6 Waste as resource: Unlocking opportunities for Africa

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What the reader can expect

The global waste sector is undergoing a paradigm shift from "waste" to that of "secondary resource" within the vision of a circular global economy. The circular economy emphasizes keeping resources in use for as long as possible through re-use, recycling and recovery of materials. This chapter focuses on understanding the economic and social opportunities in waste that could potentially be unlocked in Africa, and how these opportunities can be used as lever to overcome the challenges in solid waste management on the continent. It covers (i) economic opportunities in waste as a resource (i.e. the economic value of waste as an input to downstream economic activities); (ii) social opportunities, including social benefits (job creation), poverty alleviation, enterprise development and integration of the informal sector; (iii) regional approaches to secondary resource management; (iv) waste trading; and (v) resource crime. It aims to estimate the intrinsic value of waste as a resource in Africa and the associated economic and social benefits that could potentially be unlocked for Africa through increased waste recovery and recycling. It also touches on Africa's role within the global waste management system.

Key messages

The following are the key messages regarding unlocking the opportunities presented by waste in Africa:

- A conservative estimate of the value of MSW generated in African urban areas is US$8.0 billion per annum, of which US$7.6 billion worth of valuable resources (96 per cent) is currently lost through the disposal of waste each year, typically to open dumpsites with associated burning. This takes into account only a limited set of waste streams and should therefore be seen as a conservative, lower-bound estimate.
- Opportunities in Africa to develop a "waste as secondary resource" approach are still largely unexplored.
- Labour-intensive collection and sorting of secondary resources could create many direct jobs and even more indirect and induced employment opportunities at higher levels of pay, with a specific focus on empowerment of women.
- Local beneficiation of these secondary resources will ensure that fewer jobs are likely to migrate to other countries.
- The best functioning systems are those that embrace and include the large, very active informal waste sector.
- Crime organizations are known to collude with local institutions to control waste markets, and organized crime and corruption are major obstacles to achieving better waste performance.

6.1 Introduction

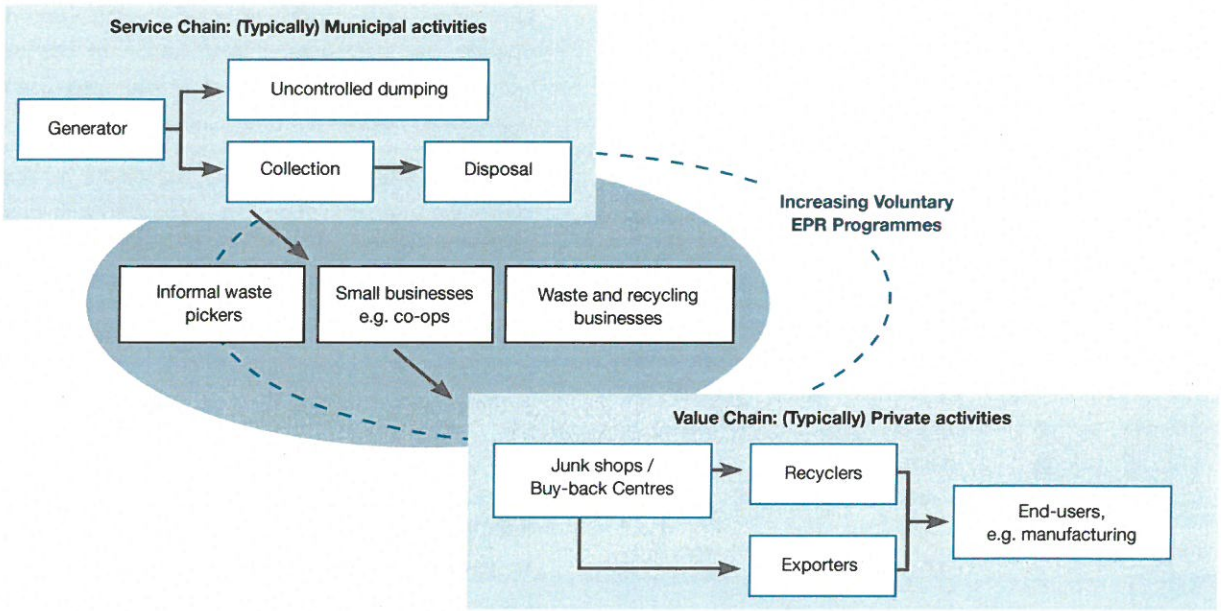
Open dumping and unsanitary landfilling tend to be the cheapest and therefore the predominant form of waste disposal in many African countries (**see chapter 3**) (Simelane and Mohee 2015). In many cases, alternative waste treatment (AWT) technologies are either not required by law or have not yet achieved the economies of scale that would enable them to compete with the business-as-usual approach. As such, there is little incentive from a purely financial perspective for moving up the waste management hierarchy (i.e. away from dumping/landfilling, towards waste prevention, reuse, recycling and energy recovery). Achieving economies of scale in alternative technologies requires an initial investment in such technologies (**see chapter 8**). However, to make the case for increased investment in AWT technologies, it is essential to highlight the benefits of these alternatives relative to the status quo.

Although AWT technologies cannot currently compete with open dumping and unsanitary landfilling from a purely financial perspective, from a broader "green economy" or sustainable development perspective (i.e. from a broader economic, social and environmental perspective), there are a number of benefits to moving up the waste management hierarchy (EEA 2011; UNEP 2013; DST 2014). These include:

- Waste prevention, reuse and recycling all reduce the social and environmental costs ("externalities") associated with landfill disposal (health hazards, odours, visual impacts, contamination of soil and water resources, emissions of greenhouse gases, reduced land availability and value, etc.).
- Waste prevention and re-use can reduce the financial, social and environmental costs associated with waste collection and disposal, and hence their place at the top of the waste management hierarchy.
- Recycling and energy recovery contribute to economic growth and job creation, and can also foster innovation and create new business opportunities.
- Recycling and energy recovery allow for valuable materials and energy to be recovered and recirculated into the economy. These materials can in turn be used as inputs in the manufacturing of new products.
- Recycling and energy recovery displace the use of virgin materials and therefore reduce the financial, social and environmental costs associated with virgin material extraction.

Unlocking the above social and economic opportunities from waste requires a combination of an enabling governance environment (**see chapter 4**) and the development of local and regional value chains to create demand for end-of-life products. It also requires bridging the service- and value-chains, thereby diverting waste away from dumping and landfilling towards value-add opportunities (**Figure 6.1**). Advanced policy instruments such as EPR can play a role in developing local recycling businesses in Africa.

Figure 6.1 Bridging the service- and value- chains in unlocking opportunities in Africa



Source: Adapted from OECD (2015)

6.2 Economic opportunities

The total MSW generated on the African continent in 2012 was 125 million tonnes per annum (**see chapter 3**). However, the average waste collection rate in Africa is only 55 per cent, and more than half of the collected waste is disposed of through uncontrolled dumping and open burning (**see chapter 3**). The average MSW recycling rate in Africa is 4 per cent (**see chapter 3**). In Africa, waste reuse, recycling and recovery is mostly associated with informal pickers and salvagers and is often processed through unsafe and informal activities (**see chapter 5**).

According to Simelane and Mohee (2015), alternative uses for waste in Africa, such as energy-generation, composting and recycling, are all capable of converting waste into valuable assets. Adoption of these technologies is desirable to allow African countries to address the waste management challenges they face, and in so doing unlock the economic and social potential of waste for economic growth and job creation (**see chapter 7**). Therefore, the choice of technology should aim to maximize the benefits of waste for the economy and society.

For the continent to attain this, however, a number of hurdles still need to be overcome. These include improving the methods currently used to collect and dispose of waste. Discussion around moving waste away from landfilling towards AWT technologies are usually stalled by the perceived higher cost of alternatives

relative to landfilling (DST 2014). The lack of advanced waste management methods, supported by appropriate technologies, means that there are very few alternative practical uses for solid waste in Africa.

Furthermore, where alternative technologies do exist, they tend to be expensive relative to dumping or landfilling and are therefore a less attractive option. Tipping fees at "landfills", if charged at all[15], tend to be artificially low, since many municipal landfill sites are not designed and operated according to sanitary engineered landfill standards. Higher capital and operating costs associated with sanitary landfilling would drive up costs and make alternative waste treatment options more attractive (DST 2014). At the same time, investment in solid waste management and related technologies needs to be attracted to increase economies of scale and reduce the costs of alternatives relative to dumping and landfilling (Simelane and Mohee 2015) (**see chapter 8**).

6.2.1 Economic value of waste as a resource

This section focuses mainly on the first of the benefits referred to above, namely the recovery of valuable resources and energy and their insertion back into the economy. We quantify this in terms of a "resource value". In other words, we estimate the monetary value of the resources that can potentially be recovered through recycling and WtE applications.

Importantly, this implies that the values reported in this section are a crude (but indicative) estimate that will, inevitably under-estimate the full benefits of moving up the waste hierarchy. The other benefits mentioned above (e.g. benefits associated with job creation and economic growth, as well as the avoided costs and externalities associated with virgin material extraction and landfilling), are not taken into account here, owing to a lack of data for Africa.

The value of waste resources in Africa was quantified using the same methodology applied in South Africa (DST 2014), where the resource value associated with potential increased recovery of 13 waste streams currently being landfilled in South Africa was estimated. This methodology draws on the following insight, namely that:

> *"Data on... waste generation signal the maximum amount that could be recycled. Assuming that all waste is recycled provides an indication of the maximum potential for recyclables to meet... material consumption needs. Of course, this upper limit is theoretical because in reality not all waste can be recycled."* (EEA, 2011:18).

Essentially, this methodology involves quantifying the amount (in tonnes) of each of the key materials that could potentially be recycled, and multiplying this by a representative unit value per tonne of the recovered material to arrive at an indication of the value of additional recoveries:

$$\text{Resource value}_{i-n} = (Q_1 \times UV_1) + (Q_2 \times UV_2) + \cdots (Q_n \times UV_n)$$

Where: Q_i = quantity of waste stream '*i*' available to the economy (tonnes)

UV_i = unit value per tonne of waste stream '*i*' (US$/tonne)

Here, we apply this methodology to the data available for waste generation in Africa. Owing to data limitations, we focus specifically on those waste streams for which status quo data was available, as presented in **chapter 3** of this report. As such, we focus specifically on MSW generated in African urban areas (cities), with specific reference to the following streams:

- organic waste
- paper
- glass
- plastic
- metals
- other (**see chapter 3**)

15 Inability to collect cost-reflective charges is a consequence of poor governance and may even relate to political interference and corruption

Data on quantities (in tonnes) of each of these waste streams were derived from **chapter 3**. It is noted in **chapter 3** that total urban MSW generation for the continent amounts to 125 million tonnes per year. The composition of this waste (percentage of the total) across the above-mentioned waste streams is also provided. Based on that information, the quantity generated each year for each waste stream was calculated (**Table 6.1**).

Data on unit values (prices per tonne) were not available for a representative sample of countries across Africa. It should be noted that values can vary significantly across the continent, depending on, among other factors, the maturity of the end-use market. South Africa has a relatively mature recycling market with a relatively high demand for recyclate. As such, prices may be higher than would be paid in countries with a less mature end-use market. Relevant unit values for specific countries should therefore ideally be used to estimate the resource value at a country level. For the purposes of this report, however, owing to a lack of price data from other countries, the unit values used in the South Africa study (DST 2014) were used. These unit values were based on average industry prices paid by recyclers to collectors for the recovered waste materials (note, therefore, that the resulting values do not reflect the further value adding that occurs along the value chain). These prices (in 2013 South African rand) were adjusted to 2016 values using South African Producer Price Index (PPI) inflation rates[16] and then converted to United States dollars[17] (see **Table 6.1**).

Note that the methodology described above requires assumptions regarding the proportions of waste currently being disposed of that could potentially be reclaimed (i.e. regarding the extent to which reclamation rates could potentially be increased). Generally speaking, it is not realistic to assume that 100 per cent reclamation rates can be achieved, particularly not in the short- to medium-term. Materials differ in terms of the physical and economic feasibility of recycling. The secondary resource value for Africa was therefore modelled for a number of scenarios:

- **Scenario 1:** Status quo, based on current recovery rates, in order to provide an indication of the value currently derived from resources that are already being recycled in Africa. According to **chapter 3**, the average recycling rate for urban MSW in Africa is 4 per cent (with much variation between cities)
- **Scenario 2:** Based on 25 per cent recycled or recovered

Table 6.1 Municipal solid waste generation and average composition in selected African cities, and relevant unit values

Waste stream	Composition (percentage of total)	MSW generated, urban areas (tonnes per year)	Average unit value (US$ per tonne)
Organics	57	71 246 580	16.28
Paper	9	11 249 460	64.26
Glass	4	4 999 760	42.30
Plastic	13	16 249 220	269.28
Metals	4	4 999 760	195.95
Other	13	16 249 220	31.71
TOTAL	**100**	**124 994 000**	–

Source: MSW composition from Hoornweg and Bhada-Tata (2012); unit value from (DST 2014)

16 http://www.statssa.gov.za/publications/P01421/P01421September2016.pdf

17 Based on currency exchange rates as at 28 October 2016 (R13.88 per United States dollar)

- **Scenario 3:** Based on 50 per cent recycled or recovered
- **Scenario 4:** Based on 100 per cent recycled or recovered. Although a rate of 100 per cent is not realistic, the intention of this scenario is to provide an indication of the maximum value of all waste resources that are currently being generated, and which could (hypothetically) be reclaimed

The results for each scenario are presented in **Table 6.2**. The results imply the following:

- Currently (scenario 1), of the 125 million tonnes of MSW generated annually in African urban areas, only 5.0 million tonnes per annum (4 per cent) is reclaimed for recycling or other uses. The estimated value of these recovered resources is US$318.6 million per year.
- If the recovery rate were to increase to 25 per cent (Scenario 2), 31.3 million tonnes per annum could be reclaimed (an additional 26.2 million tonnes per annum relative to the status quo), and the estimated value of the resources reclaimed would increase to US$2.0 billion per annum (an additional US$1.7 billion per annum).
- If the recovery rate were to increase to 50 per cent (Scenario 3), 62.5 million tonnes per annum could be reclaimed (an additional 57.5 million tonnes per annum relative to the status quo), and the estimated value of the resources reclaimed would increase to US$4.0 billion per annum (an additional US$3.7 billion per annum relative to the status quo).
- Finally, although a 100 per cent recovery rate (Scenario 4) is not realistic to achieve, it is worth noting the total estimated value of waste resources that are currently being disposed of to landfill (or open dumping), i.e. the value of potentially recoverable resources that are not being reclaimed and that are essentially lost the economy. The 125 million tonnes of MSW generated annually in African urban areas has a total value of US$8.0 billion per annum. However, with only 4 per cent (5.0 million tonnes per annum, valued at US$318.6 million) currently being reclaimed, this means that 120.0 million tonnes per annum of potentially recoverable materials are currently being disposed to dumpsite or landfill. As such, purely in terms of MSW from urban areas that is not being recovered; US$7.6 billion worth of valuable resources are currently lost to African economies each year.

These results are an underestimate of the total value of waste resources in Africa, as they are based on only MSW generated in urban areas (**chapter 3**), for a limited number of waste types.

In order to put the results for Africa into context, it may be useful to compare them with the results from the South Africa study (DST 2014). That study was based on 13 waste types (including MSW), amounting to 101.1 million tonnes per year (2011 data), of which approximately 10.9 million tonnes per year (11 per cent) was being reclaimed, with the rest (90.2 million tonnes per year, or 89 per cent) being landfilled. The total value of waste resources (based on 2013 Rands) in that study was estimated at R25.2 billion (US$2.2 billion in current US$), of which only R8.2 billion (US$700 million) was being reclaimed. The study concluded that, just for South Africa, R17.0 billion (US$1.5 billion) of potentially recoverable valuable resources were therefore lost to the economy each year as a result of waste being landfilled rather than reclaimed. Unfortunately, it is difficult to extrapolate these values to the African continent as a whole owing to a lack of data on overall waste generation (as described in **chapter 3**), but suffice it to say that the values provided in **Table 6.2** are only a small part of the overall picture.

Furthermore, as discussed above, in addition to the value of recovered resources, there are a number of other benefits associated with moving up the waste management hierarchy that are not taken into account in the analysis provided in this section. As such, the values presented in this section should be seen as lower-bound estimates of the overall benefits of moving up the waste management hierarchy. Some of the social benefits (e.g. in terms of job creation) are discussed in more detail overleaf.

Table 6.2 Resource values per waste stream (based on MSW generated in Africa)

	Tonnages recovered per annum				Unit values, US$ per tonne	Total resource value, US$ per year			
	Status Quo 4% Recovery	Scenario 2: 25% Recovery	Scenario 3: 50% Recovery	Scenario 4: 100% Recovery		Status Quo 4% Recovery	Scenario 2: 25% Recovery	Scenario 3: 50% Recovery	Scenario 4: 100% Recovery
Organics	2 849 863	17 811 645	35 623 290	71 246 580	16.28	46 395 773	289 973 581	579 947 161	1 159 894 322
Paper	449 978	2 812 365	5 624 730	11 249 460	64.26	28 915 612	180 722 575	361 445 150	722 890 300
Glass	199 990	1 249 940	2 499 880	4 999 760	42.30	8 459 594	52 872 462	105 744 924	211 489 848
Plastic	649 969	4 062 305	8 124 610	16 249 220	269.28	175 023 598	1 093 897 490	2 187 794 981	4 375 589 962
Metals	199 990	1 249 940	2 499 880	4 999 760	195.95	39 188 119	244 925 743	489 851 486	979 702 972
Other	649 969	4 062 305	8 124 610	16 249 220	31.71	20 610 511	128 815 692	257 631 383	515 262 766
Total	**4 999 760**	**31 248 500**	**62 497 000**	**124 994 000**	–	**318 593 207**	**1 991 207 542**	**3 982 415 085**	**7 964 830 170**
Increase relative to status quo		**26 248 740**	**57 497 240**	**119 994 240**	–	–	**1 672 614 336**	**3 663 821 878**	**7 646 236 963**

6.3 Social opportunities

In addition to the economic opportunities associated with a secondary resources economy, there are a number of social opportunities that could be realized by diverting waste away from landfill towards prevention, reuse, recycling and recovery. These social opportunities include job creation, poverty alleviation, enterprise development, entrepreneurship and women's empowerment. Given the large, active informal waste sector in Africa, opportunities also exist to improve the livelihoods and working conditions of waste pickers through the integration of the informal sector into the waste and secondary resources economy, being mindful not to marginalize women working in the sector. If implemented sustainably, this will also create environmental benefits, such as improved resource efficiency, environmental quality and the maintenance of ecosystem services (UNEP 2013). It is important to ensure that the social opportunities created by treating waste as a secondary resource, are realized locally and regionally on the African continent. This creates an opportunity for the waste sector to contribute to achieving the SDGs particularly the targets for SDGs 1, 5 and 8 (**see Topic Sheet 6 in chapter 9**). To achieve this, local and regional approaches to improved waste management must be developed and implemented and export of secondary resources managed. More importantly, markets for recycled materials and processing capacity must be developed on the African continent, supported by all African states.

6.3.1 Job creation

According to the European Environment Agency, recycling and recovery "*create more jobs at higher income levels than landfilling or incinerating waste*" (EEA 2011:7). This statement is confirmed by a study in the United States, where waste collection and landfill disposal creates less than one job per 1,000 tonnes managed, while the collection, processing and manufacturing of products with recycled materials as feedstock creates 6–13 or more jobs per 1,000 tonnes, depending on the material (NRDC 2014). For the European Union and the United Kingdom, Friends of the Earth (2010) used a multiplier of 1.5 and 1.75 to calculate the indirect and induced new jobs in the recycling sector. Moving waste up the hierarchy not only results in a net increase in employment,[18] these new jobs are typically higher paid and the working conditions greatly improved relative to landfilling and incineration (DST 2014). Experiences from the United States and the European Union suggest that exporting recyclate could create overseas jobs at the expense of local employment opportunities (Friends of the Earth 2010). It can therefore be concluded that the more opportunities for recycling that are created within Africa (rather than exporting recyclate off the continent), the more jobs can be created on the continent rather than in other countries.

In Ouagadougou, Burkina Faso, a project for collecting and recycling plastic waste has helped improve the environmental situation and created jobs and generated income for the local community. The project gave rise to the first recycling centre in the country, which is managed by 30 women and supported by around 2000 informal collectors. The recycling centre is also assisted by two technicians. All are locals, working eight hours a day, five days a week, earning the equivalent of US$67 per month, a reportedly good salary compared to other occupations in the local economy. The 2,000 or so waste collectors earn up to US$1 per day. Since implementation, the city and its suburbs are cleaner. The recycling centre has allowed many people to secure an income, either by collecting the plastic waste or by working as full-time employees at the recycling centre. Many of them used to be among the poorest of Ouagadougou's suburban population (ILO 2007).

18 Where job losses in landfilling are outweighed by the creation of "green" jobs in recycling and recovery.

Workers at a material recovery facility in South Africa
Photo credit: © Suzan Oelofse, CSIR

Workers at an e-waste dismantling and pre-processing facility in South Africa
Photo credit: © Linda Godfrey, CSIR

6.3.2 Poverty alleviation

A study of informal waste pickers in Victoria Falls, Zimbabwe, revealed that involvement in resource recovery improved the socio-economic status of the respondents (Masocha 2006). The study showed that most respondents (84.6 per cent) could afford to pay school fees for their children. As many as 61.5 per cent of respondents had improved their living conditions by moving from informal settlements to Chinotimba, where they stayed in decent accommodation with electricity, piped water and flush toilets. At the time of the survey, most waste pickers were paying monthly rent for their accommodation using the income generated from the sale of recovered materials. A local scrap metal dealer in Victoria Falls bought the scrap metal from waste pickers, sold some of the metal to recycling companies in Bulawayo and manufactured various metal products, such as window frames, gates and door frames. The sale of five standard gates and 10 four-pane window frames earned the dealer a monthly income of about US$1,881 (Z$190,000). At the time, this income compared favourably with the monthly salary of most middle-level managers in the town. From this example, it can be concluded that if informal waste pickers are up-skilled to add value to the material they collect, they can increase their earning potential significantly (Masocha 2006). It is, however, important to ensure gender equality in realizing opportunities and earning potential.

6.3.3 Enterprise development

The collection, reuse, recycling, recovery and disposal of various waste streams provides economic opportunities for the private sector to partner in service provision, given an enabling environment for private sector investment in waste management. Micro-, small- and medium-sized enterprises (SMEs) have an important role to play in waste management in Africa. However, a major challenge that public authorities face is in creating an environment that enables such enterprises to enter the waste management industry, and in so doing, increase employment potential and productivity (UN-Habitat 2014). When appropriately supported, SMEs can play an important role in solid waste management on the African continent.

Small-scale entrepreneurs can, for example, play a role in the recycling of non-harmful wastes, such as composting of organic materials (UN-Habitat 2014). Currently, such activities are mostly being done by informal pickers, but with appropriate assistance, they could be scaled-up and better managed at the neighbourhood level. Such efforts can improve urban environments while simultaneously generating income opportunities and improved livelihoods for the men and women of Africa.

6.3.4 Entrepreneurship

There are multiple opportunities for entrepreneurship in the waste economy in Africa. They are spread throughout the value chain, including the uptake of technological innovation to reduce waste generation. Some examples are discussed below and also in **chapter 7**.

Construction and demolition waste (e.g. bricks, concrete and scrap metal) reclaimed from dumpsites in Zimbabwe are reportedly sold to small-scale entrepreneurs for construction of tuck shops. Some materials, such as bricks and concrete stones, require no processing before they are sold, while others, such as stone, are reclaimed from concrete slabs, converting the waste materials into reusable items with resale value (Masocha 2006). Similar observations were made for South Africa, where reclaimed bricks are sold at varying prices, based on the type of brick (Oelofse and Strydom 2010).

Reclaiming bricks from a landfill in the City of Tshwane, South Africa
Photo credit: © Suzan Oelofse, CSIR

Manufacturing of dog kennels from waste wood on a landfill in the City of Tshwane, South Africa
Photo credit: © Suzan Oelofse, CSIR

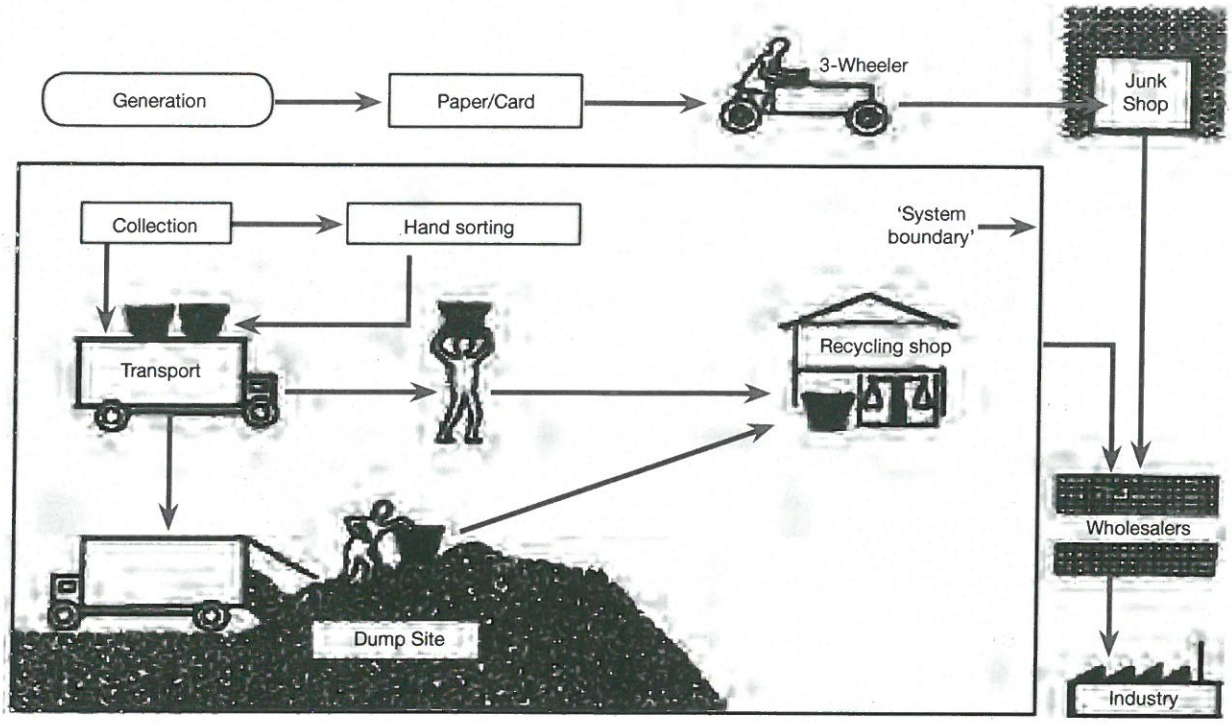
Reclaiming garden (organic) waste also presents opportunities for entrepreneurs, as was observed in the City of Tshwane, South Africa, where plants recovered from waste sites are planted in pots and sold. At one drop-off site in KwaZulu-Natal, South Africa, a make-shift nursery was constructed from shade netting. This type of entrepreneurial activity can be expanded to a profitable, full-scale operation and combined with the benefits of a composting facility (Oelofse and Strydom 2010).

Manufacturing of products is another innovative entrepreneurial activity observed at landfills in South Africa and Zimbabwe. One entrepreneur, assisted by at least two co-workers, manufactures dog kennels from reclaimed wood at a landfill in the City of Tshwane, South Africa. Each manufactured kennel is painted to add further value and is sold either directly from the dump or next to a nearby road. The co-workers are proud of being involved in this venture and managed to improve their social status from waste pickers to craftsmen (Oelofse and Strydom 2010).

6.3.5 Integration of the informal sector

Informal waste management is prevalent in many African cities (**see chapter 5**). While waste management by the informal sector can often be innovative, the non-integration of the informal sector is a major limitation to the social acceptance of their activities. According to Nzeadibe (2015), social acceptance of informal waste management as a legitimate economic activity is important to achieve the objective of an "inclusive city", meaning a place where everyone, regardless of wealth, gender, age, race or religion, is able to participate productively and positively in the opportunities the city has to offer. There remains much debate, still, on whether this means formalization, integration or professionalization. Unfortunately, there is no one-size-fits-all solution, with the model of integration depending on things like local circumstances, cultures and needs. Integration is not without its challenges, as developing countries across the world are experiencing.

Figure 6.2 Schematic representation of the informal recycling system



Source: adapted from Wilson *et al.* (2001)

The integration of informal waste pickers has been further complicated by the recent emergence of EPR schemes, or at least discussion thereof, in some African countries. If not implemented correctly, EPR can threaten the livelihood of informal waste pickers, who see this policy instrument as a potential threat. Discussions among key stakeholders in South Africa, including informal waste pickers, identified possible scenarios for their integration, including (Godfrey *et al.* 2016):

- *Status quo (no interference):* Informal waste pickers continue in their current role, as a largely marginalized, unregulated community, recovering value at little to no cost to the value chain (and hence producers)
- *Independent entrepreneurs:* Informal waste pickers are recognised as independent entrepreneurs, but are left largely to operate in their current form, with some level of increased control and monitoring (e.g. registration, provided with personal protective equipment) and increased support (e.g. access to recyclables through source separation programmes and in industry-provided buy-back centres (static or mobile) to increase the tonnages collected) (*Producer Responsibility Organisation (PRO) supports end-use recyclers thereby creating demand (pull) for recyclables*).
- *Formalization:* Government and business push to formalise the informal sector through the establishment of co-operatives and SMEs, taking on the responsibility for business development support (incubation, mentoring and training). These emerging businesses are assigned geographic areas to "service" (*PRO provides financial and operational support for business development, potentially increasing supply (push) of recyclables*)
- *Employment:* The formal waste and recycling sector drive a labour-intensive collection, sorting and recycling process based on an employment model of absorbing informal waste pickers into new businesses as employees. In so doing, the sector also takes on the responsibility for training and capacity building (*PRO sets clear contracting conditions to participate in formal EPR collection, sorting and recycling programmes that require labour intensive approaches*).

The OECD (2015:33) notes that "*the best-functioning systems are those which embrace an open strategy that includes both informal collectors and the existing value chain enterprises in the system*". In reality, it is likely that a combination of the above scenarios will have to be implemented, based on the specific conditions of the city or town (Godfrey *et al.* 2016). The slums in Lagos, Nigeria, provide an example of integration of the informal sector (Nzeadibe and Anyadike 2010).

6.4 The global waste management system

The secondary resources economy has emerged as a global business (Hoornweg and Bhada-Tata 2012). In the light of the earlier discussion on the establishment of local end-use markets for secondary resources, a discussion on transboundary waste management, regional approaches, global trade in recyclables and the evolution of crime, including transnational organized crime in the waste sector, is particularly relevant. It is noted, however, that these issues are often in contravention of global and regional policies on the transboundary movement of waste (**see chapter 1**) and can result in local environmental impacts (**see chapter 5**).

6.4.1 Regional approaches to secondary resource management

Developing countries often generate too little waste to warrant investment in reprocessing technologies, and little progress has been made towards regional approaches for managing secondary resources in Africa.

A recent study on the e-waste dismantling, pre-processing and processing technology landscape in South Africa showed that one of the biggest challenges affecting sourcing, operation and implementation of e-waste recycling technologies was the low volumes of e-waste in South Africa, resulting in the inability of companies to achieve economies of scale, remain profitable and invest in upgrading and expanding operations (Lydall *et al.* 2017). At current collection volumes, e-waste recycling was found not to be profitable as a standalone business for small firms, with 58 per cent of small businesses regarding e-waste recycling as a secondary activity, the more profitable aspect being e-waste refurbishment (making up to 60 per cent of revenues) (Lydall *et al.* 2017). Creating regional economies (within or across countries), amasses more recyclable waste and creates economies of scale necessary for investment in local end-use markets. Some key features of existing regional management systems for specific waste streams are outlined below.

Waste oil

The management system for waste oils is not highly organized in Africa and tends to be informal. There is little reliable information on the existing waste oil management systems. It is reported, however, that in all countries, waste oil is collected from most of the larger sources by some very active waste oil collectors, some of which apply relatively high standards. Waste oil finds ready markets, mostly as fuel for burning in a variety of combustion systems, and the informal sector plays a key role in the collection systems. Waste oil collected in several African countries is sent to South Africa for recycling, because the export countries do not have treatment facilities or because prices paid by the South African recyclers are higher. Some cooperation is reportedly developing between major waste oil generators seeking common solutions for common problems, resulting in economies of scale and higher standards. There are also reports of investment or planned investment in facilities that process waste oil into high quality fuel in several African countries (Africa Institute 2013a).

Used lead-acid batteries

According to the Africa Institute (2013b), the management system for ULAB in Africa is not highly organized and tends to be informal, much like the system for waste oil. The main sources of ULAB are automobile batteries generated by many small generators and collected by the informal sector. Industrial and other uses of ULAB in

Africa, such as for storage of solar power in rural areas, are growing. Economically viable, environmentally sound collection of used batteries is a challenge. However, it is reported that the majority of ULAB (70–90 per cent, depending on the country) are captured by the existing systems owing to their high value. All ULAB collected finds ready markets, but only three Africa Institute member countries (South Africa, United Republic of Tanzania and Zambia) have proper lead smelters. A large portion of ULAB is reported to be exported to Asia, where the prices paid are higher. There is a high demand for lead from secondary lead smelters in the African region, giving ULAB a high value and ensuring that most ULAB are captured in the existing collection system. There is thus potential to extend the current collection system in the future, however, there is also a need to strengthen the policy framework around ULAB and potential for exchange of knowledge and expertise among Africa Institute member countries.

E-waste

EACO has developed a model policy for e-waste management in the East African region to guide the development of e-waste management policies in their member countries (EACO 2013). It is not clear, however, whether this model policy framework has had any uptake in the region (**See Topic Sheet 2 in Chapter 3**).

6.4.2 Global trade in recyclables

Cross-border trade of recyclables such as metal, paper and plastics is driven by demand. Trade in recycled materials is growing rapidly, with the recycling market becoming increasingly globalized. This has been fuelled largely by growing demand for both raw and secondary materials in emerging economies, particularly China and India (Fakir 2009). The volume of traded recyclables has become significant in the resource trade market, which includes trade in virgin resources and recyclables (Michida 2011). Growth in demand from these highly populated, rapidly growing economies is driving a sustained trend in rising commodity prices, while increasing demand for recycled materials. China's recent notice to the World Trade Organization that it intends to ban imports of certain waste streams by end of 2017 (WTO 2017) will have huge implications, including job losses in the recycling industry, especially for countries that do not have their own local processing facilities. This ban by China may, however, also create an opportunity for Africa to develop local markets and processing facilities for recyclables, thereby creating some resilience to global shocks in the secondary resources market.

World markets

Secondary commodities (recovered and recycled materials) are increasingly behaving like primary resources (BIR 2010). In an environment where primary commodity supply has lagged behind demand, secondary materials shadow primary materials both in demand and pricing. Secondary materials can function as a backup that ensures steady supply (Fakir 2009). This statement holds true for non-ferrous and ferrous scrap and at a certain level also for recycled paper and plastics (BIR 2010). The development of derivative markets could therefore also affect the recycling industry in the near future. In the secondary materials market, the materials move to where the demand directs them, irrespective of their origin. Unlike the trade in primary commodities, which can be affected by large inventory swings, the secondary resources trade is a volume business. Recyclers do not buy secondary resources inherently expecting to hold them until prices increase; they buy them to meet their customers' monthly requirement (ISRI 2016).

Prices are based on a marketplace made up of consumers who use these recycled materials to manufacture steel, aluminium, copper, paper, electronics, glass and rubber products, among others. The processors buy materials from thousands of sources to keep up with expected consumer demand, process the material into specification-grade material and deliver their product based on current market conditions dictated by the customer. Secondary materials processors are viewed as the price taker, not the price setter, hence the phrase, *"Scrap is bought, not sold."* (ISRI 2016).

Geographical location also plays an important role in price setting owing to differences in machinery and materials prices, and production and labour costs (Ferreira *et al.* 2012). Africa should therefore consider developing local markets for recyclables rather than selling them into existing world markets and effectively exporting job opportunities (and opportunities for the development of downstream manufacturing industries) together with the waste material.

Paper

The global trade in recovered paper amounts to approximately 50 million tonnes per annum (ISWA 2012). Africa collected 2.46 million tonnes of paper in 2011 and consumed 2.39 million tonnes of recovered paper in 2011 (BIR 2011), and is therefore a net exporter of recovered paper (**Table 6.3**). This suggests opportunities for growing local end-use markets for waste paper recycling.

Plastic

The annual volume of globally traded plastics waste is around 15 million tonnes, which is less than 15 per cent by weight of new plastic production (2012 figures). The international recycling markets for plastic waste depend on a complex interplay of five key market factors (Velis 2014):

- National (domestic) solid waste collection capabilities (formal and informal), reprocessing capabilities and needs, and export/transport laws and controls.
- Market demand and import controls at the major destination countries and investment in raw material production elsewhere (e.g. Chinese investment in Africa).
- Global supply chain networks: transport, logistics and costs.
- Cost of primary resins, which is dependent on oil and natural gas prices (prime determinant of the price of recycled plastics).
- Technological innovation (e.g. new resins, composites, compostable plastics, sensor-based sorting and chemical recycling).

E-waste

Lundgren (2012) provides an indication of the main flows (import and export) of e-waste globally (**Figure 6.3**). The trade in e-waste shows similarities with that of other commodities (Lepawsky and McNabb, 2010). Trade in e-waste in Africa was mostly externally oriented in 2001, with e-waste mostly exported to Korea and Spain, but by 2006 had shifted by more than ten percent towards internal trade of e-waste in Africa (Lepawsky and McNabb, 2010), likely reflecting the growing use of digital technologies by consumers and businesses within Africa. E-waste is imported into Africa through the ports of Lagos, Mombasa, Dar es Salaam and Cairo (Schmidt 2006). In 2001, imports of e-waste into Africa were exclusively from Europe and America, but the number of regions from which e-waste was imported had increased by 2006 (Lepawsky and McNabb 2010).

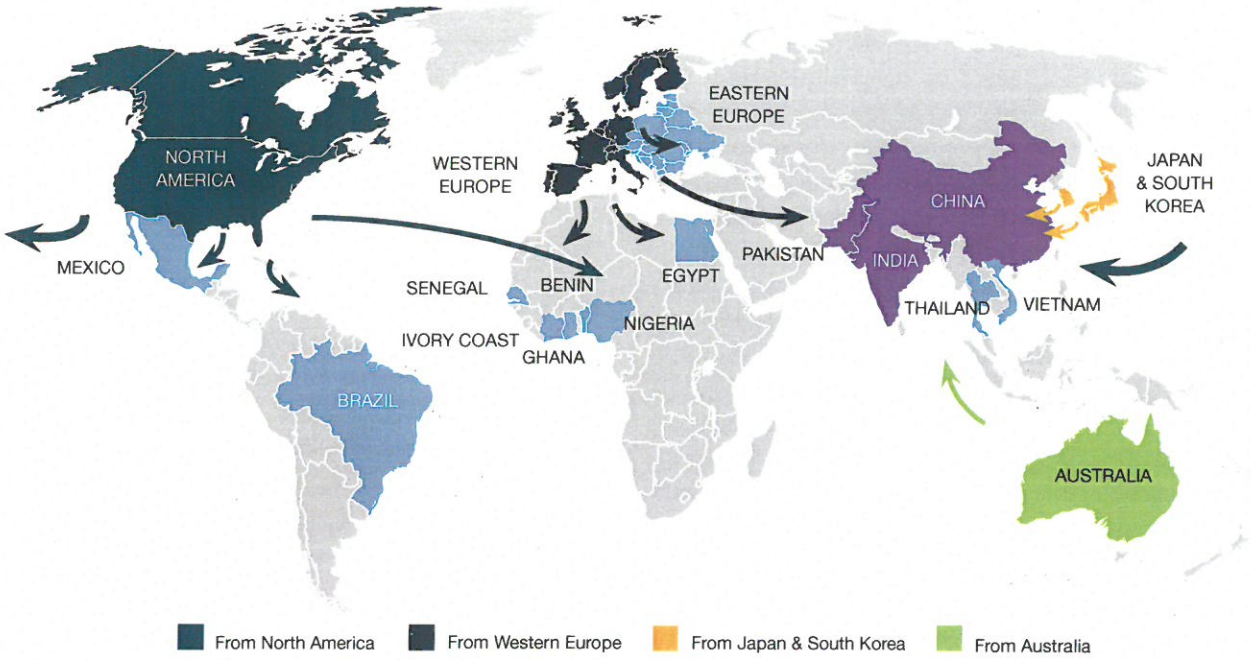
In the case of e-waste, there is not necessarily a one-way transformation of value-to-waste along a linear chain of production-consumption-disposal (Lepawsky and McNabb, 2010). More e-waste is predicted to end up in West Africa in future owing to the increased tightening of import regulations in Asian economies. While this could create significant environmental and human health risks (**see chapter 5**), it also provides opportunities for Africa to develop the required capacity and acceptable standards to handle this waste stream responsibly (minimizing associated environmental impacts), while creating jobs and benefiting local and regional economies (**See Topic Sheet 2 in chapter 3**).

Table 6.3 Collection, net imports and apparent consumption rates for recovered paper in 2011 (tonnes)

Country	Collection	Imports	Exports	Apparent consumption
Asia	96 505 000	39 802 000	8 090 000	125 430 000
Europe	61 760 000	15 800 000	24 800 000	52 750 000
North America	52 390 000	1 740 000	23 000 000	30 380 000
Latin America	11 465 000	2 130 000	920 000	12 670 000
Australasia	3 610 000	3 000	1 580 000	3 033 000
Africa	2 450 000	30 000	140 000	2 338 000
Total	**228 180 000**	**59 505 000**	**58 530 000**	**226 601 000**

Source: Bureau of International Recycling (2011)

Figure 6.3 Flow of e-waste



Source: Lundgren (2012)

6.4.3 Resource crime

The evolution of crime in the waste sector, including transnational organized crime, is a significant threat. According to Rucevska *et al.* (2015), criminal activity can occur at various stages of the waste chain. It can range from illegal dumping or unsafe waste management to organized crime, including tax fraud and money laundering. The extent of illegal trade in waste in Africa is unknown. Common criminal actions include falsification of customs forms and tax fraud through over- or under-invoicing costs and income. Waste is deliberately classified as "other items" to deceive law enforcement authorities. For example, non-hazardous waste codes or product codes are used for hazardous waste, and many shipments of e-waste are disguised as second-hand goods.

Key destinations for large scale shipments of hazardous waste in Africa, including e-waste, include Ghana and Nigeria, but high volumes also go to Côte d'Ivoire and the Congo (**see chapter 3**). Capacity for repairs and reuse of WEEE accounted for high imports into the West-Africa sub-region. The key driver for illegal waste shipments to destination countries is reported to be the profit generated from payments for safe disposal of waste that is then either dumped illegally or unsafely recycled. It may further include additional profits from recycling of certain components, while the majority of the waste is simply dumped (Rucevska *et al.* 2015).

Criminal activities in the waste sector are usually structured along a legal chain of operations, albeit where the players take advantage of loopholes in control regimes and actual control capacities. According to Rucevska *et al.* (2015), "*There is likely no other area of organized crime that provides such a significant opportunity for money laundering and tax fraud as waste disposal, with its near complete lack of monitoring, statistics or reporting*". Without effective enforcement efforts aimed at mapping, investigation and possible prosecution of criminals involved in illegal waste management activities, illegal dumping and transport activities are likely to grow, as will the associated threats to human health and environmental integrity. Crime organizations are known to collude with local institutions to control waste markets, and the role of organized crime within local municipalities is a strong obstacle to achieving better waste performance (D'Amato *et al.* 2015).

6.5 Conclusion and recommendations

Current waste management practices on the African continent are characterized by significant backlogs in waste collection coverage; and disposal to open dumps or unsanitary landfills (**see chapter 3**). These practices are not conducive to realizing the potential economic and social opportunities in waste as a secondary resource. It is estimated that the 125 million tonnes of MSW generated annually in African urban areas has a total resource value of US$8.0 billion, of which only a small percentage (4 per cent) is currently being recovered. This value estimate is based on only a limited set of waste streams, and only on the direct value of the resources at a specific point in the value chain, and therefore understates the true value of all waste streams across the continent. The value of the potentially recoverable resources that are not currently being collected and are essentially lost to the economy is estimated at US$7.6 billion per year. Moving waste up the waste management hierarchy is essential if this potential for Africa is to be realized.

Unlocking the opportunities associated with waste as a secondary resource will unlock social and economic opportunities, including economic growth, poverty alleviation, job creation, women's empowerment, improved livelihoods for people and improved environmental health and ecosystem services. However, the benefits for Africa will depend on the extent to which the opportunities associated with secondary resources are realized within Africa or exported to other countries.

Secondary materials are part of the global economy, and will therefore be subject to global market fluctuations and volatility. However, it is important to ensure that the benefits are realized on the African continent, and not abroad through the export of materials. Economies of scale will be required to develop sustainable local processing capacity, markets for recyclables and facilities for processing materials and manufacturing high quality goods using recycled input materials. A regional approach to secondary materials management will have to be followed to maximize the benefits for Africa.

It is therefore recommended that an "*African regional strategy for secondary materials management*" be developed and implemented. An enabling governance environment, combined with supporting data, infrastructure, institutional capacity, financial provisions, monitoring and control mechanisms, will also have to be put in place to enforce such a strategy.