

SoCo Tool - User Guide

**Waste and Recycling Cost-Benefit Analysis Tool for Inclusive
Recycling (Solidary Selective Collection)**

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Appendices:

Appendix 1: Example Material Flow Diagram

1 Introduction

1.1 Background

The 'SoCo tool' is an MS-Excel based software tool that allows estimation of the full costs and benefits (direct and indirect) of different waste collection and recycling services. The tool is intended to allow assessment of the costs and benefits associated with both the informal sector and formal sectors.

As well as providing a means for assessment and comparing direct services costs and revenues (e.g. from the sale of recycled materials) it also allows assessment of the 'economic externalities' associated with waste and recycling (e.g. the jobs created for marginalised members of communities, greenhouse gas reductions associated with recycling materials and pollution impacts caused by uncontrolled dumping of materials).

The tool has been developed by the University of Leeds (UK), Sustentar and UNICAMP/FLUXUS under the *Critical Stakeholder Training on Assessing the Potential for Solidary Selective Collection and Inclusive Recycling of Solid Waste* project. Funding for the development of the tool has been provided by the British Council's Newton Fund and Sustentar.

1.2 Model Overview

The SoCo tool includes several key worksheets that allow users to input data and generate useful analysis outputs:

1. **Waste Generation.** A worksheet that allows users to input details of quantities and composition of waste generated by households and on streets in the study area (e.g. city district). The first element of this worksheet captures some key characteristics for the study area (e.g. name and population). It is important that the study area is clearly defined because all other data used in the tool will relate to this study area. The main element of the worksheet is a list of Materials in the waste (e.g. white paper, HDPE plastics, etc). The Materials are grouped into Categories, which can be selected from a drop-down menu.
2. **Collection Systems.** This worksheet serves several functions:
 - a. It allows users to define 'Actors' that play roles in the waste and recycling system. These Actors are defined for two key stages of the system: collection (e.g. recycling collections or street cleansing operations) and handling and processing (e.g. sorting of recyclable materials). So for example, recycling collection Actors might include waste picker co-operatives collecting recycled materials, private companies providing residual waste collections and municipality-operated street cleansing operations. Each Actor has a code comprising a letter (C for Collection Actor and H for Handling & Processing Actor) and a number given sequentially to the Actors.
 - b. It allows the user to define what proportion of waste (i.e. materials put out for collection by households, or disposed of on the streets) and which materials they are collecting. For example, the majority of these materials might be collected by the municipality's street cleansing crews but autonomous waste pickers may collect some of the recyclable materials in the street waste.
 - c. It allows the user to define the proportion of materials are being removed from dump sites by wastepickers.
 - d. Finally, it allows users to define a number of 'Financial Actors'. These are organisations that have an active role in funding the Actors involved in providing waste and recycling services. For example, this is likely to include the municipality but may also include organisations such as NGOs that fund or providing 'in-kind' support to wastepicker co-operatives (e.g. through the donation of equipment or premises).
3. **Materials flows.** This worksheet records the flow of materials between different Actors. It is a complex worksheet as it needs to be able to capture the flow of numerous materials between a number of

different Actors, over several stages of the waste and recycling system. The worksheet is broken into a set of tables (one for each Actor). Here, the user can define the destinations for the materials obtained by each actor. At the end of the worksheet are a series of tables that summarise the final destinations of different materials.

4. **Actor-specific worksheets.** There is one worksheet for each Actor. These are named in accordance with the code of each Actor, such as 'C1' or 'H2' (see above). These worksheets allow the user to enter operational, financial and environmental data that is specific to that Actor (e.g. number of workers, salaries, overheads costs, greenhouse gas emissions, occupational health risks, etc).
5. **Dashboard.** This provides a summary of the main 'metrics' generated by the Tool. These are the key output parameters that the SoCo Tool generates, allowing the system to be assessed. For example, cost per tonne, number of workers, percentage of costs covered by revenues, etc. A number of charts also provide visual representations of key metrics.
6. **Schematic.** A simplified schematic representation of the waste collection and recycling system. This shows key material flows and
7. **Finance.** This provides a more detailed breakdown of the costs and revenues from different parts of the business for each actor.

The SoCo Tool also includes a number of calculation worksheets that allow the Tool to function, and also a number of worksheets that enable the user to create a Sankey Diagram, using Google Sheets.

2 Using SoCo

2.1 Before Using the Tool

Before starting to use the tool, the user needs to define the study area. It is important that the study area is clearly defined because all other data used in the tool will relate to this study area. This could be a city district or perhaps the city as a whole. It might, for example, be an area where the user is considering different options for providing waste and recycling services or an area where a recycling services need to be introduced.

The user then needs to define the study year that will be modelled and assessed using the tool. This might be the current year or perhaps a future year. It is important that robust data is available for the year in question. If it is a future year then the quantity and composition of waste generated (and other inputs for the mode) will need to be estimated for this future year.

Finally, before beginning to set up the model for a city, it is highly recommended that the following activities are performed:

- A Material Flow Analysis (MFA) is drawn for the city, which identifies all relevant Actors and quantifies material flows between them. Appendix 1 contains an example of an MFA.
- Data on business practices and financial flows is gathered from the main Actors identified in the MFA.

Note that the 'iterative calculation' function must be enabled within Excel in order for the MFA tab to accurately calculate material being passed between different Actors. It is very important to check that this setting is enabled each time that the workbook is opened. This can be done by going to:

File > Options > Formulas > Enable Iterative Calculation.

2.2 Data Entry

Once the necessary input data has been collated, the user should then proceed through the main data entry worksheets and add the required data:

1. Waste Generation.
2. Waste Collection.
3. Materials flows.
4. Actor-specific worksheets.

The details of the individual data entry worksheets are described below.

2.3 Assessing Results and Comparing Scenarios

The SoCo Tool can be used to model one scenario at a time. The user should first use the tool to model the 'Baseline Scenario'. This would normally represent the current situation for a city or perhaps a future year when recycling targets need to be met.

The user should then review the outputs from the model using the Dashboard, checking for any erroneous results that might indicate an incorrect input parameter. Once the user is happy with the baseline scenario, s/he should generate the results and save the scenario.

Next, a number of alternative scenarios can be run by changing the input parameters (e.g. altering the types of Actors). For each scenario, the user should collate the outputs from the Dashboard and save the scenario as a separate file.

Once the user has run the required number of scenarios, the metrics shown on the Dashboard can be collated and compared. It is intended that the tool be used iteratively. Running a new scenario is likely to reveal interesting factors about the system and prompt input parameter to be checked and refined, and to indicate new scenarios that can be run and tested.

3 Individual Worksheets

3.1 Waste Generation

Enter the name of the city, country, and population. Enter (in tonnes) the annual amount of solid waste generated by households, and the annual amount of solid waste that is generated on the streets.

List the materials contained within solid waste generated by households and solid waste generated on the streets, choose categories for each material, and indicate their relative percentage of the total weight.

The tool will automatically calculate the amount of each material produced per year.

3.2 Waste Collection

Under the heading 'Collection Actors', specify up to five waste management Actors who provide waste collection services.

Under the heading 'Handling & Processing Actors', specify up to five Actors who handle and process waste. These can be the same Actors specified at the collection stage, or they can be different.

Under the heading 'Financial Actors', in the white cells, specify up to fifteen Actors who are involved with financial transactions relating to waste management. This may include all of the collection and handling & processing Actors who buy and sell waste, but also other Actors who might make financial or material contributions to the running of activities (e.g. if an NGO donates equipment to a Waste Picker Cooperative, ensure that the NGO is listed).

At present, it is not possible for the user to specify final disposal options for the waste.

The first table below the list of collection Actors shows the amount of material generated by households (as specified by the input values in the Waste Generation worksheet - see Section 3.1). Indicate the percentage of each material that is collected by each of the collection Actors.

The second table below shows the amount of material generated on the streets (as specified by the input values in the Waste Generation worksheet – see Section 3.1), and also the amount of material that is deposited as litter by waste management Actors (taken from the Material Flows worksheet – see Section 3.3). Indicate the percentage of each material that is collected by each of the collection Actors.

The third table below shows the amount of material which ends up at uncontrolled dumpsites (taken from the Material Flows Worksheet – see Section 3.3). If any collection Actors recover materials from uncontrolled dumpsites, indicate the percentage of each material that is collected by these Actors.

If the Material Flows worksheet is blank, then the amount of waste deposited as litter and ending up at uncontrolled dumpsites will initially be zero. However, this amount may increase as data is inputted into the Material Flows tab on the activities of different Actors who dispose of waste at uncontrolled dumpsites or as litter. It may therefore be necessary to return back to the Waste Collection worksheet after completing the Material Flows tab to check and refine the values in this table.

3.3 Material Flows

The material flow analysis model contains ten tables - one for each of the collection and handling & processing Actors. Each table shows the amount of waste received by that Actor and allows the user to specify (in %) the destination of each different type of material, which can be any of the handling & processing or final destination Actors.

For each table, ensure that any rows with a positive input of waste (meaning that the Actor has received some of that material) indicates a destination for that waste. This is done by entering a % value. If 100% of the material goes to a particular destination, enter '100' under the relevant destination column. If 20% of material goes to one particular destination, and 80% to another, enter '20' and '80' under the relevant destination columns. Waste can be split to as many destinations as required; the only important consideration is that the total adds to 100%.

If an Actor collects and processes waste, ensure that all waste at the collection stage is sent to the same Actor at the handling stage. For instance, if 'Private Company' collects and processes waste, in the collection Actor 'Private Company' table, make sure the destination of all waste is the handling & processing Actor 'Private Company'.

At the bottom of the tab, the amounts of waste reaching each of the final destinations is shown.

4 Actor-specific worksheets

4.1 Introduction

Note that if an Actor carries out both collection and handling & processing activities, then two worksheets must be completed. All costs and revenues associated with collection services should be entered into the collection Actor worksheets, and all costs and revenues associated with handling & processing activities should be entered into the handling & processing Actor tab. Any costs and revenues which are not directly associated with either activity (such as administration costs, salaries of people who work on multiple activities, or equipment which is used for multiple activities) should be entered into one tab only.

4.2 Orange Summary Boxes

The user can choose what degree of detail in which to enter data into the Actor-specific worksheets. If the user would like a detailed picture of the Actor's activities, they can enter information into the blue tables. However, if preferred, the user can complete the orange boxes instead. These provide a summary of general costs and revenues for each section. The user can complete a mixture of orange boxes and blue tables for each Actor worksheet, provided that all sections are completed.

Please note that not all of the metrics on the dashboard will be functional if orange boxes only are completed.

4.3 References

Underneath each data entry table is a cell labelled 'references'. It is suggested that the user enters here a list of data sources that were used to complete information in the table. This could be the reference of an article or web page, or could provide details of an interview (date, place, interviewer and interviewee).

4.4 Collection Actors

At the top of the tab is a table showing the amounts of each type of material received by that Actor.

4.4.1 Expenditure

Labour Costs

If employees receive salaries, enter this information here. If salaries are based on weeks, hours, or days worked, or amounts of material collected, ensure that the relevant information is entered into the blue boxes under the title 'Labour Costs'. Ensure that all employees performing waste management services for the Actor are listed, even if their salary is not paid by the Actor (e.g. if the municipality pays for a driver to help with selective collection services carried out by the Actor, ensure that the driver is listed, but their salary is listed as being paid for by 'Municipality').

Other Worker Costs

If workers receive any kind of subsidies or benefits (such as health insurance, lunch) list these here. Ensure that all subsidies are listed, even if they are not paid for by the Actor.

Training and Capacity Building

If workers receive any kind of training or capacity building, list these here. Ensure that all training costs are listed, even if they are not paid for by the Actor.

Equipment (excluding vehicles)

List all capital equipment used by the Actor for their services in this section – excluding vehicles used for transporting goods (this is covered in a separate section below). The purchase price of the item should be listed, along with the expected lifetime of the item, and the price for which the item (or any components) might be sold for at the end of its useful life. Ensure that all equipment is listed, even if it was not paid for by that Actor (e.g. if the Municipality donates some reflective vests to the Actor, ensure that the reflective vests are listed, but the purchase price is listed as paid for by 'Municipality').

Vehicles

List all vehicles used by the Actor in this section. The purchase price of the vehicle should be listed, along with the expected lifetime of the vehicle, and the price for which the vehicle (or any components) might be sold for at the end of its useful life. Ensure that all vehicles are listed, even if they was not paid for by that Actor (e.g. if an NGO donates a truck to the Actor, ensure that the truck is listed, but the purchase price is listed as paid for by '[NGO name]'. The average number of kilometres covered by the vehicle on a typical working day should also be entered, along with the number of days driven per year. If the vehicle requires fuel to operate, ensure that the cost of fuel and fuel efficiency is entered, along with the financial Actor who covers the cost of fuel. Also ensure that any costs related to insurance and licenses are listed.

Variable, Fixed and Disposal Costs

If waste is disposed at a sanitary landfill or an unmanaged dumpsite, then a positive number will appear in the 'Amount of waste disposed' boxes. These values are taken from the Material Flows worksheet (see Section 3.3). If waste is disposed at either of these destinations, indicate the cost per ton of disposal, and the financial Actor who covers the cost.

List all variable and fixed costs relating to the service. This might include water, electricity and rent for offices, and maintenance of equipment. Ensure that all costs are listed, even if they are not paid for by that Actor (e.g. if a charity pays the electricity bill for the office of the Actor, ensure that the electricity bill is listed, but the value is listed as paid for by '[Charity name]'.

Business Costs (Taxes and Fees)

If the Actor pays any costs relating to the registration and running of their business (such as taxes or fees), list these here. Ensure that all costs are listed, even if they are not paid for by the Actor.

Social Responsibility

If the Actor carries out any projects or activities for the purpose of providing social or environmental benefits, such as supplying autonomous waste pickers with facilities to wash or make hot drinks, list these here, recording the expenditure on the project, and worker time donated to it. Ensure that all costs are listed, even if they are not paid for by the Actor.

Service Provision

List all payments that the Actor receives for providing their collection service. If the Actor receives payment from households, and also from the municipality for their service provision, list these two incomes separately. Note whether the revenue is regular (i.e. received regularly in a predictable fashion), irregular (i.e. not received regularly, and cannot predict when it will be received), or seasonal (only available for certain months of the year).

Material Sales

The first table in this section shows the amount of material sent to each handling & processing or final destination Actor. These values are taken from the Material Flows Tab (see Section 3.3). The user should not alter these values. In the table below, the user can enter the price per ton of each material that is paid to the Actor. The table will automatically colour cells grey if no material is sent to an Actor, and so white cells show where values should be entered. Note, this price represents the price paid **to the Actor**. Therefore, if materials are sent to a destination such as a landfill, and a price is paid **to** the landfill for receiving these materials, this cost should not be entered here, but should be entered separately in the disposal section.

Materials and Products in Storage

If any materials are kept in storage, enter the amount and approximate value of these materials here.

Grants and Contributions

Enter details of any monetary grants or contributions given to the Actor here. Note that these should be monetary grants or contributions; if donations of equipment are made, or if costs of salaries or other expenditures are covered by another financial Actor, this should be described in the relevant expenditure section

with the correct financial Actor covering the costs specified. In order to make a general estimate of the value of grants or contributions received in an average year, enter the value of grants and contributions received over a defined number of past years. An average value will then be calculated.

4.4.2 Summary and Profit

The Expenditure per Year Table shows the expenditure incurred by the Actor broken down category, and disaggregated according to the financial Actor who covers the cost of the expenditure.

The Revenue per Year Table shows the revenue received by the Actor, broken down by category, and disaggregated according to the financial Actor who the revenue is collected from.

Profit per Year is also given. This is calculated as the revenue received by the Actor, minus expenditure from the Actor. The destination of profit made by the actor (i.e. reinvested, shared between workers) can be entered.

4.4.3 Institutional Capacity

Enter the value of savings held by the Actor. Indicate whether credit is available to the Actor (through banks, private loan companies, or other means), and approximately how much credit is available.

4.4.4 Employment, Social, and Occupational Health Metrics

This table collects information about various aspects of worker employment. This includes: the benefits provided to workers; the nature of their employment; children engaged in or affected by work activities; presence of safe working practices; and whether workers experience harassment, abuse, or feel unsafe at work.

4.4.5 Carbon Metrics

In order for the tool to calculate greenhouse gas emissions which are avoided through recycled materials replacing virgin materials, it is necessary to specify a greenhouse gas emissions factor for the generation of electricity. This value will be specific to the country of study. Some guidance values on emissions factors for selected countries are given on the 'Start' tab of the worksheet. However, emissions factors for a full list of countries are available from the GIZ Solid Waste Management Greenhouse Gas Calculator Manual, available online at:

<https://www.giz.de/expertise/downloads/giz-kfw-ifeu2009-en-climate-calculator-swm-manual.pdf>

If waste from this Actor is sent to a sanitary landfill, indicate whether gas from this landfill is collected/flared or not, and specify the amount of gas collected.

If waste from this Actor is sent to an unmanaged dumpsite, indicate whether waste on this dumpsite is burned or not.

If organic waste from this Actor is valorised, indicate how much of this waste is digested and how much is composted.

4.4.6 Local Environmental Pollution Metrics

Here, the user is requested to provide a rating for the suitability of the collection vehicles used by the actor. This, combined with the amount of litter created by the actor, are used to produce a 'Local Amenity' rating.

If material is disposed of in an unmanaged dumpsite, the user should complete a number of questions about the nature of the site so as to provide risk ratings for potential harm to: people living around the dumpsite; watercourses; the environment; and air.

4.5 Handling & Processing Actors

At the top of the tab is a table showing the amounts of each type of material received by that Actor.

4.5.1 Expenditure

Labour Costs

See Section 4.3.1 for guidance.

Other Worker Costs

See Section 4.3.1 for guidance.

Material Purchases

The first table in this section shows the amount of material purchased from each collection or handling & processing Actor. These values are taken from the MFA Tab. The user should not alter these values. In the table below, the user can enter the price per ton of each material that is paid by the handling & processing Actor. The table will automatically colour cells grey if no material is purchased from an Actor, and so white cells show where values should be entered. Note, this price represents the price paid by the handling & processing Actor.

Training and Capacity Building

See Section 4.3.1 for guidance.

Equipment (excluding vehicles)

See Section 4.3.1 for guidance.

Vehicles

See Section 4.3.1 for guidance.

Variable, Fixed and Disposal Costs

See Section 4.3.1 for guidance.

Business Costs (Taxes and Fees)

See Section 4.3.1 for guidance.

Social Responsibility

See Section 4.3.1 for guidance.

4.5.2 Revenue

Material Sales

See Section 4.3.2 for guidance.

Other Product Sales

If the Actor converts materials into products (e.g. creating bags or jewellery out of collected recycled materials) then enter the number of units of products sold per month/year to merchants/industry, and the revenue received per unit.

Materials in Storage

See Section 4.3.2 for guidance.

Grants and Contributions

See Section 4.3.2 for guidance.

4.5.3 Summary and Profit

See Section 4.3.3 for guidance.

4.5.4 Institutional Capacity

See Section 4.3.4 for guidance.

4.5.5 Employment, Social, and Occupational Health Metrics

See Section 4.3.5 for guidance.

4.5.6 Carbon Metrics

See Section 4.3.6 for guidance.

4.5.7 Local Environmental Pollution Metrics

Identify whether the Actor is responsible for managing the workplace. The Actor might not be responsible for managing the workplace if, for example, they are a waste picker working on a dumpsite. In this situation, the workplace environment might be unhealthy and polluting, but this would not necessarily be under the control of the Actor.

If material is disposed of in an unmanaged dumpsite, the user should complete a number of questions about the nature of the site so as to provide risk ratings for potential harm to: people living around the dumpsite; watercourses; the environment; and air.

5 Dashboard

The key outputs from the Tool are presented on the 'Dashboard' worksheet. This summarises a range of 'metrics' and allows them to be compared between Actors. Each set of metrics is summarised below.

5.1 Financial metrics

These metrics provide a summary of the financial performance of each Actor.

- **Cost per tonne collected / handled** – the total costs (as described below) divided by tonne of waste managed by the Actor.
- **Total costs**– total cost for providing the service by the Actor (including costs paid for by other parties, such as equipment donated by NGOs or grants provided in-kind).
- **Business costs (taxes and fees)** – the total expenditure per year on costs which relate to running a business, such as taxes, registration fees, etc.
- **Revenues (service fees and materials)** – the total of the revenues received by the Actor in the form of service fees and revenues from materials sales.
- **Grants and in-kind contributions** – support received by the Actor from other parties (e.g. donated equipment, free premises, grant support, etc).
- **Percentage cost covered by revenues** – the percentage of the total costs covered by the service fee and materials sales revenues. This represents how sustainable the Actor's service is as a commercial activity (i.e. without grant and in-kind support). However, it is important to note that the external benefits (e.g. job creation for marginalised groups) may well justify the grant or in-kind support.
- **Cost to households per year** – the amount of money which households pay to the Actor per year. Note this is an aggregate amount for all households, not per household.
- **Net profit per year** – the amount of profit made by the Actor per year. This is calculated as: revenue received by the Actor minus expenditure by the Actor.
- **Percentage of profit shared equally among workers** – the percentage of profit made by the actor which is shared equally among all workers.
- **Value of savings** – the value of savings held by the actor, in a bank or elsewhere.
- **Potential available capital indicator** – this indicates how much capital is potentially available to the actor, using the value of savings held by the actor and potential available credit.

5.2 Material flow metrics

These capture the way in which materials and wastes are managed by each Actor.

- **Tonnes of waste managed** – total tonnes of waste managed by each Actor.
- **Tonnes of waste managed per worker** – total tonnes of waste managed divided by number of workers.
- **Tonnes of waste recycled (diverted from landfill)** – a metric to capture the proportion of material which is recycled. Note that this does not necessarily capture the actual environmental benefit of recycling, which may vary significantly between materials and end-uses.
- **Tonnes of waste passed to another actor** – total tonnes of waste which are passed to another actor, for further processing, or otherwise.
- **Tonnes of waste disposed at sanitary landfill** – total tonnes of waste which are disposed of in an environmentally controlled way.
- **Tonnes of waste disposed at uncontrolled dumpsites** – total tonnes of waste being disposed of in a way which has the potential to cause environmental damage and human health impacts.
- **Tonnes of waste discarded as litter** – total tonnes of waste which becomes street litter and thus requires clean-up. For example, autonomous waste pickers may discard unwanted materials in the street. These wastes will need to be collected by municipal-operated services.

5.3 Employment metrics

- **Formal permission to collect waste** – does the Actor have formal permission from the relevant Local Authority, or is allowed by law, to collect waste.
- **Regarded as professional service provider** – is the Actor viewed (by the general public, and authorities) as a professional worker, providing a service.
- **Number of workers** – how many people work for the Actor, or work as the Actor (in the case of autonomous waste pickers).
- **Number of workers with regular full-time employment** – how many of these workers have a regular (i.e. predictable and regularly recurrent) full-time (i.e. more than 30 hours a week) job.
- **Number of workers with formal contracts** – how many of these workers have a formal employment contract with the Actor.
- **Number of workers with full access to legal social benefits** – how many of these workers receive the benefits (e.g. holiday, maternity leave, etc.) that they are entitled to by employment law.
- **Employment benefits rating** – a rating for the quality of employment benefits provided by the Actor to workers. This can be used for comparison purposes between different Actors only.
- **Equal pay for men and women** – do men and women receive the same pay for performing the same work.
- **Average earnings per hour** – total earnings by all workers divided by number of hours worked by all workers.
- **Average hours worked per week** – average number of hours worked by workers per week.
- **Wage equity** – highest wage paid to workers divided by lowest wage paid to workers.
- **Expenditure on training and capacity building** – average expenditure per year on activities to train and build capacity of workers. Some of this cost may be subsidised.
- **Number of children engaged in work activities** – a metric to reflect the extent to which child labour plays a role in the system.

5.4 Social metrics

- **Number of worker's children absent from school** – if workers for the Actor have school-age children, and these children are not attending school, these are counted here.
- **Time dedicated to social responsibility projects per year** – if workers contribute time to projects to help society and the environment, such as litter picking, environmental education, or supporting autonomous waste pickers, this time is counted here.
- **Expenditure on social responsibility projects per year** – counts money donated to social responsibility projects, as described above.

5.5 Occupational health metrics

- **Safe working practices rating** – this rating uses a combination of parameters to provide a comparative rating of how safe the working practices are for each Actor. Note that the rating itself is not meaningful. It only allows comparison between Actors.
- **Percentage of workers feeling unsafe or vulnerable** – if workers feel unsafe when carrying out their work, perhaps because they must visit insecure and isolated locations to collect waste, or because there is a general threat of violence at their workplace, these are counted here.
- **Percentage of workers experiencing harassment and abuse** – similarly, this metric measures the amount of workers who experience harassment and abuse as they carry out their work.

5.6 Local environmental pollution metrics

- **Tonnes of waste disposed as litter per year** - total tonnes of waste which becomes street litter and thus requires clean-up.
- **Collection / Handling local amenity** – this uses the proportion of waste which becomes street wastes (litter) combined with the suitability of work activities (such as collection vehicles, and cleanliness of work place) as a proxy for amenity impact (i.e. the cleanliness of the local environment).

- Waste-bourne disease risk rating – this metric assesses the risk to human health from waste as a result of the Actor’s activities. It considers factors such as where waste is dumped in the environment, and the proximity to human habitation.
- Air quality health risk rating – this metric assesses the risk to air quality from waste. It considers factors such as whether waste is burned, and the proximity to human habitation.
- Water resources risk rating – this metric uses several parameters to estimate the potential risk posed to water resources. It considers factors such as the quantity of waste disposed of in watercourses and water bodies and the proximity of dumps to boreholes used for drinking water.
- Ecological site risk rating – this considers the potential risk that dump sites pose to important ecological sites.

5.7 Carbon metrics

Assessment of greenhouse gas (GHG) emissions associated with a specific waste and recycling system is a complex issue that requires a lifecycle assessment (LCA) approach. Some emissions are relatively straightforward to estimate. For example, motorised waste collection vehicles emit carbon dioxide when they operate, and landfill sites emit methane, a powerful GHG. However, the emissions associated with other parts of the system, such as emissions from energy use, or emissions *avoided* by recycling materials, requires a much more sophisticated approach.

There are some data available that can be used as simplifying metrics for some of these impacts. For example, there are estimates of the GHG savings associated with recycling a typical tonnes of glass. This is a simplification of the actual but is sufficient to provide an estimate of the GHG emissions or savings associated with a specific system (and also with the actions of a particular Actor in the system).

This simplified approach has been used in the SoCo Tool by considering GHG emissions or saving for each Actor in terms of:

1. Emissions saved by recycling materials
2. GHG emission generated by dumps and landfills.

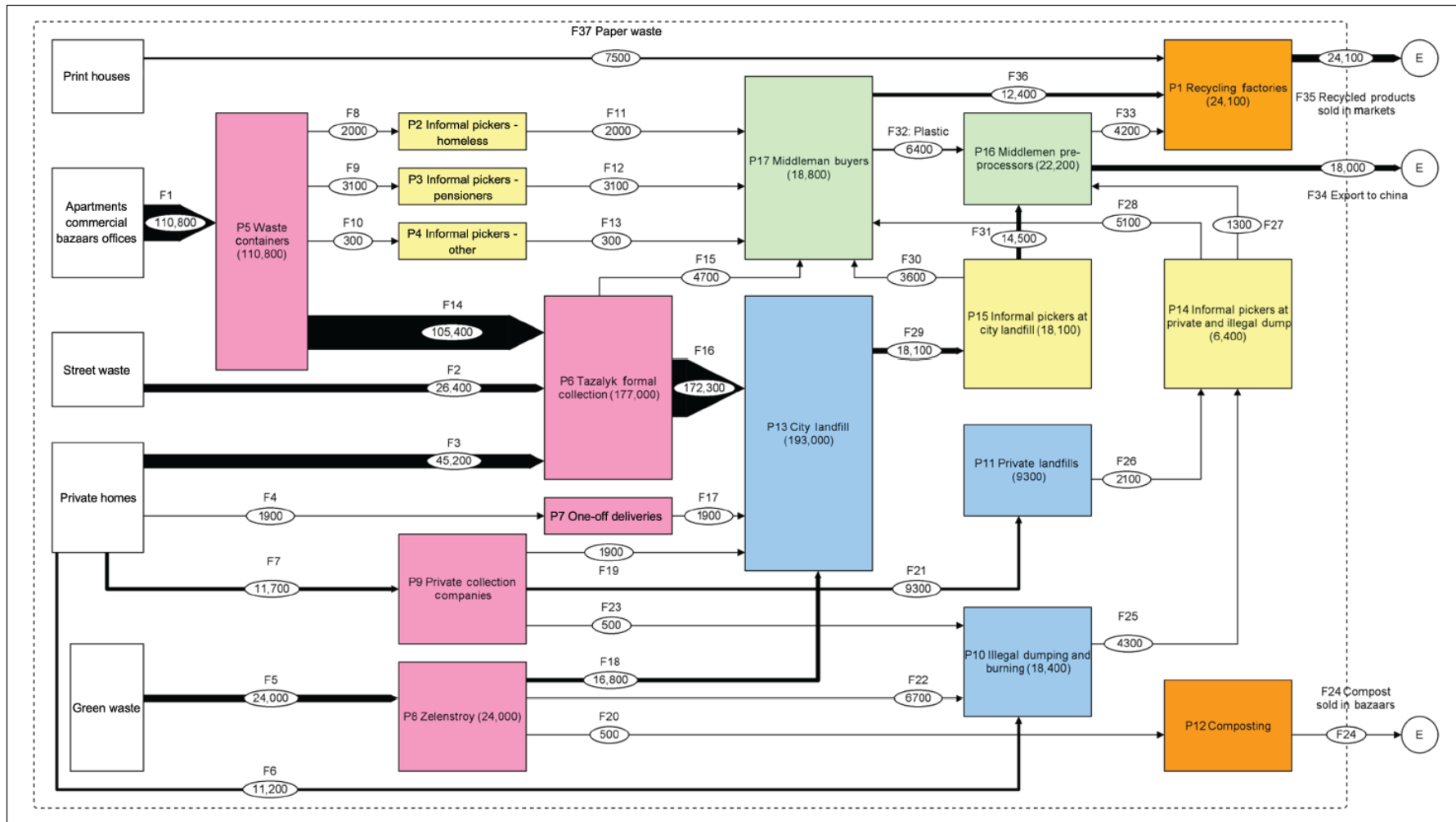
This approach provides an overall estimate of the GHG impacts or benefits associated with a specific system and allows a comparison between different Actors and Scenarios.

6 Schematic

This worksheet provides a simplified schematic of the system. It shows the main Actors and illustrates the transfer of materials between them.

A 'Sankey Diagram' to show the movement of waste between Actors can be created using the purple 'Sankey' tabs. Instructions are given on tab Sankey1.

Appendix 1: Example Material Flow Diagram



Taken from: Sim, N. et al., 2013, Waste management and recycling in the former Soviet Union: The City of Bishkek, Kyrgyz Republic (Kyrgyzstan). *Waste Management & Research*. 31(10), pp.106-125.