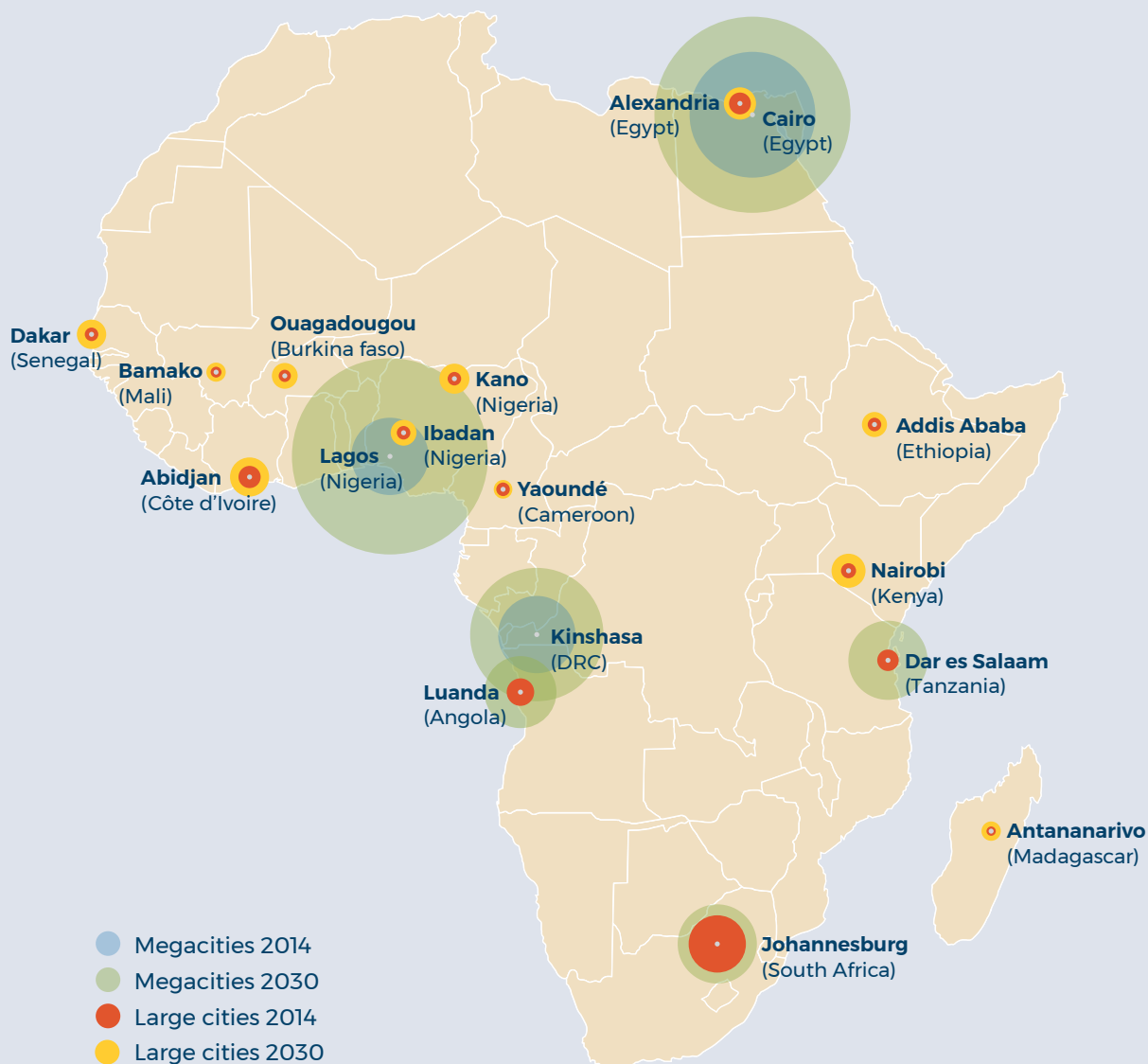
³ *Ibid.*

⁴ UN Population Division, *World Urbanisation Prospects: The 2018 Revision*. Washington DC: UN, 2018.

⁵ UN Population Division, *World Urbanisation Prospects: The 2017 Revision – Key Findings and Advance Tables*. Washington DC: UN, 2017.

This burgeoning growth is illustrated by the projected increase in mega-cities on the African continent, which will host six of the world's 41 mega-cities by 2030 – Cairo, Lagos, Kinshasa, Dar es Salaam, Luanda and Johannesburg (Figure 2).⁶

Figure 2 Emergent and current mega-cities and large cities, 2014 versus 2030

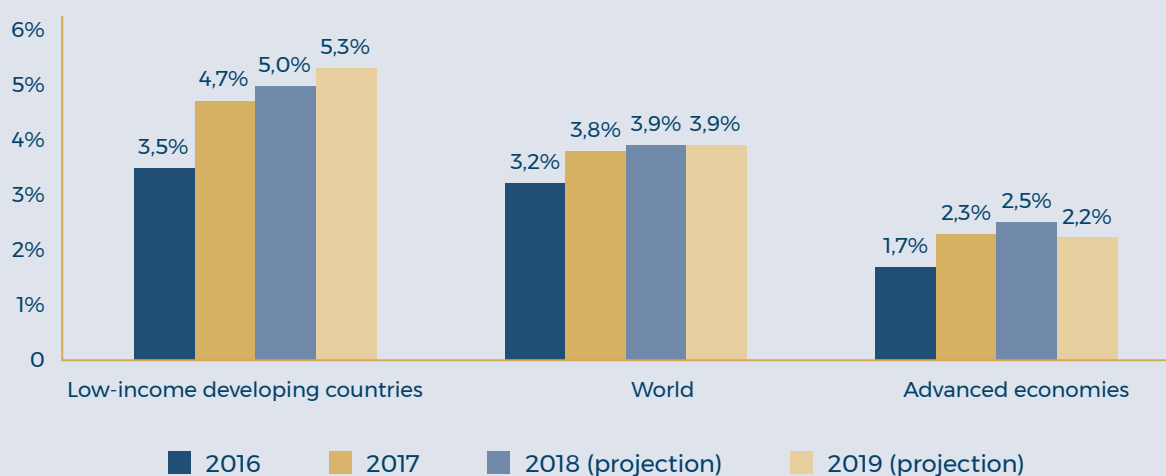


Source: Bello-Schünemann J & C Aucoin, *African Urban Futures*. Pretoria: ISS (Institute for Security Studies), 2016

6 Bello-Schünemann J & C Aucoin, *African Urban Futures*. Pretoria: ISS (Institute for Security Studies), 2016.

Recent estimates and projections of growth in gross domestic product (GDP) by the International Monetary Fund indicate that economic growth in low-income developing countries has significantly outstripped both that in advanced economies and global average GDP growth between 2016 and 2018, and is anticipated to continue doing so in 2019 (Figure 3).⁷ With the majority of African nations considered to be low-income developing countries, it is not unreasonable to assume that the continent will experience some of the highest global rates of economic growth over the next two to three years.

Figure 3 Projected changes in economic output, 2016–2019
(% change)



Source: IMF (International Monetary Fund), *World Economic Outlook: Cyclical Upswing, Structural Change*. Washington DC: IMF, 2018

Waste management and pollution in high-growth cities

The uptick in economic growth prospects is likely to bring with it the potential for improved quality of life and better provision of basic services and infrastructure for many Africans. However, the potential negative impacts of this scenario must also be considered, especially in the context of rapid population growth, urbanisation and economic growth as described above.

⁷ IMF (International Monetary Fund), *World Economic Outlook: Cyclical Upswing, Structural Change*. Washington DC: IMF, 2018.

Solid waste management in African cities

Economic growth and the resultant improvements in quality of life are closely associated with increased consumption of resources. As the populations of cities grow and their footprint spreads, they increasingly become nodes of consumption.⁸ Similarly, a by-product of a more urban lifestyle is more waste, and the amount of solid waste that urban dwellers generate is one of the few parameters that outstrip population growth and urbanisation itself.⁹

Economic growth and the resultant improvements in quality of life are closely associated with increased consumption of resources

In the African context, rapid population growth and urbanisation have left many local governments and city authorities ill-equipped to deal with the challenges of solid waste management. A variety of institutional, technical and financial constraints at national and local government levels has created significant service delivery backlogs,¹⁰ which in turn have a direct impact on socioeconomic development, environmental pollution, standards of living, and human health.¹¹ In addition, there is a strong correlation between urban solid waste generation rates and greenhouse gas emissions.¹²

The management of solid waste is set to assume ever-greater importance as African governments strive to make cities more liveable for both residents and visitors

While certainly not a new challenge to urban Africa, the management of solid waste is set to assume ever-greater importance as African governments strive to make cities more liveable for both residents and visitors. The World Bank has argued that solid waste

8 Swilling M et al., *The Weight of Cities: Resource Requirements of Future Urbanization. International Resource Panel Report*. Nairobi: UN Environment, 2018.

9 Hoornweg D & P Bhada-Tata, *What a Waste: A Global Review of Solid Waste Management*. Washington DC: World Bank Group, 2012.

10 Oteng-Ababio M, Melara Arguello JE & O Gabbay, 'Solid waste management in African cities: Sorting the facts from the fads in Accra, Ghana', *Habitat International*, 39, 1, 2013, pp. 96-104.

11 Mukhtar EM et al., *op. cit.*

12 Hoornweg D & P Bhada-Tata, *op. cit.*

management is the fulcrum upon which the delivery of a number of key municipal services hinges, such as health, education and transport.¹³ While functional solid waste management systems are crucial to urban sustainability, cities are largely the masters of their own destiny in this respect – notwithstanding systemic financial, capacity and governance constraints – as implementation of solid waste management tends to be one of the few mandates falling entirely within the sphere of local or subnational government.¹⁴

Globally, current waste generation levels are approximately 1.3 billion tonnes per year, and are expected to increase to approximately 2.2 billion tonnes per year by 2025.¹⁵ In regional terms, Africans generated an average of 0.65kg of waste per capita per day in 2012, while their counterparts in the Organisation for Economic Co-operation and Development (OECD) countries (comparable to the advanced economy nations in Figure 3) produced significantly more, at an average of 2.2kg of solid waste per capita per day.¹⁶ In terms of future trends, by 2025 the generation of waste by African cities is expected to peak at 0.85kg per capita per day, while the consumption of OECD countries is expected to remain relatively static at 2.1kg of solid waste per capita per day.¹⁷

Single-use plastics and marine litter

Conventional approaches to solid waste management are predicated on a linear process of collection and disposal, with little to no consideration given to reducing the waste generated, reusing materials or recycling.¹⁸ No discussion of solid waste would be complete without reference to the burgeoning issue of marine plastic waste and litter. In perhaps the most striking example of a linear production and consumption system, only about 9% of global plastic is recycled: 12% is incinerated and the remaining 79% is disposed of in landfills or ends up as marine or terrestrial litter.¹⁹ Chief among the culprits in this system are ‘single-use’ plastics.

African cities are large consumers of single-use plastics, often generated in other regions of the world such as China and Indonesia. While plastic waste is generated and consumed on land, the issue has gained prominence globally for its devastatingly negative impact on marine and coastal biodiversity and ecosystems. Marine litter and waste undermines the ocean’s ability to absorb much of the CO₂ produced by humans, and negatively impacts the ability of coastal and marine ecosystems to provide food and income for an estimated

13 *Ibid.*

14 *Ibid.*

15 *Ibid.*

16 *Ibid.*

17 *Ibid.*

18 Schroeder P et al., ‘Circular economy and power relations in global value chains: Tensions and trade-offs for lower income countries’, *Resources, Conservation & Recycling*, 136, 1, 2018, pp. 77–78.

19 UN Environment (UN Environment Programme), *Single-use Plastics: A Roadmap for Sustainability*. New York: UN, 2018.

1 billion people.²⁰ If current consumption and waste management practices continue, the UN estimates that plastic waste will literally outweigh fish in the global ocean by 2050.²¹

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Coupled with the high levels of informality and unplanned urban development that are an inherent feature of much of Africa's urbanism, this is a dire situation for sustainable and efficient solid waste management. Modes of urban and economic growth that are decoupled from the challenges described above become increasingly difficult goals to achieve.

Responses to urbanisation and development challenges

A number of theories, frameworks and approaches to development and economic production attempt to entrench sustainable development and respond to the idea that the global economy is on an unsustainable path.²² Broadly speaking, these approaches try to reconcile economic growth with environmental protection or sustainable consumption. An increasingly popular concept is the Green Economy, which has its academic genesis in the late 1980s but began to enter mainstream political and social discourse a decade or so after the turn of the century.²³

The Green Economy

UN Environment described the Green Economy in 2011 as 'a new economic paradigm – one in which material wealth is not delivered perforce at the expense of growing environmental risks, ecological scarcities and social disparities'.²⁴ Put differently, the Green Economy aims to transform environmental protection into a creative process, encouraging society to think

²⁰ *Ibid.*

²¹ *Ibid.*

²² Altenburg T & C Assmann, *Green Industrial Policy: Concept, Policies, Country Experiences*. Geneva, Bonn: UN Environment, 2017.

²³ UN Environment, *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication – A Synthesis for Policy Makers*. New York: UN, 2011.

²⁴ *Ibid.*, p. 8.

of the environment as more than a resource pool to be exploited.²⁵ While the principles that underpin the concept are best described as being in a state of flux, common values of the Green Economy include inter- and intra-generational equality and justice; conformity to the principles of sustainable development; consideration of natural and social capital; sustainable and efficient use of resources; eradication of poverty; and competitiveness and growth in the key sectors of the economy.²⁶ The concept has been touted as a potential solution to challenges as complex as climate change, poverty and environmental pollution.

The circular economy

Under the umbrella of the Green Economy, the circular economy is an emergent concept based on two important premises: a closed loop business model that reaches through a company's value chain; and a re-design of the entire system of production and consumption in order to use resources efficiently and remove waste as a category.²⁷

A circular economy approach entails a shift towards new modes of production, consumption and indeed economies that makes explicit provision for efficient use of resources where materials can be reused or recycled at their highest possible value

More specifically, a circular economy approach entails a shift towards new modes of production, consumption and indeed economies that makes explicit provision for efficient use of resources where materials can be reused or recycled at their highest possible value.²⁸ By keeping products, materials and resources at their highest value and utility at all times, the circular economy incorporates elements of restoration and regeneration, which in turn creates new value.²⁹ By going beyond narrow conceptions of efficiency and profit,³⁰ a circular economy can contribute to environmental protection by reducing unsustainable exploitation of natural resources while increasing human well-being and economic wealth. Circular economy strategies also have the ability to help lower-income countries 'leapfrog' to more sustainable modes of consumption and production, avoiding a development pathway that locks in resource-intensive economic practices.³¹

25 Rudneva L, Pchelintseva I & M Gureva, 'Scenario modelling of the "green" economy in an economic space', *Resources*, 7, 29, 2018, pp. 1-18.

26 *Ibid.*

27 Altenburg T & C Assmann, *op. cit.*

28 Schroeder P *et al.*, *op. cit.*

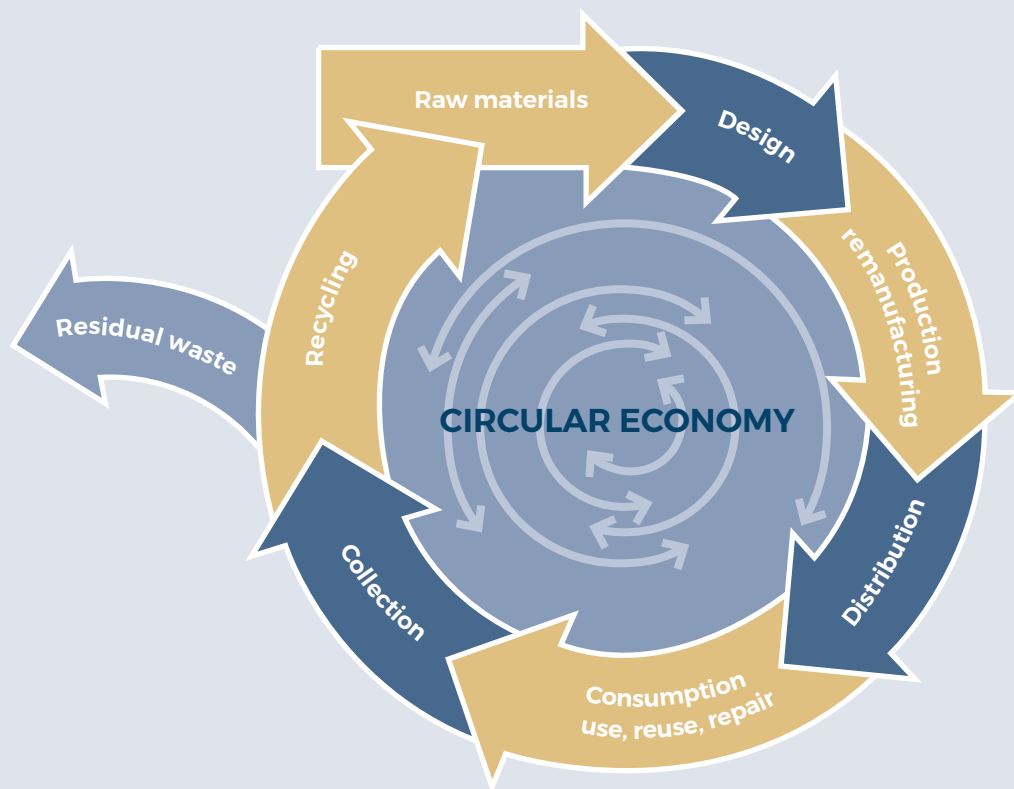
29 Ellen MacArthur Foundation, *Cities in the Circular Economy: An Initial Exploration*. Cowes: Ellen MacArthur Foundation, 2017.

30 Altenburg T & C Assmann, *op. cit.*

31 Schroeder P *et al.*, *op. cit.*

For this move away from the entrenched linear model of production and consumption to occur, a holistic or life-cycle approach to resource extraction, production, transportation, consumption, reuse, recovery and recycling is necessary (Figure 4).³²

Figure 4 The circular economy concept



Source: Schroeder P et al., 'Circular economy and power relations in global value chains: Tensions and trade-offs for lower income countries', *Resources, Conservation & Recycling*, 136, 1, 2018

Examples of such an approach include designing products that have a longer lifespan and are easy to maintain, and/or modular products that are easy to repair, replace and recycle.³³

Examples of good practice and sector innovation

While no country can yet be said to have achieved a circular economy, local and sectoral pockets of innovation and good practice that contribute to this concept are emerging.³⁴

³² *Ibid.*

³³ *Ibid.*

³⁴ Altenburg T & C Assmann, *op. cit.*

The changes needed to realise a circular economy must include strategies for waste minimisation, innovative business models and technologies, and changes in consumer behaviour. Recognising that Africa's waste economy is fertile ground for entrepreneurs who spread themselves across the waste value chain,³⁵ the following sections provide some examples of perceptible progress at the city level.

Integration of the informal waste management sector

While there have been a number of efforts to import and establish new waste management technologies in African cities that have been successful elsewhere, such approaches seldom take local conditions and context into account and have yielded limited success.³⁶ A key shortcoming has been the failure to incorporate or integrate the informal waste sector into formal or mainstream municipal waste management frameworks.

In many – if not most – African cities, the informal waste sector or 'waste-pickers' make or supplement their living by recovering post-consumer materials and recyclables from the formal waste stream. This is undertaken on a largely informal and unorganised basis by the urban poor, although examples of semi-formal and organised associations of waste-pickers have emerged in certain African cities. In South Africa, the informal waste sector is estimated to recover up to 90% of recyclable paper and packaging before this material reaches landfills, which translated to estimated savings to local government of between ZAR³⁷ 302 million (\$30 million) and ZAR 748 million (\$74 million) in landfill space in 2014 alone.³⁸ In addition, this informal economic sector has the potential to provide a reliable supply of secondary raw materials for local manufacturers that can replace more expensive imported raw materials.³⁹

While efforts to modernise and promote the efficiency of municipal solid waste management systems in developing countries can yield positive results, failure to account for or incorporate the informal waste sector in urban waste management can have negative socio-economic and environmental impacts. In many cases, the attitude of the formal waste management sector towards waste-pickers is profoundly negative, regarding it as backward, unhygienic and generally incompatible with modern waste management systems.⁴⁰ This is despite the fact that incorporating the informal waste economy into mainstream waste management has the potential both to significantly improve the efficiency of the formal system and to contribute towards poverty alleviation for marginalised sectors of urban society.

35 UN Environment, *Africa Waste Management Outlook*. Nairobi: UN, 2018.

36 Oteng-Ababio M, Melara Arguello JE & O Gabbay, *op. cit.*

37 Currency code for the South African rand.

38 Godfrey L, Strydom W & R Phukubye, *Integrating the Informal Sector into the South African Waste and Recycling Economy in the Context of Extended Producer Responsibility*. Pretoria: Council for Scientific and Industrial Research, 2016.

39 Wilson DC, Velis C & C Cheeseman, 'Role of informal sector recycling in waste management in developing countries', *Habitat International*, 30,1, 2016, pp. 797-808.

40 *Ibid.*

Given the waste management challenges that African cities face, merging formal and informal waste management systems in ways that maximise the benefits to both sectors seems an obvious choice and low-hanging fruit for cities hoping to move towards a more circular economy.

Re-use of waste tyres

Cities in many developing countries have experienced substantial growth in the generation of waste tyres, owing to increasing demands for vehicular transport on the back of strong economic growth and growing urban populations.⁴¹ Ouagadougou is one such city, where the majority of used tyres are imported from Western countries because of the relative poverty of consumers in Burkina Faso and the savings realised when buying second-hand tyres.⁴² While this arrangement may suit consumers' pockets, it means that the lifespan of tyres in Ouagadougou is extremely limited when compared to those of new tyres, which results in concomitant increases in the amount of waste tyres generated.⁴³

Local entrepreneurs – individuals, families and small businesses – have stepped into the gap provided by the absence of formal recycling and recovery facilities in the city to collect waste tyres for reuse in various applications lower down the value chain. These include the manufacture of furniture, shoes, handicrafts and even traffic-regulation infrastructure.⁴⁴ This has the dual benefit of creating employment and reducing the amount of waste tyres that would otherwise be sent to landfill or merely discarded.

Re-use of electronic waste

The generation of electronic waste (e-waste) is on the rise owing to the rapid advances in and roll-out of new technology, and the speed at which consumers tend to replace electronic equipment and appliances. Abidjan, Côte d'Ivoire was estimated to generate in the order of 15 000 metric tons of e-waste per year in 2016.⁴⁵

Emulating their counterparts in neighbouring Burkina Faso, entrepreneurs in Abidjan have formed a cooperative that buys salvageable electronic components from collectors who comb recycling centres in the city for potentially re-usable e-waste.⁴⁶ These cooperative-controlled 'refurbishment markets' rent space to individual repair technicians, who are thus incorporated into the formal economy through registering and paying taxes.⁴⁷

⁴¹ UN Environment, 2018, *op. cit.*

⁴² *Ibid.*

⁴³ *Ibid.*

⁴⁴ *Ibid.*

⁴⁵ *Ibid.*

⁴⁶ *Ibid.*

⁴⁷ *Ibid.*

Municipal composting

The circular economy approach ultimately aims to remove waste as a by-product of human activity. While this remains a lofty goal, a practical way for African cities to work towards this is to adopt a system of waste diversion in the form of composting in municipal waste management systems. With separation of waste at source being the exception rather than the norm in most African cities, the majority of organic waste tends to end up in landfill sites, where it is dumped or burned. Despite the waste stream in many developing countries' comprising a high percentage of organic material, composting is seldom formally undertaken or organised. At the same time, markets for and awareness of compost are often lacking.⁴⁸

Aside from reducing the amount of waste that is disposed of in urban areas, an important benefit of compost is its use as an organic fertiliser. While composting in developing countries has to compete with cheap (and often subsidised) synthetic fertilisers, there are a number of benefits to the end user and producer of composting. These include improvements in soil fertility and carbon absorption capacity, land restoration, moisture retention, and long-term crop nutrition.⁴⁹

Table 1 provides a comparative overview of the costs of various methods of waste disposal by country income level. Composting of organic solid waste has been shown to be significantly cheaper than landfill disposal at all levels of income, making it a particularly attractive option for low-income countries and cities.

TABLE 1 COSTS OF SOLID WASTE MANAGEMENT BY DISPOSAL METHOD				
	Low-income countries	Lower-middle-income countries	Upper-middle-income countries	High-income countries
Waste generation (tons/capita/year)	0.22	0.29	0.42	0.78
Collection efficiency (% collected)	43%	68%	85%	98%
	Cost of collection & disposal (\$/ton)			
Collection	20-50	30-75	40-90	85-250
Landfill	10-30	15-40	25-65	40-100
Composting	5-30	10-40	20-75	35-90

Source: Hoornweg D & P Bhada-Tata, *What a Waste: A Global Review of Solid Waste Management*. Washington DC: World Bank Group, 2012 (Adapted)

⁴⁸ Kaza S, Yao L & A Stowell, *Sustainable Financing and Policy Models for Municipal Composting*. Washington: World Bank Group, 2016.

⁴⁹ *Ibid.*

Policy innovation

At a more strategic level, innovation in the policy space can drive meaningful change with regard to instilling Green and circular economy principles among consumers. In Africa, a number of key regional strategic frameworks address issues related to growth, sustainable investment and resource management. Agenda 2063, the flagship strategy

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of the AU, was drafted in 2013 to drive socioeconomic transformation of the continent through coordinated growth initiatives and sustainable development.⁵⁰ Agenda 2063 recognises that the nexus of resource management and innovation has real potential to drive economic growth and job creation. This manifests in policy priorities that emphasise economic catalysation and transformation by means of beneficiation and value-addition of natural resources.⁵¹ These priorities relate specifically to:

- promoting social dialogue, sectoral and productivity plans and regional and commodity value chains to support the implementation of industrial policies at all levels, with a focus on small, medium and micro-enterprises;
- establishing commodity exchanges for strategic African products; and
- developing strategies to grow the African Blue/ocean and Green economies.

Many coastal African countries recognise the importance of looking after their coastal and marine environments from the perspective of both sharing common resources and addressing regional environmental issues such as marine litter and waste. Three African regional seas conventions and action plans, namely the Barcelona Convention (Mediterranean), the Abidjan Convention (West Africa) and the Nairobi Convention (East Africa), have driven the development and subsequent implementation of regional seas action plans on marine litter.⁵² The African Marine Waste Network – a cross-sectoral initiative of the Sustainable Seas Trust, a non-profit organisation – has a continental mandate to prevent marine pollution in Africa at source. This is achieved by fostering

⁵⁰ AU Commission, *Agenda 2063: The Africa We Want*. Addis Ababa: AU, 2013.

⁵¹ *Ibid.*

⁵² UN Environment, 2018, *op. cit.*

networks and enterprise development between government, industry and civil society, with active platforms to collaborate, share knowledge and resources across the continent.⁵³

Table 2 highlights potential strategies and technologies that cities and countries at different levels of development could adopt to hasten the transition to more circular economies. Innovative products and services for higher-middle- and high-income countries are listed for comparative purposes, while those for low- and lower-middle-income countries are likely to be more contextually appropriate for African cities. These emphasise low and medium levels of technology (as opposed to high-tech and complex products and solutions) and low-cost, labour-intensive services that have co-benefits for employment and poverty alleviation.

TABLE 2 POTENTIAL GREEN PRODUCTION AND SERVICE OPPORTUNITIES FOR COUNTRIES WITH DIFFERENT INCOME LEVELS		
	Higher-middle- and high-income countries	Low- and lower-middle-income countries
New products	Renewable energy technologies, including high-tech components of solar photovoltaics, concentrated solar power, wind turbines and geothermal technologies; energy storage technologies, including fuel cells and lithium-ion batteries; electric vehicles; new lightweight materials; bioplastics; carbon capture and storage technologies; high performance building façades.	Low- and medium-tech, low-cost products such as solar water heaters, solar water pumps, solar driers; drip irrigation systems; rainwater harvesting technologies; liquid-paraffin gas, liquid natural gas or ethanol cook stoves; liquid natural gas-based three-wheeler taxis. Inputs for global green production for which factor endowments exist, such as lithium, rare earths, cellulosic ethanol.
New services	Design and operation of smart grids, closed-cycle eco-industrial parks, intelligent transport systems, advanced energy management systems, electronic road pricing, tracking and tracing systems for environmental performance along value chains.	Simple low-cost services such as operating and maintaining decentralised and mini-electric grid solutions; labour-intensive waste recycling; low-carbon livestock management; management of rapid transit systems. Labour-intensive tasks in emerging green global value chains, such as assembly of solar panels or lithium-ion cells.

Source: Altenburg T & C Assmann, *Green Industrial Policy: Concept, Policies, Country Experiences*. Geneva, Bonn: UN Environment, 2017 (Adapted)

53 Sustainable Seas Trust, *African Marine Waste Network*, <https://africanwastenet.org.za/>, accessed 9 March 2019.

Conclusion and recommendations

African cities face many challenges against the backdrop of ongoing population and economic growth, as well as looming threats such as climate change. The management of solid waste in urban areas is one such challenge, with wide-ranging implications for the sustainability and liveability ambitions of urban Africa. Adopting Green and circular economy frameworks has the potential to catalyse green growth and improve sustainability on a number of levels and at a number of scales in African cities.

Opportunities exist for researchers, policymakers, governing authorities and civil society to capitalise on a regional and international policy space that is favourably inclined to connect waste management, innovation and entrepreneurialism. Integrating the informal waste

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sector and composting of organic material into formal municipal solid waste services are two ways for African cities to begin moving in the right direction at relatively low cost and effort. Similarly, interventions that aim to reduce waste at source – particularly plastics – can be implemented at various points of the value chain, ie, upstream and downstream.⁵⁴ In reviewing the outlook for waste management in Africa, UN Environment has emphasised that a continuum of solutions is most appropriate for ensuring that attempts to move towards more circular modes of production and consumption succeed.⁵⁵

⁵⁴ UN Environment, 2018, *op. cit.*

⁵⁵ *Ibid.*

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Acknowledgment

This paper has been funded by SIDA. SAIIA gratefully acknowledges this support.

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Cover image

Waste 'reclaimers' earn a living by collecting recyclables, sorting them and selling on to the recycling plants in Johannesburg, South Africa. (Vladan Radulovic (RSA)/iStock)

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