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TNO report

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

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

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Methodology

The goal of Output 3 is to prioritize a waste stream for which a roadmap and pilot plan will be developed for Malawi in Output 4 and 5. The decision on the prioritized waste stream is based on a stakeholder meeting with the 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 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 Malawi's nationally determined contributions (NDC) and SDGs. This first step will give the reader a general idea of how circularity in general can be useful for Malawi.

Activity 3.4: Development of an indicator matrix: Multi-Criteria Analysis
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 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 consultation

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.

1 Analysis of the perceived benefits (activity 3.1)

1.1 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 is at the core. The circular economy is much broader and more extensive than waste management alone, in essence regarding 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, targeting among others reuse or repurposing of products before they become waste. As the scope of this project is explicitly focused on six household waste streams the focus will be on identifying how maximum value for these streams can be recovered or retained as possible, following the principles of the circular economy.

At this moment, a sound waste management system in Malawi is far from being implemented. It is not the policies that are lacking but the practical implementation of these policies, partly due to a lack of appropriate funds for setting up a sound waste system. As a consequence, Malawi faces a very low waste collection rate, a multitude of uncontrolled and unmanaged waste dump sites of which none has properly engineered environmental protection measures implemented. The hope or belief that further privatization will alleviate these issues underestimates the pivotal role that governments play in setting up sound waste management systems including the financing of it.

However, many forms of circularity already take place throughout Malawi. Households normally separate waste that has economic value to them. Waste that is re-usable for other uses such as plastic bottles, jars and containers are also usually separated at source at low income areas. 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 never enter the bin. In rural areas, there is virtually no waste collection, but also very few waste generation. Most waste is reused and if the waste truly has no value anymore, it is burned or buried. In urban areas, however, there are still large quantities of waste that end up in open dumpsites that harm the environment while still having economic value.

Thus, economic necessity leads to very high levels of circular behaviour. 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 waste system, including proper solid waste management, will allow Malawi to extract maximum value from the different waste streams, while reducing health and environmental risks that come with the current waste management practices.

1.2 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 Output 2. Note that this is by no means an extensive list, but it does give an indication about the options towards value products from waste that could be interesting for Malawi.

Waste stream	Products
Plastic	Plastic can be shredded or smelted 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 reused in the primary process, this will require educating aggregators and manufacturers. Additionally, art can be made out of metal and sold as garden art or tourist souvenirs. Additionally, metal can be shredded or smelted to produce new base material or construction material, depending on the quality of the base material.
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 curd 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 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 as food for livestock or for food programmes if the food-waste is of sufficient quality. Other ways to valorise organic waste are: Biogas: • Community biodigester (requires training and devices to utilize/transport gas) • Individual biodigester (requires training and devices to utilize/transport gas). Composting: Composting for cooking (making briquettes) and supply cheap cooking equipment to cook with briquettes, make fertilizer pellets or central composting sites in low-income areas, community owned composting.
Agricultural	Agricultural waste has various options for circularity, because of these options, very little agricultural waste actually exists in rural communities. Some options are: • 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.

1.3 Economic, social and environmental benefit of circularity

The 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. Deliverable 3.2/3.3 and 3.4 will give a detailed overview of the economic, social, environmental and institutional benefits and barriers regarding implementation of circularity per waste stream. This chapter will discuss general benefits, independent of the chosen waste stream.

Economic

Circularity offers potential for the private sector to create profitable economic activities. With the right stimulants, increasing private companies might want to be involved, speeding up the circularity transition. However, if private sector involvement is difficult to create, then more public involvement is necessary, which is often more difficult to organize budget wise. Additionally, circularity offers potential for local businesses as well. Depending on the waste stream and pathway, the value from waste can create jobs for various activities taking place along of 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. Factors like market readiness, existing technologies per waste stream available within the country and capital investment potential, will largely influence the probability of reaching the aforementioned economic benefits.

Social

The social benefits of circularity in Malawi are plentiful. Inadequate waste management activities such as open dumping, which are common throughout Malawi, can lead to the spread of diseases such as cholera or diarrhea. Additionally, our questionnaires showed that people do not like the looks of waste around their neighbourhood and the smell of waste. Additionally, accumulation of waste is blocking rivers jeopardizing Malawi's energy supply, which is dependent on hydro energy. 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. Separation of waste will most likely be necessary to reach economy of scale for recycling and processing options. Additionally the acceptance of jobs in waste management needs to increase.

Environmental

Benefits regarding environmental consequences of circularity in Malawi 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 realise plenty GHG emissions when not handled properly, 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 Africa and will drive up the demand for compost and fertilizer.

1.4 Contribution to NDC and SDG

Note that in report WP2 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 INDC's

The Government of Malawi has described its climate actions and the INDCs in the National Climate Change Management Policy. The Nationally Determined Contributions or NDC's embody the efforts that each country has committed in order to reduce national emissions, in line with the Paris Climate Agreements of 2015. The Malawi's national determined contribution (NDC) is being represented by the NDE of Malawi. This project on circular economy was endorsed by Malawi's NDE as a project to contribute to the INDC.

The report on the INDC expects the total annual GHG emissions to increase from the a level of approximately 29 Mton CO_2 equivalents in 2015 to approximately 42 Mton Gg CO_2 equivalents in 2040. Depending on the development path (as a least-developed country) of the economy and the international capacity building, Malawi estimates that approximately 15 Mton CO2 equivalents can be saved by 2030, i.e. a reduction of about 35% in 2030.

The INDC states that "Management of municipal solid wastes (MSW) is a big challenge to existing and new urban establishments, resulting in the emission of GHGs." In that respect the TA Project may contribute to decreasing the uncontrolled emission of greenhouse gases, although its contribution may be small: the contribution attributed to waste is estimated to be 2% of the total emissions.

The largest potential to decrease waste related emissions are on recovery and use of landfill bio-gas, controlled waste incineration, and composting for organic manure. The potential of such measures is estimated to be around 0.4 Mton CO2 equivalent by 2025, provided sufficient external support is available.

Contribution to SDG's

The VNR (Voluntary National Review) reports general progress on all SDGs but a specific focus is given by Malawi to Health (SDG3), Education (SDG 4), Gender (SDG 5), Clean Water and Sanitation (SDG 6), Sustainable Cities (SDG 11), Climate Change (SDG 13) and Strong Institutions (SDG 16). Of the SDGs mentioned as the core attention of this TA Project only SDG13 is specifically mentioned. The focus of activities in and monitoring of SDG13 is the prevention of casualties caused by natural disasters and to improve the data infrastructure and warning systems. No specific activities related to (bio)waste management and landfills are mentioned.

The SDGs are implemented through the country's overarching medium-term national development strategy known as the Malawi Growth and Development Strategy (MGDS) III.

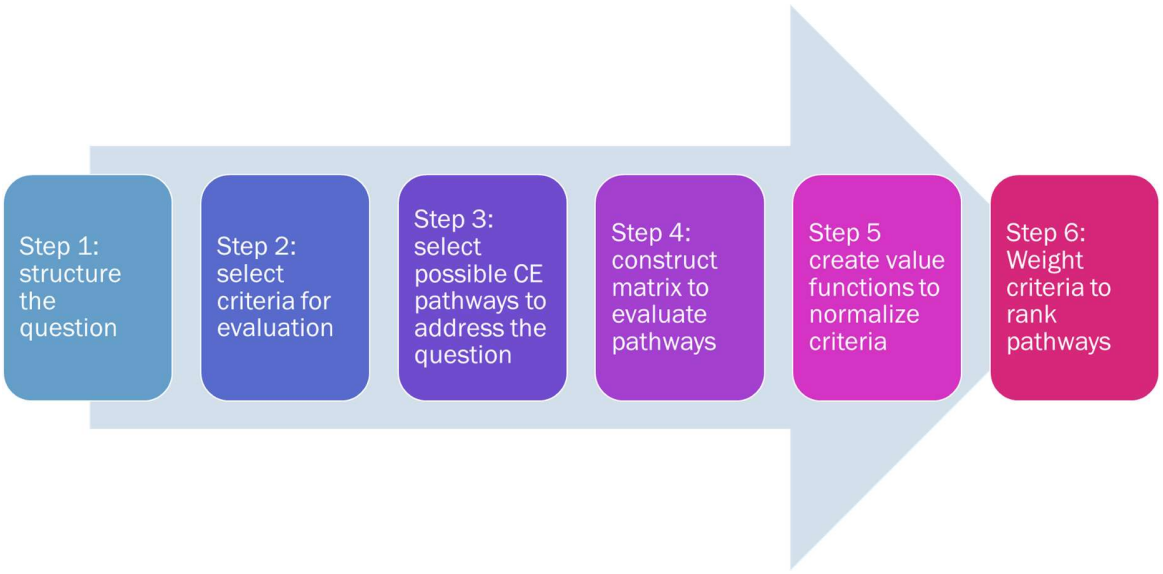
Though the TA focus is on the contribution to SDGs 9,12 and 13, Malawi's activities in the framework of the SDGs focus on other SDGs indicated above. Activities related to SDG12 are not specifically reported. In itself the position for SDG12 is understandable: as the Malawi economy will develop (and thus improving on a number of SDGs, such as SDG1), it can be expected (and even hoped for) that this will lead to significant increases of the domestic material consumption, thereby counteracting target 12.2.

However, this TA has the potential to address other SDG's that were mentioned in the VNR:

- SDG2 Zero Hunger: reduce harvest and food losses along the supply chain
- SDG3: Good health and well-being: preventing (toxic) waste improves the state of health
- SDG11 (Sustainable Cities and Communities) is mainly aimed at improving the living conditions in the slums that emerged as a consequence of fast urbanization. In order to achieve this one of the indicators is set up to monitor the "proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated by cities". As the VNR states, the current level of regular collection and decent disposal is about 30%.

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

For the development of a transparent indicator matrix, the Multi Criteria Analysis methodology was chosen. Multi-Criteria Analysis 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 contribute on 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 in the rest of the project?”

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.

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 Annex 4.

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

MALAWI	plastic	metals	paper	glass	organic waste	agricultural waste
Normalized Weighted Ranks	9,6	5,1	6,5	4,7	9,6	10,0

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

This chapter discusses 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. There are some key dynamics that play a role in the SWOT analysis for each waste stream, these are discussed below and aim to provide a brief summary of the key characteristics of Malawi's current waste system. For more information about the current waste system, we refer the reader to the WP2 sub report.

Malawi is an agricultural society with over 80% of the population working in the agriculture sector. This makes the economy sensitive to, particularly climate, shocks. Around 70% of the population lives below the poverty line of 1.90$ per day. Urban areas house about 20% of the population, however the border between urban and rural area is much less clear than in surrounding countries such as Zambia and Zimbabwe. Malawi is experiencing rising urbanization, a growing middle class, changing consumer habits and production patterns, all driving increasing waste amounts. Lilongwe the Capital City is growing at an average rate of 4% per year.

Public authorities, in general, experience difficulties providing basic services (food, housing, education, sanitation), and as such waste management is rarely a priority. Waste collection rates are at 30% and only around 4% of the collected waste is recycled, with the remainder deposited at solid waste disposal facilities. Waste that is not collected is either burned, buried or dumped in the environment, which leads to land and water pollution from accumulation of waste and air *pollution* from burning waste. This accumulation of waste is hindering the nations power supply which is mainly hydro. While access to sufficient energy is an enabling factor to fight poverty. At this moment only 11,4% of the population has regular access to electricity.

The waste that ís collected by local authorities is mixed waste, since there is no capacity for separate collection. Some private companies do separate collection and collect organic waste as input for their feedstock. They provide households with financial incentives to separate their organics. Separation is rarely taking place at the household level. If waste is separated, this is mainly organic waste to use for composting, fertilizer or biogas. Waste pickers are the main form of separation on dumpsites and landfills. However, waste pickers cannot aggregate sufficient volumes to sell on the market directly. As such, in Malawi an intermediary sector has emerged of Waste Transfer Centers and more informal aggregators of waste from which many of the recyclers buy. Hence, the pickers are dependent on these middle men, waste aggregators that buy up various waste streams and accumulate until sufficient volume is achieved to sell.

According to country environmental analysis carried out by World Bank, Malawi has the necessary legislation to make waste management work, but financial constraints, inadequate service coverage and operational inefficiencies, ineffective equipment, inadequate landfill, and limited utilization of recycling initiatives are all found to be challenges to the infrastructure of waste management systems in Malawi. These gaps in service relate not merely to availability of infrastructure and investments, but also to inappropriate management of the service once this is in place. This prevents policy surrounding proper waste management from being implemented in practice.

3.1 Plastic waste

Status Quo	Potential
Strengths: – Value of products from waste is high – Large volumes that are expected to increase with urbanization – Strong plastic legislation including banning of plastic bags by Supreme Court in 2019 – Availability of a better developed upstream value chain with stakeholders specializing in different forms of valorization – Presence of plastic manufacturers who are willing to increase plastic recycling	**Opportunities**: – High potential for local businesses and the informal sector, leading to job creation – High potential to contribute to climate mitigation and adaptation – High potential to align public and private agendas – Potential for internal industry for plastics – Potential for high value recovery (deposit schemes, EPR) – Large SADC market for export of valorized products – Plastic now often contaminates organic waste. Separating plastics also provides opportunities for being able to valorize organics – Creates economic damage (e.g. clogging of waterways, hydro power), opportunity for additional benefits
Weaknesses: – Plastic is not separated at all and often burned or disposed of in the environment – The number of plastic manufacturers is limited, even though they are there – 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 – Inadequate national data on plastic (imports, exports) – Burning of plastics creates huge health effects	**Threats**: – Social status of people working downstream in the plastic industry is low – Contamination with organics can prevent efficient recycling – Mixing of different types of plastic hinders recycling – Importing technology/machinery is difficult and expensive due to policy (taxes) – Lack of commitment to enforce policies and legislations including local authority bi-laws on waste management

Strengths

The volumes of plastic waste is relatively high compared to metal, paper and glass. Due to the growing population, urbanization and the growing middle class the volumes of plastic waste is expected to increase significantly over the past 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. Plastic waste stream has players in each stage of the value chain even though more players are expected to join in. This create a good platform to mainstream circularity in the plastic waste sector.

Weaknesses

In current practice very few people are separating their plastic waste. Some plastic waste is collected to dumpsites, while a lot of plastic waste is dumped in the environment leading to accumulation in rivers and lakes blocking electricity production. Plastic is also burned or buried, which poses both environmental and health risks. At this moment there is hardly any internal industry for recycled plastics. The small amount of plastics that are recycled, are often exported in bulk and recycled abroad. Higher value plastic handling is inexistant, except for in-house reuse in low income areas. Currently plastic mismanagement leads to severe health effects, mostly due to burning and environmental effects due to degrading.

Opportunities

Due to the growing volumes and the relative high value and advanced international practices of plastic processing, there is high potential for the complete value chain from local businesses to informal workers to the private sector. All these parties have a different role to play in the value chain. Informal workers can collect plastic from households or from dumpsites, and sell it to aggregators (local businesses), who can then sell it to an internal private sector recycling industry for plastics. Other opportunities are to implement deposit schemes (e.g. for PET bottles), or other extended producer responsibility schemes regarding plastics. Moreover, separating and recycling plastics also gives opportunities for cleaner organic streams, allowing for double valorization.

Threats

The social status of people working in plastic waste management downstream the value chains (such as waste pickers) is low. When the internal industry for plastic grows, this will create the opportunity for jobs all along the value chain. However, there might be unwillingness to fill the need of downstream jobs if the attitude towards- and safety of waste pickers is not improved. Additionally, proper separation or cleaning mechanisms are essential to prevent plastic from being contaminated with organics beyond repair. Additionally, it is important to separate the different types of plastics which are often mixed. Furthermore, lack of commitment to enforce policies and legislations including local authority bi-laws on waste management is a threat to positive behavior change towards waste that is anticipated. The current policies complicate the import of needed machinery and technology.

3.2 Metal waste

Status Quo	Potential
Strengths: – Households are willing to separate and/or store metal – Easy to separate unlike organic or plastic waste – Perception of metal waste as a resource by stakeholders is higher than all other waste streams – Value of metal such as aluminium and copper is high – There is an internal steel recycling sector	**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 Malawi develops, metal waste will increase (second hand cars, large household appliances and so on) – Decrease health risks – There is an export market for metal – There is very high internal demand for metal
Weaknesses: – There is no internal industry for (non-steel) metal processing in the country – The metal waste stream is small – Handling metal can be dangerous and is heavy – Little opportunities for gender equality – Does not greatly contribute to climate mitigation or adaptation	**Threats**: – Internal industry will require large amounts of unavailable energy – Dependency of global metal prices and export arrangements – Very limited potential for job creation, since the stream is small and an internal industry will most likely not emerge – There is a thriving black market

Strengths

The value per ton of metal waste is quite high, specifically aluminium. 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. Perception of metal waste as a resource by stakeholders is higher than all other waste streams. For steel, the country already shows to have an internal recycling industry.

Weaknesses

There is no significant internal industry for non-steel metal processing within Malawi. This means that all non-steel metal waste needs to be exported, limiting the profit that can be made out of metal waste. Additionally, the metal waste stream in Malawi as of this moment is small and handling metal waste can be dangerous. Because of the dangerous reputation of metal waste and the heavy weight of the material, as well as the fact that it is considered to be a man's job, the metal waste stream holds limited potential for gender equality. Furthermore, the metal waste stream does not offer opportunities for climate mitigation or adaptation, since end of life processing requires a lot of energy which is currently not readily and consistently available in Malawi.

Opportunities

As Malawi develops, the metal waste stream is expected to increase in volume. For example second hand cars or large household appliances will increase in volume and at the end of their life this results in large volumes of metal waste. Since the value per ton of metal is quite high, it does offer potential for an internal market focused on aggregation and export. Currently, there is already very high demand domestically and this will probably only increase with economic expansion. Moreover, there is a promising export potential for this waste stream as well. Households on a larger scale might be willing to sell their metal waste to waste collectors, who can then sell it to an aggregator taking care of transport. 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.

Threats

It is unlikely that an internal industry for processing metal will emerge soon, due to several reasons: (i) the waste stream is relatively small, (ii) processing metal waste requires large quantities of energy which are currently not readily available in Malawi, and (iii) knowledge on technology for metal processing is not widely available. Therefore, large changes and investments are needed before this waste can be handled properly. And even if this would be set up, it should have to compete with a thriving black market. Thus, there is predominantly potential for a more downstream value chain (waste collection, aggregation and export). But this will result in limited potential for job creation since the stream as relatively small and it is no likely that an internal industry will emerge. This means that for processing of metal waste, Malawi will be dependent on global metal prices and export arrangements.

3.3 Paper waste

Status Quo	Potential
Strengths: – Using paper products from recycled material is normal – Availability of small scale recycling CBOs – Availability of large quantities of paper from households	**Opportunities**: – Potential for gender equality – Volume and value will increase (mainly increase in cardboard boxes, etc) – Potential for local businesses, the informal sector and thus job creation, dependent on private sector – Potential for private sector and upstream value chain development – Paper processing requires relatively little energy and is relatively easy to recycle – Potential for GHG reduction due to import reduction
Weaknesses: – No separation of most of the paper waste leading to being contaminated by organic waste – Willingness to separate at household level is currently low – Minimal impact on climate adaptation and mitigation – Very small internal paper industry – Negative health impacts from burning paper in households – Lack of awareness of the value of the waste stream	**Threats**: – Low knowledge capacity on existing processing technology within the country – Availability of investment capital might be limited – Separation and collection levels need to increase for future industry to be profitable – Waste water management from recycling needs huge capital investments

Strengths

Using products from recycled paper is quite normalized within Malawi. Behavioral acceptance towards products from paper will thus not be an issue. There is enough volume of paper waste to sustain recycling businesses, it only needs to be separated at source and during transportation.

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. Otherwise, it is burned in households which poses negative health effects. This lack of separation at household level can be due to the lack of awareness of the value of the waste stream. Additionally there is only a very small internal paper industry and much of the paper that ís collected, is aggregated and exported. Lastly, 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. It also not contributes to sustainable food security, which will be an important topic for Malawi regarding climate adaptation.

Opportunities

The paper waste stream holds quite some potential in Malawi. Due to urbanization and a growing middle class, the amount of paper waste (mainly from cardboard boxes, packaging) is expected to increase over the next decade. As of this moment, there is only a small internal paper industry, however, there is a huge potential since paper recycling is relatively easy and does not require large energy intensive and complicated processes (as is the case for glass and metal). Moreover, recycling could greatly reduce the amounts of imports needed, reducing corresponding GHGs (now a lot of paper comes from China, India). Giving a value to clean paper will increase the volume of a clean waste stream. This thus offers potential for job creation in all levels of the value chain, from waste pickers, to local businesses (such as aggregators) and processors. Additionally, paper is easy to handle so it also offers opportunities for gender equality in all levels of the value chain.

Threats

As of this moment there is only a very small internal paper industry. To handle paper in a more circular way, Malawi needs to develop an internal paper industry. However, there is limited knowledge on existing processing technologies within the country. Malawi will thus be partly dependent on expertise (and willingness of companies to do business in Malawi) from abroad. Additionally, for paper waste recycling it is important to handle the waste water, which can be difficult and capital intensive. The value chain needs to be created from scratch, which might limited the willingness of parties to invest in the beginning. Additionally, separation and collection levels of paper need to be improved to have a growing and profitable paper industry. Now paper waste is not separately collected (if collected at all) and thus contaminated with other waste such as organics, decreasing the value of paper waste. The paper that is not collected is currently burned or buried.

3.4 Glass waste

Status Quo	Potential
Strengths: – There is value in circularity options for glass (remanufacture, recycle) – Local acceptance of glass reuse	**Opportunities** – There is value in glass products, so better management of glass can increase income – As Malawi develops, glass waste will increase – Glass can be recycled perpetually if separated properly
Weaknesses: – There is no internal industry for glass processing in the country – The glass waste stream is small – Handling glass can be dangerous and is heavy – Little opportunities for gender equality – Does not contribute to climate mitigation or adaptation – Separation and collection of glass is more difficult than for other waste streams (such as organics or plastics)	**Threats**: – Internal industry will require large amounts of energy – Dependency of global glass prices and export arrangements – Limited potential for job creation, since the stream is small and an internal industry will most likely not emerge – Lack of designated landfill to streamline management of this waste – Inadequate industries to scale upstream activities along the waste value chain

Strengths

There is value in glass remanufacturing or recycling, although not as high as metal or plastic. Supported take-back system for reuse of glass instituted by breweries and beverages industries is available. However this is only limited glass bottles in beverages and beer industries.

Weaknesses

As of this moment there is no internal industry for glass processing within the country, and the limited amount of glass that ís collected is mainly exported for recycling. Additionally, the glass waste stream is small and difficult to handle, it can break easy 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. There is also no take-back system for glass, e.g., beverage bottles. 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

As Malawi develops, the glass waste stream is expected to increase in volume, e.g., single use glass bottles from imported beverages. So better management of glass waste offers some potential for job creation. If separated properly, glass could potentially be recycled perpetually, giving a high circularity potential.

Threats

It is unlikely that an internal industry for processing glass will emerge due to several reasons: (i) the waste stream is relatively small, (ii) processing glass waste requires large quantities of energy which are currently not available in Malawi, and (iii) knowledge on technology for glass processing is not available. Thus, there is only potential for a more downstream value chain (waste collection, aggregation and export), which will result in limited potential for job creation since the stream as relatively small and difficult to handle. This means that for processing of glass waste, Malawi will be dependent on global glass prices and export arrangements.

3.5 Organic waste

Status Quo	Potential
Strengths: – Large volumes of organic waste generated at household level – Already existing value chain – Use of circularity products is somewhat normalized – Willingness to participate in the waste stream is high (NGOs, private sector and local authorities)	**Opportunities**: – High potential for climate mitigation and adaptation and NCRE – 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 – Increased demand of organic fertilizer and as a result of growth of agriculture sector
Weaknesses: – Social status of people working in organic waste is low – Current separation and collection levels are insufficient to scale – Waste often polluted with plastics	**Threats**: – Limited knowledge on state of the art technology – Without better collection and separation there will be no larger scale solutions possible – Relatively poor country, might pose challenges in ensuring sufficient investment capital – Threat to public health – Competition with chemical fertilizer – Food waste varies in type and quality, hindering the direct applicability to biogas production – Scaling of organic composting activities is hindered by the subsidies for chemical fertilizer – High bureaucracy in governmental institutions hinders innovation and scaling of valorization

Strengths

Organic waste is available in large quantities throughout Malawi 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 brickets out of organic waste. Usage of these products (although often not originating from waste just yet) is quite normalized throughout Malawi.

Weaknesses

The social status of people working in organic waste is extremely low, 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. 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 cell to businesses themselves, is collected or dumped with other waste, making separation virtually impossible. Sometimes the organic waste is burned, releasing GHG emissions. Moreover, the lack of separation means organic waste is often very polluted, with mainly plastics. This hinders valorisation.

Opportunities

The organic waste stream holds great potential for climate mitigation and adaptation as well as for generation of non-conventional renewable energy through biogas. 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. A changing climate will result in issues with food and water security in Malawi, meaning that efficient ways to deal with food resources will become a priority. Circularity pathways for organic waste can help in adding to this food security. Additionally, since there are large volumes of organic waste not being used, it holds great potential for job creation of both local businesses and the private sector. Products of organic waste can either be sold in Malawi itself, where due to a growing population *and* growing middle class the market for products might increase, or can be exported abroad. 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

Limited knowledge of state of the art technology can be an issue when trying to make high value products from organic waste. The varying character of the waste coming in, can also make it difficult to sustain a steady stream of quality of the products. Additionally, the current separation and collection rate is a real threat to exploiting the potential of the organic waste stream. Incentives and storage bins should be provided to households to separate organic waste, as well as separated collection of waste. It is very difficult to pick organic waste from dumpsites, so better separation and collection are key here. Further, since Malawi is a relatively poor country, this might pose challenges in ensuring sufficient investment capital and attracting foreign investors. The process for approval of handling this waste takes long and might discourage investors. In addition, the subsidies for chemical fertilizer that are currently in place hinder the market entry for organic fertilizers such as compost. This is a big threat to organic waste valorization. Lastly, although this applies to all waste streams, particularly for organic waste bureaucratic hinder the potential for converting the waste into valuable products, as these processes are tedious and thereby expensive.

3.6 Agricultural waste

Status Quo	Potential
Strengths: – Large volumes – Already existing value chain – Use of circularity products is normalized – Much is already processed on the farm itself	**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 – High potential for other products such as briquettes
Weaknesses: – Social status of people working in agricultural waste is low – Current collection levels are insufficient to scale (no infrastructure at all) – Lack of awareness of the value of agricultural waste	**Threats**: – Limited knowledge on state of the art technology – Without better collection there will be no larger scale solutions possible – Relatively poor country, might pose challenges in ensuring sufficient investment capital – Hesitant to use as organic fertilizer, because of fear for spreading pests and diseases that were present in the previous plants – Subsidies for chemical fertilizers hinder market entry for organic fertilizers

Strengths

Agricultural waste is available in large quantities throughout Malawi and there is already a (small) existing value chain surrounding agricultural waste handling. Over 80% of Malawians are involved in the agricultural sector and even in urbanized areas there is quite some agricultural activities. Some local businesses or private sector companies make fertilizer, biogas, compost or cooking brickets out of agricultural waste. Usage of these products (even though now often not originating from waste) is quite normalized throughout Malawi. In rural areas, it is seen that quite substantial volumes are already reused or valorised on the farm directly, leading to quite high circularity scoring.

Weaknesses

The social status of people working in agricultural waste is a bit low, 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 with agricultural waste. The biggest weakness of the current agricultural waste system is that there is virtually no separation or separate collection, meaning that all agricultural waste that households don't reuse within their farm, compost or cell to businesses themselves, is collected or dumped with other waste, making separation virtually impossible. Sometimes the agricultural waste is burned, releasing GHG emissions. Burning the agricultural waste is also partly due to the lack of awareness of the value of the waste and lack of knowledge for other usages.

Opportunities

The agricultural waste stream holds great 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 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. A changing climate will result in issues with food and water security in Malawi, meaning that efficient ways to farm will become a priority. Circularity pathways for agricultural waste can help in adding to this food security. Additionally, since there are large volumes of agricultural waste not being used, it holds great potential for job creation of both local businesses and the private sector. A range of products can be made, such as briquettes. Products of agricultural waste can either be sold in Malawi itself, where due to a growing population *and* growing middle class the market for products might increase, or can be exported abroad. Furthermore, since large amounts of agricultural waste become available around the same time (after harvesting), this does hold potential for large scale collection also to rural areas that might be not economically interesting to reach for other types of waste collection. This waste stream also holds potential for alignment of public and private agendas, since it can improve hygiene and prevent disease outbreaks, while also improving soil quality, 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

Limited knowledge of state of the art technology can be an issue when trying to make high value products from agricultural waste. The varying character of the waste coming in and the timing of waste (depending on harvest season), can also make it difficult to sustain a steady stream of quality of the products. Additionally, the current collection rate and lack of collection infrastructure is a real threat to exploiting the potential of the agricultural waste stream. Moreover, the fact that much is already being reused could pose a threat to achieving the right volumes. To potentially scale, incentives should be provided to farms to store agricultural waste, which could lead to unintended GHG emissions. Furthermore, using organic waste as fertilizer is not always seen as a good option, it is perceived as a risk due to spreading diseases and pests. Therefore, the actual value of this waste stream is not appreciated. Since Malawi is a relatively poor country, this might poses challenges in ensuring sufficient investment capital and

attracting foreign investors. Lastly, the subsidies for chemical fertilizer that are currently in place hinder the market entry for organic fertilizers such as compost. This is a big threat to organic waste valorization.

3.7 Conclusions

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

For plastics, the main reasons for this high potential are that there is already a developed downstream value chain for plastics to be built upon. Additionally, the stream is sufficiently large to be profitable and expected to increase, plus the value of plastic waste is relatively high. However, there is hardly any internal industry for processing plastic waste and most plastics are exported after aggregation. 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 organic and agricultural waste stream, the high potential is mainly due to the high volumes of organic and agricultural waste that is generated in Malawi as well as the amount of urban and peri-urban farming. This results in large quantities of organic and agricultural waste being available in various areas. The use of products that could also be made out of these waste streams (fertilizer, cooking pallets, manure, biogas) is already quite normalized. However, for these waste streams 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 these waste streams is lacking and could hinder to market uptake.

That plastic, organic and agricultural waste currently hold the most potential for circularity, does not mean it is not worth considering boosting the other waste streams. It might also make sense to choose the metal, paper or glass waste stream since these are still underdeveloped. However, one should realize that more effort will be needed to develop these waste streams towards circularity in an economic attractive manor than for plastics, organic or agricultural waste. For both metal, paper 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.

4 Stakeholder meeting on prioritization of waste streams (activity 3.5)

STAKEHOLDER MEETING REPORT

28TH OCTOBER 2021
CROSS ROADS HOTELS, LILONGWE, MALAWI

4.1 Introduction

This report is made in line with Activity 3 of the CTCN response plan requested by the Malawi National Designated Entity on the Assessment of the current status of the circular economy in the waste sector for developing a waste stream specific roadmap for Malawi. The report was drafted by TNO in collaboration with Sustainable Inclusive Business-Knowledge Centre as the local consultants in the development of the response plan.

The meeting served as a validation workshop for the Malawi stakeholders to deliberate on the status of waste management in the country as well as to make a consultative decision on a particular waste stream that Malawi would like to prioritize for the development of a national roadmap and the conceptualization of a pilot project. The meeting was attended by 19 stakeholders drawn from civil society, government agencies, and private sector.

4.2 Opening Remarks

The meeting was opened by Professor Elijah Wanda, giving a brief overview of the National Commission of Science and Technology as well as the value of the project in streamlining circularity in the country. Also, during the session the Acting Director General for the Malawi Environmental Protection Authority (MEPA) Mrs Tawonga Mbale-Luka sent an emissary to give her speech which echoed support of the project including rallying stakeholders to fully support the project by being open and fully participating in the deliberations. The representative from MEPA mentioned the timely assessment on the National Waste Management System as well as Clean-up Day Initiative as just some of the activities the government is implementing for circular economy and waste management.

Opening words by Professor Elijah Wanda, NCST

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

The presentation was made by Mr. Paul Oosterkamp as the project manager (TNO) for the project assisted by Mr. Ebenezer Amadi, (SIB-K). They presented on the project timelines as well as the juncture where the project

is at the particular time. The overview of the project was shared including mentioning the fairly low stakeholder responses from the questionnaire shared. It was mentioned project touches on SDG 1,2,3,6 and 13.

4.4 Summary of Activity 2: Baseline assessment of the status quo of household waste management and circularity in Malawi

The summary of the activity was facilitated by Mr. Andrew Chinyepe from Zimbabwe who is the local consultant in charge of Malawi. The following is a summary of key issues identified from the primary and secondary data collected and analysed. The data was collected in low-, middle- and high-income areas in Lilongwe, Blantyre, Mzuzu, Dowa, Chikwama, Nkhata Bay.

Key Highlights

- The urban environment in Malawi is experiencing major challenges in managing MSW due to rapid population growth, lack of capacities with local governments leading to poor waste collection, recovery and disposal systems.
- On a broader scale, the circular economy as an intentional economic system is only very partially developed in Malawi. There are very little incentives in place that steer towards value retention processes.
- However, there is quite some market activity around the recycling of plastics and valorisation of the organic waste stream, showing some circular activity such as composting, production of fertilizer and biogas. However, no full-scale markets exists, mainly pilots and individual entrepreneurs.
- Malawi is estimated to produce less than 3.1 million tonnes of waste annually.

Waste Generation, Separation and Collection

- The most abundant waste stream in Malawi is organic waste, at 82%. This is followed by plastics (7%), paper (4%) and glass and metal (only ~1% of the total).
- Collection rates are very low and collection is infrequent. Local authorities do not have the resources to collect waste frequently.
- A significant number of households ±30% separate some waste, but this can only be collected by private parties as there is no separate collection by local authorities.
- Since the livelihoods and consumption patterns of people in cities and towns are still quite similar, there is no significant difference in volumes (expressed in kg/person per year) generated between the larger cities and smaller municipalities and towns.
- In rural areas waste is not collected at all and people dispose of waste by burying, dumping or open burning.
- Waste pickers are the main form of separation on dumpsites and landfills. However, waste pickers cannot aggregate sufficient volumes to sell on the market directly, so they make use of aggregators and Waste Transfer Centres.

High and low incomes

- Difference between waste handling between high- and low-income areas is that for low-income areas the necessity for in-house reuse and recycling is very high. Only when something really does not have any value anymore, it will be thrown away. In other words, there is actually quite a high adoption of circular practices. The same pattern is seen in rural areas.

Private Players

- There is need for incentives in the waste sector in order to support companies and entrepreneurs in the sector for their products to be completive.

Issues communicated on the data collection

- Academic responses were low
- Comparison data on waste generation in different towns
- Investigate mode of waste collection
- No reliable data on gender in waste
- Waste management policies are archaic
- E-waste is an issue of concern but falls out of the scope of this project

4.5 Summary of Activity 3: Strengths Weaknesses Opportunities and Threats (SWOT) Analysis

Ms Naomi Montenegro Navarro from the TNO research team presented the initial findings from the SWOT analysis for the different waste stream under focus. After going through the SWOT for each waste stream Ms Naomi presented the preliminary conclusions from the research that for the Malawian context plastics, organic household waste and agricultural waste show the largest opportunities for circular economy action and improvement of the waste management system.

The session was consultative, and sticky notes were used to gather comments from stakeholders, as well as discussing several of the comments by the stakeholders directly during the meeting, so as to enrich the information gathered. The outcomes of the SWOT can be found in the attached presentation. The following additional comments were shared by the stakeholder during the session:

Plastic

- More awareness creation is needed on the economic value of plastic waste
- Development of a fund to spur development of innovation and inventions in valorisation of plastic waste
- Review curriculum to ensure the young people appreciate the value of waste and see it as a resource

Glass

- There is currently increase in single use glass beverages
- Scaling for glass recycling needs to be supported

Metal

- There are actually four companies operating in metal waste recycling plants (working on steel)
- The demand for the waste is high in both national and local quarters
- Black market for the waste is thriving.

Paper

- Paper importation from China and India results to GHG contributions
- Package paper is a big contributor to waste
- Waste water treatment is an issue in paper waste recycling

Organic

- Citizens have a lot of knowledge to scale circularity in the waste stream
- Institutional bureaucracy has discouraged inventions and innovations from young people. This is a threat to all waste streams, actually
- A lot of waste is already there to be valorised
- Administration units could serve as collection platforms

Agricultural

- Opportunities to expand the waste to scale agricultural productivity in an organic manner
- There are opportunities to expand knowledge on small scale circular economy at the household level
- They can be used to feed livestock in the event animal feeds are not available
- This waste can be used as a fertilizer in the event chemical fertilizer is not readily available

4.6 Focal Group Discussions

To further provide a vision for the future of waste management in Malawi, 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, glass and plastics. The results of this exercise will contribute to the to be developed roadmap. Many interesting visions were set and remarks and suggestions were made, among others:

Glass and Metal Waste

- Separation at source should be ambitioned at 99% in urban areas and 90% in rural areas by 2035
- Shift from execution by NGO's to private parties and local businesses
- Acceleration of public private partnership to spur investments
- Enhancement technology transfer from the developed countries
- Development of bylaws that make it mandatory for waste separation at source
- Economic incentives: reduction of taxes, tax waivers, capital investments tax breaks etc.

Focal group discussions on organic waste

Agricultural and Organic Waste

- Waste separation at source is key
- More private sector players in the value chain necessary
- Infrastructure and investments are viable i.e., mechanization
- Policy regulation and implementation is being felt and seen i.e., public private partnership law
- Enhanced capacity for local councils to enforce the law

- Biogas and digesters established countrywide

Paper and Plastics

- Increase in recycling crucial
- Upgrading possible of plastics to become pavers
- Pyrolysis is a common industrial process that could be replicated
- Media has mainstreamed waste management issues to become a national debate where action is bottom- up
- Investment in human resources to develop a knowledgeable economy
- Policy interventions: single Use Plastic ban
- Enhanced budget and allocation for waste management

Based on the discussion, a few common issues became apparent. First of all, that in the transition from the current to a circular, sustainable waste system technology is not the key issue. The technology is usually available. The key issues lies in the lack of (financial) capacities, the lack in policy enforcement, the high levels of bureaucracy, and the lack of private sector development (much is done by NGO's only). Moreover, underlying any potential form of recycling, a well-developed separation and collection system is necessary, as this is currently lacking. There is a key and active role for the local authorities to play here, to develop the necessary infrastructures, awareness and capacities.

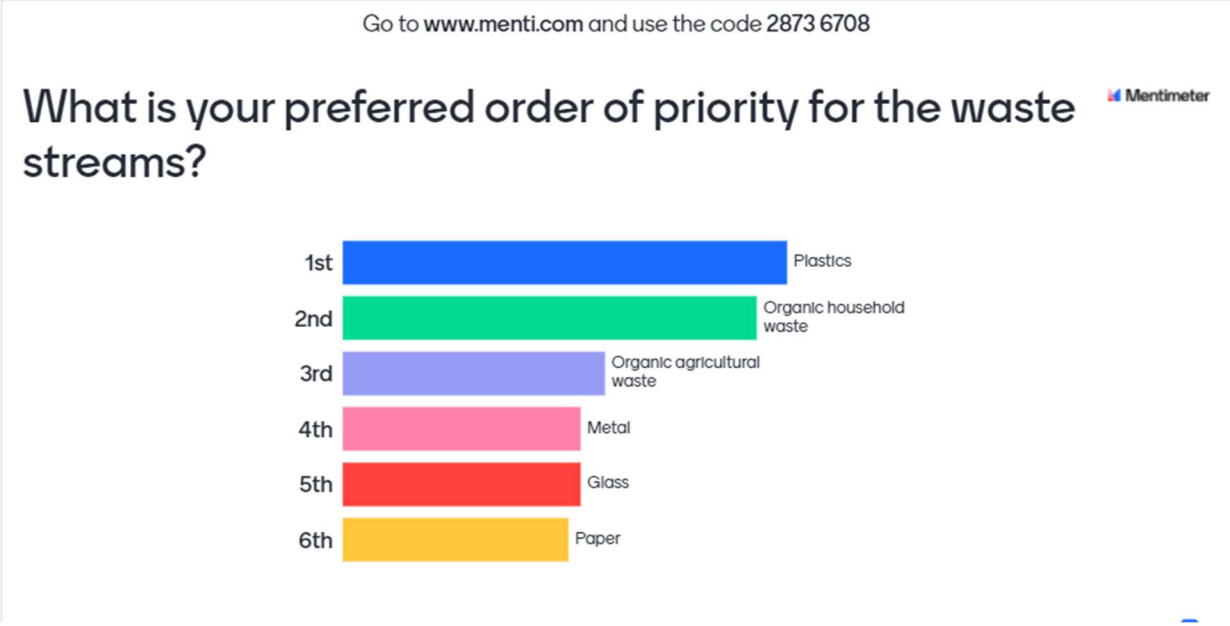
Focal group discussion on plastics and paper

4.7 Prioritization of the waste streams

After the Focal Group Discussions a voting session was held, facilitated by mr. Lyson Kampira, to get the views of the stakeholders in the room on the prioritization of the waste stream. The voting results showed plastic as the most voted waste stream, followed by organic waste and agricultural waste respectively. Following, mr. Kampira facilitated discussion and asked for comments from the stakeholders in the room on the outcome. The discussion was mostly between plastics and organics. Although the volumes of organics are much larger, remarks were made that due to the lack of processing opportunities, the large economic damage caused by plastic waste and the persistent nature of plastic waste, it would be most opportune to focus on this waste stream instead of

organics. In the end, there was a general agreement that plastic waste will be chosen as the waste stream to prioritize for the development of pathways as well as the pilot concept.

Results of the voting session



A Photos


ORGANIC

B List of participants

Registration participants Stakeholder Workshop on the Development of a Circular Economy Roadmap in the Waste Sector in Malawi, Linlongwe, 28 October 2021

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C Programme

Agenda for the Stakeholder Workshop on the Development of a Circular Economy Roadmap in the Waste Sector in Malawi
Crossroads Complex Mchinji Roundabout Lilongwe, 28 October 2021

Time	Activity	Responsibility
18 October 2021		
09:00-09:30	Arrival & Registration /Coffee Tea	TNO
09:30-09:35	Welcome, Introductions and Objective of Workshop	TNO
09:35-09:40	Openings remarks	Professor Mr. Elijah Wanda, NCST
09:40-09:45	Opening of the meeting	Mrs Tawonga Mbale-Luka, Ag. Director General, MEPA
09:45-10:00	Overview of the CTCN Circular Economy Project and progress to date	Paul van den Oosterkamp – TNO/ Ebenezer Amadi – SIB-K
10:00-10:45	Summary of Activity 2 : Analysis of household waste streams and circularity	Mr Andrew Chinyepe
11:45-11:00	Discussion/Q&A	All
11:00-11:20	Tea & Coffee Break	
11:25-12:40	Presentation of SWOT analysis on circularity routes per waste stream + feedback and discussion	Ms Naomi Montenegro Navarro, TNO
12:45-13:45	LUNCH	
13:50-13:55	Introduction Focal Group Discussion	Ms Naomi Montenegro Navarro, TNO
13:55-14:30	Focal group discussion	All
14:30-15:00	Presentations from focal groups	Per group
15:00-15:30	Prioritization of the waste stream	Ms Naomi Montenegro Navarro
15:30-15:45	Closing Remarks	Paul van den Oosterkamp
15:45-16:00	Tea and Departure	

D MCA analysis

MALAWI	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 returing the packaging to get their deposit back.	4	(+)	(-)	(+)	(-)	(+)	(++)	General: in low incomes areas all waste that has value is reused quite a bit, it only becomes waste when there is no use for the product anymore. Limited space in houses forces households to dump both organic and inorganic waste. In high income areas, people are less willing to change their behaviour, however they can afford to contribute to a deposit system. Plastic: there is some internal industry and thus using the products is already normalized, meaning there is some behavourial acceptance, so (+) is the score. Metal: no internal industry, thus no normalized use of this waste, so (-) is the score. Paper: there is some internal industry and thus using the products is already normalized, meaning there is some behavourial acceptance, so (+) is the score. Glass: no internal industry, thus no normalized use of this waste, so (-) is the score. Organic waste: there is some internal industry and thus using the products is already normalized, meaning there is some behavourial acceptance, so (+) is the score. Agricultural waste: behavioural acceptance towards agricultural waste is highest, since it is a agricultural society, so (++) 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	(-)	(-)	(-)	(-)	(---)	(-)	General: social status of waste workers is generally low, especially downstream (waste picking). Plastic: there is a quite good value chain for plastic and the status for handling this waste is a bit higher, so (-) is the score. Metal: no developed recycling chain and thus low social status, so (-) is the score. Paper: small scale paper recycling, but value of this waste stream is low, thus low social status of waste workers, so (-) is the score. Glass: handling glass is dangerous resulting in lower social status, so (-) is the score. Organic waste: it is considered dirty and smelly, so handling this waste has a very low social status, so (--) is the score. Agricultural waste: handling this waste stream is more normalized than organic waste, due the large agricultural sector, so (-) is the score.
	willingness to separate waste at source (household level)	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.	3	(-)	(-)	(--)	(-)	(+)	(+)	Plastic: separation is difficult, due to lack of organization and space to store waste in households, so (-) is the score. Metal: although there is some willingness to separate, separation is difficult, due to lack of organization and space to store waste in households, so (-) is the score. Paper: low value of the waste leads to very low willingness to separate this waste stream and sacrifice space in their houses, so (--) is the score. Glass: separation is difficult, due to lack of organization and space to store waste in households, so (-) is the score. Organic waste: better waste separation, many people compost this waste stream (especially residential or rural areas where people have the space to do so), so (+) is the score. Agricultural waste: better waste separation, many people compost this waste stream (especially residential or rural areas where people have the space to do so), 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: women are already heavily involved in this waste stream, holding great opportunity for gender equality, so (++) is the score. Metal: handling this waste stream is heavy and dangerous, therefore there is very low potential for gender equality, so (--) is the score. Paper: women are already heavily involved in this waste stream, holding great opportunity for gender equality, so (++) is the score. Glass: handling this waste stream is heavy and dangerous, therefore there is very low potential for gender equality, so (--) is the score. Organic waste: women are already heavily involved in this waste stream, holding great potential for gender equality, so (++) is the score. Agricultural waste: women are already heavily involved in this waste stream, holding great opportunity for gender equality. Additionally, the high volume of this waste streams creates even more potential for women involvement, especially more involvement in the upstream value chain creates opportunities, 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: some possibility for combustion, this will at least prevent open burning, so (-) is the score. Metal: no opportunity for energy generation and internal industry is very small, holding not much potential for recycling and lowering energy use through reduced input for the manufacturing of products, so (---) is the score. Paper: no opportunity for energy generation and internal industry is very small, holding not much potential for recycling and lowering energy use through reduced input for the manufacturing of products, so (--) is the score. Glass: no opportunity for energy generation and internal industry is very small, holding not much potential for recycling and lowering energy use through reduced input for the manufacturing of products, so (---) is the score. Organic waste: large potential for biogas and very voluminous stream, so (+++) is the score. Agricultural waste: large potential for biogas, however, although this waste stream has a high volume, a large quantity is already used for composting, 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	(+++)	(--)	(-)	(--)	(++)	(++)	Plastic: plastic has a very high value and it is a very voluminous stream offering great potential for local business and informal sector, so (+++) is the score. Metal: not much potential, since there is not much internal industry and these industries are very energy intensive, which is a limiting factor in Malawi, so (--) is the score. Paper: there is a small internal industry and the waste is easy to handle, giving some potential for local business and informal sector, however value of the waste is low, so (-) is the score. Glass: not much potential, since there is not much internal industry and these industries are very energy intensive, which is a limiting factor in Malawi, so (--) is the score. Organic waste: high potential, due to the diversity of products that can be made from organic waste and the stream is voluminous, so (++) is the score. Agricultural waste: high potential, due to the diversity of products that can be made from organic waste and there is a lot of agricultural activity, so (+++) is the score.
	impact on NDC regarding climate change 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.	4	(++)	(--)	(-)	(--)	(+++)	(+++)	Plastic: is often burned, preventing burning reduces GHG emissions, so (++) is the score. Metal: no additional GHG emission after the products become waste, therefore no opportunities for mitigation climate change, so (--) is the score. Paper: no additional GHG emission after the products become waste, except small scale burning of paper at household level, therefore opportunities for mitigation climate change are limited, so (-) is the score. Glass: no additional GHG emission after the products become waste, therefore no opportunities for mitigation climate change, so (--) is the score. Organic waste: high degree of GHG leakages to the ground on dumpsites, therefore high potential for climate mitigation, so (+++) is the score. Agricultural waste: high level of GHG emissions from burning agricultural waste that is not used on the farms, giving high chances for mitigation, so (+++) is the score.
	impact on NDC regarding climate change 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.	3	(++)	(-)	(-)	(-)	(++)	(+++)	Plastic: potential for climate adaptation, since it creates job opportunities and thus income revenue, that are needed as substitutes for the jobs that might disappear due to climate change, so (++) is the score. Metal: low potential for climate adaptation, since less potential for job creation, due to the lack of internal industry and energy intensive processes needed for this. Especially, since climate change might endanger the availability of energy, because Malawi's main energy source is hydro, which is vulnerable for climate change, so (--) is the score. Paper: low potential for job creation, since the volume of the waste stream is relatively small, so (-) is the score. Glass: low potential for climate adaptation, since less potential for job creation, due to the lack of internal industry and energy intensive processes needed for this. Especially, since climate change might endanger the availability of energy, because Malawi's main energy source is hydro, which is vulnerable for climate change, so (--) is the score. Organic waste: due to droughts and climate change, agricultural yields and food security will decrease. Therefore it is important to better handle and use organic waste to increase yields and food security, so (+++) is the score. Agricultural waste: due to droughts and climate change, agricultural yields and food security will decrease. Therefore it is important to better handle and use organic waste to increase yields and food security, 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. Focus is on SDGs 1, 2, 3, 5, 6, 8, 11, 13 and 15.	5	(++)	(--)	(-)	(--)	(++)	(+++)	Plastic: high potential for job creation (also international pacts and partnerships), so (++) is the score. Metal: waste stream has a low volume and handling the waste stream is dangerous, therefore potential is very low, so (--) is the score. Paper: does not hold much value, so potential for job creation is low. Additionally, there is some potential for health improvement, when preventing burning paper at household level, however this potential is small, so (-) is the score. Glass: waste stream has a low volume and handling the waste stream is dangerous, therefore potential is very low, so (--) is the score. Organic waste: high potential since organic waste can prevent diseases from spreading and improve health, so (+++) is the score. Agricultural waste: high potential since agricultural waste can prevent diseases from spreading and improve health, so (+++) is the score. ---------There are lots of employment opportunities for plastic (also international pacts and partnerships). Organic and agricultural waste hold a lot of potential for disease prevention and health improvement. For metal and glass there is not a lot of impact on SDGs, since these streams are small and dangerous. For paper the impact is also low, because paper does not hold much value and not a lot of health gains when addressed better.
	volume of products and	If the volume of the products and materials then can be made of the waste is high (+++), then this can positively impact the transition	5	(++)	(-)	(+)	(-)	(+++)	(+++)	Plastic: waste stream is voluminous, furthermore, value is high and a lot of products can be made from it, so (++) is the score. Metal: waste stream has low volume and there is not much internal industry, so (-) is the score.

	materials from waste	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.							Paper: stream has a low volume, compared to plastic and agricultural waste, however there are some opportunities to make products since it is easy to handle, so (+) is the score. Glass: waste stream has low volume and there is not much internal industry, so (-) is the score. Organic waste: waste stream is very voluminous and a lot of valuable products can be made from it (e.g., biogas, fertilizer, cooking pallets), so (+++) is the score. Agricultural waste: waste stream is very voluminous and a lot of valuable products can be made from it (e.g., biogas, fertilizer, cooking pallets), 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 stimulans, 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 budgetwise.	4	(++)	(-)	(+)	(-)	(++)	(++)	Plastic: holds a lot of potential because of high volume, high value and presence of internal industry, so (++) is the score. Metal: not much potential, low volume, lack of internal industry and processing this stream is very resource intensive, so (-) is the score. Paper: compared to organic and plastic waste there is low volume of the waste stream, and there is some internal industry present, however this is also small, so (+) is the score. Glass: not much potential, low volume, lack of internal industry and processing this stream is very resource intensive, so (-) is the score. Organic waste: high potential, due to the high volume and potential for production. An issue, however, might be the lack of separation, so (++) is the score. Agricultural waste: high potential, due to the high volume and potential for production. An issue, however, might be the lack of separation and collection, but this does not affect the whole stream since is farming in urban areas as well, and in these areas there is better infrastructure, 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: high value, because it can be used easily in new products, that are valuable, so (+++) is the score. Metal: there is some value in this waste stream, however the stream has a low volume and there is a lack of awareness of this value, so (+) is the score. Paper: there is some value, however the internal industry for this waste stream is still small, so (+) is the score. Glass: there is some value, however the volume is low and there is a lack of internal industry, so (+) is the score. Organic waste: high potential for products (e.g., biogas, fertilizer, cooking pallets), so (++) is the score: Agricultural waste: high potential for products (e.g., biogas, fertilizer, cooking pallets), 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.	5	(+++)	(-)	(+)	(-)	(++)	(++)	Plastic: big internal industry, voluminous stream and high value, so large potential for job creation, so (+++) is the score. Metal: dangerous and difficult to handle, the stream is mainly exported, leading to low opportunities for job creation, so (-) is the score. Paper: potential of job creation, since it is easy to handle. There is some internal industry, however this industry is still quite small, so (+) is the score. Glass: dangerous and difficult to handle, the stream is mainly exported, leading to low opportunities for job creation, so (-) is the score. Organic waste: high potential, since the stream has a high volume and there are many opportunities to design products, so (++) is the score. Agricultural waste: high potential, since the stream has a high volume and there are many opportunities to design products, 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: there is some knowledge on this waste stream, however in general access to technology and knowledge is a big issue, so (-) is the score. Metal: almost no technological capacity or knowledge on handling the waste stream within the country and most of the waste is exported, so (---) is the score. Paper: almost no technological capacity or knowledge on handling the waste stream within the country and most of the waste is exported, so (---) is the score. Glass: almost no technological capacity or knowledge on handling the waste stream within the country and most of the waste is exported, so (---) is the score. Organic waste: there is some knowledge on this waste stream, however in general access to technology and knowledge is a big issue, so (-) is the score. Agricultural waste: there is some knowledge on this waste stream, however in general access to technology and knowledge is a big issue, so (-) is the score. ----------Most knowledge is on plastics, organic and agricultural waste streams. These value chains are already more developed. For metal, paper and glass there is almost no technological capacity within the country and most of the waste is exported. However, for all waste streams access to technology and knowledge is a big issue.
	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: recycling into new products is normalized, which positively influences market acceptance, so (++) is the score. Metal: this waste stream is never just dumped, it is being recycled, but the waste stream has a low volume and most of this is exported, so (-) is the score. Paper: there is no internal market for paper products developed, so (-) is the score. Glass: the glass market is not well developed and there is a lack of capacity to process glass, due to lack of investments. Additionally, glass is less affordable than for example plastic, so (-) is the score. Organic waste: recycling into new products is normalized, which positively influences market acceptance, so (++) is the score. Agricultural waste: recycling into new products is normalized, which positively influences market acceptance, 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.	4	(+)	(--)	(-)	(--)	(+)	(+)	Plastic: there is some willingness to invest, due to the potential of plastic, so (+) is the score. Metal: investment is low due to the high level of resources needed and the low volume of the stream, so (--) is the score. Paper: there is low potential for paper, due to the small size of the stream and the small internal industry, so (-) is the score. Glass: investment is low due to the high level of resources needed and the low volume of the stream, so (--) is the score. Organic waste: voluminous stream and variety of products that can be made from this waste offer opportunity for selling the products both nationally and internationally, offering potential for investment, so (+) is the score. Agricultural waste: voluminous stream and variety of products that can be made from this waste offer opportunity for selling the products both nationally and internationally, offering potential for investment, so (+) is the score. ----------Plastic there might be some willingness to invest. Metal requires a lot of energy and low stream size, the same is for glass, thus investment is low. Paper some opportunity so some capital. More willingness to invest in organic/agricultural since the products that can be made can also be sold both nationally and internationally and these are quite big streams. However, willingness to invest is generally low.
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	(+)	(--)	(--)	(-)	(++)	(++)	Plastic: some policies and regulations are in place for plastic, however there is for some policies a lack of enforcement, so (+) is the score. Metal: not much policies are present to better address this waste stream within the country, so (--) is the score. Paper: not much policies are present to better address this waste stream within the country, so (--) is the score. Glass: not much policies are present to better address this waste stream within the country, so (-) is the score. Organic waste: there are some policies and regulations favourable towards this waste stream, so (++) is the score. Agricultural waste: there are some policies and regulations favourable towards this waste stream, so (++) is the score.
	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: high potential for alignment in terms of job creation, health, investment and capital, so (++) is the score. Metal: low volume, of which most is already used informally. Additionally, processing this stream is very resource intensive, so there is little potential for alignment, so (-) is the score. Paper: some potential for alignment, since there are some opportunities for handling this waste stream, however the volume is relatively small, so (+) is the score. Glass: low potential for alignment, due to the low volume and the resource intensive process needed, so (-) is the score. Organic waste: very high potential for alignment in terms of job creation, big health improvements, invesment, capital and food security, so (+++) is the score. Agricultural waste: very high potential for alignment in terms of job creation, big health improvements, invesment, capital and food security, so (+++) is the score.
	sufficiency of current separation level (on dumpsites)	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.	4	(-)	(+)	(-)	(--)	(---)	(---)	Plastic: current level of separation is low, however separating this waste stream is not too difficult, so (-) is the score. Metal: metal is easy to separate and there is willingness to separate, so (+) is the score. Paper: current level of separation is low, however separating this waste stream is not too difficult, so (-) is the score. Glass: often broken and therefore difficult to separate, so (--) is the score. Organic waste: very difficult to separate, when it is not separated at household level, since it is often contaminated, so (---) is the score. Agricultural waste: very difficult to separate, when it is not separated at household level, since it is often contaminated, 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.	3	(-)	(+)	(-)	(--)	(---)	(---)	Plastic: separation is not too difficult, making collection possible, however this is not organized yet, so (-) is the score. Metal: easy to separate and willingness to collect and store, so (+) is the score. Paper: separation is not too difficult, making collection possible, however this is not organized yet, so (-) is the score. Glass: difficult to separate and collect since glass is often broken and can be dangerous, so (--) is the score. Organic waste: often contaminated and difficult to collect, better collection is essential here, so (---) is the score. Agricultural waste: often contaminated and difficult/heavy to collect (also do the rural character of agricultural waste, hence bad infrastructure), better collection is essential here, so (---) is the score.
Sum				102	56	70	51	103	108	
Weighted Ranks				**391,0**	**208,0**	**264,0**	**191,0**	**390,0**	**407,0**	
Normalized Weighted Ranks				**9,6**	**5,1**	**6,5**	**4,7**	**9,6**	**10,0**	