Value chain analysis in plastic waste management in 4 cities in Mali - Bamako, Koulikoro, Kayes, Gao

Opportunities for job creation

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1. Introduction

Young people in Mali often lack decent employment opportunities, leading to high levels of unemployment. Funded by the European Union, a consortium of ICCO, WASTE, APEJ, led by SNV, is implementing the Value Chain Development and Youth Employment in Mali (EJOM) project. The project takes place in the four regions of Kayes, Koulikoro, Gao and the district of Bamako, all areas where young Mali people face systemic employment challenges.

WASTE's interventions in the project focusses on setting up small businesses in solid waste management and improving existing ones to help them to grow and create employment. Based on the inception reports of the 4 cities (see references in annexes), this report maps and analyses the plastic waste value chains to identify the bottlenecks hampering the functioning of the value chain and the activities with the highest potential for job creation.

Additional input is obtained from a rapid market assessment of plastics executed by 11 students of the Ecole Nationale d'Ingenieurs Abderhamane Baba Toure (ENI-ABT) in December 2019.

Chapter 2 summarizes the solid waste management situation in cities Bamako, Koulikoro, Kayes and Gao with special focus on plastic waste and ends with a description of the solid waste management situation in Mali in general. Chapter 3 analyses into the plastic waste value chains, identifying actors and bottlenecks resulting in recommendations how to overcome these bottlenecks and at the same time create jobs. Chapter 4 concludes with insights learnt from the value chain analysis.

2. Plastic waste management in Mali and in the 4 cities

In 2018, the EJOM project contracted local consultants to perform a detailed study on the solid waste situation in the 4 cities of the project: Bamako, Koulikoro, Kayes and Gao. The reports (see reference 1-8) showed that solid waste systems in all 4 cities are far below the minimum acceptable standard. Even in Bamako, half of the household waste is never collected.

2.1 Bamako

Bamako is the capital and largest city of Mali, with a population of 2,049,000 (2013) and is located alongside the river Niger. The city is divided in 7 administrative departments: 6 Communes and the overarching District of Bamako. Due to inadequate waste management in the city an estimated 50% of the household waste is not collected, and ends up littering the streets or dumped on the banks of the river Niger.

Household waste collection generally takes place in two steps: a primary and secondary collection. Regarding primary collection, about 180[1] private small and micro – enterprises (GIEs) are in charge of household waste collection to transfer stations (both official and illegal). This is done on behalf of the Communes, who are responsible for the realisation of the waste collection in their neighbourhood. A private company called OZONE is responsible of transporting the waste from the transfer stations to the disposal site. The only real controlled landfill Noumoubougou is located about 45 kilometres from Bamako and is hardly used. OZONE transports the waste to other informal areas in and around the city such as unused stone quarries.

Plastic waste management in Bamako

As only 50% of the household waste is collected in Bamako, a considerable amount of plastic waste will end up polluting the environment and waterways or are burnt. Burning of waste takes place continuously on the dumpsites of Bamako evidenced by the smell of burning waste when leaving the airport. These fires are sometimes lit, but also caused by internal heat of the waste. Especially burning plastic is a polluting and unhealthy activity, as it releases carbon monoxide, dioxins and furans, all of which are toxic.

Recycling of plastic waste does take place in Bamako. Thousands of waste pickers roam streets and dumpsites picking valuable plastic waste after which it is sorted, washed, grinded and recycled in recycling companies or exported abroad to surrounding countries.

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[1] *Bamako, the time to act is now. An engine of growth and service delivery. – World bank group Feb. 2019*

(vervolg voetnoot)

Fig 1: The banks of the Niger River were covered with rubbish on February 9, 2018[2].

2.2 Koulikoro

Koulikoro is located 60 kilometers north of Bamako alongside the Niger banks. The city is the last stop on the rail line to Dakar, Senegal and has 56,592 inhabitants. Many of the city's inhabitants are fisherman or work to dredge sand from the Niger, that they sell throughout the region. Industry in Koulikoro is centred on the production of peanut (groundnut) oil, cottonseed oil, and soap. These socioeconomic factors affect the waste profile of the city. As can be expected, the relatively more affluent inhabitants in Koulikoro produce 0.7 kg of waste per day per person, slightly higher than the national average[3].

Only 1 GIE is collecting the waste from the households of Koulikoro and some women and youth groups clean the streets on a voluntary basis. This means that 80% of the household waste is not been collected and ends up on illegal dumping sites (more than 100 of these illegal waste dumps are present). Because these piles are unprotected, rainwater leaches waste into the groundwater and runoff carries the solid waste directly into the Niger River along with storm water. Additionally the practice of waste burning in neigbourhoods causes air pollution. At the time of the assessment these results were produced, shortly after the municipality pointed out an uncontrolled dumping site and was donated one collection truck.

Plastic waste management in Koulikoro

No plastic recycling takes place in Koulikoro. Waste pickers collect valuable plastic waste which is washed and then sold to intermediaries and traders based in Bamako.

2.3 Kayes

Kayes is the capital of the Western region of Mali, with a total population of 159,482 inhabitants in 2016. Located along the river Senegal, and with a railway connection, it is the commercial centre for the Western region. The present waste management system is in urgent need of improvement. It is estimated that the total amount of household waste generated in the city is 92 tonnes per day and that only about 20-40% of that amount is collected by 8 GIEs and transferred to transfer sites which are in the city itself. The rest is illegally dumped in the neighbourhoods, in the river or burned.

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[2] *https://observers.france24.com/en/20180216-bamako-niger-river-trash-mali*

[3] *BETRAP-SARL (2004) Plan Strategique d'Assainissement de Koulikoro, Rapport Finale Bamako, Mali*

Plastic waste management in Kayes

From the generated amount of household waste, 13% is estimated to be plastic waste. Almost no recycling activities take place, 2 enterprises are known sourcing and selling recyclables including plastic items such as jerry cans and PET bottles. The latter probably for reuse only. One enterprise is known that recently started the production of paving tiles out of plastic waste.

2.4 Gao

Gao is situated on the Niger River at the southern edge of the Sahara and has a population of 115,444 inhabitants (2018).

21 GIEs provide the garbage collection inside the city, which is far from covering the needs of the whole city. It is estimated that only 34 % of the household waste is collected and transported to transfer sites. The municipality transports the waste to a final dumpsite. The uncollected part of the waste ends up in the environment or on the river banks. Burning household waste is also common practice. The UN peace keeping mission, MINUSMA , has implemented its own internal waste management system.

Plastic waste management in Gao

From the plastic waste stream, PET bottles are the most interesting. They are collected by waste pickers and sold to be reused in Goa or even transported to Bamako. There is one recycling unit present producing paving tiles out of plastic waste but this is still in the pilot phase. The military army MINUSMA also creates an exceptional high amount of plastic waste as they mainly use bottled water (PET) and transported equipment is packed in film wrap.

2.5 Plastic waste management in general in Mali

Mali is a low income country with a relatively low waste generation average of 0.58 kg/person/day[4]. The plastic waste percentage in the household waste is also estimated to be low compared to high income countries: 6-8%. All 4 cities use a dual collection system in which waste is collected door to door by GIEs who transport this to a centralized transfer station (often a waste dumping site within the city boundaries). From this site, waste is collected in bigger trucks to a dumping site on the outskirts of the city. Bamako's waste collection services is slightly better than the other cities resulting in higher collection rates.

Plastic waste with value is sourced at the following manners:

1. GIE waste collecting workers take the plastic waste with value out of the collected waste and sell it themselves directly to intermediary businesses (scrap dealers).
2. Waste pickers roam the streets, transfer stations, dumping sites and take out the valuable plastics and sell it to intermediary businesses (scrap dealers).

In a low income country such as Mali, plastic recipients such as water bottles, food containers and jerry cans are used over and over again and end up in the waste stream when they are too damaged.. Furthermore, valuable plastic waste such as hard plastic, film plastic and PET bottles are extracted from the household waste in Bamako. Whether this happens in the other three cities is uncertain. Nevertheless a considerable amount of plastic waste will end up in the environment or being burned in the 4 cities as can be seen in table 1.

[4] *Bamako, the time to act is now. An engine of growth and service delivery. – World bank group Feb. 2019*

Table 1: Estimates of amount of plastic waste recycled and ending up in the environment

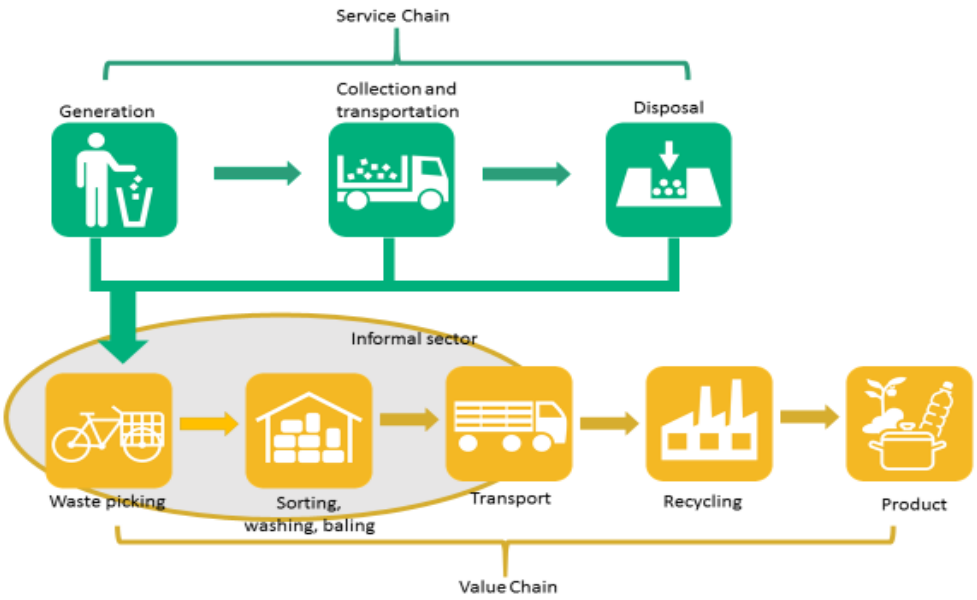
	Generation per capita in kg/day	Amount of hh waste generated/day (ton)	Percentage of hh waste collected (%)	Percentage of plastic waste at household level[5]	Estimate of percentage of plastic waste reused, recycled[6] and exported	Amount of plastic waste burned/in environment (tons/day)
Bamako	0.66	1320	40-50[7]	8	48%	55
Koulikoro	0.7	40	20-40[8]	8	30%	2
Kayes	0.58	92	40	8	20%	6
Gao	0.58	67	34	8	10%	5

The service chain and value chain in waste management

In waste management systems we identify two important chains that are interlinked: the service chain and the value chain (see figure 2).

The **service chain** is about providing services to remove waste from their point of generation to a (dump or disposal) site where they are burned, buried or stored. Often transfer sites are present which is the case in Bamako. These services are traditionally a public sector activity; and removal and disposal of waste are considered a public responsibility but can be outsourced to private service providers (GIEs or private waste collection companies).

The **value chain** of solid waste (organic and inorganic waste) involves activities that add value to waste in such a way that as a result products can be sold to customers. This is the chain where the informal sector (waste pickers and informal scrap dealers) are active.



[5] Africa waste management outlook, UNEP, 2018
[6] *Own estimates*

[7] *Bamako, the time to act is now. An engine of growth and service delivery. – World bank group Feb. 2019*
[8] *Bamako, the time to act is now – An engine of growth and service delivery – World bank group Feb. 2019*

3. Value chain approach

Value chain analysis is a widely used tool to analyse complex systems with the aim to identify bottlenecks hampering development or to identify potential for job creating. The overall objective of the analysis of the value chain is to create the basis for recommendations how to intervene in the present system to create jobs. This is done by evaluating where and how the change towards increased recycling can be made by overcoming the major bottlenecks and creating jobs at the same time. Bottlenecks are defined as factors that limit the performance and efficiency of the value chain and thus prevent or limit the move towards increased recycling. The bottlenecks can be either technical or non-technical (financial, organizational, legislative or societal) in nature. The value chain analysis consists of the following steps:

Step 1: Map the value chain and actors in the value chain
Step 2: Determine the value added in each step of the value chain
Step 3: Identify bottle necks hampering the value chain
Step 4: Give recommendations to overcome the bottlenecks and create jobs at the same time

3.1 Step 1: Map the value chain and the actors in the value chain

Figure 3 maps the simplified plastic waste value chain in Mali. It shows the steps in the value chain, beginning upstream on the left with the waste pickers, the waste collection workers in the GIEs and importers, moving through intermediaries performing processing activities (washing, sorting, baling, grinding) towards the recyclers and plastic product manufacturers who need to market their secondary raw material (flakes, pellets) or (recycled) plastic products. Intermediaries also sell volumes of plastic waste or flakes to traders who export higher quantities to surrounding countries.

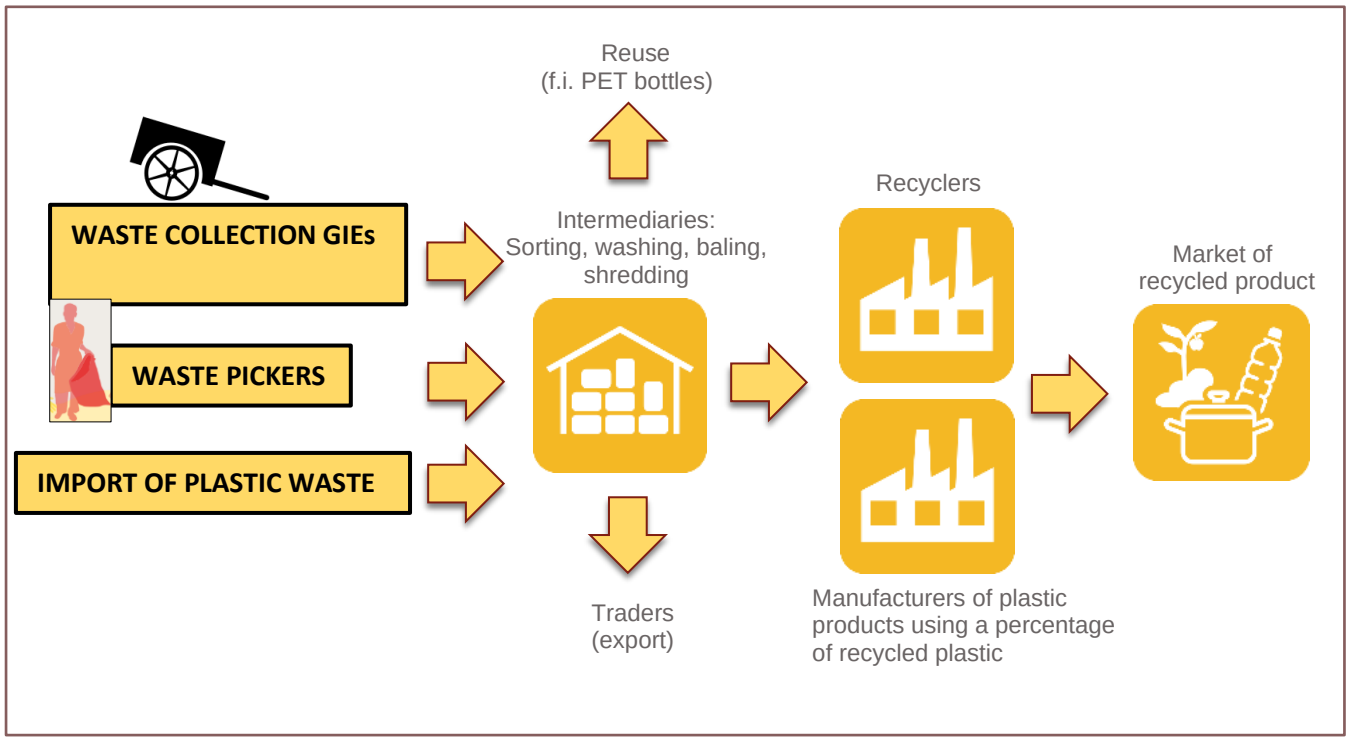


Figure 3: Map of simplified plastic value chain in Mali

Waste pickers and primary waste collectors (GIEs) are the first actor in the value chain. Collection and primary sorting creates the material streams, to which other actors add value:

1. **GIE waste collectors** take the plastic waste with value out of the collected household waste and sell it themselves to intermediary businesses.
2. **Waste pickers** roam the streets, transfer stations, dumping sites and take out the valuable plastics.

In this simplified value chain, the following key stakeholders are identified:

Actor 1: GIE (Groupement d'intérêt Economique)
Primary collection services are performed by GIEs, micro and small enterprises collecting the household waste mostly with a donkey cart or motorized vehicles such as a tractor with a lorry or a small truck. The households pay a monthly fee directly to the GIE for the waste collection. After collection, the GIEs transport the residual waste to one of the (informal) transfer sites. Valuable plastic waste is taken out and sold to intermediaries.

Actor 2: Informal waste pickers
Informal waste pickers refer to individuals that collect waste (not only plastic waste) from households, streets, public places or dump sites. Many of them are women, children, elderly, unemployed, or migrants, who work under unhealthy conditions with no social protection and often face social exclusion. We estimate that they collect daily an amount of 5 up to 25 kg of plastic waste maximum and can earn a daily living this way.

Actor 3: Intermediaries/scrap dealers
A business that buys, processes (washing, sorting, baling) and sells recyclables. The end product can be a certain quantity of plastic waste but can also be a secondary raw material product such as flakes (grinded hard plastic). Each step in the process adds value to the plastic waste material. Quite some intermediaries only take up one small step in the process. Most of these activities produce solid residues, dust and waste water and have environmental pollution risks and health hazards when pollution control measures and safety regulations are not implemented.

Actor 4: Traders
Plastic waste and secondary raw materials are transported cross boundary to other countries. This is done by traders who can afford to rent a truck and can finance the transportation. It is known that PP/PE flakes and baled PET bottles are exported from Mali to Ghana, Ivory Coast and Morocco.

Actor 5: Recyclers
A business involved in the recycling of plastic waste, producing a product by transforming plastic waste materials into a secondary raw material such as flakes or pellets or transforming plastic waste into a recycled product (buckets, crates, brooms, etc.).

Actor 6: Plastic product manufacturers
Plastic product manufacturers produce plastic products out of primary raw materials but often mix this with a certain percentage of secondary raw materials (20-40%). Prices of primary raw materials are high in Mali and this causes that markets for recycled materials are thriving.

Commitment-oriented relationships
Analysis of the plastic waste value chain revealed that there is a lot of mistrust between the different actors. Intermediaries are afraid to be cheated by waste pickers or other individuals by selling them

plastic waste materials with rocks and stones. The relationships are characterized by a stronger mutual commitment between the actors than it would be the case in a purely market based relationship. This is typical for a value chain dominated by informal actors.

3.2 Step 2: Determine the value added in each step of the value chain

In December 2019, a research study was conducted into the value of plastic waste by 11 students from Ecole Nationale d'ingenieur Abderhamane Babe (ENI-ABT). The objective was to gain more insight into the values of the different types of plastic waste in the value chain. The survey included data collection using questionnaires. The students performed 57 interviews in total of waste pickers GIEs, waste collection enterprises, intermediaries and recycling companies. From the study four important value chains are identified: hard plastic HDPE, hard plastic PP, soft plastic LDPE and PET bottles[9].

The following tables show how, in Bamako, value is added in each step of the value chain:

The HDPE value chain

Plastic materials comprised of high density polyethylene (HDPE) play an important role in the plastic recycling sector in Mali. They are found in the waste stream in the form of jerry cans of different sizes, buckets, crates but also shampoo bottles.

<table>
<tr><th colspan="4">Hard plastic HDPE (shampoo bottles/jerry cans (1 l up to 20 l)) – Dec 2019</th></tr>
<tr><td></td><td>Price (CFA/kg)</td><td>Actor</td><td rowspan="6">  </td></tr>
<tr><td>Unsorted (mixed colour)
Quantity 5-25 kg/day</td><td>25-80</td><td>Waste picker/GIE</td></tr>
<tr><td>After sorting and aggregation (one colour, regular supply)
Quantity 750–3000 kg/day</td><td>150-300</td><td rowspan="3">Intermediary</td></tr>
<tr><td>After shredding (one colour)</td><td>300-400</td></tr>
<tr><td>After washing</td><td>350-450</td></tr>
<tr><td>After pelletizing</td><td>500-600</td><td>Recycler</td></tr>
<tr><td>Final product: electricity tubes
  </td><td>1400</td><td>Final producer (recycler or plastic product manufacturer)</td><td></td></tr>
<tr><td>Virgin HDPE:</td><td>1000</td><td></td><td></td></tr>
</table>

[9] *The PVC value chain is also important but is not discussed in detail here as we do not promte the recycling of chlorid containing plastics*

Lessons learned from the HDPE value chain:

- Value chain already in place, in need of consolidation and improvement.
- Market is present and there is demand for reliable supply of well sorted HDPE waste material of one colour.

The PP value chain

Polypropylene or PP is typically sold to intermediaries by waste pickers who picked them out of the municipal waste. PP products which can be found on dumpsites are for instance yoghurt pots, sweet and snack wrappers but also caps of soda bottles are known to be manufactured from PP. However the PP value chain is less developed than the HDPE value chain.

Hard plastic PP (caps of soda bottles, yoghurt pots) - Dec 2019			
	Price (CFA/kg)	Actor	
Unsorted (mixed colour) Quantity 5-25 kg/day	30-80	Waste picker/GIE	
Sorting in colour	150-250	Intermediary	
After shredding	250-350		
After washing	350-450		
After pelletizing	550-600	Recycler	
Final product (20-40[10]% recycled) (for example: bowl) 	1500	Final producer (recycler or plastic product manufacturer)	
Virgin PP:	**1100**		

Lessons learned from the PP value chain:

- Value chain already in place, in need of consolidation and improvement.
- Market is present and there is demand for reliable supply of well sorted PP waste material of one colour and secondary raw materials (flakes and pellets).
- Upgrade of machines needed, f.i. in extruders with low energy consumption

The LDPE value chain

Low density polyethylene (LDPE) plastics maybe play the most important role in the recycling sector in Mali. Typical products made out of this polymer are the water sachets, the milk pouches and other film material. Workers in GIEs and waste pickers extract these materials from the household waste to sell to intermediaries.

[10] Depending on the quality of flakes/pellets

LDPE/PP film: water sachets/milk pouches, unprinted film material – Dec 2019			
	Price (CFA/KG)	Actor	
Unsorted	30-40	Waste picker/GIE	
After sorting to intermediary	70-80	Intermediary	
After sorting to industry (higher quantities)	200-400		
After washing (company)	250-450		
After agglomerating	350-550	Recycler	
Final product: carrier bag, black waste bin bag	1800-1900	Final producer (recycler or plastic product manufacturer)	
Virgin LDPE:	**1200**		

Lessons learned from the LDPE/PP film value chain:

- Value chain already in place, in need of consolidation and improvement.
- Market is present and there is demand for reliable supply of well sorted film waste material of one colour
- Upgrade of machines needed, for instance in extruders with low energy consumption

The PET value chain

Poly ethylene terephthalate, or PET, has a quite distinctive value chain compared to the previously presented cases. PET is easily recognizable as all mineral water bottles and soda bottles are made out of PET. Different colours are possible but transparent is mostly used and has the highest value. As far as we know no crushing or recycling of PET bottles takes place in Mali, only baling has been encountered. The bales are exported to Ghana or Morocco.

PET bottles (f.i. mineral water bottles) – Dec 2019 in Bamako, Mali			
		Actor	
Unsorted	25-50	Waste picker/GIE	
After sorting, removal of caps and labels	50-75	Intermediary	
White/transparent	75		
Green/mixed colour	50		
After baling (mixed) for intermediary	100		
White/transparent in higher quantities, baled	180-280		

Bales of 25 kg (transparent/ sorted colours) to the trader for export	600	Trader	
Virgin PET:	**1000**		

Lessons learned from the PET value chain:

- Value chain is not yet in place, only reuse is observed (of known), value chain can be improved with some simple measures.
- Market is present for baled PET bottles and flakes
- Investment in balers and grinders needed

3.3 Step 3: Identify bottle necks hampering the value chain

Based on the 4 inception reports and the research study (December 2019) into the values of plastic waste in Bamako, the following bottle necks hampering the plastic waste value chain, are identified:

Bottle neck 1: No reliable data available about the amount of plastic waste generated and recycled
Reliable data about the generation of household waste and the percentage of plastic waste in this household waste are vital for every waste management strategy and the implementation of activities. Many reports about waste management in Mali base the figures on generation of waste and composition of waste on outdated information. Even a recent report of the World bank (feb 2019) uses figures from 2014[11]. This hampers decision making at government level and creates difficulties when implementing activities with the objective to improve the SWM system.

Bottle neck 2: Lack of household waste collection services and no segregation at source
Bamako has developed slightly better waste collection services than the other 3 cities but nevertheless it is estimated that only 50% of the household waste is actually collected. Deplorable household waste collection services can be identified as one of the main bottlenecks of a well-functioning plastic waste value chain. GIEs workers take out valuable plastic waste from the collected mixed household waste and sell it to intermediaries, possibly through the sorting center of the GIE.

Plastic waste without value (multi-layer packaging, contaminated and printed bags, etc) is not segregated at household level but is mixed with other waste materials and ends up on dump sites. Waste pickers collect this plastic waste from these dumpsites in the city, where it has become dirtier and less valuable. All in all, not a good starting point for the well-functioning of the plastic waste value chains.

Bottle neck 3: The plastic waste that remains is difficult to recycle
Plastic waste seems to be everywhere in the 4 cities: on the streets, in street drainage , on river banks and on illegal waste dumps; plastic waste is scattered everywhere around. The valuable plastic such as whole and clean PET bottles, jerry cans, shampoo bottles, etc. is already picked up by workers in the GIEs or by the waste pickers. As already stated this is done in an inefficient way. Waste pickers only collect a minimum amount of plastic waste (5-20 kg per day per person), mixed and contaminated.

[11] *http://documents.worldbank.org/curated/en/154691549486819482/pdf/127221-repl-Bamako-Report-final-v4.pdf*

What is left over in the cities on the streets and on dumpsites has little or no value and is very difficult to recycle and is often burnt.

Bottle neck 4: Plastic recycling sector is weak

In Bamako only a few plastic recycling companies are present that produce products out of 100% recycled material (examples: Mama Plastico/SIGMA, GICMA, ZH Plastique) but they are not very well developed with regard to technology or quality of products. Environmental measures to prevent pollution of air and water are not implemented and health and safety risks exist for the workers in the factories.

Next to these recycling companies we estimate that around 40 manufacturers are present producing products from virgin plastic material mixed with a certain percentage of recycled plastic. An example of such a company is SIMPLAST.

Box: SIMPLAST

SIMPLAST manufacturers plastic products out of Poly Ethylene (PE) or Polypropylene (PP) virgin pellets and a certain percentage of recycled flakes or pellets from the local market. Examples of end products are buckets, plates, crates, etc. SIMPLAST has 11 extrusion mould machines and 5 blow mould machines. SIMPLAST is interested in buying more recycled pellets.

Electricity cuts and high prices of electricity are also hampering the well-functioning of the plastic recycling processes.

PET bottles are collected and baled but no recycling of PET takes place nor grinding (producing flakes).

Bottle neck 5: Lack of knowledge about types of plastic and plastic recycling technology

Only a few people in Bamako have a thorough understanding about the different types of plastics and related plastic recycling technologies. The processes that take place in Bamako, if they take place, are mainly manual sorting and rudimentary recycling activities without adding a lot of value to the plastic waste material.

Young people without a job are not likely to start a business in plastic waste management and recycling. A reason for this can be that they just not know the opportunities involved and do not have

the knowledge about the needed equipment and products that can be produced. Besides working is waste management has a negative image.

Bottle neck 6: The SWM financing system is not in favour of improving the system
Solid waste collection enterprises or recycling companies that would like to expand have difficulties to obtain a loan for their expansion needs and when available, interest rates are high (8-11% depending if it concerns a long term loan and short term and if the enterprise is managed by women). For start-ups it is nearly impossible to obtain funding to start a waste collection or plastic recycling enterprise.
The way the SWM system is financed at this moment (for example households pay GIEs directly for the collection service) is not very transparent and makes it easy for free riders.

Bottle neck 7: Mistrust between actors in the value chain/informality of the sector
Informality within the plastic waste recycling sector also creates a lot of mistrust between the actors as prices are not always clear and there is a fear of being cheated. On top of this, due to the informality of the sector, waste pickers and workers in these sector are regarded as inferior, despised by the general public and the formal sector.

3.4 Step 4: Give recommendations to overcome the bottlenecks and create jobs at the same time

Above several bottlenecks are identified and described, that hamper the functioning of the plastic waste value chain in Mali. The following solutions are proposed in recommendations keeping in mind the highest potential for job creation.

1. No reliable data available about the exact amount of plastic waste generated and recycled
Many reports about waste management in Mali base the figure on generation of waste and composition of waste on outdated information. It is vital to have recent figures for the 4 cities to be able to choose the right interventions.

Opportunities to seize:
The UN advises to determine these figures twice a year but once every three year is more feasible for the four cities using the following method[12]:

For countries and cities that do not have the data or have outdated information, a household survey to identify daily waste generation should be done. In the household survey, liner bags will be distributed to each household to be surveyed and ask head of household to put 7 days of waste generated. Then the liner bags are collected and its weight is measured. Household to be surveyed should be picked up according to the income levels. Composition of the different materials (glass, paper, cardboard, plastic, etc.) in the waste can be measured at the same time. Municipal waste from other sources such as market, restaurants, hotels, schools and so on also should be measured.

2. Lack of household waste collection services and no segregation at source
In all 4 cities coverage of waste collection services is very low, from 20 up to 50%[13]. In Mali, waste collection is executed using a lot of manpower. In Bamako, for example, it is estimated that over 2000 people are involved in waste collection through 180 GIEs (see annex 1). Better organization, upscaling

[12] https://unstats.un.org/wiki/display/SDGeHandbook/Indicator+11.6.1#Indicator11.6.1-DefinitionandRationale
[13] http://documents.worldbank.org/curated/en/154691549486819482/pdf/127221-repl-Bamako-Report-final-v4.pdf

and improving waste collection services in the 4 cities will provide enormous potential for job creation and at the same time result in an increase of the amount of plastics prevented from being burnt and dumped. It is not totally clear how many people really have a full time job in a GIE, as many people in Mali t on more than one income generating activity to spread the risks for having no income at all. . When improving waste collection services, It is estimated that 1 waste collection GIE employs 10 people and can collect approximately 3-4 tons of waste per day. The amount of jobs that could be created in waste collection is given in the table below and in the schematic figures in annexes 1 to 4.

Table 2: Estimates of amount of jobs that can be created in household waste collection

	Amount of hh waste generated (tons/day)	Amount of hh waste **not** collected	Amount of GIES that can be created (collection capacity is 3-4 tons/day)	Amount of jobs that can be created (10 jobs per GIE)
Bamako	1320	660 (50%)	165	1650
Koulikoro	51	36 (70%)	9	90
Kayes	67	40 (60%)	10	100
Gao	34	22 (66%)	5	50

The importance of segregation at source is without doubt and would improve the plastic waste value chain enormously. Introduction of segregation at source at household level (for instance in wet waste and dry waste) and the establishment of municipal sorting centres offers great opportunities to create jobs.

Opportunities to seize:

- ***Ongoing***: provide training and SEED funding to individuals and waste pickers to establish waste collection GIEs.
- ***In consultation***: cooperate with local governments to facilitate zoning and contracting with GIEs to cover the whole city with waste collection.
- ***Ongoing (one pilot)***: Promotion of segregation at source

3. The plastic waste that remains is difficult to recycle

Although Mali is a low income country and the consumption of plastic is low compared to high income countries, the amount of plastic waste on the streets and at illegal dumpsites is enormous. High value plastic is already taken out, and what is left is difficult to recycle. Additional financing mechanisms (public or EPR) are needed to be able to treat this type of plastics in an environmental safe way, the government should play a bigger role in this.

Opportunities to seize:

- ***Ongoing***: Provide training in sorting of waste plastics and value in the plastic waste.
- ***In consultation:*** Promote a ban on thin plastic waste and single use plastic items (planned to take place in August).
- ***New:*** Lobby with national government about installing an EPR mechanism.

4. Plastic recycling sector is weak

If we look at the amount of plastic recycled in Mali, we estimate that the percentage in Bamako is around 48% (including reuse and export). In the other 3 cities this percentage will be considerably lower (see table 3). Additionally, the plastic recycling machinery used in Bamako is outdated, unsafe

and in need of renewal. In the other 3 cities no recycling takes place, only some rudimentary tile producing in Gao and Kayes. Because the price of virgin plastic material is high in Bamako the demand for secondary raw material is high, it is even imported from the surrounding countries.

Modernisation of the plastic recycling sector in Bamako would improve the quality of recycled plastic in the value chain and increase the demand for secondary raw material from the other 3 cities. At the same time new jobs will be created (see annex 1 to 4).

Table 3: Estimates of amount of amount of plastic waste recycled in the four cities

	Amount of plastic waste generated (tons/day)	Rough estimate of amount of plastic waste reused, recycled or exported (tons/day)	Percentage of plastic waste reused, recycled or exported (tons/day)
Bamako	103.0	50.0	48%
Koulikoro	6.6	2.0	30%
Kayes	8.7	1.8	20%
Gao	7.5	0.8	10%

Opportunities to seize:

- ***Ongoing:*** Provide training in business skills to existing plastic recycling enterprises
- ***Ongoing***: Provide certificates to skilled workers
- ***Ongoing*** : Provide certificate/ guarantee letter to the recycling entrepreneur to collect industrial waste (to assure the manufacturer that it will be recycled and not to be reused)
- **Ongoing:** Capacitate all actors of the value chain in health and safety issues.
- ***Ongoing:*** Transfer knowledge of plastic recycling equipment especially the ones using less electricity
- ***New:*** Pilot innovations with profitable business cases in plastic recycling
- ***New***: With regard to PET bottles: Invest in balers and in the establishment of a washing and grinding line to produce flakes.

5. Lack of knowledge about plastic recycling technology

To tackle this bottleneck capacity building about plastic waste sorting, washing, pre-processing and recycling is important.

Opportunities to seize:

- ***Ongoing:*** Develop training materials about plastic recycling technology for beneficiaries
- **New**: Organize periodic group discussion to help business to develop their ideas in plastic recycling
- ***New***: Produce small products with small scale machines (innovations), start pilots

6. The financing system is not in favour of improving the SWM system

Solving this bottle neck will not create direct jobs in the plastic waste value chain but enables enterprises to start a business in plastic recycling or to expand their existing business.

Opportunities to seize:

- ***Ongoing:*** Provide finance (grant or loan with low interest) to start or expand plastic waste recycling enterprises based on a profitable business case

7. Mistrust between actors in the value chain/informality of the sector

To overcome this bottle neck it is important to improve the social status of waste pickers and of all workers working in solid waste collection and recycling.

Opportunities to seize:

- ***New:*** Design and implement a local outreach strategy to inform the general public about the importance of the work of the waste pickers and workers in solid waste through media circulation.

4. Conclusions

Plastic waste has value, our value chain analysis shows that, in Bamako, certain plastic waste value chains are functioning and thousands of people earn an income in plastic waste value addition activities. The following value chains work quite well: hard plastic HDPE, hard plastic PP and film plastic LDPE/PP. The value chains start with the waste pickers and the waste collection workers at GIEs, moving through intermediaries towards recyclers and plastic product manufacturers. Secondary raw materials (flakes and recycled pellets) are even exported to the surrounding countries. Other value chains such as used PET bottles and multi layer packaging, that is difficult to recycle, are hardly developed.

Nevertheless, although some value chains seem to function, the analysis of the value chain in the 4 cities showed various bottlenecks hampering the consolidation or improvement of the plastic waste value chains. These bottlenecks can be overcome by improving the efficiency of the whole value chain starting with improvement of segregation at source, better sourcing and sorting of plastic waste and investments in new technology and innovations. These initiatives will result in new jobs. The EJOM project can play an important role here to capacitate waste workers/pickers, providing seed funding and investments, function as intermediary and provide guarantees to the plastic recycling sector that are looking for reliable partners to supply them.

Potential for job creation

The potential for job creation in the plastic waste value chain is enourmous. In Bamako alone we estimate that 1,650 jobs can be created in the collection of household waste and up to 750 more jobs in improving sorting and recycling. The potential in the other three cities is less but is more important as unemployment rates are higher in the rural area. It is estimated that a total of 2,755 jobs can be created in the 4 cities.

Important to mention here that we want to create decent jobs meaning jobs with social security in place and with all health and safety measures taken into account. This can be done by integrating waste pickers in waste collection GIEs and in sorting centers.

Differences in the 4 cities

In **Bamako,** good working value chains exist for hard plastic and film plastic waste and here focus should be on improvement of the quality of recycled material and on improvement of recycling technology.

Koulikouro can benefit from the Bamako market as it can transport secondary raw material to Bamako more easily witht the recent finalisation of the highway. There is no need to start actual recycling activities here.

Activities in **Kayes and Gao** can focus on producing secondary raw materials to transport in truck loads to the nearest markets (Bamako or abroad). Next to this the tile making activities should be improved to be able to recycle low value plastics in an environmentally safe way.

Annex 1: Plastic waste value chain and potential for job creation in Bamako (2.094.000 inhabitants in 2013)

Value Chain Constraints/identified bottle necks	Value Chain Opportunities:	Value Chain Development Strategies
• Lack of knowledge about plastic recycling technology • Technology not available • Lack of separation at source • Plastic recycling sector not very well developed/weak • Low quality recycled products • Difficult to access credit	• Amount of plastic waste in the house hold waste: 106 tonnes/day (2 mln x 0.66 x 0.08) • Profitable value chains: hard plastic and film plastic • There is a demand for well sorted plastic waste, plastic flakes and recycled pellets (demand is also from abroad) • Presence of informal sector (labour and knowledge about plastic types with market value) but business mind can be improved	• Develop the plastic recycling sector: manufacturing of flakes, pellets and recycled plastic products, this will drive plastic waste collection and sorting • Exchange knowledge between Mali and India • Bring innovations (for instance paving tiles) to kickstart entrepreneurship • Integrate informal sector

Core value chain

Existing: 2000 workers and 5000 waste pickers[14]	200-300 Intermediaries	10 recycling enterprises and 40 plastic product manufacturers
Potential (estimate): 1650 jobs at GIEs	**400-600 jobs**	**50-100 jobs**

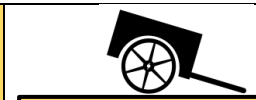
Opportunities for youth employment		Input from EJOM – WASTE	
• Improvement of collection, sorting, washing, baling, shredding of plastic waste • Increase knowledge about types of plastic • Improve business skills	• Improvement of recycling • Small scale recycling/ innovations to kickstart entrepreneurship	• Technical training and positions for beneficiaries to gain experience: MACROWASTE, KATURA, GICMAPLAST, SANUVA, others • SEED funding and investment funding for expansion	• Link to equipment catalogue

[14] *Based on: https://www.giz.de/en/downloads/giz2011-cwg-booklet-economicaspects.pdf*

Annex 2: Plastic waste value chain analysis and potential for job creation in Koulikoro (56.592 inhabitants in 2018)

Value Chain Constraints	Value Chain Opportunities:	Value Chain Development Strategies
• No separation at source • Plastic recycling sector not existent • Difficult to access credit	• Abundance of raw materials (plastic waste): 2.6 tonnes/day (56,592 x 0.7 x 0.08) • Market is near (Bamako) • Presence of informal sector (labour and knowledge about plastic types with market value)	• Improve sorting, washing and pre-processing • Exchange knowledge between Mali and India • Integrate informal sector

Core value chain



WASTE COLLECTION GIEs
1 GIE

WASTE PICKERS

Existing: 500 waste pickers
Potential (estimate): 90 jobs at GIES

Sorting, washing, baling, shredding

2-3 Intermediaries
20-25 jobs

Factory Process

0 Recyclers
0 jobs

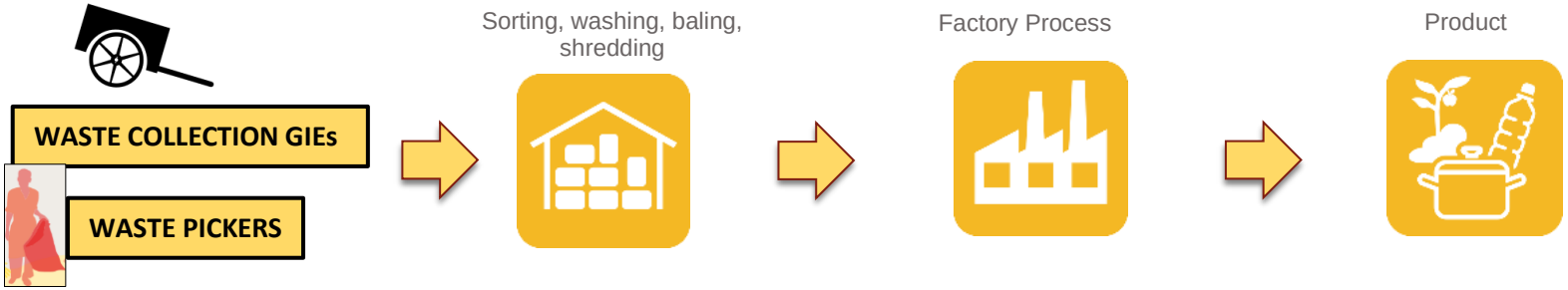
Product

Opportunities for youth employment		Input from EJOM – WASTE	
• Improvement of sorting, washing, baling, shredding to produce secondary raw materials		• Technical training and positions for beneficiaries to gain experience in Bamako • SEED funding and investment funding for expansion	• Link to equipment catalogue

Annex 3: Plastic waste value chain analysis and potential for job creation in Kayes (159.482 inhabitants in 2016)

Value Chain Constraints	Value Chain Opportunities:	Value Chain Development Strategies
• Lack of market of recycled products (545 km to Bamako) • Lack of separation at source • Plastic recycling sector not existent • Difficult to access credit	• Abundance of raw materials (plastic waste): 7.4 tonnes/day (159.482 x 0.58 x 0.08) • Presence of informal sector (labour and basic knowledge about plastic types with market value) • Market opportunities in Senegal, Nigeria • Recycling is socially accepted • The existence of pioneers in the field of waste recovery.	• Develop the plastic recycling sector: manufacturing of plastic recycled products, this will drive plastic waste collection and sorting • Exchange knowledge between Mali and India • Bring innovations adapted to local circumstance to kickstart entrepreneurship • Integrate informal sector

Core value chain



Existent : 300 waste pickers
Potential (estimate) : 100 jobs at GIEs

2-3 Intermediaries
60-65 jobs

1 plastic recycler (paving tiles)
10 jobs

Opportunities for youth employment		Input from EJOM – WASTE	
• Improvement of sorting, washing, baling, shredding to produce secondary raw materials		• Technical training • SEED funding and investment funding for expansion	• Link to equipment catalogue

Annex 4: Plastic waste value chain analysis and potential for job creation in Gao (115.444 inhabitants in 2018)

Value Chain Constraints	Value Chain Opportunities:	Value Chain Development Strategies
• No market for plastic waste or recycled plastic • Isolated • Safety situation • Lack of separation at source • Plastic recycling sector not very well developed/weak	• Abundance of raw materials (plastic waste): 5.3 tonnes/day (115.444 x 0.58 x 0,08) • Presence of informal sector (labour and basic knowledge about plastic types with market value) • Favorable institutional framework: priority of government and existence of financing structure (FAFPA, EJOM, APEJ, PROCEJ, ANPE, etc) • Existence of special plastic waste from military activities (BARKHANE, MINUSMA)	• Develop the plastic recycling sector: manufacturing of plastic recycled products, this will drive plastic waste collection and sorting • Exchange knowledge between Mali and India • Bring innovations to kickstart entrepreneurship • Use informal sector

Core value chain

Existent :500 waste pickers
Potential (estimate) : 50 jobs at GIEs

3 Intermediaries
50-55 jobs

1 existing enterprise (paving stones :UGVD))
10 jobs

Opportunities for youth employment		Input from EJOM – WASTE	
• Improvement of sorting, washing, baling, shredding to produce secondary raw materials especially for used PET bottles from military activities		• Technical training • SEED funding and investment funding for expansion	• Link to equipment catalogue

Annex 5: References

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3. **GRRD** Etat des lieux de la situation de la gestion des déchets dans la ville de **Koulikoro,** 2018
4. **BEIRCO-SARL** Recherche sur le secteur privé (PME et autres entreprises) travaillant dans les chaînes de gestion des déchets urbains y inclus la chaine alimentaire urbaine **Koulikoro,** 2018
5. **ISTAM**, Etat des lieux de la situation de la gestion des déchets dans les villes de Koulikoro, Kayes, Gao et le district de Bamako, Cas de la ville de **Kayes,** 2018
6. **EDR**, Recherche sur le secteur privé (PME et autres entreprises) travaillant dans les chaines de valeur de la gestion de déchets urbains y inclus la chaine alimentaire dans la ville de **Kayes,** 2018
7. **CEFAD**, Etat des lieux de la situation de la gestion des déchets dans la ville de **Gao,** 2018
8. **CODES**, Evaluation sur le secteur privé de la filière de gestion des dés déchets solides et le marché des matières recyclables et/ou de récupération dans la région de **Gao,** 2018