



Operationalization Model for an Optimal Recycling System in Ghana

GIZ E-Waste Programme Ghana

LOT 2: Recycling chains, business models, and capacity development

October 2019



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Executive Summary

This report is a result of a stakeholder process facilitated by experts from Mountain Research Institute (MRI) and the World Resources Forum (WRF) under the technical component of the e-waste programme implemented by GIZ.

The main objective of this report is to present a consolidated analysis of discussions and decisions related to the operationalization of the Hazardous and Electronic Waste Control and Management Act (Act 917). The analysis provides an **input to the relevant governmental entities to further optimize the recycling system in Ghana**. Specifically, the report aims to:

- systemize possible recycling options for Ghana,
- analyze the optimal allocation of actors to the Ghanaian value chain
- discuss open issues and requirements towards an implementation roadmap

The report provides a short introduction to the background given by Act 917, the levy and the fund, as well as the current challenges for a sustainable e-waste management system in Ghana. A brief summary is given of the political consultation process and related milestones since 2018. The key framework conditions towards the implementation of Act 917 have been set by the adopted *National E-Waste Management Scheme* and the legally binding *Ghana Technical Guidelines*. Based on this, a first concept for an optimal recycling system in Ghana has been drafted in a stakeholder workshop in early 2019. Our analysis suggests a more detailed interpretation of the outcome of this workshop. The concept is structured according to the schematic of a generic recycling chain and could form the basis to further operationalize the national integrated e-waste management scheme and develop the necessary sustainable business models.

The report concludes with some open questions related to the operationalization of the national scheme, which are mainly related to the role of the “National E-Waste Recycling Facility”. The required further steps for the political process are summarized. All of them heavily depend on the correct implementation of the recycling levy and the disbursement of the fund and need to be discussed and amended through the political stakeholder process.

1. Introduction

1.1. The background: Act 917, the levy and the fund

In 2016 Ghana adopted the Hazardous and Electronic Waste Control and Management Act (Act 917). Part 2 of the Act provides details of the Electrical and Electronic Levy (Sections 20-22) and the Electrical and Electronic Waste Management Fund (Sections 23-30). To achieve the funds objectives, money from the fund shall be used for the following purpose, among others (section 24):

- to provide support for the construction and maintenance of electrical and electronic waste recycling and treatment plants (letter a)
- to offer incentives for collection and disposal of electronic waste (letter f)
- to provide support for the collection, safe disposal and recycling of electrical and electronic waste (letter i)
- to provide support for matters related to hazardous wastes and other wastes (letter j)

More concretely section 28 “Disbursement of the Fund” states (among others), that “20% of the funds shall be allocated for the collection of electrical and electronic waste and collection centres” (letter a) and “40% of the funds shall be allocated for the construction and management of electric and electronic waste recycling plants and related facilities“(letter b). Though new developments and decisions state that a national recycling facility should be constructed from purely private funds. Nevertheless, in combination with the electronic waste levy, this is the backbone of growing a sustainable and competitive recycling industry in Ghana.

1.2. The challenge: Unsound formal and informal practices

Over the last decade Ghana has seen a growth of formal e-waste recyclers, but also an increase of informal recycling activities. Most of the formal recyclers are not fully compliant with legal standards. Their processes are often technically not optimized due to the lack of knowledge and access to required infrastructure and technology. Economic viable options for connecting to down-stream markets are not available for all e-waste fractions. In addition, formal recyclers need to compete with the informal sector, who externalize their full costs through unsound processes and hence get an unfair advantage when accessing waste materials by being able to pay higher prices. Therefore, formal recyclers cannot access enough volumes to justify investments for more efficient and professionalized operations.

1.3. The solution: growing an optimal recycling chain in Ghana

Act 917 and its related financing strategy (levy and fund) offers a great opportunity to address the above challenge by providing the right incentives and enabling necessary investments in order to grow a sustainable and inclusive recycling industry in Ghana. The government has taken the first step by announcing the construction of a national e-waste facility and with further detailing a model of the national integrated e-waste management scheme. In order to leverage the great opportunity offered by the current situation and address the correct level of sound competition with the already growing formal recycling industry, as well as a beneficial and fair cooperation and collaboration with the ubiquitous informal sector (e.g. Old Fadama / Agbogbloshie scrap metal yard), it is of great importance to define a clear role of the individual actors in the recycling chain. Each role ideally should be

subordinated to an optimal recycling chain in Ghana, where the different actors and stakeholders can be clearly allocated to their processes and activities (both rendered and required) in view of an overall sustainable solution for the environment, the society and the economy. A huge step towards such an optimal recycling has been taken with the Ghana Technical Guidelines, which foresee a clear, yet flexible permitting process for actors along the recycling chain to obtain licences for different activities.

1.4. Objectives

In support of the stakeholder process lead by MESTI and based on the legal framework and decisions made by the governmental stakeholders, this report presents an analysis of the possibilities to operationalize an optimal recycling system for Ghana, with the main objectives to:

- Systemize possible recycling options for Ghana (appliances – fractions – materials).
- Analyse the optimal allocation of actors to the Ghanaian value chain and how they should be connected on local, regional and international level.
- Discuss open issues and next steps towards the operationalization of an optimal recycling system in Ghana.

2. Political consultation process

A political consultation process has been initiated by the national authorities, namely by MESTI and EPA. Preliminary discussions have led to a better understanding about which actor should be doing what in the e-waste recycling chain (incl. municipalities, collection centre, scrap workers, independent SMEs, national facility, global industry / exporters). The process aimed at identifying the interfaces, where the different actors and stakeholders would ideally need to come together and supplement each other regarding the services rendered and the related responsibilities that need to be taken on. This contributed towards a common understanding and inclusive vision of the governments preferred operator model of the national recycling facility.

The process has been running since some time, whereas the main discussions have been happening since approx. one year since May 2018, which can be broken down into the following main milestones:

Milestone 1: Workshop “Feasible E-Waste Recycling Solutions for Ghana” (June 2018)

This one-day interactive workshop¹ was addressed predominantly at governmental officials. The key objective and related outcome of the workshop was to gather opinions and discuss solutions to support the decision-making process for feasible e-waste recycling solutions for Ghana. Discussions confirmed that there is a common understanding of the general need of a “national recycling facility” fulfilling a certain purpose, but controversy opinions about the operator model and the use of the available “recycling fund” to drive responsible WEEE management in Ghana (inside and outside this facility) remained. The workshop also made clear to everybody that the possibilities and permissible scope for any recycling related activities in a small-scale environment are mostly pre-defined and determined through the mandatory Technical Guidelines on Environmentally Sound E-Waste Management.

¹ Schluep M. et al 2018: Workshop Report Feasible e-Waste Recycling Options for Ghana, 6 June 2018, Accra/Ghana, , GIZ e-Waste Programme Ghana.

Milestone 2: “National Integrated E-Waste Management Scheme” by EPA (November 2018)

Based on the political stakeholder process and closely tuned with the requirements of Act 917 for the levy and fund, as well as the Ghana Technical Guidelines, the Environmental Protection Agency (EPA) presented further details of an integrated e-waste management scheme for Ghana (see *Figure 1*). The scheme has been adopted by the governmental stakeholders and as such form the basis of any further interpretation and operationalization of an optimal recycling system for Ghana. The scheme is a first step towards defining more precisely how the eco levy will be disbursed among the actors in the recycling compliance scheme. In addition, the foreseen key interactions between the recycling partners are highlighted.

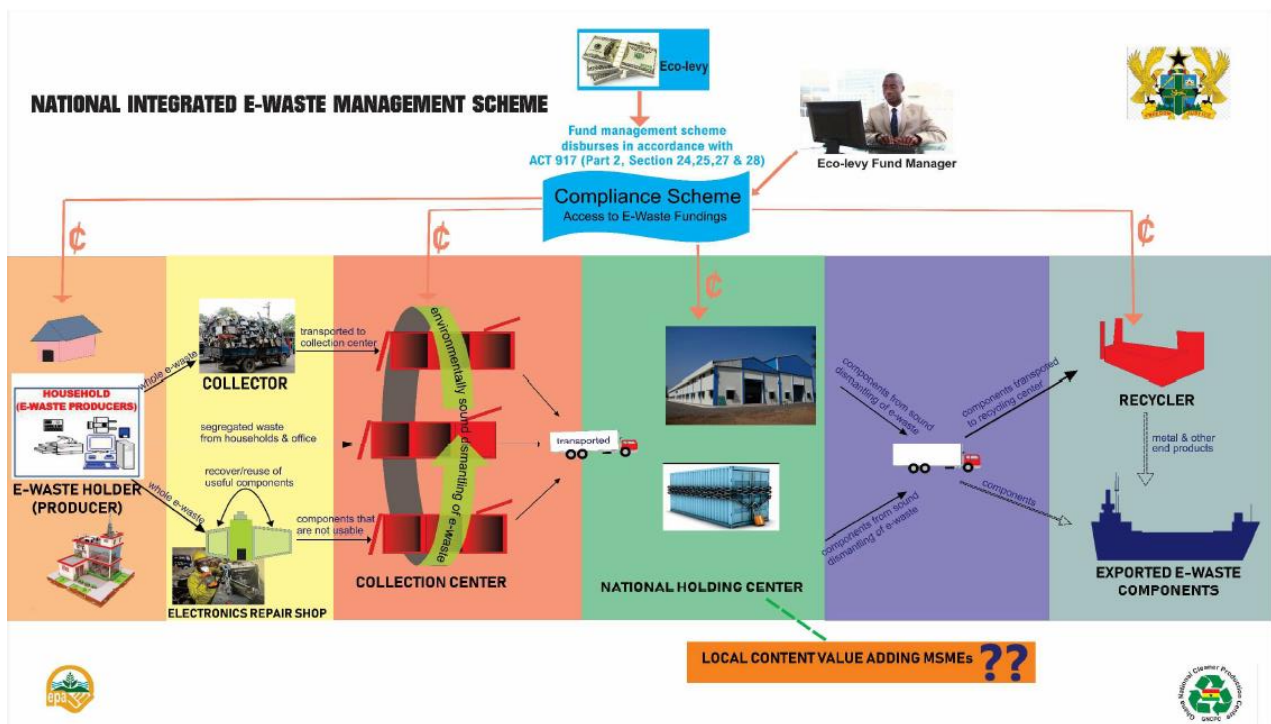


Figure 1: National integrated e-waste management scheme (EPA)

Milestone 3: Stakeholder workshop e-waste recycling options (January 2019)

In a next step MESTI and EPA have gathered in a stakeholder workshop and developed their preferred options for an optimal recycling chain², with the aim to analyse different options in the light of the national laws, the national integrated e-waste management scheme (*Figure 1*) and visions regarding e-waste management in Ghana. The participants were tasked to think outside the box and come up with detailed recycling options that embraces current operators on the field and new entrants in the recycling business. The workshop was also required to clearly and carefully define the role of the National E-waste Recycling Facility to enhance efficiency on the recycling chain. The workshop result is depicted in *Figure 2*. A further consolidation of these proposal is explained in more detail in chapter 4.

² Atiemo S. 2019: GIZ e-waste recycling options, Report of workshop held on 17th-18th January 2019 at Hill Palace Hotel Peduase (near Aburi Akuapem). Mountain Research Institute, Koforidua/Ghana.

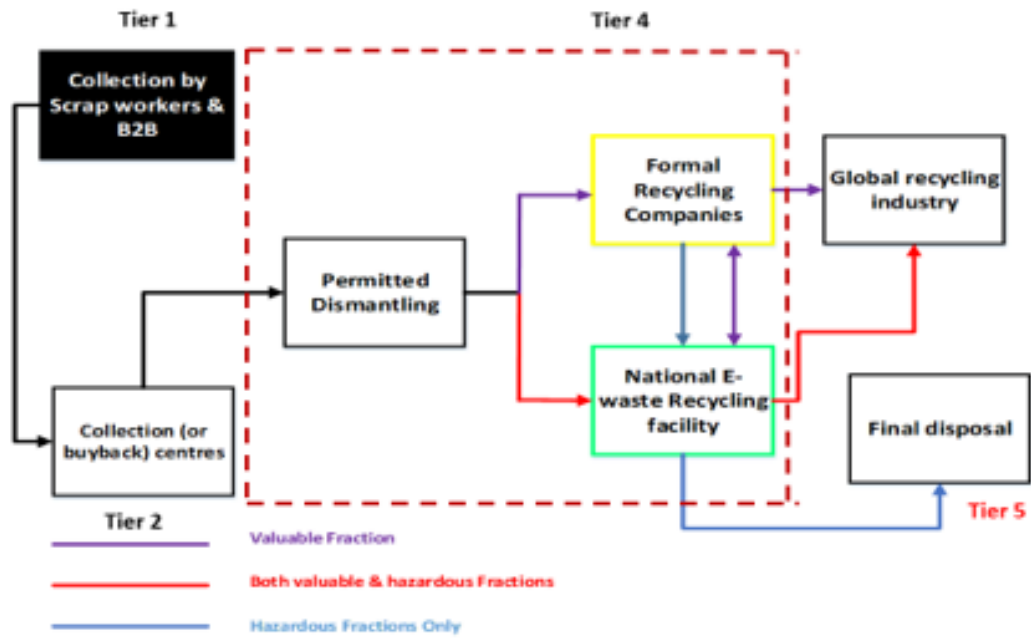


Figure 2: Recycling options for Ghana - outcome of the MEST / EPA stakeholder workshop January 2019.

3. Recycling chain and technical guidelines

3.1. Overview recycling chain

A typical recycling chain consists of collection, pre-processing and end-processing steps. The pre-processing step receives entire appliances from collection and transport activities and may include manual and mechanical processing. With the manual processing step (manual dismantling) appliances are broken down into fractions and further into materials through mechanical processes and refining (see *Figure 3*). Manual processing is crucial for the purpose of depollution of appliances and fractions, separating hazardous from valuable materials respectively.

Mechanical processing can serve as pre-processing or end-processing step. Refining is always seen as an end-processing step, usually entails technologies with high investment requirements, such as for large integrated smelters and is subject to an international market.

Depending on various factors, such as the size and economic development status of the country, volumes of e-waste, access to technologies and investments, etc. end-processing options can be found on local, regional or international level. Typically, and also in the African context, a respective recycling infrastructure can be found on local or regional level for some plastics and base metals, such as for iron, steel and aluminium.

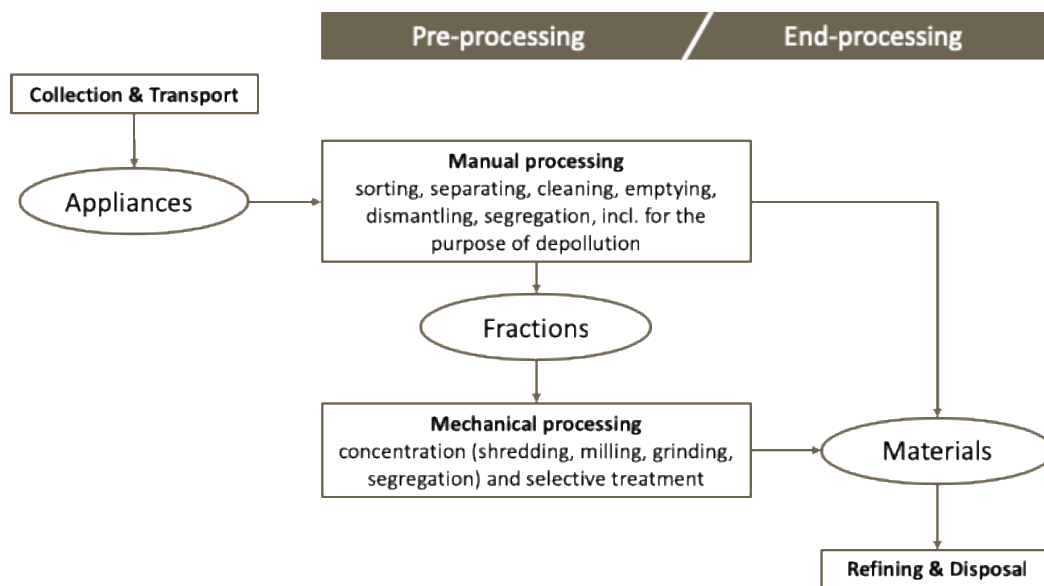


Figure 3: Schematic overview of a generic recycling chain

3.2. Compatibility with the Ghana Technical Guidelines

Any future solution will have to be compatible with the Ghana Technical Guidelines, and the national integrated e-waste management scheme (*Figure 1*) respectively. The Technical Guidelines contain principles and specific management requirements for collection, transport, storage and recycling of e-waste. The requirements are widely derived from acknowledged international standards (e.g. CENELEC). Though, a major difference between the Technical Guidelines and international standards

is the Ghanaian approach of introducing 4 level of tiers (see *Figure 4*). The background of this tier-approach is the policy intention that all operators involved in waste and e-waste management shall be registered, even if they engage in small-scale and currently still informal activities such as collection.

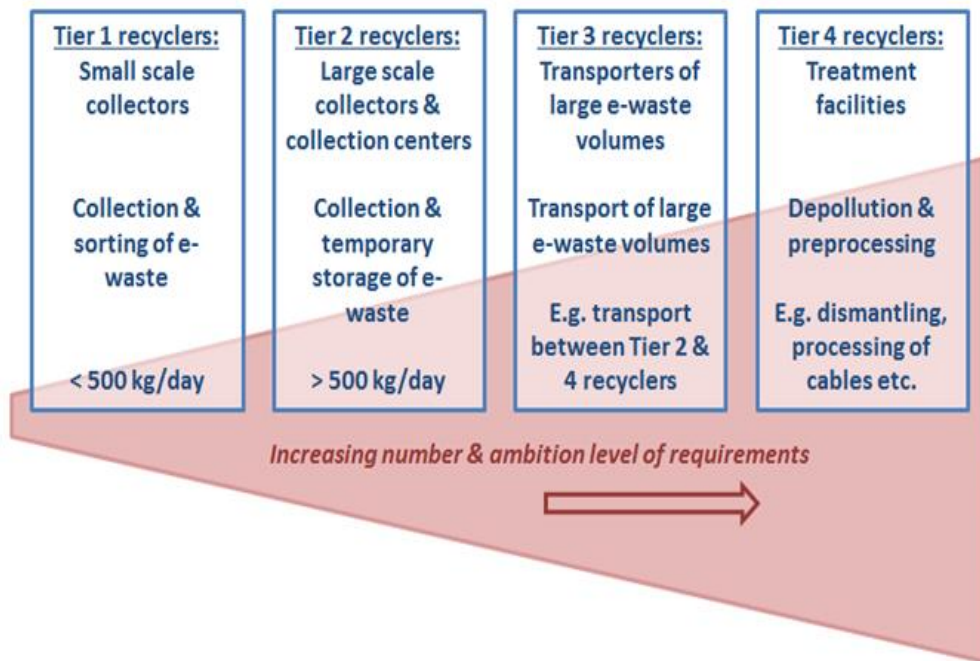


Figure 4: Overview tiered approach Ghana technical guidelines.

4. Suggested operationalization model for an optimal recycling system

As part of the political consultation process, MESTI and EPA have gathered in a stakeholder workshop³ and developed their preferred options for an optimal recycling chain. Figure 5 is a more detailed interpretation of the outcome of this workshop (see Figure 2) and structured according to the schematic of a generic recycling chain (see Figure 3). While the integrated e-waste management scheme (Figure 1) remains as the legal basis of the permitting process, Figure 5 should form the basis to operationalize the national system and develop sustainable business models. The possible role of all actors and processes are explained in the following sub-chapters.

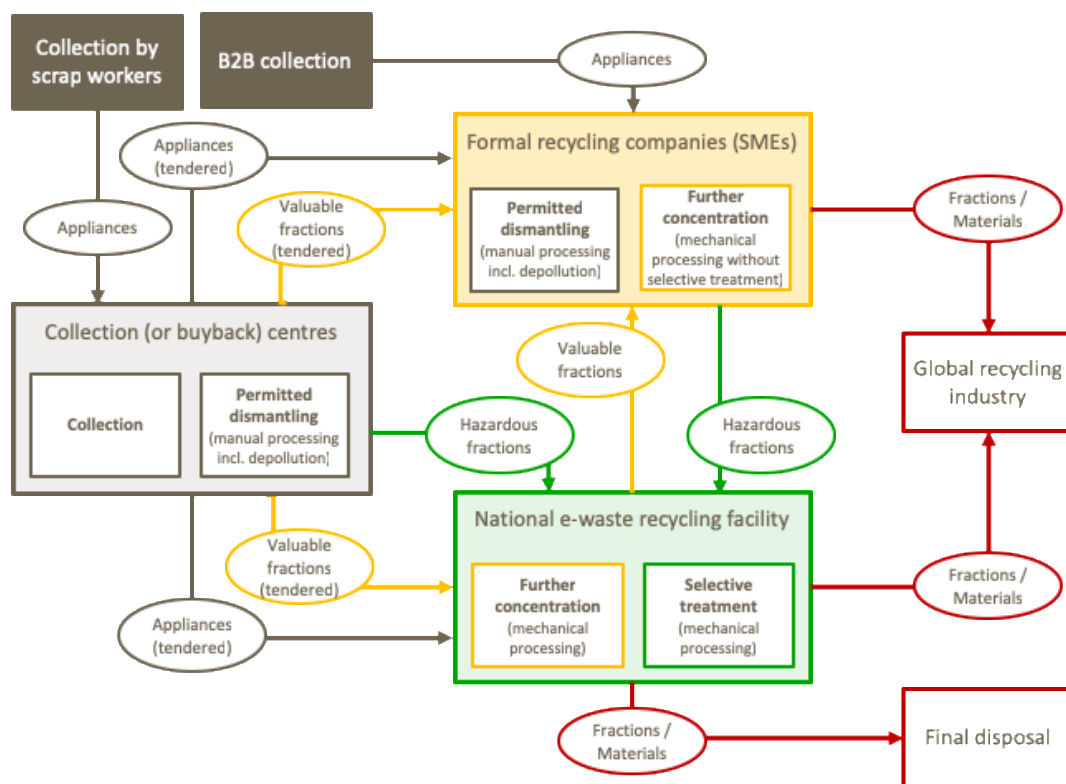


Figure 5: Suggested optimal recycling chain for Ghana

4.1. Small scale collectors

Collection by (informal) scrap workers

According to the Technical Guidelines the collection by (informal) scrap workers is foreseen as a Tier 1 activity. This reflects the current situation in Ghana, where a large informal workforce is earning a daily income through the collection of scrap material. Through the course of time, those actors have gained considerable expertise and experience in the door-to-door collection. It is suggested that

³ Atiemo S. 2019: GIZ e-waste recycling options, Report of workshop held on 17th-18th January 2019 at Hill Palace Hotel Peduase (near Aburi Akuapem). Mountain Research Institute, Koforidua/Ghana.

nothing should be done to deprive them of their livelihoods. Hence the domestic collection should solely be handled by the (informal) scrap workers.

B2B collection

Over the past 10 years existing formal recycling companies have gained relevant experiences and secured service provider positions in business to business (B2B) collection schemes. It was noted that there are some (corporate) holders of e-waste who may not be comfortable in handing over their e-waste to the informal collectors due to the perception that it will not be properly handled related to either environmental, health or data safety concerns. Hence any existing and future formal recycling companies should be allowed to grow their share in B2B collection activities. However, if (informal) scrap workers have the ability to collect directly from businesses, there should be no restrictions either. B2B collection is also a Tier 1 activity under the Technical Guidelines.

4.2. Collection or buyback centres

Collection or buyback centres are classified as a Tier 2 activity under the Technical Guidelines. Such centres should be established as the aggregation point to receive e-waste collected by the (informal) scrap workers. Some of the collection centres can be designated by the e-waste fund manager for the payment of the funds for collection.

According to the technical guidelines, some of the collection centres who fulfil the right pre-requisites regarding basic environmental health & safety (EH&S) protection can apply for a permit to engage in manual dismantling (incl. depollution) activities. It has to be noted that the same activity is similarly classified as a Tier 4 activity. In line with the technical guidelines, collection centres are only allowed to send their collected e-waste to licensed operators for further treatment. Whole appliances or separated valuable fractions (as a result of in-house permitted dismantling) would be tendered to formal recycling companies, whereas the national recycling facility can also participate in such tenders and as such directly compete with the formal recycling industry. Hazardous fractions (as a result of in-house permitted dismantling and for the purpose of depollution) only can be send to the national recycling facility.

4.3. Formal recycling companies (SMEs)

The SMEs in the e-waste sector in Ghana have been at the forefront of formal e-waste business before the passage of Act 917. During the period of their operations, they have specialized in B2B collection, dismantling, segregation and trade in valuable fractions. In effect they have mostly engaged in 'cherry picking' as their historically chosen business model. Under the current model, these formal recycling companies should be allowed to continue their operations. The SMEs are allowed to tender for whole appliances and valuable fractions from collection centres and their permitted dismantling facilities. According to the proposed model the SMEs are not permitted to engage in selective treatment and disposal of hazardous fractions that are a result of their operations. All hazardous fractions must be sent to the national e-waste recycling facility. The SMEs are also allowed to engage in business trade relationships with the national e-waste recycling plant. SMEs are only allowed to engage in international trade for valuable e-waste fractions. SMEs are supposed to maximize the local value

chain (through maximized manual and mechanical processing) before exporting recovered materials to the global recycling industry.

The SMEs in the course of time may optimize their operations to be able to safely treat certain types of hazardous fractions, however, such permit may be granted only on a case by case basis with due regard to the legal framework. The departure point is that (unless exception is granted via the government) all hazardous fractions have to be exclusively (and without any exception) sent to the national e-waste recycling facility.

4.4. National e-waste recycling facility

The national recycling facility is an ambitious project envisaged by the Government of Ghana. The purpose of this facility is to address the growing e-waste problem in Ghana, including the lack of safe handling options of hazardous fractions. It is therefore a key objective of the e-waste fund to support optimal e-waste recycling by financing the treatment of hazardous fractions and invest in necessary technical infrastructure. Therefore, it is envisaged that the facility shall be focusing first and foremost on receiving and treating all hazardous fractions coming directly from collection centers and formal recycling companies (from collection, permitted dismantling and other mechanical processes). Hence, under the proposed model, the national e-waste recycling facility may be designated mainly for the treatment of hazardous fractions. As a consequence, all hazardous fraction must be channelled to the national e-waste recycling facility.

However, in competition with the formal recycling industry, the national e-waste recycling facility may also participate in tenders for whole appliances and valuable fractions that are on sale at the collection centers or possibly sold by formal recycling companies or via business or government based auctioning off of former ICT assets. Subsequently, the national e-waste recycling facility may handle both hazardous and valuable fractions. Whereas it holds a monopoly over receiving and treating any of the liability or hazardous fractions, the facility may compete for valuable fractions too. In general, the national e-waste recycling facility should not engage in “dismantling” as this is an activity already permitted and forming part of the core business of both Tier 2 and Tier 4.

The national e-waste recycling facility may establish its own final disposal facility (Tier 5) or may collaborate with other investors. The facility may be designated as the only entity in Ghana to engage in export of hazardous fractions and materials for the purposes of disposal or recycling.

4.5. Final disposal

Disposal facilities are Tier 5 activities that specialize in the final disposal of non-recyclable e-waste fractions or materials. These facilities may be part of the national e-waste recycling facility or a separate entity permitted by the EPA to undertake such activities. As such (and dependent on a case to case basis) disposal facilities may not be permitted to undertake dismantling activities or other unpermitted activities that require material recovery to ensure environmental sustainability. The disposal facility may not be additionally permitted to engage in export of hazardous waste or transfer of hazardous waste to another entity. This undertaking may only be the preserve of the national e-waste recycling facility.

4.6. Global recycling industry

The global recycling industry refer to any e-waste treatment entity in any part of the world. This industry does fall under the laws of Ghana concerning any export to the global recycling industry must be undertaken with due regard to the relevant international treaties (such as the Basel Convention).

5. Conclusion

5.1. The role of the National e-Waste Recycling Facility

Open questions related to the operationalization of the national integrated e-waste management scheme are mainly related to the role of the “National e-Waste Recycling Facility”. While the political process so far defined the national facility as being the only one to be permitted for selective treatment (of hazardous fractions), newer discussions suggest that any private recycling company should be allowed to apply for such permits, as long as they comply with the given requirements. At the same time new decisions also suggest that a national facility should be built solely from private funds and should not receive direct investment support from the recycling fund established under Act 917.

This development suggests the conclusion that the National e-Waste Recycling Facility in fact can be re-interpreted as being equal to just any other private recycling company willing to invest into new recycling technologies for selective treatment of hazardous fractions. That would mean that the term “National e-Waste Recycling Facility” mainly has to be understood as an intermediate, hence historical step for the operationalization of an optimal recycling system in Ghana. If this is the case, the recycling system as depicted in *Figure 5* would have to distinguish between the Tier 4 recyclers without selective treatment and Tier 4 recyclers with selective treatment. This two types of recycling facility would replace the idea to have private recyclers (SMEs) on one side and the National e-Waste Recycling Facility on the other side.

Still, the legal and economic conditions most probably will lead to only one physical facility involved in the selective treatment of a specific hazardous fraction. This will not differ greatly from the original idea of a National e-Waste Recycling Facility. The reasons are:

- Incentives for the private industry to invest in such facilities are low, due to the high risks related to the uncertainty of sufficient waste volumes, high costs of treatment and unsolved final disposal options.
- Hence this will leave the government in a leading role to initiate such investments (e.g. through a guaranteed service fee, an interest free loan, private-public partnership models, etc.)
- Volumes in Ghana are probably still too low to justify a competitive approach through several service providers. Hence economy of scale will only allow for one facility to concentrate on the selective treatment of certain fractions. However, it could be, that different companies are concentrating on different fractions (e.g. one facility for lighting equipment, one for temperature exchange equipment, etc.)

In addition to the yet to be clarified situation above, a few additional issues need further clarifications in order to assign clearly assign the roles specific actors could play in the national scheme:

- Better (normative) clarification of hazardous vs valuable fractions: Distinguishing between valuable fraction and hazardous fraction is not that easy in practical terms. Tendering of waste fractions will demand for a better and more clear description for what it means to tender for valuable fractions vs. whole appliances.
- Related to this, also explanations are needed, distinguishing clearly between the requirement to transfer hazardous fractions to a permitted tier 4 recycler and the requirement of not being allowed to export hazardous fractions. Hazardous fractions still might be part of exported

materials and fractions, such as printed wiring boards. Under the current wording it is not clear if those would be allowed to be exported.

5.2. Required further steps for the operationalization of the national scheme

The operationalization of the national integrated e-waste management scheme heavily depends on the correct implementation of the recycling levy and the disbursement of the fund. In addition, all open questions around the National e-Waste Recycling Facility, as discussed in the previous chapter, need to be clarified. While this is mainly a political process, decision will also rely on a scientifically and technically sound analysis of the situation. The suggested required further steps are summarized below. It is however pivotal that this list gets discussed and amended through the political stakeholder process.

- Clarify legal definitions and possible loopholes, such as valuable vs. hazardous fractions and the permission of exporting fractions possibly containing hazardous parts. Such definition should consider the fact that some fractions currently cannot be treated within national borders and hence need to be exported.
- Decide if the term “National e-Waste Recycling Facility” should persist in its original meaning, or if the main difference should be made between permits for Tier 4 recyclers without selective treatment and permits for Tier 4 recyclers with selective treatment. Based on this decision agree on an updated model to operationalize the national scheme (possibly based on *Figure 5*).
- Develop a priority list of downstream technology options, which are required and suitable to be installed for the selective / non-selective treatment of e-waste in Ghana. The *GIZ report “Downstream Technology Options for e-Waste”* will deliver the necessary background information for this exercise. The report provides a technical reference book with a systematic overview of downstream technology options for Ghana.
- Agree on a public-private partnership model, which should initiate private investments into technologies / facilities for the selective treatment of hazardous fractions (as identified in the previous step, e.g. batteries, lighting equipment, temperature exchange equipment, etc.). Such a model should contain a financing scheme, which clarifies how investments can be triggered (e.g. interest free loans, exclusivity right on certain fractions, etc.) and how services should be paid (e.g. service fee through national recycling fund).
- Analyse the financial needs for the public-private partnership model, which will be borne by the national recycling fund. The *GIZ report “Businesses cases for selected recycling technologies in support of an optimal recycling chain in Ghana”* will deliver the necessary background information for this exercise. The report provides economic basics related to selected downstream technologies in order to be able to calculate specific business plans for Ghana.
- Integrate the necessary disbursement process of the national recycling fund into the model to operationalize the national scheme.

