



United Nations  
Development Programme

# RECYCLABLE WASTE SUPPLY CHAIN IN LOMBOK ISLAND



Programme for Earthquake and Tsunami  
Infrastructure Reconstruction Assistance  
(PETRA)

2021

# Contents

Contents.....	i
Tables of Content.....	ii
Figures of Content.....	iii
1 INTRODUCTION .....	1
1.1 Background .....	1
1.2 Objectives .....	2
1.3 Output .....	2
2 Methodology .....	3
2.1 Geographical Scope .....	3
2.2 Source of Data Collection .....	3
2.3 Value Chain Analysis .....	4
3 RECYCABLE WASTE SUPPLY CHAIN.....	5
3.1 Recycle Actors in Lombok.....	5
3.2 Recyclable Materials Supply Chain and Waste Segregation.....	6
3.3 Waste Price Evolution.....	10
4 CONCLUSIONS AND LESSON LEARNT .....	1
4.1 Conclusions.....	1
4.2 Lesson Learnt.....	1
References .....	2
Appendix .....	3

## Tables of Content

Table 1. Recycle Rate of West Nusa Tenggara .....	5
Table 2. Waste Segregation from categories to detail .....	9
Table 3. Waste Segregation from categories to detail .....	11
Table 4. Waste prices in Middleman level.....	12

## Figures of Content

Figure 1. Lombok Island Map .....	3
Figure 2. Middleman level II Mrs. Surakyah Kediri West Lombok .....	6
Figure 3. Recyclable Materials in Lombok .....	7
Figure 4. Waste Segregation and End Buyer activity .....	8

# 1 INTRODUCTION

## 1.1 Background

Waste management is a big issue in West Nusa Tenggara Province. The government initiated a “zero waste” program with the concept of treating waste as a resource. The implementation of zero-waste program in NTB Province is to penetrate a circular economy concept to the waste management system. Therefore, the waste management program in Genggelang Village supported by UNDP uses the circular economy concept through TPS3R. Inorganic waste will be recycled through a waste bank, and organic waste will be managed with bioconversion technology using BSF maggot.

Circular Economy (CE) is a concept that would turn goods at the end of their service life into resources for others, closing loops in industrial ecosystems, minimizing waste and following sustainable methods (Valavanidis, 2018). A circular economy aims to generate economic growth by maintaining the value of products, materials, and resources in the economy as long as possible, thereby minimizing the social and environmental damage caused by a linear economic approach. It is not just a better form of waste management with more recycling (UNDP, The Economic, Social, and Environmental Benefit of Circular Economy, 2021).

Formal and informal recycling are fundamental to address environmental, social and economic issues linked to waste management in developing countries. The implementation of sustainable solid waste management in Genggelang village is depending on the recyclable supply chain in Lombok which mostly conducted by informal actors. The term of “supply chain” for this project include the recyclable material commercialization and the price evolution from the waste producers to end buyer in Lombok.

Solid waste management program in Genggelang village by UNDP PETRA is a part of output (2) Rehabilitation of affected communities’ economic infrastructure to promote more resilient and sustainable livelihoods. Hence, the aim of the waste management program is to provide new livelihood for the community

by manage the solid waste to change into tangible materials i.e., compost, protein (BSF maggots), and raw materials for recycle industries. The main problem of the solid waste management institutions for village level is the availability of end buyer for recyclable waste who able to buy with the highest price.

## **1.2 Objectives**

The objectives of recyclable waste value chain analysis include to provide information about recyclable waste stream and end buyer availability in Lombok, to ensure the waste segregation system suitable with the end buyer needs, and to provide information of the price and price evolution of the materials.

## **1.3 Output**

The output to be produced under the assignment is this final study report.



## 2 Methodology

### 2.1 Geographical Scope

The geographical scope of supply chain analysis is North Lombok, West Lombok and Mataram City. The location was determined based on the centre of middleman include Kediri West Lombok, Pemenang and Tanjung North Lombok, and Ampenan Mataram.

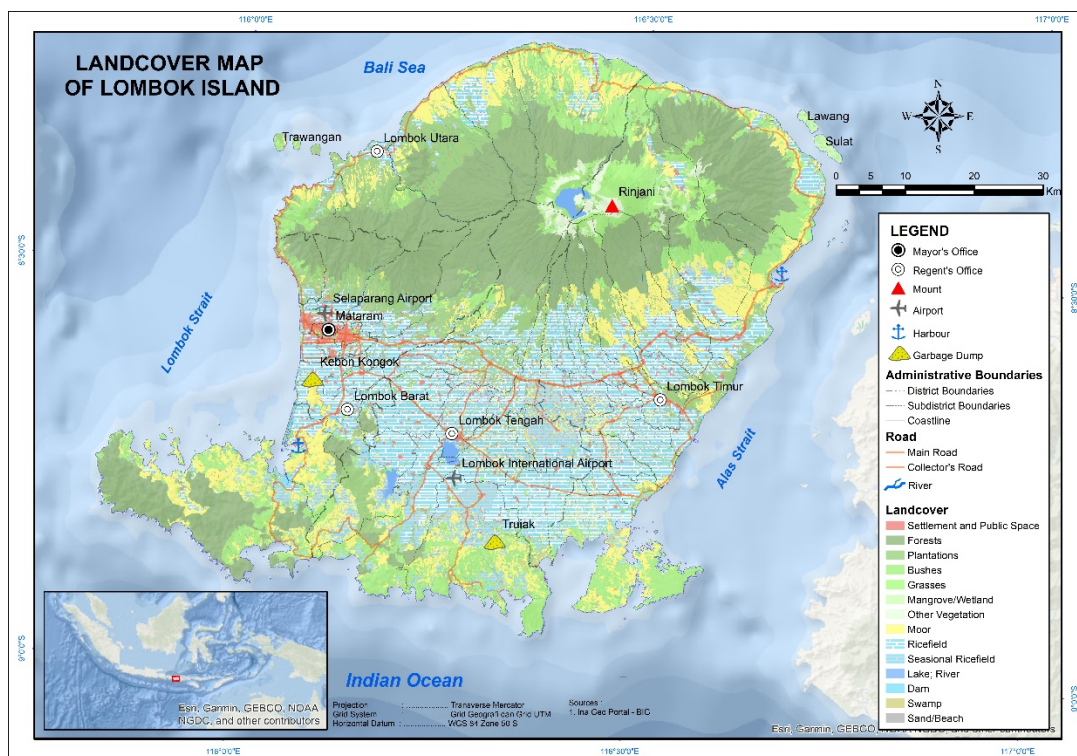


Figure 1. Lombok Island Map

### 2.2 Source of Data Collection

This study used both primary and secondary data, primary data coming from interviews with respondents, while secondary data came from previous study and other materials. The respondents of this study were selected with snow ball methods which started from the middleman from Genggelang village as the recyclable materials buyer for village level.

Recycle activities in Indonesia has been conducted by informal sectors which unrecorded by Indonesia Statistical Bureau. In order to select the

representative respondent, the survey was conducted in the centre of middleman as a collection point of the materials for shipping from Lombok to the factories in Java. Hence, the respondent was determined by snow ball methods.

### **2.3 Value Chain Analysis**

Value chain analysis (VCA) is a process where a firm identifies its primary and support activities that add value to its final product and then analyse these activities to reduce costs or increase differentiation. In case of recyclable materials in this project, the value chain analysis is focused to the recyclable waste as raw materials for recycle factory. The value chain will be analysed with the descriptive qualitative and crosstab analysis.



## 3 RECYCABLE WASTE SUPPLY CHAIN

### 3.1 Recycle Actors in Lombok

The actors in the recyclable waste supply chain in Lombok include scavenger, waste bank, TPS3R (Transfer Station with 3R facilities) and middleman. The middleman type is divided into three categories include

- “rongsok keliling” (middleman who pick and buy the recyclable materials direct from the waste producers) : middleman level III
- “pelapak” (middleman with small stall, and they usually bought the materials from perosok keliling : middleman level II
- “End buyer” (middleman who sell the recyclable materials direct to the recycle factory): middleman level I

Waste bank is the formal recycle activity for the community level that established by the Government. The main activity of waste bank includes recyclable waste collection from the waste producers, waste segregation, and sell the waste to the middleman. According to Environmental Agency of West Nusa Tenggara, the waste generation in NTB about 3.388,76 tons/day which transported to landfill about 641,92 tons/day. The waste bank managed about 51,21 tons per day. Unmanaged waste about 2695,63 tons/day. Hence, the recycle rate of this province only about 1,51% of the total waste generation. However, the main problem for the waste bank is the off taker of the materials. The dependency of waste bank from the middleman is very high. They mostly have stopped the operation due to the buyer or off taker. Presentation of waste recycle rate of NTB in 2018 as follow:

Table 1. Recycle Rate of West Nusa Tenggara

waste generation	3.388,76	100%
transported to landfill	641,92	18,94%
managed by waste bank	51,21	1,51%
unmanaged *)	2695,63	79,55%

\*) burnt, dumped to the river, collected by scavenger, etc.

Source: data.ntbprov.go.id

In contrast, TPS3R focused to the waste collection service and organic waste treatment. They usually segregate the recyclable waste based on the value

of the waste. They focused to the most valuable waste include PET (Polyethylene terephthalate); PP (Polypropylene), and papers. The single used plastic bag mostly ended to the landfill, for it categorized as low value materials. Moreover, the middleman in Lombok refuse to buy the single used plastics bag due to the transportation cost.

Generally, recycle activities in Indonesia are conducted by informal sector include scavenger and middleman. The recyclable waste collection in the landfill, vacant land, and water body mostly conducted by informal scavenger. Moreover, the recyclable waste from the households and public facilities in the project location ended those locations. The scavenger will pick the valuable waste freely, and they will segregate the waste to improve the value. The buyer will pay with the highest price for segregated waste.



Figure 2. Middleman level II Mrs. Surakyah Kediri West Lombok

### 3.2 Recyclable Materials Supply Chain and Waste Segregation

Supply chain analysis is the process of evaluating every stage of a supply chain starting from the time the business acquires raw materials or supplies from its suppliers to the delivery of final products to the customers. Based on the field assessment, the type of recyclable waste in Lombok is slightly different with the type of recyclable waste in Java. The middleman chose the valuable waste instead of all of the recyclable waste. The recycle factory mostly located in Java, so the

materials have to be sent to Java. Most of the middleman consider the shipping cost of the materials from Lombok to Java, so they only chose high price materials.

The supply chain of recyclable material is quite opposite with other materials (agriculture commodities and consumer goods). The supply chain of consumer goods and agriculture commodities start from producer who sell in big scale to consumer who bough in small scale. In contrast, the recyclable materials start from waste producers who sell in small scale to recycle factory who have to buy in big scale. The recyclable waste supply chain flow in Lombok is presented in the following picture.

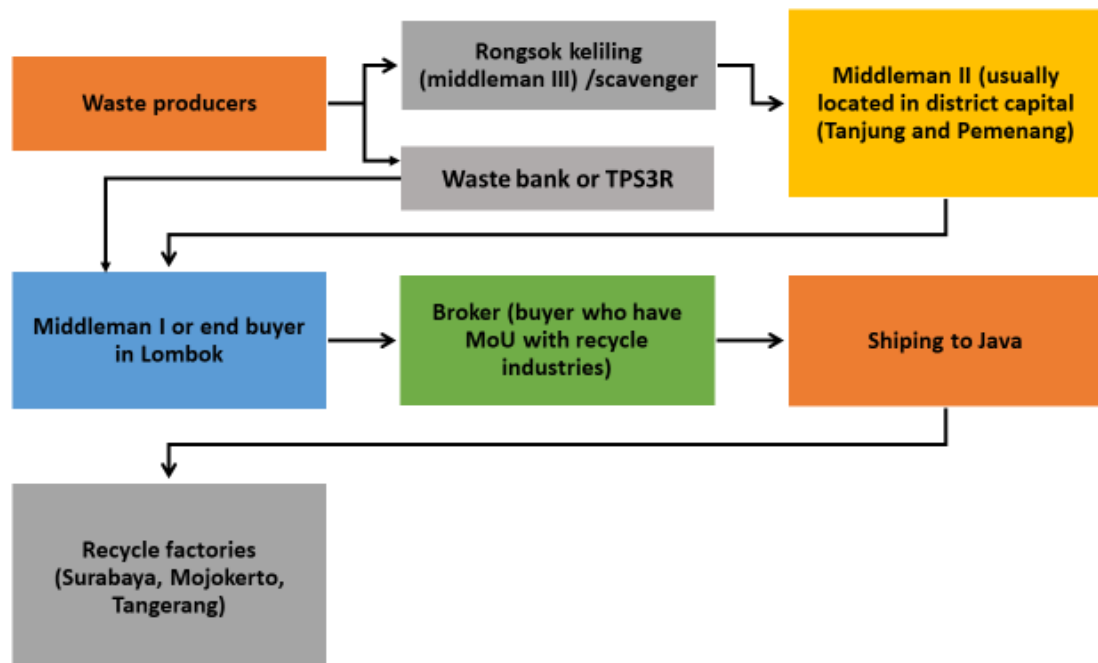


Figure 3. Recyclable Materials in Lombok

The previous flowchart showed the chain of inorganic market waste from the waste producers to the recycle factories quite long. The materials from the waste producers are bought by the scavenger or middleman III. The middleman III will segregate the waste based on the type to increase the price. The middleman II will segregate the waste based on the polymer and materials, and they will sell the waste to the middleman I. The end buyer of the waste in Lombok Island is middleman I who become highest level of the junk dealer. The end buyer usually focuses to a few types of waste for instance mineral water bottle, cardboard, glass bottle, metal.

The waste segregation is divided into three stages based on the actor who collect the recyclable waste. The first level middleman (tukang rongsok keliling/scavenger) prefer to buy unsegregated materials, so they can pay in lowest price. For example: the “tukang rongsok keliling” buy the mineral water bottle and cup about Rp 500 – Rp 1000/kg from the community. They will sort the materials more detail, and they will sell the sorted materials to the higher level of middleman (level II or III). The buyer will pay the mineral water bottle about Rp 2500 – Rp 3500/kg for middleman level II, and Rp 3500 – Rp 4500/kg for middleman level I.



Figure 4. Waste Segregation and End Buyer activity

The location of recycle factories are mostly in Java, so the waste market flow in Lombok is affected. The collected waste must be transported by ship to Surabaya. It resulted that the inorganic waste market is eventually vacuum due to the demand and shipping process. The segregation system in waste bank and TPS3R is more detail than “tukang rongsok keliling” or scavenger. The waste bank usually improves the capacity building of the member to segregate the waste which aimed to get the highest price. The waste bank and TPS3R will sell the segregated waste direct to the end buyer or middleman level I.

Middleman I usually focus to specific materials for instance middleman specialist metal, middleman specialist paper, middleman specialist plastic PET and PP etc. They will send the baled materials to Java. End buyer from Lombok sell the waste not necessary to the factories. They sell the waste through broker who have MoU or contract with the factory. The factory mostly bought the baled waste in big scale. The waste segregation based on the materials is presented in the following table:

Table 2. Waste Segregation from categories to detail

Waste producers (Categories)	Wastebank			end buyer		
Plastics	Plastics	Polyethylene terephthalate (PET Bottle)	PET Botol	Plastics	PET natural	PET Botol
Paper		Polypropylene cup	PP Gelas		PET blue ice	PET Botol biru muda
Metal		HDPE Blow	putihan		PET colour	
Glass		coloured PP	emberan		PET yellowish	
clothes		HDPE coloured	HD warna		PP Plastic	
electronics		other plastics	kerasan		HDPE Blow	HD putihan
residue		cardboard	Kardus		jerry cans (HDPE)	jerigen
	Papers	papers	Kertas		coloured bottle (HDPE)	HD warna
		duplex	duplex		Vixal bottle (HDPE)	HD warna
	Metal	Ferro A	Besi A		Indomilk bottle (HDPE)	HD Putihan
		Ferro B	Besi B		bottle cap (HDPE)	tutup botol air mineral
		Brass	Kuningan		IV bottle (PP)	PP infus
		copper	tembaga		gallon cap (PP)	tutup galon
		aluminium	aluminium		PP Plastic cup transparent	PP gelas
		soda can	aluminium sari		PP plastic cup colour	PP gelas sablon
		tin	Besi A		Ring of plastic cup	Ring gelas PP
	electronics	batteries	batrei		sheet plastic (LDPE)	lembar PE (plastik gula)
		Wet battery	aki		sheet plastic (PP)	lembar PP

Waste producers (Categories)	Wastebank			end buyer		
		other electronics	elektronik lainnya		others plastics	kerasan
	Glass			Paper	white sheet paper (plain paper)	kertas HVS
		beer bottle	botol bir		newspaper	koran
		ketchup bottle	botol kecap		mixed papers	kertas campur
					books/magazine	buku/ majalah
					cardboard	kardus
					cardboard with glossy sheet	duplex
				Metal	Ferro A (tin, pipe, etc)	Besi A
					Ferro B	Besi B
					soft drink cans	aluminium sari
					aluminium	aluminium
					copper	tembaga
					brass	kuningan
					bronze	perunggu
					electronics	Battries
				big battries		batrei besar (aki)
				small battries		batrei kecil
				Others		elektronik lainnya
				Glass	beer bottle	botol bir
					ketchup bottle	botol kecap

Source: Survey, 2021

### 3.3 Waste Price Evolution

The solid waste price was collected during end buyer mapping with the respondents include middleman, scavenger, and waste bank. The social condition informal recycler (scavenger and middleman) categorized as closed community, so most of them hesitate to answer the question about waste types and price. Based on the interview with the recycle factory owner in Semarang, most of the middleman refuse to inform the segregation detail based on the factory needs and

the price. The waste segregation is the biggest secret of the recycle business. They will get more price margin if the scavenger and waste producers sell the waste unsegregated.

The information of waste price was collected both from middleman for village level in Genggelang and middleman level I in Kediri West Lombok. However, the information of waste types based on the factory needed was collected from Bank Sampah Induk Kota Mataram called Lisang. The waste price from the middleman in the village is presented in the following table.

**Table 3. Waste Segregation from categories to detail**

Materials	Condition	Buy Price	Sale Price
Cardboard	Good	Rp 2000 – Rp 2500 /kg	Rp 3500/kg
Cardboard	Bad	Rp 2000 /kg	Rp 2500/kg
PET Bottle	Dry	Rp 1500 /kg	Rp 3000/kg
PET Bottle (1500 ml)	Dry, clean	Rp 300 / piece	n/a
PET Bottle (600 ml)	Dry, clean	Rp 100 /piece	n/a
PP	Dry	Rp 1500 / kg	Rp 3500/kg
Zinc roof	Dry	Rp 1700/kg	n/a
Cooper	Dry	Rp 45.000/kg	n/a
Aluminium	Dry	Rp 9000 / kg	n/a
Brass	Dry	Rp 45.000 / kg	n/a

Source: UNDP, 2021, (UNDP, Solid Waste Masterplan of Genggelang Village, 2021)

The result of interview showed that the waste price from the household to the scavengers or middleman are various which decided by the buyers (scavenger or middleman. In comparison, the price of waste from the middleman level III to the end buyer is affected by the detail of segregation and market condition. However, the price of the materials from middleman II to middleman I is extremely higher than the waste price from the household to middleman II or scavenger.

The results of survey showed that the middleman get the benefit from both the price margin and weight margin (the middleman will cut the result of weight measurement result/ reduce the waste weight). The waste from the middleman III and scavenger will be evaluated by the middleman I or end buyer. The weight for unsorted waste will be cut around 15 - 35% per kilogram, and the weight of sorted waste will be reduced around 5 – 10%. The price of waste in the middleman is presented in the following table.



Table 4. Waste prices in Middleman level

Waste categories	Waste type (English)	waste types (local name)	Price (IDR)	Remarks
Plastics	PET natural	PET Botol	4500	per kg
	PET blue ice	PET Botol biru muda	4500	per kg
	PET colour	PET warna	3200	per kg
	PET yellowish	PET kuning	3200	per kg
	PP plastic sheet	PP lembar	5000	per kg
	HDPE Blow	HD putihan	4000	per kg
	jerry cans (HDPE)	jerigen	5000	per kg
	coloured bottle (HDPE)	HD warna	2000	per kg
	Vixal bottle (HDPE)	HD warna	2500	per kg
	Indomilk bottle (HDPE)	HD Putihan	5500	per kg
	bottle cap (HDPE)	tutup botol air mineral	2000	per kg
	IV bottle (PP)	PP infus	3300	per kg
	gallon cap (PP)	tutup galon	3000	per kg
	PP Plastic cup transparent	PP gelas	6000	per kg
	PP plastic cup colour	PP gelas sablon	2000	per kg
	Ring of plastic cup	Ring gelas PP	n/a	
	sheet plastic (LDPE)	lembar PE (plastik gula)	n/a	
	others plastics	kerasan	n/a	
Paper	white sheet paper (plain paper)	kertas HVS	2000	per kg
	newspaper	koran	1500	per kg
	mixed papers	kertas campur	n/a	
	books/magazine	buku/ majalah	2000	per kg
	cardboard	kardus	2500	per kg
	cardboard with glossy sheet	duplex	500	per kg
Metal	Ferro A (tin, pipe, etc)	Besi B	3000	per kg
	Ferro B	Besi A	5000	per kg
	soft drink cans	aluminium sari	3000	per kg
	aluminium	aluminium	5000	per kg

Waste categories	Waste type (English)	waste types (local name)	Price (IDR)	Remarks
	copper	tembaga	57000	per kg
	brass	kuningan	3600	per kg
	bronze	perunggu	9000	per kg
electronics	Batteries	batrei	8000	per kg
	big batteries	batrei besar (aki)	8000	per kg
	small batteries	batrei kecil	8000	per kg
	Others	elektronik lainnya	n/a	
Glass	beer bottle	botol bir	700	per unit
	ketchup bottle	botol kecap	550	per unit

Source: Survey UNDP, 2021

## 4 CONCLUSIONS AND LESSON LEARNT

### 4.1 Conclusions

The recyclable waste supply chains in Lombok start from the community as waste producers to the middleman level I as end buyer.

- In order to improve the recycling activities in Lombok, the waste supply chains have to be simplified.
- Improvement to the waste collection system a
- Capacity building to the waste segregation must be implemented in Lombok, so the waste bank and TPS3R can access the middleman I directly.
- In conclusion, the price of recyclable materials will increase which will be followed by the willingness to segregate the waste by the community.

### 4.2 Lesson Learnt

The lesson learnt of the waste supply chain analysis include:

1. The recyclable materials collection and chains actors are dominated by informal sectors (i.e., scavenger and middleman) with untransparent system, so the information about waste price is various. The recycle actors mostly refuse to inform about the waste price, buyer, and detail segregation, for they get the main revenue stream of the business include price margin from the detail of materials segregation system. As result, the waste price survey must be conducted with grounded method to get information about the real price of the materials.
2. Recyclable waste price is affected by the transportation cost and distance. Unfortunately, the transportation cost from the village to the middleman centre couldn't be estimated in this research. The estimation of transportation cost should be conducted with trial of high volume of recyclable waste transport from the village to the middleman centre. This process could not be implemented due to the materials availability and time constraint.

## References

- Mulatsih, S., & Wijayanti, S. (2018). *Survey and Feasibility Study of Municipal Solid Waste Management using Mobile App in Tangerang, Bogor, Lombok (limited publication)*. Jakarta: Ecoasia Initiative. Ltd.
- NTB, K. (2021, June 25). *NTB official Website* . Retrieved from <https://www.ntbprov.go.id/program-unggulan-ntb/zero-waste>
- UNDP. (2021). *Solid Waste Masterplan of Genggelang Village*. Mataram: UNDP Petra.
- UNDP. (2021). *The Economic, Social, and Environmental Benefit of Circular Economy*. Jakarta: UNDP Indonesia.
- Valavanidis, A. (2018, July). Concept and Practice of the Circular Economy : Turning goods at the end of their service life into resources, closing loops in industrial ecosystems and minimizing waste. *Scientific Review*. Athens: <https://www.researchgate.net/publication/326625684>.

# Appendix

Appendix 1. End Buyer Mapping Results in Center of middleman

Remarks	Farhanah	Marianardi	Tanwir	Surakyah
Umur	30 - 40	40 - 50	50 - 60	40 - 50
Jenis kelamin	Perempuan	laki-laki	Laki-laki	perempuan
Status kependudukan	Warga ber KTP Lombok	Warga ber KTP Lombok	Warga ber KTP Lombok	Warga ber KTP Lombok
Alamat	Banyumulek Timur	Montong Are Kediri	Sedayu Tengah Kediri	Sedayu Tengah Kediri
Kendaraan pengangkut	truck	motor	motor	mobil pick up
Gudang	gudang permanen milik sendiri	gudang permanen milik sendiri	tidak punya gudang (halaman rumah)	gudang tidak permanen milik sendiri
Status lapak	Level I Langsung kirim ke surabaya	Level II jual ke pelapak lebih besar	level II	Level I
Kontak	08193220599	087745727704	087883607094	081946380564
Lama bekerja sebagai pengepul	3 tahun	5 tahun	1 tahun	10 tahun
jumlah tenaga kerja	17 orang	5 orang	2 orang	1 orang
mekanisme pengumpulan	menunggu penjual datang ke lapak, menjemput sampah dari penjual keliling	menjemput sampah dari penjual keliling	keliling sendiri, membeli dari pemulung dan masyarakat	menunggu penjual, menjemput sampah dari penjual
Spesifikasi	Botol PET	Plastik	kardus	Botol PET
	Gelas PP	Kardus		Besi
	Plastik lembar PE dan PP			Kertas/buku
				Kardus
Lokasi penjualan	Surabaya (shipping)	UD Usaha Baru (Jumain)	pelapak level I	pelapak level I
Penyebaran informasi harga	pada saat transaksi, melalui pesan singkat untuk pelanggan	ketika ada transaksi, melalui pesan singkat untuk pelanggan	ketika ada transaksi	ketika ada transaksi

Remarks	Farhanah	Marianardi	Tanwir	Surakyah
Harga	PET Beli 2500	Plastik (PET) beli 2200	kardus beli 2200	botol PET campur beli 2500
	PET Jual 3300	Kardus (Beli) 2500	kardus jual 3000	besi campur beli 1500
	Plastik daun beli 2000			kertas/buku campur beli 2000
	Plastik daun jual 5000			kardus beli 2200
				Pet pilah jual 4500
				Besi campur jual 4000

Appendix 2. Lisang Waste Bank Price List

Waste types	Condition	Code Name	Price (IDR)
Plastics	clean	HDP A	400
Plastik PE		PE A1	5800
Plastik PE bening		PE A2	3200
Plastik PE warna		PE A2	3200
Plastik PE kekuningan		PE Karet	3000
Plastik PP		PP	1000
PET bening		PET Clean vacuum	2150
			0
HD Blow nasso		HD blow naso	5050
HD Blow Putih		HD blow white	4150
HD Blow Hijau		HD blow green	1650
HD Blow Hitan		HD blow black	1950
HD blow kuning		HD blow yellow	1950
HD blow merah		HD blow red	2850
HD Blow abu-abu		HD blow grey	1950
HD blow biru		HD blow blue	2150
HD Blow vixal		HD blow vixal	3650
HD Blow botol indomilk		HD blow indomilk bottle	6650
HD Blow tutup botol		HD bottle cap	1650
Botol infus		LD transparat	3300
tutup galon		LD gallon cap	3000
			0
PET natural (Mangkak)	dirty	PET transparant	2000
PET natural (bersih)	clean	PET	3350
PET Blue Ice	clean	PET blue ice	2000
PET campur	clean	PET	2000
PET warna	clean	coloured PET	1500
			0
PP Gelas super	clean	PP super	6500
PP gelas	dirty		3000
	dirty	PP C	2150
		PP ring	1950
PP cacah kering	dry		8000
PP cacah basah	wet		7500
PET cacah kering	dry		4200
	wet		3000



Waste types	Condition	Code Name	Price (IDR)
		emberan	2000
		coloured PP	
		PP (pp with alluminium foil)	
			2200
			1500
			1500
			1500
karton			1700
Duplex		Duplex	799
Besi B			14500
Besi B		ferro	5000
Besi A			
aluminium sari	pressed	alluminium	5000
aluminium sari	unpressed	alluminium	3000
tembaga			57000
botol kecap			750
botol bir			1000
kuningan			3600
perunggu			3600
batrei besar			12500
Batrei kecil			12500
Kerasan			
Kerasan			500
			1600

Source: Bank Sampah Lisan Mataram, 2021

### Appendix 3. Middleman

Pengepul	Contact	Lokasi
UD Bintang Sejahtera	087865258027	Tatak, Nusa Tenggara Bar. 83573, Tanak Awu, Pujut, Kabupaten Lombok Tengah, Nusa Tenggara Bar. 83573
No Name	082147489463	Gunungsari Mataram Barat
Zuriati		Pejeruk Ampenan Lombok
Siti Aisyah (Bank Sampah NTB Mandiri)	087822596766	JL. Leo no. 24 lingkungan banjar selaparang, Pejeruk, Kec. Ampenan, Kota Mataram, Nusa Tenggara Bar. 83114