SUPPLEMENTAL MATERIAL

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Benchmarking performance of solid waste management and recycling systems in East Africa: comparing Kigali Rwanda with other major cities

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Supplemental Material

For a summary of the methodology for the Wasteaware benchmark indicators, please refer to Section 2 of the main paper, or for more details to Wilson et al., 2015a and/or to the detailed User Manual (Wilson et al., 2015b). In this Supplemental material, we present six out of eight detailed Tables, showing how the Wasteaware indicators for Kigali have been derived (the other two Tables were included in the main paper). This introduction contains a summary of the methodology used, including the scoring system used for deriving the qualitative indicators and the ‘traffic lights’ system used to visualize the results.
For the three physical components, quantitative indicators are defined, complemented by a ‘quality’ indicator derived from assessing performance against five or six qualitative criteria. Similar qualitative indicators are used for each of the five governance factors.

Each criterion (e.g. 1C.1, 1C.2 etc.) is assessed by the user against a standardized, five-fold scoring system following detailed guidance in the User Manual: no compliance scores 0, low compliance scores 5, medium 10, medium/high 15 and high 20. This assessment requires the User to exercise their professional judgment and to provide full details in the Indicator Form to ensure full traceability (see Section 2 of the main paper).

The resulting aggregate score is then converted into a five-fold qualitative assessment of the system’s performance against that indicator – these assessments are colour-coded to allow rapid visual assessment of the tabulated data and to highlight areas of performance requiring immediate attention – as denoted by the colour red. The convention used is that an assessment of LOW corresponds to an overall score in the range 0-20% and is coded as red; LOW/MEDIUM to 21-40% and red-amber; MEDIUM – 41-60%, amber; MEDIUM/HIGH – 61-80%, amber-green; and HIGH – 81-100%, green.

The same traffic lights coding system from LOW to HIGH has been used to rate performance for each quantitative indicator. The values that are currently considered good practice differ, which means that these indicators do not follow the same gradation pattern when assessing relative performance, and that gradation is not linear. Full details of this is provided in the original Wasteaware paper (Wilson et al., 2015a).
Table S.1: Wasteaware assessment of waste treatment and disposal in Kigali

| No. | Short name                                      | Score | Observations                                                                                                                                                                                                 |
|-----|------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2   | Controlled treatment or disposal               | 0%    | Nduba is the main disposal site. To be classified as ‘controlled’, it would need to meet a threshold score of at least 10 against all three ‘quality’ criteria 2E.1, 2E.2 and 2E.3. Nduba scores ‘10’ on two criteria, but ‘0’ on 2E.3; so, it is classed as semi-controlled. Limited composting by private companies (0.4% of total waste) may be considered as controlled. |
| 2E.1| Degree of control over waste reception and general site management | 10    | All vehicles entering Nduba disposal site are monitored and recorded by permanent site staff. There is no weighbridge, so records show numbers and sizes of vehicles - one weighing exercise in 2014. |
| 2E.2| Degree of control over waste treatment and disposal | 10    | Vehicles directed to a designated discharge area with 36 staff. Waste is placed using a bulldozer and compacted twice a week. Cover materials are used once a month on average. |
| 2E.3| Degree of monitoring and verification of environmental controls | 0     | Neither waste treatment nor leachate or gas control at Nduba. No EIA (environmental impact assessment) carried out prior to site development. No monitoring of surface or ground water quality around the site. |
| 2E.4| Efficiency of energy generation and use (used for energy recovery facilities only) | N/A   | No landfill gas collection for either control or utilization, so this criterion is not applicable. |
| 2E.5| Degree of technical competence in the planning, management and operation of treatment and disposal | 5     | Number of SWM staff is limited, for example in the whole of the City of Kigali there is only one waste management officer. Staff at the site lack capacity and training. |
| 2E.6| Occupational health and safety                  | 0     | Protective clothing not routinely made available to workers and working conditions not monitored. |

2E

Degree of Environmental Protection of waste treatment and disposal

25% Overall score. Gives an overall assessment of Low/Medium (L/M)

Table S.2: Wasteaware assessment of resource value in Kigali. Covers the ‘3Rs’ – reduce, reuse, recycle

| No. | Short name                                      | Score | Justification                                                                                                                                                                                                 |
|-----|------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3   | Recycling rate                                  | 12%   | Calculated from the material flow diagram (MFD - Figure 3). Estimated based on observations and interviews, triangulating data from different stakeholder groups, including authorities in charge of solid waste management (SWM), waste companies, waste collectors and pickers, and eight recycling companies in Rwanda. |
| 3R.1| Source separation of dry recyclables            | 5     | Currently very little segregation at source, following the failure of an earlier attempt to introduce separate collection across the city. |
| 3R.2| Quality of recycled organic materials           | 10    | MFD shows two very small flows to two private composting companies (COOPED and AGRUNI). One flow is source separated and one is from mixed waste on the dumpsite. |
| 3R.3| Focus on the top levels of the waste hierarchy  | 5     | The City has tried in the past to prioritize recycling, both via separate collection of source segregated wastes, and the design of a new recycling facility at Nduba. |
| 3R.4| Integration of the community and/or informal recycling sector with formal SWM system | 10    | Most recycling is carried out by the waste collectors employed by the officially-contracted private companies. Picking at Nduba and illegal dumpsites is outside of the formal system. |
| 3R.5| Environmental protection in recycling           | 10    | Most recycling by waste collection workers - so the residual waste after recycling is reliably transported to Nduba as per the company contract. |
| 3R.6| Occupational health and safety                  | 5     | See also 1C.6 for protective clothing worn by the waste collectors/ pickers. Some of the dumpsite pickers wear gloves as the only type of personal protective equipment. |
| 3R  | Quality of recycling                            | 45    | Total score                                                                                                                                                                                                   |

38% Normalized score. Gives an overall assessment of Low/Medium (L/M)
Table S.3: Wasteaware assessment for degree of provider inclusivity in Kigali

| No.   | Short name                                      | Score | Observations                                                                                                                                 |
|-------|------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 4P.1  | Legal framework                                | 15    | Clear regulations and guidance for service contracts with private companies in charge of solid waste collection. Contract duration is three years. When the contact is not respected it is annulled. |
| 4P.2  | Representation of the private sector           | 15    | The private sector is well represented in the whole process. Private companies participate in each and every step of development, and in the various solid waste management planning forums, task forces, committees and steering groups. |
| 4P.3  | Role of the ‘informal’ and community sector    | 5     | Most ‘picking’ is carried out by the employees of the private waste collection companies, so in this sense, ‘informal’ recycling is integrated into the system. Scavenging is prohibited by law but that at Nduba disposal site is legal. |
| 4P.4  | The balance of public vs. private sector interests in delivering services | 15    | The utility regulator RURA oversees balancing the profit of private companies and the quality to the consumers. However, the collection workers only earn around the legal national minimum wage. |
| 4P.5  | Bid processes                                  | 15    | The bidding process is very clear and done properly                                                                                         |
| 4P    | Total score                                    | 65%   | Gives an overall assessment of Medium/High (M/H)                                                                                           |

Table S.4: Wasteaware assessment for degree of financial sustainability in Kigali

| No.   | Short name                                      | Score | Observations                                                                                                                                 |
|-------|------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------|
| SF.1  | Cost accounting                                | 10    | The budget allocated to municipal solid waste management is audited by the Auditor general office (as for all public institutions). Regarding the collected fees, the amount of money paid by households is very clear as that depends on their household social class Ubudehe classification. |
| SF.2  | Coverage of the available budget               | 10    | The City of Kigali’s solid waste budget comes from central budgets and from gate fees at Nduba. This is mostly spent on the rental costs for heavy machines used for daily management and soil cover application at Nduba but is considered insufficient by the officer in charge. A separate budget is used to pay waste collection companies. |
| SF.3  | Local cost recovery – from households          | 15    | Households pay a graduated fee for waste collection. Payment rates 95% - in most sectors, fee collected by the cell alongside that for security patrols. |
| SF.4  | Affordability of user charges                  | 15    | In Kigali, citizens always get waste collection services at a fair price. Fees payable graduated according to Ubudehe classification, with the poorest receiving a free service. |
| SF.5  | Coverage of disposal costs                     | 10    | At Nduba disposal site, companies depositing the waste are charged a gate fee of Rwf 3000 (US$ 3.6) per vehicle.                               |
| SF.6  | Access to capital for investment               | 10    | Private companies rely on private investments or loans from the bank for their infrastructures (underpinned by their contracts), while the Public sector relies on central government funds. |
| SF    | Total score                                    | 70    |                                                                                                                                            |
|      | Normalized score                               | 58%   | Gives an overall assessment of Medium (M)                                                                                                  |

Note: SWM – solid waste management
Table S.5: Wasteaware assessment for adequacy of national framework for SWM in Rwanda

| No. | Short name                                   | Score | Observations                                                                                                                                                                                                 |
|-----|----------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6N. 1 | Legislation and regulations                  | 15    | Rwanda has got important SWM-related legislation/regulations, including: • Law N° 04/2005 of 08/04/2005 on the protection, conservation and promotion of the environment in Rwanda  
• Law N° 39/2001 of 13 September 2001 establishing as utility regulator the Rwanda Utilities Regulatory Authority (RURA)  
• LAW N° 57/2008 OF 10/09/2008 prohibiting the manufacturing, importation, use and sale of polythene bags in Rwanda |
| 6N. 2 | Strategy/Policy                              | 10    | Relevant strategies and policies include: • Economic Development and Poverty Reduction Strategy – The Republic of Rwanda (MINECOFIN, 2007)  
• National Strategic Plan, and five-year operational plan, for the Management of Healthcare Waste (Ministry of Health, 2012)  
• National Industrial Policy (Ministry of Trade and Industry, 2011)  
• National Sanitation Policy (MININFRA, 2016). However, none is fully implemented. |
| 6N. 3 | Guidelines and implementation procedures    | 15    | Clear SWM guidelines and implementation procedures include: (i) Practical Tools on Solid Waste Management of Imidugudu, Small Towns and Cities: Landfill and Composting Facilities (REMA, 2010).  
(ii) Standards on the Management of Waste Disposal Sites (RURA, 2009). |
| 6N. 4 | National institution responsible for implementing SWM policy | 15    | Water and Sanitation Corporation (WASAC) Ltd is a government owned company set up to manage services for water and sanitation in Rwanda. Also responsible for implementing SWM policy. |
| 6N. 5 | Regulatory control                           | 15    | Environmental regulator: Rwanda Environmental Management Authority (REMA). Responsible for standards and guidelines development for SWM. Utility regulator: Rwanda Utilities Regulatory Agency (RURA) - balances the profit of private companies (in this case the waste collectors) and the quality to the consumers. |
| 6N. 6 | Extended producer responsibility (EPR)       | 10    | EPR as such does not exist. But there is strong regulatory control on one ley product, with an outright ban since 2008 on single use plastic (polythene) bags. |
| 6N   | Total score                                 | 80    |                                                                                                                                                                                                            |
|      | Normalized score                            | 67%   | Gives an overall assessment of Medium/High (M/H)                                                                                                             |
Table S.6: Wasteaware assessment for local institutional coherence in Kigali

| No. | Short name                                      | Score | Observations                                                                                                                                                                                                 |
|-----|------------------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6L.1| Organizational structure                       | 10    | Solid and liquid waste management is under the responsibilities of the City vice mayor in charge of social affairs. Within the Public Health Unit, there is just one Solid and Liquid Waste Management Officer. This Officer works with Directors of Health in the districts and oversees waste at the sector level. At the lower local government tiers of cell and village (limidugudu), solid waste management (SWM) activities are monitored by the sector authorities. |
| 6L.2| Institutional capacity                          | 5     | There is only one SWM Officer in the City, who is overseeing planning, coordination, monitoring and supervision of day to day waste management activities. Any form of training is rare.                                                                 |
| 6L.3| City-wide solid waste management strategy & plan| 15    | The Kigali Master Plan report 2013 used the Integrated solid waste management approach to develop a series of Environment Treatment Zones (City of Kigali 2013a). The decision on what solid waste facility, if any, to be included in each ETZ will depend on the actual type of waste generated by area contributing to it. There is also a Strategic Health Development Plan for the City of Kigali (City of Kigali, 2013b) |
| 6L.4| Availability and quality of solid waste management data | 5 | Data are limited to the numbers of vehicles arriving at Nduba disposal site. No weighbridge. One limited weighing exercise in 2014. No waste generation data. Very limited waste composition data. |
| 6L.5| Management control and supervision of service delivery | 5 | There is a vehicle available in each sector to monitor waste collection activities. However, the supervision work is not well done.                                                            |
| 6L.6| Inter-municipal (or regional) co-operation      | 20    | There is good inter-sectoral and inter-district co-operation, since they are headed by a single department at the level of the City of Kigali.                                                                   |
| 6L  | Total score                                     | 60    |                                                                                                                    |
|     | Normalized score                                | 50%   | Gives an overall assessment of Medium (M)                                                                                                                                            |

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