Radarweg 60
1043 NT Amsterdam
The Netherlands

www.tno.nl

T +31 88 866 50 10

TNO report

TNO 2021 P12330

Development of a waste stream-specific roadmap for the circular economy Zimbabwe

Sub report Output 3
Identification of the perceived value of the circular economy and of benefits, weaknesses, opportunities and challenges in Zimbabwe's waste sector

Date	28-03-2022
Author(s)	Milou Derks Jisca van Bommel Andrew Chinyepe Chandi Mutubuki-Makuyana Naomi Montenegro Navarro Paul van den Oosterkamp Dennis Kiplagat Raymond Obare Ombega Ebenezer Alenga Amadi
Number of pages	38 (incl. appendices)
Number of appendices	4

Contents

1 Acronyms

CTCN = Climate Technology Centre and Network
EMA = Environmental Management Agency
GHG = Greenhouse Gas
GDP = Gross Domestic Product
NDC = Nationally Determined Contribution
MCA = Multi-Criteria Analysis
NCCRS = National Climate Change Response Strategy
NRCE = Non-Conventional Renewable Energy sources
NDE = National Designated Entity
NDC = Nationally Determined Contributions
SDG = Sustainable Development Goals
SWOT = Strong, Weak, Opportunity and Threats
TA = Technical assistance
UNFCCC= United Nations Framework Convention on Climate Change
VNR = Voluntary National Review

2 Methodology

The goal of Output 3 is to prioritize a waste stream for which a roadmap and pilot plan will be developed in Output 4 and 5. The decision on the prioritized waste stream is based on a stakeholder meeting with the National Designated Entity (NDE), the project proponent and further participating stakeholders from the public and private sector that were identified in Output 2.

The methodology to make a well informed choice on the prioritized waste stream consists of four steps, which will be discussed briefly. Note that two small deviations were made from the Technical Assistance (TA) response plan, in agreement with the NDE and CTCN: (i) the step to analyse of strengths and weaknesses was merged with the step to analyse of opportunities and threats in one combined activity. Activity 3.4 was placed before activity 3.2 and 3.3. to create a more logical storyline. In this report the results of the following activities are presented:

Activity 3.1 Analysis of the perceived benefits
This activity provides a brief overview of the perceived benefits of the circular economy within the waste sector, based on interviews with key players in Output 2. Additionally, this activity discusses the products and by-products that can be made from waste that still have value. The economic, social and environmental benefits for the circular economy in general is discussed afterwards and the last paragraph focusses on the impact of circularizing waste streams on Zimbabwe's Nationally Determined Contributions (NDC) and Sustainable Development Goals (SDGs). This first step will give the reader a general idea of how circularity in general can be useful for Zimbabwe.

Activity 3.4: Development of an indicator matrix: Multi-Criteria Analysis (MCA)
This activity focusses on the generation of a qualitative matrix of transparent and comparable circular economy indicators on four levels, social, environmental, economic and institutional, for each of the six different waste streams. In consultation with CTCN and the NDE, 20 evaluation indicators were chosen. The evaluation of each indicator for each waste stream was based on a qualitative analysis of the results of Output 2 and additional stakeholder consultations.

Activity 3.2 & 3.3: Analysis of strengths, weaknesses, opportunities and threats
This activity analyses the strengths, weaknesses, opportunities and threats for each of the waste streams. Strengths and weaknesses refer to the current system, and provide detailed information about the system as is. The opportunities and threats refer to the potential of circularity of each of the waste streams and what opportunities or threats might emerge when trying to make a certain waste stream more circular. These results followed from the MCA assessment.

Activity 3.5: Stakeholder meeting on prioritization of waste streams
The last activity results in a choice of a prioritized waste stream. To make this choice, a meeting with the NDE, the project proponent and further participating stakeholders identified under Output 2, is conducted. In this meeting, the results of the indicator matrix and the SWOT were presented and discussed. Together, one prioritized waste stream was selected that will be further investigated under Output 4 and 5.

3 Analysis of the perceived benefits

3.1 Perceived benefits of a circular economy

A circular economy is an economic system of closed loops in which raw materials, components and products lose their value as little as possible, renewable energy sources are used and systems thinking[1] is at the core. The circular economy is much broader and more extensive than waste management alone. Circular economy, in essence also regards economic reform, in which business models and value creation are not aimed at selling as much products as possible, which is based on extensive resource use, but at creating value with minimizing and optimizing resource use. This effectively targets among others, reuse or repurposing of products before they become waste. As the scope of this project is explicitly focused on six household and agricultural waste streams the focus will be on identifying how maximum value for these streams can be recovered or retained, following the principles of the circular economy.

At this moment, Zimbabwe is not yet fully exploiting the benefits that a more circular solid waste management system may offer. In Zimbabwe, 2.5 million tonnes of waste is generated annually, which is an average of 0.46 kg per capita per day. In some areas this number goes up to 3 kg of waste per capita per day. Collection rates in Zimbabwe are very low, with an overall waste collection rate of 48% in urban areas, being lower in low income areas. In rural areas, there is no collection. Additionally, separation at households is low and there is no separate collection by local authorities, who are normally responsible for waste management. Some private companies do collect separated waste and provide households with incentives to separate.

Some forms of circularity already take place throughout Zimbabwe. Households normally separate waste that has economic value to them. For example, waste that is re-usable for other uses such as plastic bottles, jars and containers are usually separated at source in low income areas for in-house reuse. This also means that many of these streams that already have a direct reuse solution are less visible in the waste data as they do not enter the bin. In rural areas, there is virtually no waste collection, but also very few waste generation. Most waste is reused and only if the waste truly has no value anymore, it is burned or buried. In urban areas, however, there are large quantities of waste that end up in open dumpsites that harm the environment, even though there is still value in it.

Thus, the economic reality in Zimbabwe leads to relatively high levels of circular behaviour in the private sphere of low/ medium-income households. When economic circumstances improve, more waste is generated since there is more financial room to acquire products. Additionally, the level of circular behaviour decreases, since the necessity of reuse is (partly) eliminated. This poses a challenge to developing and emerging economies to embed ambitious circularity targets. To avoid reforming waste behaviour after economic growth, circularity should be well embedded in policy education and capacity building programmes to ensure that when economic circumstances increase this will not strain the waste system.

A more circular economic system, including proper solid waste management, will allow Zimbabwe to extract maximum value from the different waste streams, while reducing health and environmental risks that come with the current waste management practices.

3.2 Products from waste

This section presents a table with an identification of products that can be made from waste, that still have value, based on discussion with stakeholders, an analysis of current pilots and projects, which is documented in Sub-report Output 2. Note that this is by no means an extensive or thoroughly descriptive list, but it does give an indication about the options towards value products from waste that could be interesting for Zimbabwe.

[1] a holistic way of thinking that includes connections and relationships between fields and stakeholders

Waste stream	Products
Plastic	Plastic can be shredded or melted into recycled plastic base material. Depending on the quality of the plastic and the process, this recycled base material can then be used as base material for high quality plastic products (such as food-packaging). Low quality plastic can still be used to make plastic products like: • Recycling into construction blocks • Garden furniture • Roofs • Traffic piles • Clothes • Construction elements via 3D printing • Recycled fabrics • Melting and pressing mixed plastics into bricks/tiles/cards Other options to valorise plastic are: • Reusing plastic bottles via deposit systems • Plastic as chemical- or refinery feedstock, such as torrefaction of plastic into charcoal, or PE (polyethylene) plastic as feedstock for steam cracker or Pyrolysis into oil as substitute for fossil oil
Metal	Metal can be shredded or smelted to produce new base material or construction material, depending on the quality of the base material. In some cases metal can be reused directly in primary production process, which will require educating aggregators and manufacturers. Additionally, art can be made out of metal and sold as garden art or tourist souvenirs.
Paper	Paper can be shredded into recycled paper base material, depending on the quality of the paper and the process. This recycled base material can then be used as base material for new paper products such as cardboard boxes, egg trays, books or tissue boxes and tissue paper. Other non-conventional products that can be made from recycled paper include usage for insulation or building boards from paper.
Glass	Glass can be crushed or melted to use as recycled base material. Depending on the quality and colour various new products can be made. Mixed glass waste can be used to make base material for brown glass. When separated per type, glass can be recycled perpetually. Different options to valorise glass waste is to: • Make fibre glass from glass waste • Make art from glass • Deposit systems to take back glass bottles for reuse
Organic	Organic food-waste can be reused directly as food for livestock or for food programmes, if the food-waste is of sufficient quality. Ways to indirectly valorise organic waste are among others: Biogas: Community biodigester (requires training and devices to utilize/transport gas), individual biodigesters (requires training and devices to utilize/transport gas) Composting: Conventional composting into organic fertilizer, vermicomposting using earthworms or black soldier flies, fertilizer pellets, central or decentralised small scale composting sites in low-income areas, community owned composting.

	Other: Conversion of organic waste into briquettes for cooking for example, supplying cheap cooking equipment to cook with briquettes.
Agricultural	Agricultural waste has various options for circularity and is therefore already used extensively in rural communities. Valorisation options are (of which many are thus already applied): • Community and individual biogas (requires training and devices to utilize/transport gas) • Composting for cooking, or to make fertilizer or for water collection • Use waste as animal food • Waste that can't be used can be burned and the ash can still be used to fertilize the land • Use for mulching

3.3 Economic, social and environmental benefit of circularity

The potential economic, social and environmental benefits of circularity are plenty. However, the exact benefit depends on the waste stream and on the chosen pathways per waste stream. Output 3 will give a more detailed overview of the economic, social, environmental and institutional benefits and barriers regarding the implementation of circularity. This chapter will discuss general benefits, independent of the chosen waste stream.

Economic

Circularity offers the potential for the private sector to create profitable economic activities. Depending on the waste stream and pathway, the value from waste activities can create jobs at various staged along the value chain, such as collecting, aggregating, recycling, exporting or processing. Local businesses focussing on collection, aggregation or basic recycling could create ample job opportunities for both low and medium income areas. Moreover, valorising waste streams can provide additional market advantages, due the use of secondary resources, which in many cases have lower purchasing costs than virgin materials. From a non-waste perspective, meaning the application of circularity principles such as reuse, repair and remanufacturing, without the explicit processing of waste products, circularity provides the opportunities for achieving multiple margins on the same products. For example, by providing contracts through which the producers retain the ownership and responsibility of their products. This can lead to opportunities for taking back products after first-consumer-use, repairing them if needed and putting it on the market again.

Yet, the probability of reaching the aforementioned economic benefits from circularity are largely dependent on factors like market readiness, existing technologies per waste stream available within the country and capital investment potential.

Social

The social benefits of circularity in Zimbabwe are plentiful. In urban areas, the questionnaires showed that almost 50% of households dump their waste illegally. These inadequate waste management activities such as illegal open dumping can lead to the spread of diseases such as cholera or diarrhoea. Additionally, the questionnaires also demonstrated that people do not like the looks of waste around their neighbourhood and the smell of waste. Better solid waste management can prevent this by regularly collecting and processing waste. However, circularity and better solid waste management might require significant behavioural changes of how

waste is handled by households and have thus not only social benefits but also quite substantial social implications. Separation of waste, at source, will most likely be necessary to reach economy of scale for recycling and processing options. Moreover, the acceptance of jobs in waste management needs to increase. On the other hand, scaling the waste sector and increasing the level of recycling will provide a great stimulus to the amount of jobs available, another important social benefit.

Environmental

Environmental benefits of circularity in Zimbabwe include climate mitigation and climate adaptation. Regarding climate mitigation, circularity and proper solid waste management will decrease greenhouse gas emissions. This is especially true for organic and agricultural waste streams, which release large amounts of greenhouse gas (GHG) emissions when not handled properly (predominantly methane, which is more than 25 times as potent as CO_2), while these waste streams hold great potential for non-conventional renewable energy generation (biogas). Additionally, products from organic waste such as compost and fertilizer could help in climate change adaptation, since this might influence food security in Zimbabwe and will drive up the demand for compost and fertilizer. Moreover, the increase in waste management and recycling and thereby the reduction of illegal and uncontrolled dumping can greatly reduce the environmental pressures such as leakage of chemicals from plastics, the clogging and pollution of waterways and drainages. When at scale, a circular economy can greatly reduce the amount of virgin materials needed by looping resources within existing value networks, thereby greatly relieving the pressure on the environment caused by mining and conversion of ores to base materials.

3.4 Contribution to NDC and SDG

Note that in Output 2 an extensive analysis was done on how circularity might contribute to the NDC and SDG. In this section, we will give a brief recap of these contributions.

Relation with INDCs

The Government of Zimbabwe has presented its Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC)[2]. The NDE serves as national entity for the development and transfer of technologies, including climate change as a key factor. They also act as focal points for interacting with the Climate Technology Centre and Network. This project on circular economy was endorsed by Zimbabwe's NDE as a project to contribute to the NDC.

Zimbabwe adopted a broad approach to climate mitigation responses and incorporated perspectives on circular economy and optimized waste management in the updated NDC of 2021.This NDC update will result in revised targets and actions in which the waste sector and circularity will be more present. In Zimbabwe's National Climate Change Response Strategy (NCCRS)[3], solid waste management is considered a major challenge for the majority of urban local authorities in Zimbabwe and proposes 3 strategies to address this through; Strengthening local authorities' capacity to deliver proper, effective and efficient waste management services in order to reduce GHG emissions from waste management; Creating an enabling policy environment which encourages investment into alternative energy production using waste products and; Developing an enabling framework to promote waste minimization through education and behavioural change of waste generators.

This Technical Assistance Project is aimed to support Zimbabwe in concretizing the potential actions that can be undertaken in line with the broader scope of Zimbabwe's NDC. It will address the 3 strategies mentioned by the NCCRS and focus on developing a roadmap including a short, medium and long-term strategy for proper waste management collection services, focussing on one prioritized waste stream. Additionally, the roadmap will discuss policy and regulation advice on short, medium and long-term to create an enabling environment that will encourage investment in circularity for one prioritized waste stream. Lastly, the roadmap will also include

[2] ww4.unfccc.int/sites/ndcstaging/PublishedDocuments/Zimbabwe%20First/Zimbabwe% 20First%20NDC.pdf

[3] http://extwprlegs1.fao.org/docs/pdf/zim169511.pdf

education and awareness campaigns to mobilize the required behavioural change. Besides from supporting the 3 proposed strategies in the NCCRS by giving applicable recommendations for one prioritized waste stream, the results of this project can significantly contribute to reducing formation and emission of greenhouse gases from landfills and energy harvesting from waste materials.

Contribution to SDG's

This TA project is set out to incorporate and support Zimbabwe's commitments to the Sustainable Development Goals (SDG) and in particular SDGs 9, 12 and 13. Additionally, Zimbabwe has committed itself to implementing all the SDGs with emphasis on the following 10 SDGs (2, 3, 4, 5, 6, 7, 8, 9, 13 and 17).

With respect to SDG9, the Voluntary National Review (VNR) highlights that "Major infrastructure projects have been launched in the areas of utilities, transportation and connectivity, and industrial zones". The TA Project will only partly contribute to SDG9, but will give recommendations about proper waste management infrastructure such as separation, collection and aggregations infrastructure.

With respect to SDG13 the VNR states that though the emissions in the country are low, Zimbabwe is "highly vulnerable to the risks of climate change". The National Climate Change Response Strategy is strongly linked to Zimbabwe's efforts related to the NDCs, described above. Already at this point it can be stated that the direct contribution of an improved waste management system to the national emissions can in potential be large, as 2.48 million ton of CO_2 eq. of a total of around 65 million ton CO_2-eq comes yearly from waste (see Figure 19). And 80 percent of these emissions are from methane (Zimbabwe: CO_2 Country Profile - Our World in Data).

Remarkably, SDG12 is not among the highest ranked SDG for Zimbabwe's policies, and therefore no specific targets related to SDG12 are identified. In view of the enormous challenges in other SDG's (e.g. related to fighting poverty) this position for SDG12 is understandable. However, some of the sub-targets of SDG12 clearly demonstrate that this TA Project may contribute to SDG12, in particular:

- Target 12.3: By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
- Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

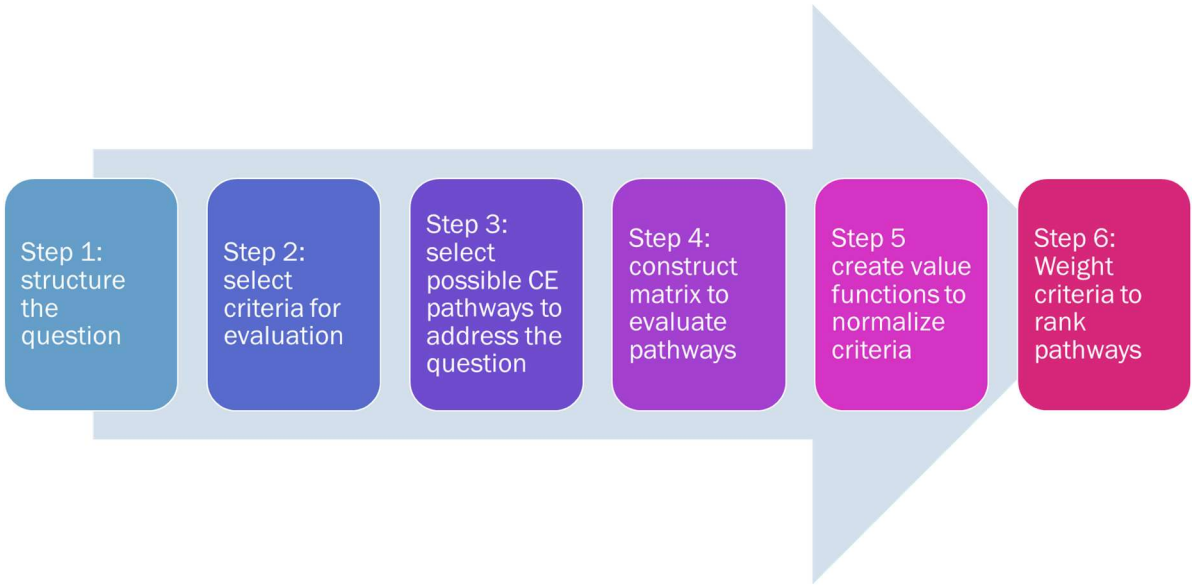
Though the TA, focus is on the contribution to SDGs 9, 12 and 13, however Zimbabwe's pledges to the SDGs relate to a much broader set than these three. For instance, the VNR describes Zimbabwe's efforts to Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all. Optimal waste management may include the recuperation of caloric value from waste streams either in the form of biogas or in the form of electricity from waste incineration. Such systems may contribute to SDG7.

Zimbabwe's efforts on SDG 2: End hunger, ensure food security and enhanced nutrition, and promote sustainable agriculture are also priorities. In this sense, Zimbabwe participates to the Zero Hunger Challenge, which has zero waste or food loss as one of its (five) pillars. Given the large contribution of food waste to the food system, waste management and circular economy initiatives are extremely important. Of course, these actions also help to achieve SDG12.3 (see above).

Zimbabwe's efforts on SDG3 include: Ensure healthy lifestyles and promote well-being for all at all ages are another example. Though the VNR's actions are primarily focused on infant mortality, HIV, and other aspects of public health, it should not be forgotten that proper waste management (facilitated by the development of value chains with increased added value) prevents the abundance of uncontrolled landfills and dump sites, which undoubtedly have a negative impact on the health of workers and residents, as well as a negative impact on the environment.

4 Development of an indicator matrix (activity 3.4): Multi-Criteria Analysis

For the development of a transparent indicator matrix, the (MCA) methodology was chosen. An MCA explicitly evaluates multiple conflicting criteria in decision making and can be used to identify and compare different implementation options by assessing their effects on criteria such as performance, economic return, impacts and trade-offs. In a six step methodology, visualized below, the MCA decision matrix is constructed that weighs criteria for different options. We will now explain the six steps and the method that was taken per step.



Step 1: Structure the question
The goal of an MCA is to contribute to the decision-making process for a certain decision problem. This creates the necessity to have a clear question for which the MCA is developed. In this case the question was: "Which waste stream should be prioritized for circularity in Zimbabwe and development of a pilot concept?"

Step 2: Select criteria for evaluation
A set of 20 social, environmental, economic and institutional criteria was developed. Each criteria is based on the criteria in the response plan and important insights from Output 2 and agreed upon with the NDE.

Step 3: Select possible CE pathways to address the question
The pathways were predefined in the project as six waste streams; plastic, metal, paper, glass, organic and agricultural waste.

Step 4: Construct matrix to evaluate pathways
The matrix was constructed in Excel with, on the y-axes, the criteria including a description and, on the x-axes, the waste streams, including a description of why a certain waste stream received a certain score. Each waste stream is ranked per criteria on a qualitative scale from (---) to (+++). Herein (---) means that there is still a lot of change needed for that waste stream regarding that criteria to move towards circularity. (+++) means that regarding that particular criteria, the waste stream is ready to move towards circularity.

Step 5: Create value functions to normalize criteria
Each criteria has a weight, this represents the importance of each criteria to CTCN and the NDE. It was developed in collaboration with the NDE and stakeholders from key line ministries.

Step 6: Weight criteria to rank pathways
To arrive at a score per waste stream, the weights are multiplied with the numerical value corresponding to each score (---) equals 1, and (+++) equals 7. The total sum product is then normalized to arrive at a final score for each waste stream.

The results of this step-by-step MCA development can be seen in Appendix D.

A brief summary of the score of each waste stream is:

ZIMBABWE	plastic	metals	paper	glass	organic waste	agricultural waste
Normalized Weighted Ranks	10,0	6,4	8,5	7,2	8,1	7,4

5 Analysis of Strengths, Weaknesses, Opportunities and Threats (SWOT) (activity 3.2 and 3.3)

This chapter summarises activity 3.3 and 3.4 , the Strengths and Weaknesses of the current status quo of each of the six waste streams under study (plastic, metal, glass, paper, organic and agricultural waste). Additionally, the Opportunities and Threats regarding the potential of each waste stream are discussed. This SWOT report is based on the MCA (Chapter 2), the WP2 sub report, interviews with practitioners and the live stakeholder meeting held on 18 October 2021. There are some key dynamics that play a role in the SWOT analysis for each waste stream, these are discussed below. The aim is to provide a brief summary of the key characteristics of Zimbabwe's current waste system. For more information about the current waste system, we refer the reader to the WP2 sub report. After the contextual background, the SWOT results per waste stream are given.

5.1 Contextual background

Zimbabwe is a landlocked country in Southern Africa with the current population estimated at almost 15 million, with a steady growth from 4 million in 1960. In 2014 the urban population was almost 33% of the total population. The workforce in Zimbabwe comprises of about 3.5 million workers of which 75% finds employment in the informal sector. This figure is expected to be an underestimation of the total informal labour force, as other (non-statistical) sources indicate a number of even up to 5.2 million workers active in the informal sector in 2020. Much of the current waste system thrives on this informal sector as well.

Zimbabwe generates 2.5 million tonnes of waste annually at a rate of 0.46 kilogram per capita per day. It is a fast growing region, with waste expected to nearly triple by 2050. Waste in Zimbabwe is primarily organic, averaging at 56 percent of the total waste generated. There is only one engineered landfill in the whole of Zimbabwe. Overall waste collection rates are about 48 percent, although the rate is much higher in urban areas than in rural areas, where waste collection services are minimal, and much higher in high income urban than in low income urban areas, where waste services are much less frequent and well-organized and less people have the financial capacity to participate. In many cities private players are active in waste collection, as many local authorities do not have the capacity to fully service their city. Source separation of multiple waste streams by households for waste collection is low, and largely non-existent in areas where waste is collected by local authorities, because they do not have capacity to collect waste separately. In rural areas all waste is disposed of in and around the own living area, in essence demonstrating circularity, as in comparison to urban behaviour much is reused. There is no formal waste management system in place. In urban areas, separately collected waste is sold to recyclers, unseparated waste is brought to the dumpsites. There, waste pickers acquire the valuable components and sell these to waste aggregators. Waste aggregators sell to recyclers or producers directly. The policy framework for Zimbabwe is not specifically aimed at circularity. No EPR schemes or other tax incentives are in place that could foster the transition and that could support the acquisition of required funds for proper waste management.

Waste management is one of the key challenges that cities in Zimbabwe are struggling with. The amount of garbage produced continues to expand at a quicker rate than the cities capacity to develop the financial and technological resources required to keep up with this expansion. The current authorities are struggling to manage waste under tight budgets, inefficient collection practices with variable levels of service, poor and unhygienic operating practices, including no environmental control systems, open garbage burning, indiscriminate illegal dumping and littering, and a public that appears to be largely ignorant about or without the economic capabilities to act on environmental issues.

5.2 SWOT per waste stream

5.2.1 Plastic waste

Status Quo	Potential
Strengths: - Availability of a well-developed upstream value chain with stakeholders specializing in different valorisation i.e. pellets, balling - Favourable government policy - The largest waste in quantity among households in both rural and urban areas - Availability of waste masterplan under Vision 2030 mainstream key waste issues - Establishment of Zimbabwe Foundry Institute has collated and enhanced development of the waste - National Development strategy that specifically mentions plastic to be managed meaningfully - Local availability of plastics	Opportunities: - High potential for local businesses and the informal sector, leading to job creation, for woman in particular - High potential to contribute to climate mitigation and adaptation - High potential to align public and private agendas - Potential for expansion of internal industry for plastics - Potential for high value recovery (deposit schemes, EPR) - Large SADC market for export of valorised products
Weaknesses: - Lack of separation at source - Poor collection regime by the local authorities - Dilapidated waste management infrastructure hampering collection targets - Lack of EPR hampering the full take-off of circularity - Lack of political good will from policy makers to develop plastic responsive policies - Inadequate national data on plastic (imports, exports) - The availability of technology and resources such as sufficient energy to process plastic waste - Low economic returns on both aggregated and recycled products	Threats: - Shifting currency usage (Zimbabwe dollar vs US dollar), discouraging investors from establishing industries - Inconsistent policies, especially economic policies discouraging investments in valorisation activities - Individual economic sanctions hampering investments in economy - Immigration of large population of young people will hinder investments especially if labour is not readily available

Strengths

The volumes of plastic waste are high compared to metal, paper and glass. Due to the growing population, urbanization and the growing middle class the volume of plastic waste is expected to increase substantially over the coming decade. This offers vast opportunities for both the informal and private sector. Additionally, the value of scrap plastic is relatively high compared to glass and paper.

The large quantities of plastic waste have accelerated the development of a robust value chain that has been supported by responsive enactment of a favourable policy and legislative framework to accelerate circular economy. Also, the Vision 2030 Master Plan has identified key waste issues that should be addressed to ensure the country is on a sustainable path to national prosperity that is pivoted on efficient and effective plastic waste management. This all has led to a fairly well-developed upstream and downstream value chain with stakeholders specializing in different valorisation methods of plastics.

Weaknesses

In current practice very few people are separating their plastic waste. About 50% of waste is collected and transported to dumpsites or the landfill, while a lot of plastic waste is dumped in the environment. Plastic is also burned or buried, which poses both environmental and health risks. There is no separation of plastics at the household level, even if there was, the collection is always mixed due to lack of resources and infrastructure to handle it as separate streams. Lack of EPR schemes in favour of plastic recycling is also a major weakness of the current attitude towards circularity in the plastic waste stream.

Opportunities

Due to the growing volumes and the relative high value and advanced international practices of plastic processing, there is high potential to expand the complete value chain. Additionally, in high income areas local authorities have been relatively efficient in waste collection (due to the continuous payment of surcharges involved in waste management). This provides an opportunity to further develop the necessary waste collection systems. Also, opportunity exists to expand behavioural change communications and efforts to mainstream waste separation at source. Other opportunities are to offer incentives to established companies to expand to rural areas, to implement deposit schemes (e.g. for PET bottles), or to set up other extended producer responsibility schemes regarding plastics. Plastics further creates business opportunities due to relatively well developed markets (especially for PET), both locally and internationally (export). The local availability of plastics can stimulate the emergence of local businesses. It also provides opportunities for women to make products such as baskets or mats. Further potential for waste plastic businesses lay in aggregation, trading of aggregated plastic waste of a specific type, developing products for the building sector or selling to the diesel market for pyrolysis. Thus, there is a large untapped market potential.

Threats

The weaker Zimbabwean Dollar causes inflation and has shifted plastic valorisation activities to South Africa, denying the country much needed revenues as well as denying young people employment opportunities. Continuous political instability witnessed during electioneering periods has also threatened industrial activities. Additionally, continuous economic sanctions that have grappled Zimbabwe have locked out key technological transfer from other countries to accelerate valorisation. As a result of poor economic performance over the years, the country has recently witnessed massive emigration of large numbers of young people seeking greener pasture in South Africa.

5.2.2 Metal waste

Status Quo	Potential
Strengths: - Availability of an extensive mining sector - Well-developed scrap metals dealerships along the value chain - Easy to separate unlike organic or plastic waste - Enactment of several mining laws that are linked to environment has encouraged enhanced waste management by mining companies - High demand of metal waste by local artisanal dealers to meet their needs - Locksmith knowledge among local communities accelerating valorisation - Recycling is cheaper than processing virgin material	Opportunities: - The value of products from metal is high, so better management of metal can increase income - Separation and collection of metal is relatively easy, so potential for larger volumes is there - As Zimbabwe develops, metal waste will increase (second hand cars, large household appliances and so on) - Decrease health risks by proper handling of metal waste and preventing environment leaking of heavy metals
Weaknesses: - Over-exportation to South Africa hampering development of a well-established recycling industry - Inadequate reliable energy sources hinders the recycling potential of the waste - Nature of the waste hinders women and youth alike to engage with the waste (i.e. heavy, dangerous) - Lack of a robust policy to curtail exportation of waste - Lack of data from the Ministry as well as ZEMA on the amounts of waste produced - Open boarders has execrated smuggling of the waste denying the government needed revenue - Metal is smelted by a few Chinese dealers who cartel the price - Difficult to get licenses to handle the waste	Threats: - Shifting currency moving valorisation activities to other countries - -Porous borders will stifle expansion of local industries - -Fragmented mining policies hampering efficient management of this waste - Poor economy will hamper investments in valorisation activities - Poor technology might spur increase in GHG from metal waste management activities i.e. smelting - Swift from metal to plastics, cheaper plastic alternatives

Strengths

The robust mining sector in Zimbabwe has continuously provided waste for the industry to recycle. The scrap is mainly sold to scrap metal dealers and artisans as well as used for export. Also, the enactment of favourable mining laws has encouraged environmental conservation. The value per ton of metal waste is quite high (specifically for aluminium) and there is a high demand for metal waste by local artisanal dealers and the mining industry, especially when compared to waste streams such as paper, glass or organic waste. Because of this high value, households that have the storage space available, are willing to separate and store metal waste in expectancy of an economic return. Relatedly, the perception of metal waste as a resource by stakeholders is higher than for all other waste streams. Collection and separation of metal is also easier than for other waste streams.

Weaknesses

Over-exportation to South Africa is hampering the development of a proper remanufacture or recycling industry. Also, there is insufficient reliable energy to spur circularity of the metal waste, since remanufacturing or recycling of metal waste is very energy-intensive. The nature of the waste hinders women and youth alike to engage with metal waste since it is heavy and dangerous. The lack of availability of data on the waste produced has led to negation of proper management. Lastly, open borders have led to smuggling of metal waste, denying the government much needed revenue. Developing this waste stream might result in an increase of such deviant behaviour. The current infrastructure is highly dependent on smelting, which is done by Chinese dealers, creating a cartel.

Opportunities

As Zimbabwe develops, the metal waste stream is expected to increase in volume. For example, second hand cars or large household appliances will increase in volume which at the end of their life results in large volumes of metal waste. Since the value per ton of metal is quite high, it does offer potential for expanding the internal market on all levels. Additionally, metal is quite easy to separate and collect for waste pickers, so when quantities rise, opportunity increases as well. Lastly, handling metal waste properly, might reduce health risks associated with leakage of metal into the environment and the improper handling of metal waste. This will especially benefit low-income households.

Threats

Porous borders will stifle expansion of local industries as long as effective surveillance is not implemented. Fragmentation of mining policies can also threaten efficient management of metal waste. Poor economic development can also hamper investments in valorisation activities, especially if favourable enabling policy or financial environment is not provided. Poor technology use might spur increase in GHG emissions from metal waste management activities i.e. smelting and burning, instead of reducing GHG impacts.

5.2.3 Paper waste

Status Quo	Potential
Strengths: - Availability of large quantities of this waste from households - Well-developed value chain with stakeholders at each juncture - Availability of a ready market of valorised products both at home and abroad - Availability of large number of processors leading to upcycling activities	Opportunities: - Potential for gender equality - Volume and value will increase - Potential for expanding local businesses, the informal sector and thus job creation, dependent on private sector - Potential for expansion private sector and upstream value chain development - Paper processing requires relatively little energy and is relatively easy to recycle - Paper provides an alternative for single use plastic packaging, although the environmental impact might be higher than for plastic - Potential to lower pressure on forestation
Weaknesses: - Lack of separation at source - Much of the waste is used as an alternative source of energy by households - Insufficient awareness among citizens on separation resulting to contamination - Lack of recycling centres	Threats: - High poverty rates will stifle valorisation of the waste stream - Weak currency will hurt importation of valorised products (negative trade balances) - Inadequate budgetary allocation by the local authorities by national government - Political instability will hinder development waste management infrastructure - Flammability of paper

Strengths

There are large quantities of this waste coming from households, as well as a well-developed robust value chain with stakeholders at each juncture. Compared to neighbouring countries, Zimbabwe has a well-developed recycling industry within the country and not much paper is exported. There is also a ready market of valorised products both within the country and abroad. The availability of large number of processors leads to upcycling activities, resulting in high value paper products.

Weaknesses

At this moment there is almost no separation of waste at household level and paper is often contaminated with organic waste, which reduces its value and sometimes completely disrupts the potential for recycling. This lack of separation at source is stifling circularity and is mainly caused by non-existing separate collection infrastructures and insufficient awareness among households. Due to inadequate energy accessibility for households, much of the waste is used as an alternative source of energy. Additionally, the low number of recycling centres makes this process more difficult. Circularity options for paper waste handling offer limited potential for climate adaptation or mitigation, since the paper industry is not energy intensive, nor greenhouse gas intensive.

Opportunities

The paper waste stream holds quite some potential in Zimbabwe. Due to urbanization and a growing middle class, the amount of paper waste is expected to increase over the next decade (particularly the use of cardboard, as conventional white paper use may decrease due to digitalization). A lot of paper is not being recycled or remanufactured yet, thus there is vast potential for job creation in all levels of the value chain, from waste pickers, to local businesses (such as aggregators) and processors. Increasing the use of recycled paper lowers the pressure on deforestation in the country. Additionally, paper is easy to handle so it also offers opportunities for gender equality in all levels of the value chain.

Threats

High poverty rates have resulted in alternative downgrading utilization of the waste stifling valorization of the waste stream. The weak currency can hurt importation of valorized products due to negative trade balances. Additionally, inadequate budgetary allocation by the local authorities by national government has clipped effective management of the waste, i.e. collection and transportation.

5.2.4 Glass waste

Status Quo	Potential
Strengths: - Extensive small scale players accelerating downstream circularity - Easy access of the waste from households and municipal transfer stations - Availability of NGOs who are supporting women and youth groups to accelerate recycling of this waste - Support from the local government in collection of this	Opportunities: - There is value in glass products, so better management of glass can increase income - Large untapped potential for the private sector, local businesses and for job creation - As Zimbabwe develops, glass waste will increase - Increased safety standards
Weaknesses: - Lack of separation of waste at source - Poor involvement of women and youth in the management of the waste - Inadequate reliable of energy stifling growth of the value chain - Few active players in the separation collection of glass waste along the value chain - Most of the waste is exported due to lack of capacity to recycle within the country - Weight of glass makes distributed collection in areas with low infrastructural developments challenging	Threats: - -Upstream players are mainly based in South Africa - Poor government policies to accelerate circularity - Lack of designated landfill to streamline management of this waste - Inadequate industries to scale upstream activities along the waste value chain

Strengths

Robust and extensive small scale players are accelerating the downstream circularity as a result of easy access of the waste from households and municipal transfer stations. Additionally, the availability of NGOs who are supporting women and youth groups to accelerate recycling of this waste also helps. There is also support from the local government in collection of this waste.

Weaknesses

As of this moment there is only a very small internal industry for glass processing within the country, glass is mainly exported abroad. Additionally, the glass waste stream is difficult to handle, it can break easily and is quite heavy. This also leads to limited opportunities for gender equality, since working in glass might be too heavy for women. Separation and collection of glass is difficult for the same reason, and at this moment there is almost no separation or collection of glass. A very limited number of parties are working in collection of glass, and the collection that is done, is mainly performed by the informal sector by picking from dumpsites. Additionally, the transport network to handle heavy glass is underdeveloped. Lastly, processing glass is highly energy intensive and does not offer much opportunity for climate mitigation or adaptation, since there is no leakage of GHG emissions at the end of life, and the stream is relatively small.

Opportunities

There is quite some untapped potential in the glass value chain, since much of the volume is not collected nor processed yet. The value from glass products is sufficient to maintain a glass recycling or remanufacturing industry. Additionally, the glass waste stream is expected to increase over the coming years as Zimbabwe develops.

Threats

Almost all of the upstream players are based in South Africa, making it unlikely that an internal glass industry will emerge without severe government intervention. Lack of designated landfills to streamline post-collection separation of glass waste make it difficult to reach volumes necessary for sufficient revenue generation throughout the whole value chain. At this moment, the existing industry is insufficient to upstream activities throughout the value chain.

5.2.5 Organic waste

Status Quo	Potential
Strengths: - Environmental Management Act, Urban Councils Act have augmented management of this waste - Largest waste in quantity from households - Availability of composting at household levels - Availability of ready market in other Southern Africa countries - Availability of large quantity of agricultural waste that would also contribute to composting activities - Agricultural based economy accelerating production of the waste - Community is aware and willing to reduce methane emissions	Opportunities: - COVID-19 pandemic has threatened food security in the African region and hence, the need to effectively maximize on food recycling and reuse measures - Availability of large rural population to scale household composting - High potential for climate mitigation and adaptation and Non-Conventional Renewable Energy sources (NCRE) - Alignment with goals from the Nationally Determined Contributions - Still lots of underused volumes - Potential for job creation, local businesses and the private sector - Potential for alignment of public and private agendas - Potential for gender equality - Potential for energy supply
Weaknesses: - Inadequate capacity by local authorities to effectively collect the waste - Lack of infrastructure to separate waste at source - Lack of infrastructure to collect this waste especially in rural areas where it is largest - Poor handling of this waste by households resulting to diseases and water sources contamination - Generation of methane as a result of uncontrolled composting contributing to changing climate - Nature of the waste negating involvement of people to manage of this waste i.e. smelly, heavy	Threats: - Social stigma experienced by waste pickers might stifle involvement of, among others, women and youth - Lack of knowledge on managing this waste might accelerate dumping or burning in both urban and rural areas - Political instability might stifle proper management of the waste - Storage can be hazardous - Unavailability of land for composting

Strengths

Organic waste is available in large quantities throughout Zimbabwe and there is already a (small) existing value chain surrounding organic waste handling. Some local businesses or private sector companies make fertilizer, biogas, compost or cooking briquets out of organic waste. The Environmental Management Act and Urban Councils Act have augmented management of this waste stream. Households are already composting organic waste at small scales and the use of products from organic waste is becoming more acceptable. There is also willingness in households to reduce methane emissions, which might help the needed behavioural change for increased collection and separation.

Weaknesses

Inadequate capacity by local authorities to effectively collect the waste due to lack of infrastructure especially in rural areas, is a big weakness of the organic waste stream. Additionally, poor handling of this waste by households results in diseases and water sources contamination as well as methane generation. The biggest weakness of the current organic waste system is that there is virtually no separation or separate collection, meaning that all organic waste that households don't compost or sell to businesses themselves, is collected or dumped with other waste, making separation virtually impossible.

Opportunities

The COVID-19 pandemic has threatened food security in the African region and hence, the need to effectively maximize on food recycling and reuse measures. This can provide an opportunity for better handling of organic waste. Additionally, this waste stream holds potential for integration of public health activities to streamline circularity of the waste, especially due to the large rural population that is already conversant with household composting.

Additionally, the organic waste stream holds great potential for climate mitigation and adaptation as well as for generation of non-conventional renewable energy through biogas. The potential to generate energy is further beneficial since there is a low coverage of main grid electricity in Zimbabwe, and aligns greatly to the goals as stated in the NDC. Organic waste currently often finds its way to open dumpsites since there is insufficient separation and collection. When the organic waste decomposes it releases GHG emissions such as methane into the environment. Better circularity options for organic waste will thus contribute to climate mitigation. This waste stream also holds potential for alignment of public and private agendas, since it can improve hygiene and prevent disease outbreaks, while also creating jobs, private sector involvement and contribute to climate change adaptation and mitigation. Lastly, since women are often the main person involved in creating and handling organic waste (as this mainly involves food and cooking activities), women can pay a large role in this waste stream.

Threats

Social stigma experienced by waste pickers might stifle involvement of women and youth and workers in general, since it is considered dirty and gross. This might become an issue when solutions are expected to scale but not enough people are willing to work in organic waste. Additionally, limited knowledge of state of the art technology can be an issue when trying to make high value products from organic waste. Lack of knowledge on managing this waste stream might lead to increased dumping or burning of organic waste. For composting land is needed, additionally, storage can be hazardous. The varying character of the waste coming in, can also make it difficult to sustain a steady stream of quality of the products. Lastly, the current separation and collection rate is a real threat to exploiting the huge potential of the organic waste stream. gross

5.2.6 Agricultural waste

Status Quo	Potential
Strengths: - Expansion of urban and peri urban farming enhancing availability of the waste - -Availability of household pits to act as refuse collection points - Small scale composting at the rural household levels - Agricultural based economy accelerating production of the waste - Large number of rural population that is mainly engaged in agriculture, potential for large scale solutions	Opportunities: - High potential for climate mitigation and adaptation - Still lots of underused volumes - Potential for job creation, local businesses and the private sector - Potential for alignment of public and private agendas - Potential for gender equality - High potential for waste to energy projects - Used to feed livestock, in periods of droughts or food shortages
Weaknesses: - Composting results to emission of GHG hence leading to climate change - Poor waste disposal strategies among citizens - Inadequate industry to accelerate utilization of the waste - Virtually no collection in rural areas of agricultural waste due to bad infrastructure and lack of resources	Threats: - Lack of players along the value chain that can upcycle resulting to loss of value - Inadequate policy to mainstream circularity to become a national issue - Inadequate coordination between Ministry of Agriculture and Environment to enhance integration of the waste to be valorized - If not disposed properly, it can cause environmental pollution and health risks

Strengths

Expansion of urban and peri-urban farming is enhancing the availability of the waste, since collection is easier in urban and peri-urban areas. This urban farming has also led to the usage of pits to act as refuse collection. Additionally, there is already small scale composting at rural household level due to the agro-economy that is supported by a large number of rural population that is mainly engaged in the activity. The volume of agricultural waste is quite high, since agriculture is a big part of Zimbabwe's Gross Domestic Product (GDP).

Weaknesses

The biggest weakness of the current agricultural waste system is that there is virtually no separation or collection, meaning that all agricultural waste that households don't reuse within their farm, compost or sell to businesses themselves, is dumped with other waste, making separation virtually impossible. Sometimes the agricultural waste is burned, releasing GHG emissions. As agricultural waste is generally generated in rural areas, this makes collection very difficult since the infrastructure in rural areas is often not well enough for frequent collection. Additionally, there are only very few players active in processing and valorising agricultural waste, so there is not much to build upon.

Opportunities

The agricultural waste stream holds potential for climate mitigation and adaptation as well as for generation of non-conventional renewable energy through biogas. Agricultural waste currently often finds its way to open dumpsites on and near the farm since there is insufficient separation and collection. When the agricultural waste decomposes, it releases GHG emissions such as methane into the environment. Better circularity options for agricultural waste will thus contribute to climate mitigation. Furthermore, in times of food shortages (e.g., due to the corona pandemic, or dry periods) agricultural waste can be used to give to livestock and substitute feed. Additionally, since there are large volumes of agricultural waste not being used, it holds potential for job creation of both local businesses and the private sector. Products of agricultural waste can either be sold in Zimbabwe itself, where due to a growing population and growing middle class the market for products might increase, or can be exported abroad. Furthermore, during harvesting periods, rural areas generate large volumes of agricultural waste, offering potential for large scale collection during these periods in rural areas as well. Due to the low density and volume of other waste streams in these areas, collection of other waste types might not be economically interesting. This waste stream also holds potential for alignment of public and private agendas, since it can improve hygiene and prevent disease outbreaks, while also creating jobs, private sector involvement and contribute to climate change adaptation and mitigation. Lastly, since women are heavily involved in practices in and around the farm women can pay a large role in this waste stream.

Threats

The lack of infrastructure to support proper collection, especially in rural areas, poses the biggest threat for this waste stream. Inadequate number of players along the value chain that can upcycle resulting to material recovery is also a major shortcoming. Additionally, the lack of political goodwill to mainstream circularity of agricultural waste is also a threat. Improper handling or improper composting can cause environmental pollution and health risks.

5.3 Conclusions

Zimbabwe currently holds the greatest potential for a transition towards circularity in the plastic, paper and organic waste stream.

For the *plastics waste stream*, the main reasons for this high potential are that there is already a well-developed value chain for plastics to build upon. Additionally, the stream is large and expected to increase and the value of plastic waste is relatively large. Also, the internal industry for remanufacturing and recycling is quite developed and not much plastic waste is exported. So if the plastic waste stream is chosen, developing the upstream value chain deserves attention as well as a proper collection system to increase volumes.

For the *paper* waste stream, the high potential is mainly explained by the easiness of handling paper waste and the well-established value chain which can be built upon. Paper processing requires low amounts of energy and is not very complicated, offering vast opportunity for both local businesses as larger private sector companies. Not much of the paper is processed yet, due to insufficient separation and collection. Difficulty to incentivize households to separate waste and resource constraints for collecting waste separately, form a major threat to upscaling the paper waste industry towards circularity.

For the *organic* waste stream, the high potential is mainly due to the high volumes of organic waste that is generated in Zimbabwe. The use of circularity products out of this waste stream (fertilizer, cooking brickets, manure, biogas) is already quite normalized. However, for this waste stream there are some major weaknesses and threats that need to be considered. There is no adequate infrastructure for both separation and collection in both urban and rural areas. Additionally, state of the art technology to develop high quality products from organic waste is lacking and could hinder market uptake.

That plastic, paper and organic waste currently hold the most potential for circularity does not mean it is not worth considering boosting the other waste streams. It can also make sense to choose the metal, glass or agricultural waste stream as priority, since these are still underdeveloped and hence require attention. However, one should realize that more effort will be needed to develop these waste streams towards circularity in an economically attractive manner than for plastics, paper or organic waste. For both metal and glass, development of the value chain within the country, creating proper separation and collection systems as well as securing sufficient capital and in-house knowledge for remanufacture or recycle should be a top priority.

6 Stakeholder meeting on prioritization of waste streams

CIRCULAR ECONOMY IN THE WASTE SECTOR
STAKEHOLDER MEETING REPORT

18th OCTOBER 2021
CRESTA LODGE HARARE, ZIMBABWE

6.1 Background

The 2015 SDGs highlight the mismanagement of solid waste and sewage as a major challenge that threatens our environment and health. SDG 12 states that there is need for sustainable consumption and production patterns through prevention, reduction, recycling and reuse. According to a study carried out by Practical Action Southern Africa, Zimbabwe generates approximately 2.5million tonnes of waste annually. These figures are projected to increase as industrialization, urbanization and economic development in the nation rises. In response to the overconsumption and mismanagement of solid waste, Zimbabwe has highlighted in the Environmental Management Act [Chapter 20:27] of 2002 as well as section 73 of the Constitution of Zimbabwe (Amendment 20) of 2013 that every citizen has a right to "a clean environment which is not harmful to health" and "protect the environment for the benefit of present and future generations". Various other public policies and strategies have been developed to address issues within the waste sector. However, of these policies, none of them address issues to do with circular economy in the waste sector.

It is against this background that the Climate Technology Centre and Network (CTCN) was engaged through the Ministry of Environment, Climate, Tourism and Hospitality Industry and Kwekwe Polytechnic to provide technical assistance in the 'Assessment of the current status of the circular economy in the waste sector for developing a waste stream specific roadmap in Zimbabwe' project. The project seeks to analyse the household waste management system in Zimbabwe, focusing on plastics, metal, paper, glass and household and small scale agricultural organic waste. The team of consultants, TNO Netherlands, is working on the assessment of the current waste management situation, the identification of potential routes for improving the waste system from a circular economy perspective, the development of a national roadmap for improvement of the waste system and the conceptualization of a pilot project for one of the waste streams.

It is with this in mind that the Ministry of Environment, Climate, Tourism and Hospitality Industry in collaboration with CTCN and TNO held a stakeholder workshop.

6.2 Objective of Workshop

The key objectives of the workshop were:

- To present and discuss the analysis of waste management in Zimbabwe
- To validate the results of this assessment with relevant stakeholders from the waste sector in Zimbabwe.
- To outline the S(trong), W(eak) aspects of the waste management, as well as the O(pportunities) and T(hreats)
- To receive the feedback from stakeholders on these aspects
- To make a joint and informed decision on which waste stream to focus on for the continuation of the project.

6.3 Opening Remarks

Ms. Mukonoweshuro delivered the opening remarks on behalf of Mr. Zhakata, Director Climate Change Management Department within the Ministry of Environment, Climate, Tourism, and Hospitality Industry. Ms. Mukonoweshuro noted that waste recycling, reduction and reuse have been identified as key mitigation actions in the waste sector to help the country achieve the its revised Nationally Determined Contribution (NDC) target of reducing greenhouse gases by 40% per capita by 2030. She also noted that to date, there have been public policies and private initiatives implemented which aim to advance towards an integrated waste management system. Amongst these policies developed are the EMA ACT, National Climate Policy and National Climate Change Response Strategy just to name a few. It was highlighted that the National Clean-up Campaign which was launched by His Excellency President E.D. Mnangagwa and takes place on the first Friday of every month, has received tremendous support from various sectors of the economy. In conclusion, the importance of creating and building on partnerships within the waste sector was highlighted as well as the need to conceptualize and develop project proposals which are bankable and scalable.

6.4 Presentation Overview of the CTCN Circular Economy Project and Progress to Date

Mr. van den Oosterkamp and Mr. Amadi presented an overview of the project which centered around the objective of the project, the project team, project activities and the project deliverables.

Summary of Activity 2: Analysis of household waste streams and circularity in Zimbabwe

Mr. Chinyepe gave a detailed overview of the results of the primary data collected in Zimbabwe. The following were the highlights of the presentation:

- Organic waste (56%) constitutes the largest part of the total domestic waste composition, followed by plastic (13%) and paper (10%)
- Waste separation after collection is mostly facilitated by private companies and CBOs
- 91% of households reported no separate waste collection
- Of the households that are supported by private players, 76% reported to separate some of their waste
- Approximately 60% of domestic solid waste generated in urban areas is disposed in official dumpsites
- All the consulted local authorities except for Bulawayo City (with lined landfill), dispose their solid waste in open dumpsite
- Where there is no collection waste is disposed in open spaces, and or burned- common in low income areas and unplanned settlements
- Residual waste that ends up at the landfill can be reduced up to 10% through resource recovery of reusable and recyclable waste and diversion of biodegradable waste to energy
- Some organic waste is composted especially in middle and high income areas
- Separately collected waste (by private parties) is brought to waste aggregators premises
- Separation at dumps or landfills is done by informal waste pickers, who collect valuable components
- As the volumes are insufficient to trade directly Waste Transfer Centres buy up the separated waste and aggregate until volumes are sufficient to sell to recyclers and producers.

6.5 Issues Raised

Mr. Muzamwese, international consultant and editor-in-chief of the Green Business Gazette, enquired whether there are organizations or individuals in Zimbabwe who are engaged in value additions of waste or the activities are concentrated around waste collection and bailing only. He also enquired why there is poor waste management in high income areas compared to low and middle income areas. He further asked if the differences could be linked to affluence in which he noted that developed countries, which have more affluent people, manage their waste better.

In response, Mr. Chinyepe (local consultant for the research team), noted that few companies are engaged in value addition of waste beyond collection and bailing. He linked this to technological challenges to further process waste, for example the lack of technology in the country to further process chains, which are thus only bailed and shipped out of the country. In regards to affluence, Mr. Chinyepe highlighted that the poor waste management system in high income areas is mostly linked to so-called upbringing. In which case it can occur that people who have lived in poor background turn to rather wasteful lives when they rise in financial status, as a sign of showing that they can now afford to buy many things that they sometimes don't even need (and thus ends up as waste). In addition, Mr. Mukwena, co-founder of and business developer for RESQ Energy, noted that the poor waste management in high income areas as compared to low income areas is also linked to a lack of awareness that waste is a resource. To ensure that waste management is enhanced across the income levels, Mr Mukwena suggested that enforcement of existing waste management policies should be enhanced.

In regards to the relationship between waste management and income levels, Mrs. Chandireka Mutubuki-Makuyana (local consultant for the research team) noted that there is a difference in the person handling waste in the different income levels. In the low income levels, she noted that it's mostly women who handle waste and they are generally good waste managers. In the middle income areas men mostly handle waste. In high income areas, the domestic workers handle the waste and are mostly not informed or concerned about what becomes waste, in which case they can throw anything that hasn't been used but still holds some value. In high income

areas, people buy more than they need, especially for organics, which end up as waste. Mr. Owen Chiwandire, Recycling Manager of Clean City, offered to provide some more data from a study they conducted to provide more information on the status of gender in waste management value chain.

6.6 Presentation of SWOT Analysis on circularity routes per waste stream, feedback and discussion

Ms Milou Derks, from the TNO research team, presented the initial findings from the SWOT analysis for the different waste stream under focus. During the presentation participants also shared their input about the SWOT for the different waste. After going through the SWOT for each waste stream Ms Milou presented the preliminary conclusions from the research that for the Zimbabwean context plastics, organic household waste and paper waste show the largest opportunities for circular economy action and improvement of the waste management system.

Metal

Mr. Muzamwese sought to know whether motor vehicle waste is included under the focus of the project as its one of the problematic metal waste streams due to the increasing importation of second hand cars to Zimbabwe from different countries, mostly Japan. He added the country has impeccable skills in metal fabrication which is an important strength that enhances management of metal waste. In response, Milou highlighted that the motor vehicle waste is not the focus of the project but appreciated the need to ensure motor vehicle metal wastes are properly managed.
Mr. Muzamwese further noted that circularity of metal waste is threatened by health and safety challenges where people handling metal waste have no personal protective equipment. This is especially a relevant concern since some processes for handling metal waste release toxins such as metal oxide which accumulates in the lungs resulting respiratory diseases. He further noted that with the advancement in technology, there is a trend of replacement of metal items with other materials using nano technology which is a threat to metal waste business. Mr. Mbaisa, Executive Director of Zimbabwe Sunshine Group, added that there is need of incentives to encourage people to let go of the metal waste they hold.

Plastic

Mr. Mukwena alluded to the fact that the paper industry is threatened by technological advancement in which case people tend to use tablets and mobile devices to read information as opposed to reading from a physical copy. Ms. Wandoreba, project manager of Zimbabwe Sunshine Group, noted that the paper recycling industry is majorly threatened by the design of paper. She gave an example of a packaging that is composed of both plastic and foil infused together which makes it difficult to separate thus making recycling difficult. Mr. Chiwandire highlighted that the paper recycling business in Zimbabwe is monopolized that making it difficult for competition which would result in more benefits for the industry. He further noted that there are no incentives to engage in the paper waste management.

Glass

Mr. Muzamwese highlighted that the perpetual nature of recycling glass provides a good opportunity to encourage more engagement in glass waste recycling. He further highlighted that the poor transport network is a big hindrance to glass waste management. He noted that there is only one glass recycling centre in Zimbabwe, in Gweru in which case all other districts needs to transport the glass waste all the way to Gweru. This situation is worsened by the bulky nature of glass coupled with the poor road situations. He recommended the establishment of more glass recycling centres in the country, improved road conditions and construction of a rail system.

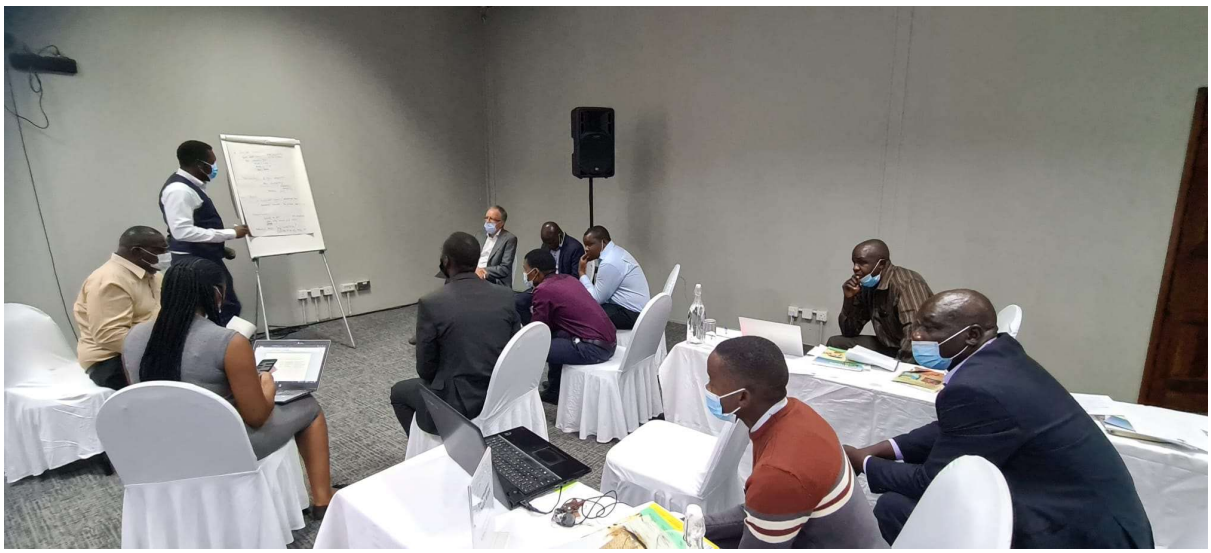
Organic Waste

Mr. Chiwandire highlighted the stigma related to handling organic waste as a great hindrance to its management.

6.7 Focal group discussions

To further provide a vision for the future of waste management in Zimbabwe, the participants were grouped into 3 focal groups. The 3 groups had in-depth discussions and provided a road map of how a circular waste management in Zimbabwe should like in 2035, for organics, metal and plastics. The results of this exercise will contribute to the to be developed roadmap. Many interesting remarks and suggestions were made, among others:

1. Posed by the group working on the metal value chain, but relevant to all streams, the point was highlighted that it is crucial to develop an integrated coordinating government body that can oversee, monitor and steer the transition to a more circular economy. As long as all sectors are addressed separately and government operates in
2. A recurring theme among all groups was to make use of levies or tax incentives to stimulate the market for circular products (from renewable or recycled products for example).
3. Another recurring theme was the important role of Waste Transfer Centres in each value chain. These Centres can play a key role both in terms of (further) separation as well as accessibility for low income areas.

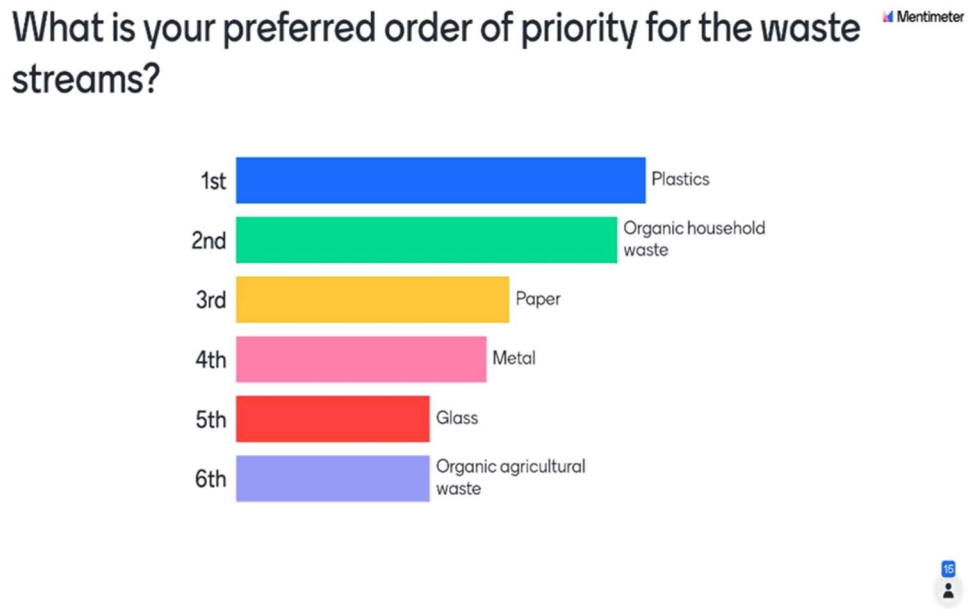


6.8 Prioritization of the waste streams

To prioritize the waste stream that should be focused on, Ms. Naomi Montenegro Navarro (lead researcher from TNO) provided an in-depth explanation of the process of prioritizing the waste and criteria for selecting the waste stream. The online Mentimeter tool was used, where participants could prioritize and vote anonymously. This led to the following results:

6.9 Results of the Mentimeter Voting

Plastic waste came out 1st on the priority list, but followed very closely by organic household waste. Ms. Mukonoweshuro advised that organic waste is a preferred stream and a priority for the government. Mr. Mashungu, Climate Change Mitigation and Renewable Energy Expert at Climate Change Management Department, supported the previous notion by highlighting that the country has prioritized the organic waste stream in its Low-carbon Emission Development Strategy (LEDS) which highlights composting and the adoption of biogas digesters as key mitigation actions which will drive mitigation in the sector. In support, Ms. Wandoreba highlighted that organic waste has previously been given little attention, despite it comprising the majority of waste, and it would be important to have it as a priority waste stream for the county. In her submission, she noted that concentrating on biogas from organic waste will provide a niche market for organic waste which is critical for Zimbabwe especially due to the low access to electricity. It was also highlighted that there is need for diligent technology development and transfer as well as continuous capacity building at community level in order for there to be a sense of ownership and adequate integrated waste management across the various waste streams. In contrast, Mr. Muzamwese opined that there is need for more consultations beyond the stakeholders meeting to identify the priority waste stream. In the end, the stakeholders present jointly agreed to prioritize household organic waste for the continuation of the project.



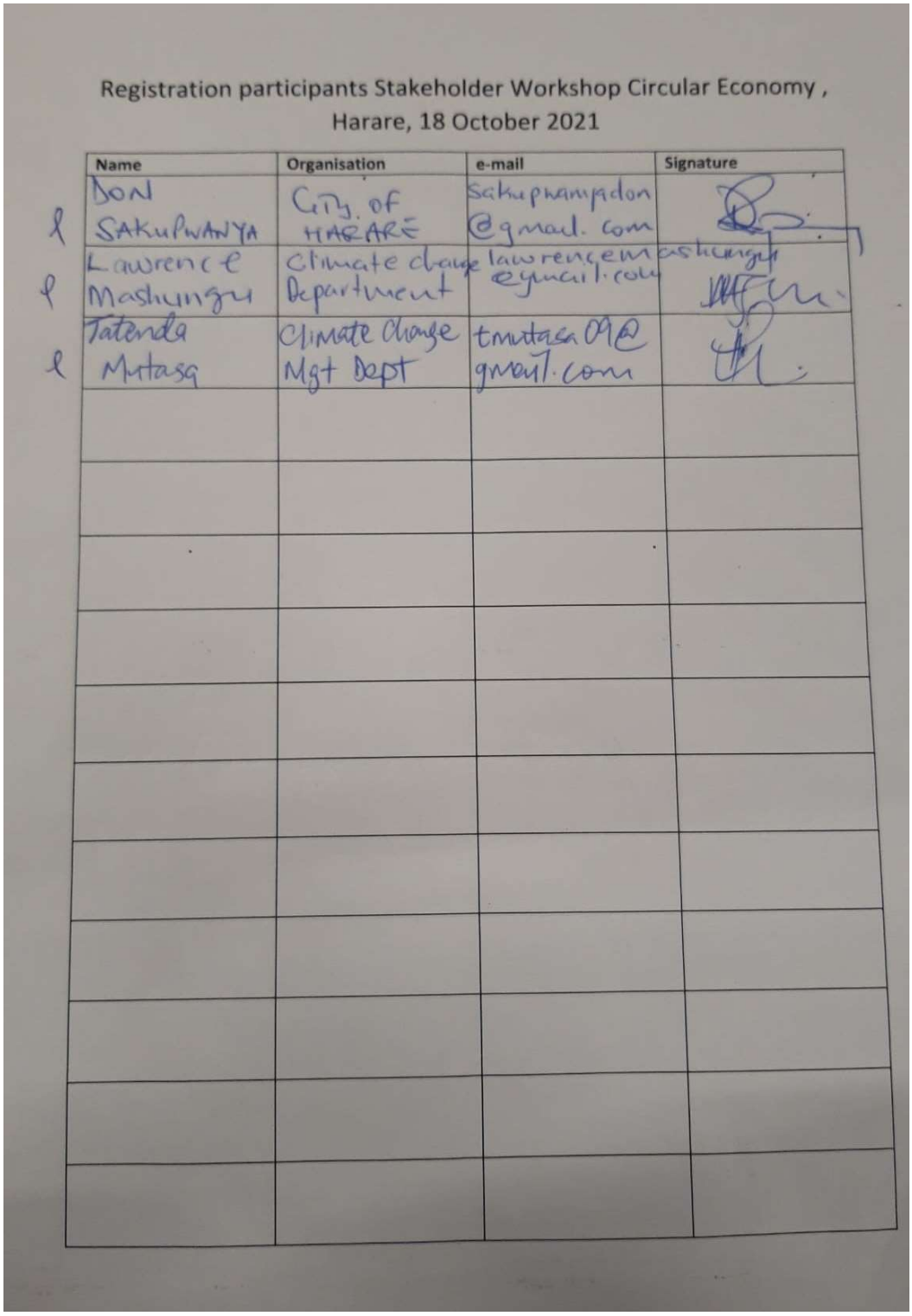
6.10 Next steps and way forward

The decision was made to prioritize organic household waste, the remainder of the research will focus mostly on this waste stream. The first action point is to work out the current value chains and (policy) context for organic waste in more detail, assess and the design what a more circular system could look like. Various pathways for valorisation will be worked out. In January, a second stakeholder meeting will be held, in which the results of the assessment will be presented and a selection will be made which pathway to work out into a pilot concept. Moreover, the results of the total research will be processed into a national roadmap for a more circular waste system, with the key focus on organic waste.

A Photo impressions

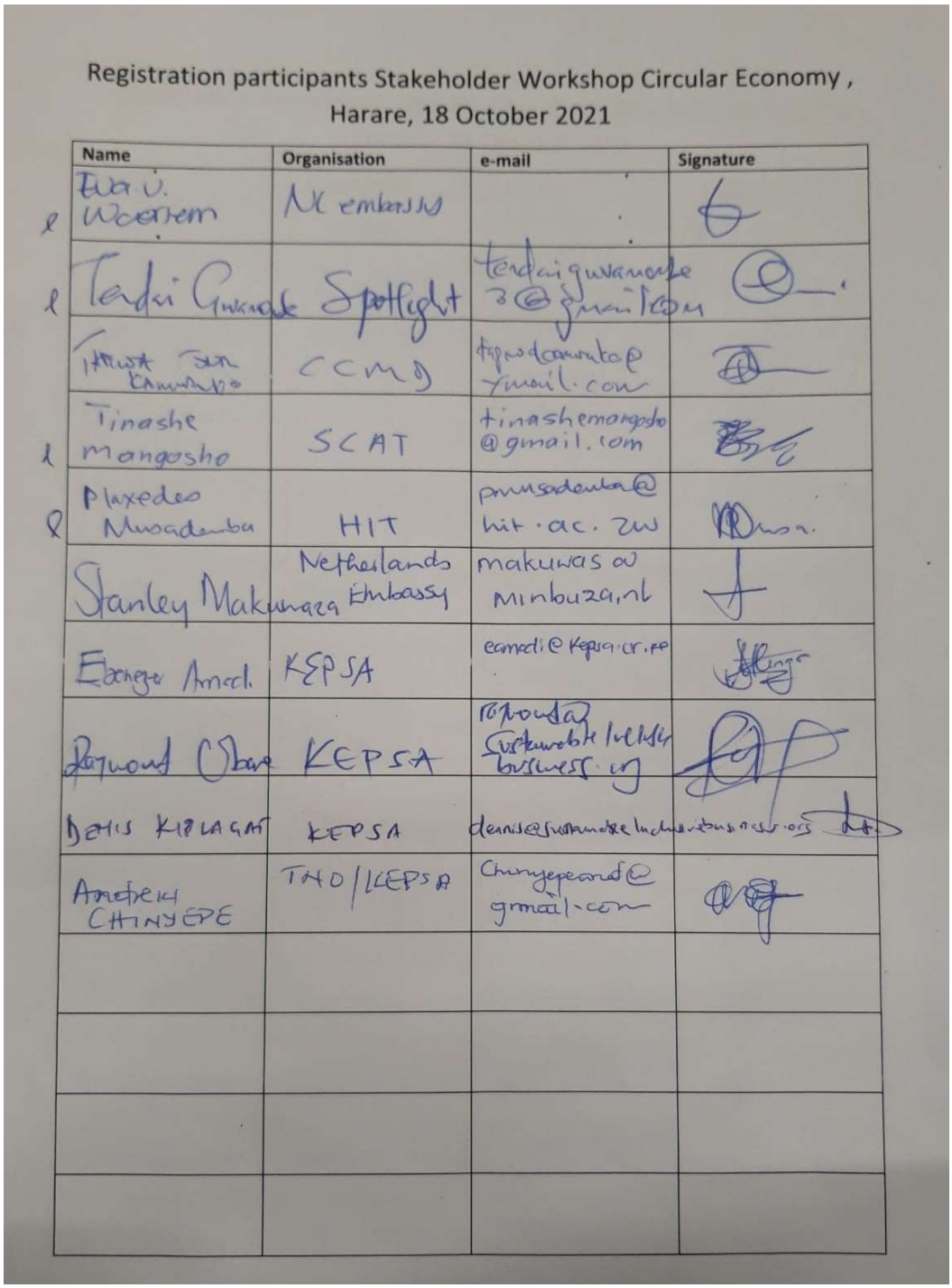

EXIT

B List of participants



Registration participants Stakeholder Workshop Circular Economy , Harare, 18 October 2021

Name	Organisation	e-mail	Signature
DON SAKUPWANYA	CITY OF HARARE	Sakupwanyadon@gmail.com	
Lawrence Mashungu	Climate change Department	lawrencem@gmail.com	
Tatenda Mutasa	Climate Change Mgt Dept	tmutasa09@gmail.com	



Registration participants Stakeholder Workshop Circular Economy , Harare, 18 October 2021

Name	Organisation	e-mail	Signature
Ella V. Woerlem	NL embassy		
Tendai Gukwe	Spotlight	tendaigukwe3@gmail.com	
[illegible]	CCMD	[illegible]	
Tinashe Mangosho	SCAT	tinashemangosho@gmail.com	
Plaxedes Musadenba	HIT	pmusadenba@hit.ac.zw	
Stanley Makuwaza	Netherlands Embassy	makuwas@minbuza.nl	
Ebenezer Amadi	KEPSA	eamadi@kepsa.co.zw	
Raymond Chibaya	KEPSA	[illegible]	
DENIS KIPLAGAT	KEPSA	denis@sustainable-inclusive-business.org	
ANDREW CHINYEPE	TNO/KEPSA	Chinyepeandrew@gmail.com	

C Programme

Agenda for the Stakeholder Workshop on the Development of a Circular Economy Roadmap in the Waste Sector in Zimbabwe

Cresta Lodge, Harare
18 October 2021

Time	Activity	Responsibility
18 October 2021		
08:30-09:30	Arrival & Registration /Coffee Tea	TNO
09:30-09:35	Welcome, Introductions and Objective of Workshop	TNO
09:35-09:45	Remarks from Circular Economy Consultants	Paul van den Oosterkamp – TNO/ Ebenezer Amadi – SIB-K
09:45-09:55	Opening Remarks	Mr Washington Zhakata – Director Climate Change Management Department
09:55-10:10	Overview of the CTCN Circular Economy Project and progress to date	Paul van den Oosterkamp – TNO/ Ebenezer Amadi – SIB-K
10:10 – 10:20	Discussion /Q&A	All
10: 20 10:40	Tea & Coffee Break	
10:40-11:10	Summary of Activity 2 : Analysis of household waste streams and Circularity in Zimbabwe	Mr Andrew Chinyepe/ Ms Chandi Mutubuki-Makuyana
11:10-11:25	Discussion/Q&A	All
11:25-12:30	Presentation of SWOT analysis on circularity routes per waste stream + feedback and discussion	Ms Milou Derks
12:35-13:35	LUNCH	
13:40-13:45	Introduction Focal Group Discussion	Ms Naomi Montenegro Navarro
13:45-14:30	Focal group discussion	All
14:30-15:00	Presentations from focal groups	Per group, moderated by Ms Naomi Montenegro
15:00-15:30	Prioritization of the waste stream	Ms Naomi Montenegro Navarro
15:30-15:40	Closing Remarks	Paul van den Oosterkamp and Ebenezer Amadi
15:40-16:00	Tea and Departure	

D MCA Analysis

Zimbabwe	Criteria	Description	Weight	Plastic	Metals	Paper	Glass	Organic waste	Agricultural waste	Explanation
social	behavioural acceptance	The level of behavioural change that is required to move towards circularity. Note that this does not include separation, for separation there is a different criteria. If there is not a lot of behaviour change necessary (+++), then this will have a positive impact when trying to make a waste stream more circular. When there is a lot of behaviour change necessary (---), then there is still a lot of change needed. An example is a deposit mechanism requiring people to pay more for their product and returning the packaging to get their deposit back.	4	(-)	(+)	(-)	(-)	(---)	(++)	Plastic: using recycled products is normalized, however better separation is required, which people will not always like, so (-) is the score. Metal: there is already an informal economy but acceptance towards used metal might be low due to quality concerns. On the other side, households are willing to separate and store metal since they know it has value, thus (+) is the score. Paper: using recycled products is normalized, however better separation is required, which people will not always like, so (-) is the score. Glass: using recycled products is normalized, however better separation is required, which people will not always like, so (-) is the score. Organic waste: is something people consider gross, so using products from organic waste will face resistance. Additionally, separation organic waste will require a significant behavior change, thus (---) is the score. Agricultural waste: the acceptance is higher since farmers are already used to use the waste efficiently and handling the waste in an even more circular way will not face much resistance, thus (++) is the score.
	social status of waste workers	If the social status of waste workers working in a particular waste stream is low (---), then this might prevent both local businesses or informal sector workers to want to get involved in the waste stream. If the social status is high (+++), then this can result in an increase of people willing to work in the sector.	2	(-)	(+)	(-)	(-)	(--)	(+)	Plastic: social status of waste workers is low, especially for waste picking, collection and transportation, so (-) is the score. Metal: social status of waste workers is low, especially for waste picking, collection and transportation, however for metal separation is so (-) is the score. Paper: social status of waste workers is low, especially for waste picking, collection and transportation, so (-) is the score. Glass: social status of waste workers is low, especially for waste picking, collection and transportation, so (-) is the score. Organic waste: social status of waste workers is very low, since it is considered dirty and gross, so (--) is the score. Agricultural waste: social status of waste workers is better, since there is lots of work in the agricultural sector this is more normalized, so (++) is the score.
	willingness to separate waste at source	Separation is key to a lot of solutions. If the willingness to separate a certain waste stream at source is high (+++), then this will positively influence circularity of that waste stream. If willingness to separate is low (---), then there is still a lot of effort (capacity building, incentives, others) needed to increase willingness to separate.	4	(-)	(+)	(-)	(-)	(--)	(++)	Plastic: currently not much separation takes place, therefore behavioral change is required, for which the willingness is low, so (-) is the score. Metal: metal is easier to separate and there is more willingness to separate this, so (+) is the score. Paper: currently not much separation takes place, therefore behavioral change is required, for which the willingness is low, so (-) is the score. Glass: currently not much separation takes place, therefore behavioral change is required, for which the willingness is low, so (-) is the score. Organic waste: it is considered gross and therefore willingness to proper separate and prevent the contamination of organic waste with plastic or paper is very low, so (--) is the score. Agricultural waste: high willingness to separate since farmers are already used to handle the waste efficiently, so (++) is the score.
	opportunities for gender equality	If there are a lot of opportunities within a certain waste stream for women (+++), then this has a positive impact on the gender balance. If the waste stream does not hold a lot of opportunities for women (---), this will have a negative impact on the gender balance. Note that this criteria relates strongly to SDG5.	3	(+)	(--)	(+)	(-)	(+)	(+)	Plastic: generally the participation of women is low, although women are involved in waste sorting and at collection centres, but there is potential for women to participate in other activities as well, so (+) is the score. Metal: handling this waste is perceived as less suitable for women, considering it is heavy and dangerous, so (--) is the score. Paper: generally the participation of women is low, although women are involved in waste sorting and at collection centres, but there is potential for women to participate in other activities as well, so (+) is the score. Glass: currently dominated by man and number of women participating is very low, so (-) is the score. Organic waste: women are involved in handling this waste stream, by separating and composting the waste (lower level of the value chain), so (+) is the score. Agricultural waste: women are involved in handling this waste stream, by separating and composting the waste (lower level of the value chain), so (+) is the score.
environmental	level of integration of NCRE	If there is a lot of opportunity (+++) for non-conventional renewable energy technologies to be deployed, then this can positively influence transitioning towards circularity. If there is not a lot of opportunity for NCRE then this can have a negative influence on transitioning towards circularity, since no synergy can be created with the energy transition.	2	(+)	(--)	(-)	(-)	(++)	(++)	Plastic: there is some potential for plastic through combustion for plastics that cannot be recycled, so (+) is the score. Metal: there is no potential for energy recovery, so (--) is the score. Paper: there is no potential for energy recovery, however there is an internal industry for recycling this waste stream, which reduces the energy needed to produce products, so (-) is the score. Glass: there is no potential for energy recovery, however there is an internal industry for recycling this waste stream, which reduces the energy needed to produce products, so (-) is the score. Organic waste: there is potential for this waste stream (biodigester), however larger quantities of waste are required, so (++) is the score. Agricultural waste: there is high potential for this waste stream, however the waste is currently already used efficiently, leaving a lower volume left to use for energy, so (++) is the score.
	potential for local businesses and informal sector	If there is a lot of potential for local businesses to create economic activity (+++), then this will have a positive impact when transitioning a waste stream towards circularity. If the potential is low (---), then this can hinder the transition to a more circular waste stream.	4	(+++)	(-)	(++)	(+)	(+)	(0)	Plastic: plastic holds very high potential, it is the largest stream and it can be separated on landfills and dumpsites and then aggregated. Additionally, there are already some opportunities for recycling within the country, so (+++) is the score. Metal: low potential since it is a small stream and already used informally, which even lowers the quantity, so (-) is the score. Paper: high potential and already some internal businesses are present, however proper separation is important since it is easily contaminated and this separation is not yet present, so (++) is the score. Glass: some internal businesses are present, however collection is heavy and more difficult, so (+) is the score. Organic waste: part of this waste is separated offering opportunities for some small-scale operations, for example cooking pallets. However, most of the organic waste is not separated at source, which makes it very difficult to separate is later, since it is considered as dirty there is less willingness for separation, so (+) is the score. Agricultural waste: holds some potential for local businesses and commercial since farmers have organic waste in larger quantities, however, infrastructure in rural areas is not so good and currently there are not much options or market opportunities for products made from agricultural waste, so (0) is the score.
	impact on NDC regarding climate mitigation	If the waste stream holds the potential to impact the national determined contributions regarding climate mitigation is high (+++), then this will have a positive effect on transitioning towards circularity, since it will be prioritized by governments and it might make investment easier. if the contribution to the NDC regarding climate mitigation is low (---), then this might hinder transitioning the waste stream towards circularity.	3	(++)	(0)	(+)	(0)	(++)	(+)	Plastic: currently plastic is often burned, resulting in CO2 emissions and toxins released, so handling this waste in a different way has the potential to lower this impact, so (++) is the score. Metal: this does not lead to GHG emissions at the end of their life, so handling this waste differently will not lead to a lower impact, thus (0) is the score. Paper: currently paper is often burned, resulting in CO2 emissions, so handling this waste in a different way has the potential to lower this impact, so (+) is the score. Glass: this does not lead to GHG emissions at the end of their life, so handling this waste differently will not lead to a lower impact, however there is some small internal industry for glass recycling, so recycling will reduce the energy needed for production and thus lower CO2 emissions, so (????0) is the score. Organic waste: this stream offers high potential, since methane and other GHG's are emitted, so handling this waste better, so that it does not end up at dumpsites, will lower this impact, so (++) is the score. Agricultural waste: this stream offers high potential, since methane and other GHG's are emitted, so handling this waste better will lower this impact, so (++) is the score.
	impact on NDC regarding climate adaptation	If the waste stream holds the potential to impact the national determined contribution regarding climate adaptation is high (+++), then this will have a positive effect on transitioning towards circularity, since it will be prioritized by governments and it might make investment easier. if the contribution to the NDC regarding climate adaptation is low (---), then this might hinder transitioning the waste stream towards circularity.	4	(++)	(0)	(+)	(0)	(++)	(++)	Plastic: high potential for climate adaptation, when better waste management prevents burning of plastic waste, so (++) is the score. Metal: little potential for climate adaptation, so (0) is the score. Paper: can easily burn during droughts setting fire to dumpsites, thus better management has potential for climate adaptation, so (+) is the score. Glass: little potential for climate adaptation, so (0) is the score. Organic waste: high potential for climate adaptation, to prevent further climate change and pollution, so (++) is the score. Agricultural waste: potential for climate adaptation, to prevent further climate change and pollution, however large part of this stream is already handled, so (+) is the score.
	impact on SDGs	If the waste stream holds the potential to have a high positive impact on the SDGs (+++), then this will have a positive effect on transitioning towards circularity, since it will be prioritized by governments, NGO and so on. It might make investment and prioritization easier. If the contribution to the SDGs low (---), then such benefits will most likely not exist.	3	(++)	(0)	(+)	(+)	(++)	(+)	Plastic: high potential, large volume holds potential for job creation for informal workers, and thus poverty reduction, so (++) is the score. Metal: no clear potential for impact on SDG, so (0) is the score. Paper: potential for employment creation along the value chain, so (+) is the score. Glass: no clear potential for impact on SDG, so (0) is the score. Organic waste: composting this waste will reduce waste on dumpsites and landfills and will increase hygiene and health, so (++) is the score. Agricultural waste: composting this waste will reduce waste on dumpsites and landfills and will increase hygiene and health, however this waste stream is already handled for a large part, so (+) is the score.

Zimbabwe	Criteria	Description	Weight	Plastic	Metals	Paper	Glass	Organic waste	Agricultural waste	Explanation
	volume of products and materials from waste	If the volume of the products and materials then can be made of the waste is high (+++), then this can positively impact the transition towards circularity since economy of scale benefits can be realized. Additionally, more value can be extracted since the stream is voluminous. If the volume of products and materials that can be made from the waste is low (---), then interest in this waste stream might be lower.	4	(++)	(-)	(+)	(+)	(+++)	(-)	Plastic: high volume and value, so (++) is the score. Metal: very small stream, so (-) is the score. Paper: some value and medium volume, so (+) is the score. Glass: some value and medium volume, so (+) is the score. Organic waste: about 50% of the domestic waste is organic, this is quite a voluminous stream and there are many products possible from this waste, so (+++) is the score. Agricultural waste: agriculture is a bigger stream but already used efficiently by farmers themselves, so (-) is the score.
economic	potential for private sector	If the potential for the private sector to create profitable economic activities is high (+++), with the right stimulant, lots of private companies might want to be involved, speeding up the circularity transition. If there is not a lot of potential (---), then private sector involvement, will be difficult to organize and more public involvement is necessary, which is often more difficult to organize budget wise.	5	(+++)	(--)	(++)	(+)	(+)	(-)	Plastic: high volume, additionally, there are already some opportunities for recycling within the country, so (+++) is the score. Metal: low volume and already used informally, so (--) is the score. Paper: is easy to handle and holds some value, additionally there are some internal recycling options in the country. On the other side separation is key to reach higher volumes, which is difficult due to contamination, so (++) is the score. Glass: not much internal recycling options in the country, however there is some value for glass, so (+) is the score. Organic waste: high volume of the waste, so (+) is the score. Agricultural waste: low potential due tot the lack of sufficient infrastructure in rural areas, making collection difficult, so (-) is the score.
	value of products and materials from waste	If the value still present in the waste stream is high (+++), then this can positively impact the transition towards circularity since money can be made out of collecting, aggregating, recycling, exporting or processing. If the value still present in the waste is low (---), then interest in this waste stream might be lower.	4	(+++)	(+)	(++)	(+)	(+)	(++)	Plastic: holds high value, so (+++) is the score. Metal: energy intensive to recycle this waste, so value is a bit lower, so (+) is the score. Paper: easy to recycle and use with existing products thus quite high value, so (++) is the score. Glass: energy intensive to recycle this waste, so value is a bit lower, so (+) is the score. Organic waste: opportunity to make different types of products (biogas, fertilizer, cooking pallets), so value is quite high, so (+) is the score. Agricultural waste: opportunity to make different types of products (biogas, fertilizer, cooking pallets), additionally the available streams are better separated, so value is quite high, so (+) is the score.
	job creation	If there is a high amount of jobs in both private and informal sector (+++) that can be created, this will positively affect the transition since people will want to get involved in the waste sector and want it to succeed/ a just transition that provides economic opportunities for workers. If the potential for job creation is low (---), people might feel more indifferent towards circularity transition.	3	(+++)	(--)	(++)	(+)	(++)	(-)	Plastic: high volume holds large potential for job creation, informal or private, throughout the value chain, so (+++) is the score. Metal: small volume and already used informally, thus there is no market for large scale, so (--) is the score. Paper: volume is not that high, however it is easy to handle which offers potential for the private and informal sector, so (++) is the score. Glass: is more difficult to handle and volume is not that high, but has some value that gives potential for job creation, so (+) is the score. Organic waste: high volume holds potential for job creation, so (++) is the score. Agricultural waste: low potential for job creation due to the lack of proper infrastructure in rural areas which makes it difficult to reach the waste, so (-) is the score.
	availability of existing technological and innovative capacity within country	If the technological and innovative capacity necessary for a certain waste stream to move towards circularity is already available within the country (+++), then this can speed up implementation of such technologies and innovations and thus accelerate transition towards circularity. If this is not available yet (---), this might hinder the transition.	4	(++)	(-)	(+)	(-)	(+)	(+)	Plastic: existing technology and knowledge regarding plastics is already available, so (++) is the score. Metal: there is not enough technical capacity in the country to recycle properly, so (-) is the score. Paper: some existing technological capacity within the country, so (+) is the score. Glass: there is not enough technical capacity in the country to recycle properly, so (-) is the score. Organic waste: some existing technological capacity within the country, so (+) is the score. Agricultural waste: some existing technological capacity within the country, so (+) is the score.
	market acceptance	If the market is already quite ready for a transition towards circularity and does not need to change too much (+++), then this will have a positive impact on the CE transition. However, if the amount of change that the market needs to do in order to transition towards circularity, is high (---) then this will negatively impact to speed of the transition.	4	(+++)	(--)	(++)	(++)	(-)	(-)	Plastic: the market acceptance towards recycled plastic is high, it is already normalized and customer demand is growing, so (+++) is the score. Metal: it is very low since informal reuse of metal is already happening, the stream is low, and there is no internal industry for metal, so (--) is the score. Paper: market acceptance is high, it is quite normalized, so (++) is the score. Glass: market acceptance is high, it is quite normalized, so (++) is the score. Organic waste: it is considered dirty, therefore market acceptance is low, so (-) is the score. Agricultural waste: it is considered dirty, therefore market acceptance is low, so (-) is the score.
	availability of investment capital	If the potential for capital investment in a certain waste stream is high (+++), then this will positively influence the transition. This might be the case in very large waste streams, or waste that still holds a lot of values, or streams where there already exists a big market. If there is not much capital available (---) in waste stream (small stream or low value), then this will negatively influence the transition.	5	(++)	(-)	(+)	(-)	(+)	(+)	Plastic: high potential for capital investment due to the high potential of this waste stream, so (++) is the score. Metal: potential is not so great, so capital investment available is low, so (-) is the score. Paper: the private sector sees some reason to invest, so (+) is the score. Glass: potential is not so great, so capital investment available is low, so (-) is the score. Organic waste: potential of this waste streams leads to potential for investment of capital, so (+) is the score. Agricultural waste: the private sector sees some reason to invest, so (+) is the score.
institutional	embedding in policy and regulations	If no drastic policy and regulation changes are necessary (+++), then this will have a positive impact on the transition speed. However, when lots of policy and regulation changes are necessary (---), this will take a lot time and hinder the speed and momentum of the transition towards circularity for a specific waste stream.	4	(-)	(-)	(-)	(-)	(-)	(-)	For all waste streams: there are limited policies that promote investment circular economy and lucrative business environment in the waste sector. And there is a conflicting recycling policy that prevents people from recycling themselves, so (-) is the score for all.
	level of alignment of public and private agendas	If the public demands (hygiene, cleanliness, poverty etc.) can be aligned with private (economic opportunity) (+++), then this will have a positive impact on the speed of the transition because of synergies between the agendas, resulting available budget and attention. However if there is less alignment (---), then these benefits will not exist.	3	(+++)	(--)	(+)	(+)	(++)	(+)	Plastic: potential for job creation and cleaner environment, can be combined with private sector investment, meaning that plastic holds high potential for alignment, so (+++) is the score. Metal: low potential for alignment, so (--) is the score. Paper: lower volume than plastic, however still possibilities for job creation and cleaner environment, so (+) is the score. Glass: lower volume than plastic, however still possibilities for job creation and cleaner environment, so (+) is the score. Organic waste: potential for job creation and increasing health and hygiene, giving potential for alignment, so (++) is the score. Agricultural waste: potential for job creation and increasing health and hygiene, however to a lower degree due to current management of the waste that is already in place, so (+) is the score.
	sufficiency of current separation level	If the current separation level and system is sufficient (+++), then this can increase the speed of the circularity transition since waste is already separated (the second step, after collection). This might mean that there are incentives for households to separate, but it can also mean that there are separation mechanisms in place for when the waste arrives to dumpsites or landfills. If the separation level is still low (---), then there is a lot of systemic change needed in order to get volumes needed for circularity.	5	(-)	(+)	(--)	(--)	(--)	(+)	Plastic: plastic is quite easy to collect from dumps, however better separation will be necessary, so (-) is the score. Metal: separation takes already place and separation is not too difficult, so (+) is the score. Paper: difficult to separate due to contamination, better separation is necessary, so (--) is the score. Glass: difficult to separate due to contamination, better separation is necessary, so (--) is the score. Organic waste: sometimes it is separated, however it is not collected separately. Additionally, separation is difficult and considered gross, thus a lot is needed to separate this waste stream, so (--) is the score. Agricultural waste: this waste is more normalized to separate and use for composting, so (+) is the score.
	sufficiency of current collection level	If the current collection level and system is sufficient (+++), then this can increase the speed of the circularity transition since waste is already collected (the first step). If the collection level is still low (---), then there is a lot of systemic change needed in order to get volumes needed for circularity.	5	(--)	(+)	(--)	(--)	(---)	(---)	Plastic: collection is insufficiently, so (--) is the score. Metal: informal collection is quite good, so (+) is the score. Paper: collection is insufficiently, so (--) is the score. Glass: collection is insufficiently, so (--) is the score. Organic waste: collection is insufficient and should become way better and in line with hygiene standards, so (---) is the score. Agricultural waste: the lack of infrastructure in rural areas cause that there is (almost) no collection os agricultural waste, so (---) is the score.
Sum				102	64	86	74	85	78	
Weighted Ranks				**379,0**	**243,0**	**321,0**	**274,0**	**308,0**	**281,0**	
Normalized Weighted Ranks				**10,0**	**6,4**	**8,5**	**7,2**	**8,1**	**7,4**	