2. Business Model

HORIZONTAL AND VERTICAL EXPANSION OF THE COMMUNITY-BASED ENTERPRISE (CBE) SYSTEM FOR PRIMARY WASTE COLLECTION IN MONROVIA, PAYNESVILLE, AND SURROUNDING TOWNSHIPS

FUNDED BY THE EUROPEAN UNION

Cities Alliance
Cities Without Slums

HOSTED BY UNOPS

This study was conducted within the context of implementation of the project "Delivering Climate Resilient Solid Waste Management Services in Greater Monrovia, Liberia through Community-Based Enterprises"

Title:
Horizontal and Vertical Expansion of the Community-Based Enterprise (CBE) System for Primary Waste Collection in Monrovia, Paynesville, and Surrounding Townships

2. Business Model

Cities Alliance – 2021

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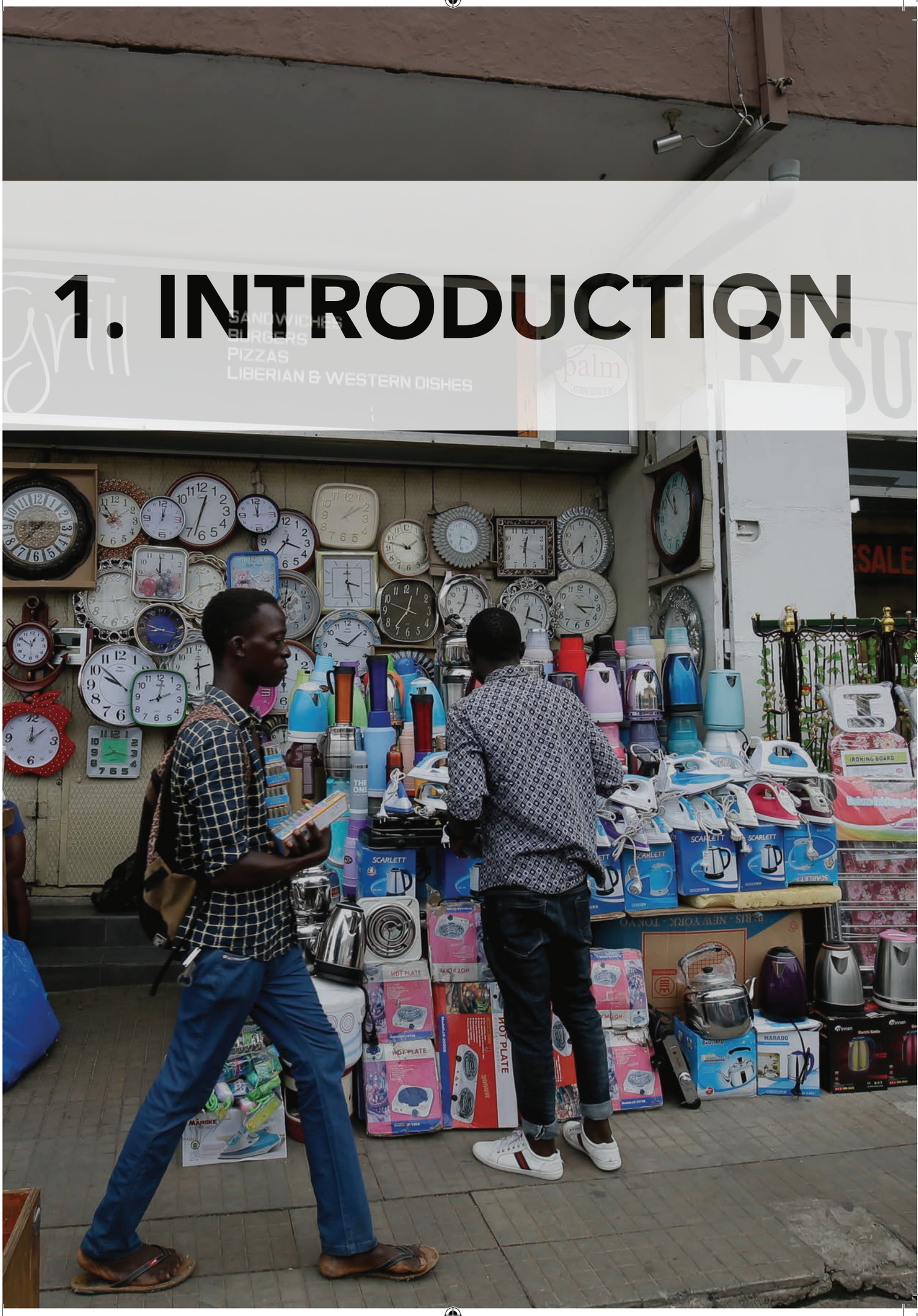
ACRONYMS

Acronym	Definition
BM	Business Model
CBE	Community-Based Enterprise
CEO	Chief Executive Officer
CLUS	Cheesemanburg Landfill Urban Sanitation
CMT	Community Management Teams
CSET	Center for Sustainable Energy Technology
EMUS	Emergency Monrovia Urban Sanitation
EU-Liberia	European Union
EPA	Environmental Protection Agency
FGD	Focus Group Discussion
HH	Household
LBR	Liberia Business Registration
MCC	Monrovia City Corporation
MIA	Ministry of Internal Affairs
MOU	Memorandum of Understanding
MPW	Ministry of Public Works
NACOBE	National Association of Community-Based Enterprises
NGO	Non-Governmental Organisation
PCC	Paynesville City Corporation
PPE	Personal Protective Equipment
PWCS	Primary Waste Collection System
SME	Small and Medium-sized Enterprise
SWM	Solid Waste Management
SWOT	Strengths, Weaknesses, Opportunities, Threats
ToRs	Terms of Reference
WTP	Willingness to Pay

1. INTRODUCTION



This is the third report related to the horizontal and vertical expansion of the CBEs, after a diagnosis report and proposal for a maturity model. It analyses the business models of the CBEs currently operating as well as projected business models, especially for future CBEs to improve the waste collection system. As in previous reports, we profile five different urban areas where specific business models have been set up (Figure 1).

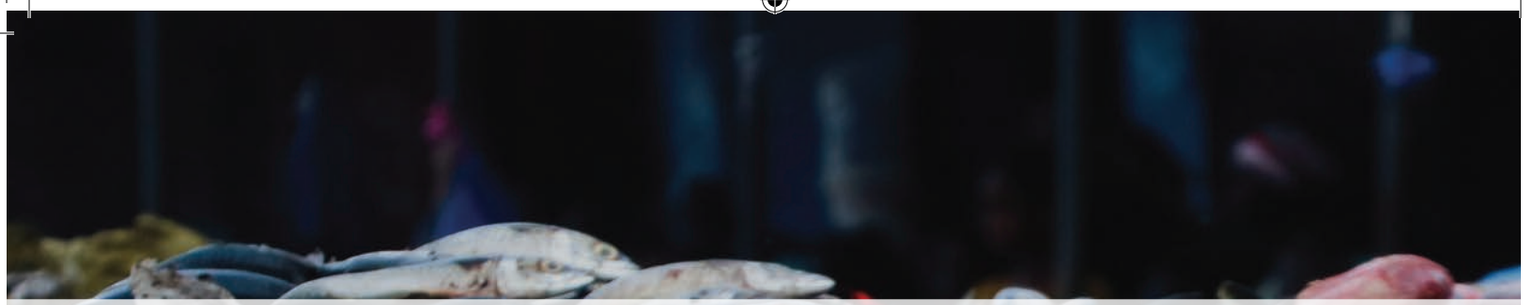
FIGURE 1: The five different urban areas identified

FIGURE 2: The five different urban profiles identified in MCC and PCC

An assessment of current business models was carried out in these different urban areas and is presented in the next chapter. The business models were drafted using data obtained in interviews with CBEs, focus group discussions, field visits during CBEs' daily or morning tours with GPS data collection, and interviews and discussions carried out for a previous assignment.

A hypothesis was created based on all the information collected. This hypothesis provides for a strong, robust business model that is closely aligned with the current CBE reality in the country.

The model may improve fees collected by CBEs, CBE work organisation for primary waste collection, and time carrying out the work, among others. A summary of the final ratio is described at the top of each business model.



2. ASSESSMENT OF CURRENT BUSINESS MODELS

2.1. Ratio for Calculation

The following tables show the ratio and hypothesis feeding the models. It is based on previous studies (such as the Arup baseline study and the Liberia National Statistics Report) as well as field data collection conducted by the consultant.

WASTE PRODUCTION

Waste Production	
Daily waste production per inhabitant	0.42 kg/day/capita
Number of people per HH	4.2 inh/HH
Projection Growth rate	1.37% per annum
Daily waste production per HH	1.764 kg/day/HH
Daily waste production per Business	1.764 kg/day/business
Waste Density	273 kg/m^3

WORKERS AND EQUIPMENT

Field data collection and interviews with CBEs:

Number of workers per equipments	
Puschart	2 workers
Wheel-Barrow	1 worker
Tricycle	1 worker
	1 driver
Pick-Up Truck	1 worker
	1 driver

Ratio of clients per worker & per equipment	
For any Puschart and Wheel Barrow	40 clients/worker
For tricycle	40 clients/worker

EQUIPMENT

Equipment for carrying	**Investment** Unit cost USD	**Capacity m³**	**Capacity T.**	**Years Life expectancy**
Mandiesel Truck-Medium Size -brand new	$ 17,500.00	22	6.5	7.5
Pick up truck-Toyota/ Mercedez-brand new	$ 14,500.00	15	3.5	5.5
Pick up truck-Toyota/ Mercedez-second hand	$ 5,000.00	15	3.5	3
Honda Tricycle brand new	$ 4,000.00	7	2	5
Honda Tricycle second hand	$ 1,200.00	7	2	3
INGO-Wheelbarrows Big size	$ 50.00	0.3	0.05	3
INGO-Wheelbarrows Small size	$ 35.00	0.15	0.04	3
Pushcarts-locally made	$ 400.00	2	0.5	5

Choosing the right equipment for waste collection is a challenge. Waste density is low compared to other materials used in, for example, construction. As a result, the truck used for both activities with a larger volume capacity and tonnage is more than needed for waste transportation. This is particularly apparent for large trucks transporting rocks and cement. For intermediate-sized equipment, such as those presented in the chart above, the ratio volume/tonnage is based on **optimal** waste density.

The most important identifiable requirements for equipment in the field are volume capacity and the ability to increase capacity for optimal functionality. Another factor is the overloading of smaller-sized equipment, particularly tricycles, which impacts their life expectancy.

We determined that the best way to "size" a model is to define the volume capacity based on the maximum tonnage given by the CBEs and the companies selling the equipment.

Maintenance and fuel consumption are some of the key costs related to the equipment. The consultant was able to estimate fuel consumption using GPS. The analysis of raw data further enabled the consultant to review some of the results: Fuel consumption was often unusually high compared to similar equipment in similar environments. However, when the fuel consumption was a bit higher than expected, the value recorded was the one kept for the business model. Higher average consumption of fuel is a good indicator of "bad" driving practices. Based on certain estimates, better driving can improve fuel consumption by around 30%.[1]

[1] Eawag conferences, Waste Collection in Developing Countries.

Equipment for carrying	**Maintenance cost/Year**	**Maintenance cost/Year**	**Fuel** L/km	**Monthly "amortization"**
Mandiesel Truck-Medium Size -brand new	$ 1,512.29	126.0	0.9	$ 182.29
Pick up truck-Toyota/ Mercedez-brand new	$ 1,392.29	116.0	0.5	$ 201.39
Pick up truck-Toyota/ Mercedez-second hand	$ 1,392.29	116.0	0.5	$ 138.89
Honda Tricyle brand new	$ 280.00	23.3	0.15	$ 66.67
Honda Tricycle second hand	$ 280.00	23.3	0.32	$ 40.00
INGO-Wheelbarrows Big size	$ 15.00	1.3	**Fuel Cost**	
INGO-Wheelbarrows Small size	$ 15.00	1.3		
Pushcarts-locally made	$ 115.06	9.6	0.94 USD/L	

Equipment for Safety PPE	**Investment** Unit cost USD	**Life expectancy**
Gloves	$ 5.00	3 months
Rainboots	$ 9.50	12 months
Raincoat	$ 12.00	12 months
Nose masks	$ 1.25	1 months
Safety Google	$ 2.50	24 months
INGO Overall	$ 20.00	1 months
Safety Boots	$ 24.00	24 months
Helmet	$ 6.50	24 months
Rain Suit	$ 15.00	12 months
Rain Coat	$ 12.00	12 months

OFFICE SPACE

Office space can vary from one CBE to another. For greater accuracy, we used a different ratio to the total, according to the area profile:

Office Space	**Monthly** Unit cost USD	*6 months rent*
Office room renting	$ 5.00	3 months
Stationaries	$ 9.50	12 months
Energy	$ 12.00	12 months

Office Space	**Investment** Unit cost USD	**Years** **Life expectancy**
Office Table	$ 132.50	5 Years
Office Chair	$ 125.00	5 Years
Laptop Computer	$ 612.50	5 Years
Desktop computer	$ 662.50	5 Years
Printer	$ 75.00	5 Years

FEES AND INSURANCE

We also included health costs. Very few CBEs provide health insurance to their workers, yet most stated that covering the medical costs of their sick workers was part of their business plan.

Fees in MCC are variable whereas PCC fees are fixed. The suggested average for MCC is reviewed for the different business model, depending on the urban profile:

Fees and Insurance	**Annual**
Health Insurance of workers	162.65 USD per worker
Hospital cost currently	174.70 USD per 12 workers
MCC Annual Fees - average	322.29 USD/year
PCC Annual Fees	600.00 USD/year
Business Registration GoL	24.10 USD
Business Registration Renewal	24.10 USD/year
UNION (NACOBE)	60.00 LRD/year

COMMUNICATION

CBEs are already spending money on communications. Additional features have been added to better prepare CBEs for future business models:

Communication	**Investment**	**Life expectancy**
Megaphone-big size	40 USD	1 Year
Megaphone-small size	25 USD	1 Year
Flyers	30 LRD/100 flyers	3 months
Call cards or any promotional aspects	35 USD/100 cards	3 months
Radio spot - recording prepared by business owner	70 USD/spot/ 2 times daily -one week	
Radio spot - recording prepared by radio station for airing	145 USD/spot/ 2 times daily -one week	

2.2. Population

Population has been estimated with figures from the Arup baseline study, with estimated growth mentioned in the hypothesis. The population data has been segregated per type of area, to highlight the impact of the different models.

TABLE 1: 2019 population per zone

Zone	Population 2019	# Household 2019	Zone
New Kru Town	93,114	22,170	2
Logan Town	73,813	17,574	2
Clara Town	70,378	16,757	2 & 3
West Point	37,455	8,918	3
Central Monrovia A	53,472	12,732	1
Central Monrovia B	51,631	12,293	1
Sinkor	55,555	13,227	1
Lakpazee	53,353	12,703	1
Old Road	61,257	14,585	1
Congo Town	32,000	7,619	1
Paynesville	445,401	106,048	5
Gardnesville	10,202	2,429	4
New Georgia	68,762	16,372	4
Bardesville	44,697	10,642	4
Johnsonville	5,728	1,364	4
Caldwell	33,736	8,032	4
TOTAL Greater Monrovia	**1,190,555**	**283,465**	
Total Zone 5	**445,401**	**106,048**	**37%**
Total Zone 4	**163,126**	**38,839**	**14%**
Total Zone 3	**58,568**	**13,945**	**5%**
Total Zone 2	**216,192**	**51,474**	**18%**
Total Zone 1	**307,268**	**73,159**	**26%**

2.3. Fee Differences Between Areas

Average fees vary between Monrovia and Paynesville (or any other type 4 areas). Figures 3 and 4 show the disaggregation between clients and businesses, and between the CBEs of MCC and PCC.

FIGURE 3: CBE fees in MCC

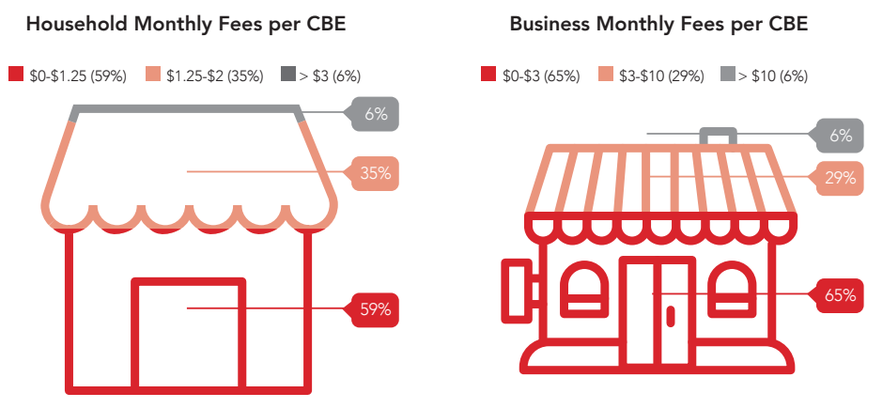
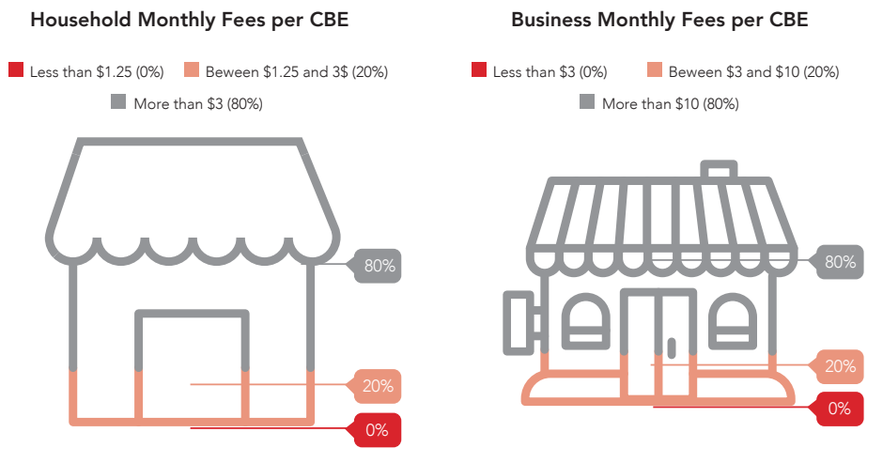


FIGURE 4: Average CBE fees in PCC and the outskirts of Monrovia



- The difference in fees between areas is in part due to differences in access to secondary waste collection. There are many secondary collection points in MCC territory, while areas in Areas 4 and 5 lack secondary collection points – resulting in higher transportation costs. The CBEs in Areas 4 and 5 cover most of the entire primary waste collection chain (unlike the CBEs in MCC), which can be attributed to clients willing to pay more for service.

3. ASSESSMENT OF THE DIFFERENT URBAN AREAS

3.1. Area Type 1

1

Central Monrovia, Sinkor, Congo Town:

Residential and business areas, densely inhabited, rich to low-income HH, slums included

The model has been drafted for a single CBE, based on the situation of OCEAN, the current number of clients, the service delivery organisation, fees, and information in this area.

	HH	Business
Number of clients	400	400
Average monthly fee	$ 1.25	$2.73
Recovery Rate	100%	100%
Monthly income	$ 500.00	$1,092.00
Total Monthly Income	**$1,592.00**	
Monthly Tonnage of waste (T.)	21	21
Total Monthly Tonnage	**43 T.**	
Monthly Volume of Waste (m^3)	77.54	77.54
Total Monthly Volume	**156.00 m^3**	

Number of working days/week	**6**
Tonnage collected/working day	**7 T.**
Volume collected/working day	**26 m^3**

Fees and recovery rate estimates were based on discussion and focus groups held during field data collection.

To carry out their work, CBEs require the following equipment. The estimated percentage of clients served by the various equipment was based on the data collected.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to SCP
Pushcart	40%	4	2	2.87	10.50	3
WheelBarrows	20%	4	4	1.43	5.25	9
Tricycle	40%	4	2	2.87	10.50	1

Transportation to the secondary collection points (SCP) is calculated based on the table below, with the results in line with field observations of this CBE:

Time spent per client				
Wheel-barrow or Pushcart collector	3 minutes			
Tricycle collector	4 minutes			
Time spent for transport	**average speed (km/h)**	**Distance RC/skip**	**Time (return) min.**	**Number of working hours/day**
Puschcart	4	1	30	5
WheelBarrow	4	0.5	15	4
Tricyle	25	3	15	6

The number of working hours per day is more or less in line with what was observed. These working hours do not include any stops or lunch break. The time spent per client is derived from the data collected by GPS. The breakdown of expenditures by item is detailed in Figure 5 and Table 2.

FIGURE 5: Breakdown of expenditures, Area 1

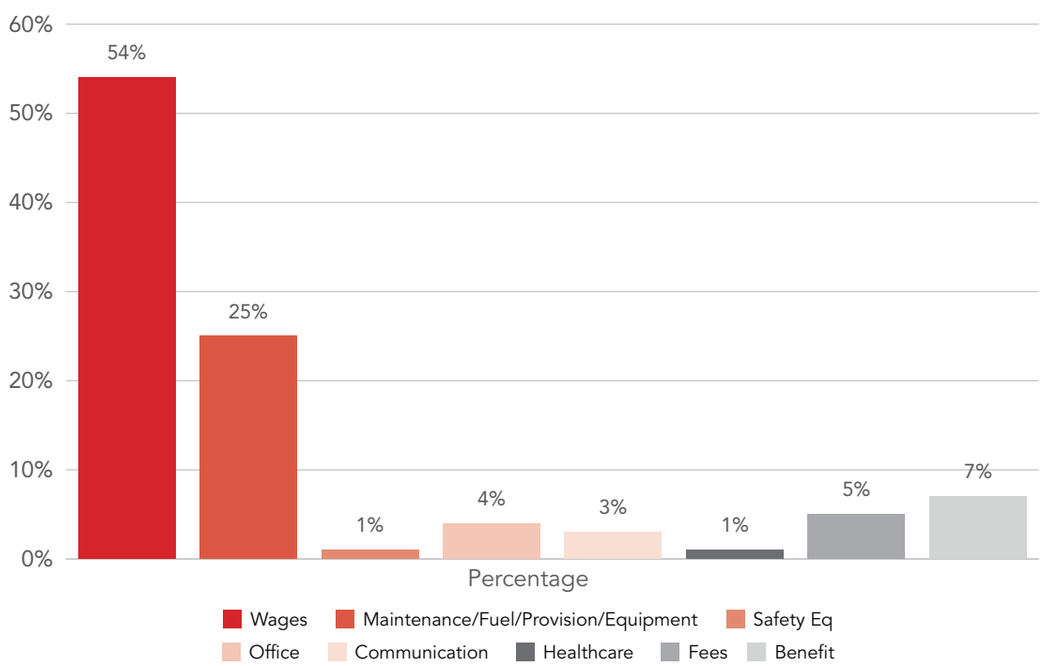


TABLE 2: Breakdown of expenditures, Area 1

	Monthly	Percentage
Wages	$ 859	54%
Maintenance/Fuel/Provision/Equipment	$ 392	25%
Safety Eq	$ 10	1%
Office	$ 71	4%
Communication	$ 49	3%
Healthcare	$ 17	1%
Fees	$ 83	5%
Benefit	**$ 112,08**	**7%**

Wages are the main expenditure, followed by maintenance, as indicated in the interviews.

A total of 14 people are working: two managers, two drivers, and 10 waste collectors.

- In the current context, with CBEs having around 800 clients, more than 90 CBEs are required to cover 100% of clients in Area 1. Currently, about 10 CBEs work in this area.

3.2. Area Type 2

2

Clara Town, New Kru Town etc:

Mainly slum areas with key business areas nearby, highly densely inhabited, low-income HH

Some CBEs have turned into SMEs, meaning they have invested in larger equipment and targeted the most lucrative clients in these areas. The business model for the SMEs is not included in this report, as they are a separate organisation, and this report focuses on CBEs.

The two companies – one targeting business clients, and one targeting HH and smaller business clients – share some equipment, such as the vehicle. Part of its maintenance is supported by the service delivered to larger business clients. The case study of the CBE Fombaco is used for this section.

	HH	Business
Number of clients	200	75
Average monthly fee	$ 1.21	$ 2.42
Recovery Rate	100%	100%
Monthly income	$ 242.00	$ 181.50
Total Monthly Income	**$ 424.00**	
Monthly Tonnage of waste (T.)	15	6
Total Monthly Tonnage	**21 T.**	
Monthly Volume of Waste (m^3)	55.38	20.77
Total Monthly Volume	**1 77.00 m^3**	

Number of working days/week	**3**
Tonnage collected/working day	**7 T.**
Volume collected/working day	**26 m^3**

Fees are almost the same as in Area 1, and the recovery rate is high. In these areas, CBEs are more active in denying services to clients that do not pay.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to SCP
Pushcart	0%	0	0	-	-	
WheelBarrows	50%	3	3	3.50	12.82	25
Tricycle	50%	2	1	3.50	12.82	

No tricycles and pushcarts are used for the collection service in this area, while a truck is used by the SME. Its purpose is to transport waste to the transfer station, as skip buckets often overflow.

Time spent per client				
Waste collector	3 minutes			
Time spent for transport	**average speed (km/h)**	**Distance RC/skip**	**Time (return) min.**	**Number of working hours/day**
Puschcart	4	0.3	9	6
WheelBarrow	4	0.3	9	6
Truck	25	3	15	0.25

Because the truck is used for other purposes in addition to transporting waste, its maintenance and amortisation cost is based on other daily activities. Interviews indicate that the waste collection from households and small businesses only accounts for 10% of a truck's activity. Consequently, 10% of its cost has been used for the current business model.

Due of the challenges faced in these areas, no amortisation of the equipment has been included in the business model.[2]

FIGURE 6: Breakdown of expenditures, Area 2

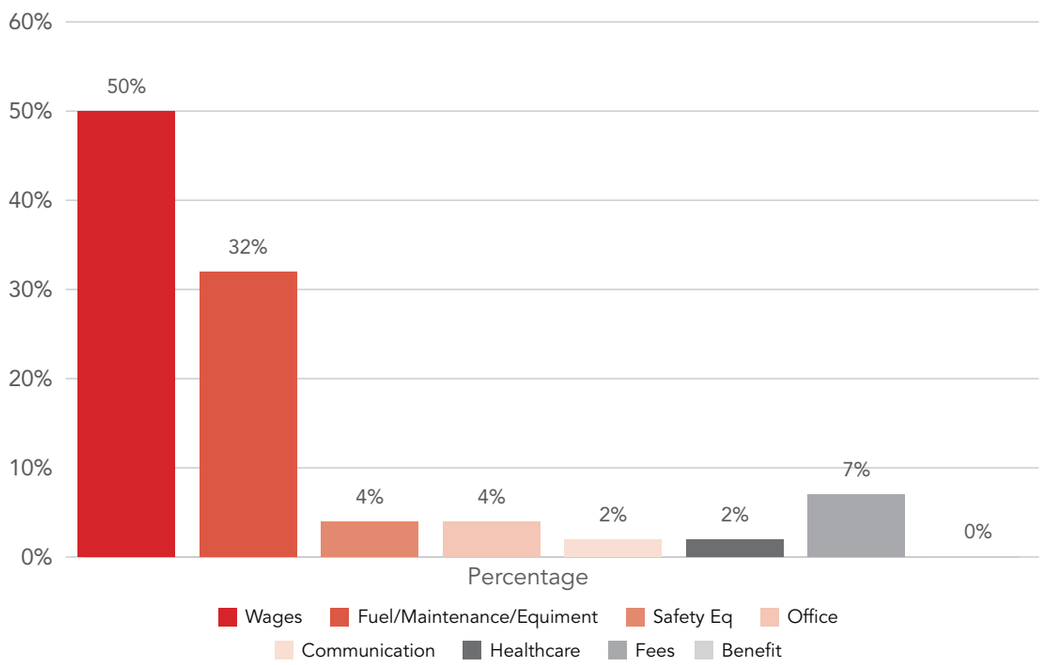


TABLE 3: Breakdown of expenditures, Area 2

	Monthly	Percentage
Wages	$ 211	50%
Fuel/Maintenance/equiment	$ 136	32%
Safety Eq	$ 16	4%
Office	$ 17	4%
Communication	$ 10	2%
Healthcare	$ 7	2%
Fees	$ 29	7%
Benefit	**$ -2,09**	**0%**

[2] The manager of Fombaco is looking at the option of a loan to invest in a new truck.

In this context, benefit is minimal, and interest in the activity is more related to community services. Some areas, however, are more profitable than those in Area 2, which presents the option for CBEs to target these more lucrative areas and invest in larger equipment. Services for households and small businesses are designed according to this business plan. The CBEs in Area 2 have found a good balance between lucrative waste collection services and low-demand areas.

Interestingly, CBEs working in these areas said that they not only stopped providing service in cases of payment default, but also because of a lack of compliance with CBE rules. The basic rule some households failed to comply with was dumping human excrement into the solid waste collection service. This raises the possibility that collecting liquid sanitation waste might be a much more lucrative business in these areas. Some services designed by organisations such as WSUP in Ghana and SOIL in Haiti are dedicated to slum areas and liquid sanitation.

- Number of HH clients per CBE in these areas is quite low. Based on the number of Fombaco clients, more than 250 CBEs would be required. Here, the service has to be pushed by strong communication skills and revised approaches to skip management. In areas where liquid sanitation is a major challenge, it could provide a form of income diversification for CBEs to offer such a sanitation service. This option could be investigated through a further study.

3.3. Area Type 3

3

West Point, SKD, etc.:

Slum areas without key business areas nearby, highly densely inhabited, low-income HH

These areas are more challenging than Area type 2 because it is difficult to engage in a side business with larger clients.

The business model outlined below is from SKD Venture Services, the most performing CBE in this area:

	HH	Business
Number of clients	110	34
Average monthly fee	$ 1.93	$ 1.93
Recovery Rate	100%	100%
Monthly income	$ 212.30	$ 65.62
Total Monthly Income	**$ 278.00**	
Monthly Tonnage of waste (T.)	8	3
Total Monthly Tonnage	**11 T.**	

	HH	Business
Monthly Volume of Waste (m^3)	30.46	9.42
Total Monthly Volume	**40.00 m^3**	

Fees were kept at the same average as other areas since many more areas are paying a bit less, according to the interviews. Cities Alliance requested including the business model of the most performing CBE, so its fees are probably higher than those of other CBEs.

Number of working days/week	**6**
Tonnage/working day	**2 T.**
Volume/working day	**7 m^3**

Waste collection is exclusively by wheelbarrow with one tricycle driving them to the SCP, as long as the roads are usable. Other CBEs working in these areas have no tricycles, only wheelbarrows and pushcarts.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to SCP
WheelBarrows	90%	4	4	1.65	6.04	9
Tricycle	10%	1	1	0.18	0.67	1

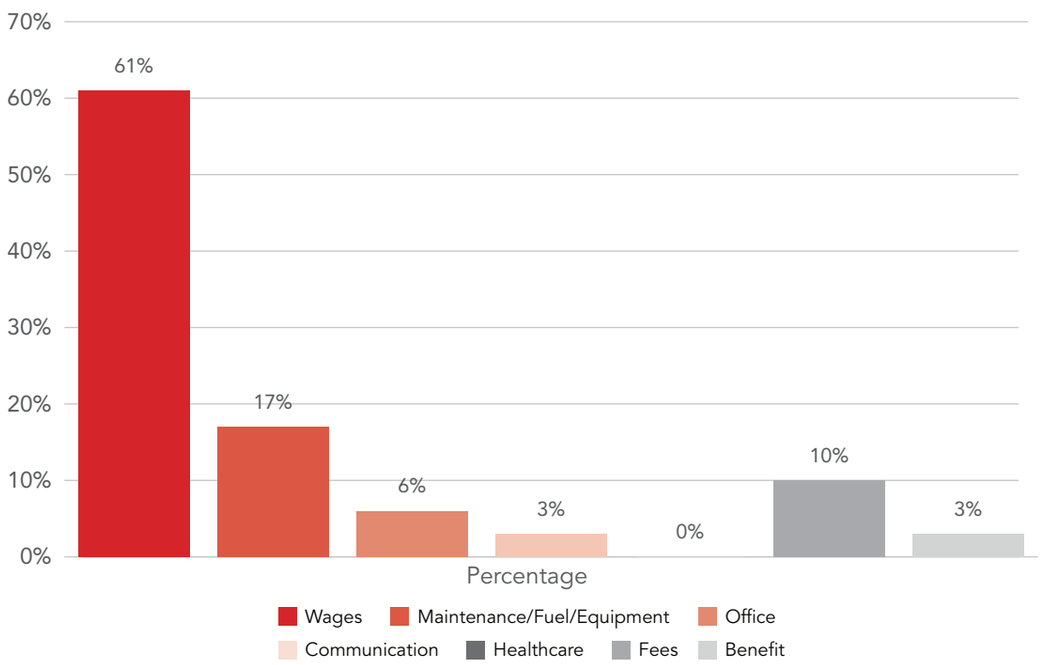
Skip buckets are much closer, and the areas profiled in Area 3 are closer together than in the other contexts. This means reduced distance between skip buckets and clients.

Time spent for transport	average speed (km/h)	Distance RC/skip	Time (return) min.	Number of hours/day
Puschcart	4	0.3	9	
WheelBarrow	4	0.3	9	3
Tricyle	25	3	15	4

Fuel-based transportation and tricycles are hard to find in these areas. The CBEs interviewed said it was difficult to pay for healthcare or any additional costs related to their workers. Any additional costs would lead to closure of the business. The salary and cost of office have been lowered to fit with their data:

Wages	**Monthly wages** Unit Cost LRD
Waste collector	$ 3,500.00
Supervisor	$ 4,500.00
Tricyle Driver	$ 4,500.00

FIGURE 7: Breakdown of expenditures, Area 3



Wage is the biggest item for expenditure, and there is little benefit for the CBEs. Fees from MCC and business registration are making an impact on the business model.

TABLE 4: Breakdown of expenditures, Area 3

	Monthly	Percentage
Wages	$ 168	61%
Maintenance/Fuel/Equipment	$ 47	17%
Office	$ 18	6%
Communication	$ 9	3%
Healthcare	-	0%
Fees	$ 29	10%
Benefit	**$ 7,15**	**3%**

CBEs that are performing the service with low wages make very few benefits. Managers have the capacity to get higher revenues, but investment capacity is very low. Stories of human excrement in plastic bags was also reported in these areas.

- More than 70 additional CBEs are required to cover this area. Without incentives and communication from institutions, reaching 100% coverage would be a real challenge. Any requirements for waste transportation that demand investment in motorised equipment would lead to business closure. Interestingly, additional activities related to liquid sanitation or management of the skip buckets may strengthen business activity.

3.4. Area Type 4

4

Garnesville, Brewerville, Caldwell, Monrovia outskirt:

Mainly residential with few businesses, less densely inhabited, middle income (rich and poor)

Area 4 covers some of the townships of Greater Monrovia. It encompasses Garnesville, Brewerville, Caldwell, and areas on the outskirts of Monrovia, townships, or municipalities.

A key characteristic that came out of the interviews is the higher fees collected in these areas. The overall willingness to pay may not be higher, but it is for the few currently subscribing to the service. Wiapad in Garnesville is the most performing CBE in this area.

	HH	Business
Number of clients	200	100
Average monthly fee	$ 1.23	$ 13.50
Recovery Rate	95%	95%
Monthly income	$ 233.70	$ 1,282.50
Total Monthly Income	**$ 1,517.00**	
Monthly Tonnage of waste (T.)	15	8
Total Monthly Tonnage	**23 T.**	
Monthly Volume of Waste (m^3)	55.38	27.69
Total Monthly Volume	**84.00 m^3**	

The average number of clients is lower than in the other areas. The table above shows that businesses are charged much more than households, based on the interviews conducted with this CBE. From field investigations and follow-up during the collection tour, households might be charged more per month than businesses pay on a weekly basis. Results from the interviews indicated that the diversity of revenues is much wider than in Monrovia or Clara Town. The business is growing in this area type and demand has not yet matured.

Number of working days/week	**3**
Tonnage/working day	**8 T.**
Volume/working day	**28.08 m^3**

Field observation did not allow for drawing a clear line between the types of areas and their waste production. It was decided to keep the same hypothesis of 0.43kg/day/capita.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)
Pushcart	0%	0	0	-	-
WheelBarrows	80%	6	6	6.13	22.47
Tricycle	20%	2	1	1.53	5.62

In this area type, there are no pushcarts, and every CBE owns a form of motorised equipment. The service delivery f WIAPAD is a good one, compared to Ocean in Brewerville, with a good optimisation of wheelbarrows and tricycles.

Time spent per client				
Waste collector	3 minutes			
Tricycle collector	4 minutes			
Time spent for transport	**average speed (km/h)**	**Distance RC/skip**	**Time (return) min.**	**Number of working hours/day**
Tricyle	25	5	24	6

What is more challenging in this context is that the distance between clients might be much further, and the average time the tricycle collector spends serving clients could therefore be much longer. In addition, distance to a skip, reconstructed bin, or transfer station is on average much more than in the other area types.

FIGURE 8: Breakdown of expenditures, Area 4

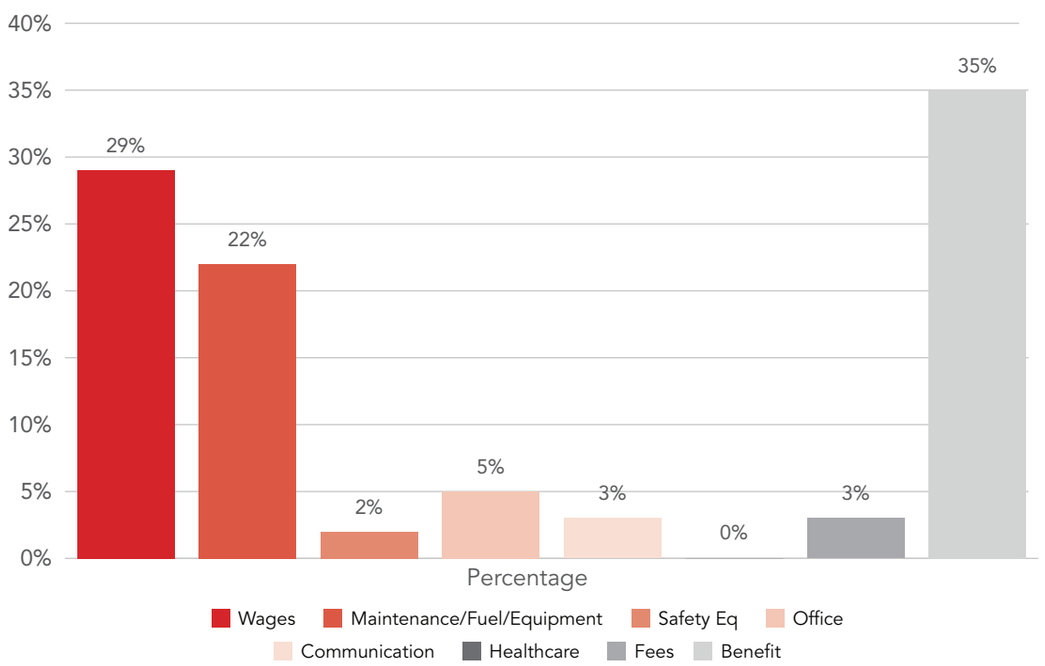


TABLE 5: Breakdown of expenditures, Area 4

	Monthly	Percentage
Wages	$ 441	29%
Maintenance/Fuel/Equipment	$ 337	22%
Safety Equipment	$ 29	2%
Office	$ 71	5%
Communication	$ 51	3%
Healthcare	-	0%
Fees	$ 52	3%
Benefit	**$ 536,05**	**35%**

Benefit in this context is high. Despite a poorly optimised service delivery system of CBE with about 100 clients, it is possible to achieve a benefit once the right balance of clients and fees is reached.

Doing business in this challenging environment requires higher capital costs than in the other areas. Fees paid by clients really changes the benefit.

- Based on the average size of current CBEs working and the population in these areas, 400 CBE are needed to cover 100% of the population. Restructuring service and optimising activities is essential for the CBEs working in these areas to be able to save on costs and invest in reliable, robust equipment. Bumpy roads need to be factored into the business plan; tricycles have lower life expectancy in such a challenging context.

3.5. Area Type 5

5

Paynesville

Mainly residential with few businesses, less densely inhabited, middle income (rich and poor) and a big market area

Area 5 is the largest area type, covering less than 50% of the population of Greater Monrovia. Nonetheless, it has yet to be served by a robust primary collection system.

In Paynesville, density may not be lower than in other contexts of Monrovia; however, this area's business model is characterised by an extremely low density of secondary collection points. Another key characteristic emerging from the interviews is the higher fees collected in these areas. The overall willingness to pay may not be higher, but it is for the few currently subscribing to the service. The CBE picked to represent the case study is Joe Cole with almost 300 clients.

	HH	Business
Number of clients	200	80
Average monthly fee	$ 7.50	$ 20.00
Recovery Rate	65%	65%
Monthly income	$ 975.00	$ 1,040.00
Total Monthly Income	**$ 2,015.00**	
Monthly Tonnage of waste (T.)	15	6
Total Monthly Tonnage	**22 T.**	
Monthly Volume of Waste (m^3)	55.38	22.15
Total Monthly Volume	**78.00 m^3**	

Although the average number of clients is lower than in the other areas, the CBE selected has twice the average. The table above shows that businesses are charged about three times more than households, based on the interviews conducted. From field investigations and follow-up during the collection tour, households might be charged more per month than businesses pay on a weekly basis. The interviews indicated that the diversity of revenues is much wider than in Monrovia or Clara Town, although it is difficult to get a precise picture. The business is growing in this area type, and demand has not yet matured. However, it is recommended to use the stated hypothesis to draft the current business model, as the average is the most representative information.

Number of working days/week	**3**
Tonnage/working day	**7 T.**
Volume/working day	**26.86 m^3**

The overall waste collected is less than in the other areas, based on the waste characterisation study. Field observation did not enable drawing a clear line between the types of areas and their waste production, so it was decided to apply the same hypothesis of 0.43kg/day/capita.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to SCP
Pushcart	0%	0	0	-	-	
WheelBarrows	10%	1	1	0.73	2.69	
Tricycle	90%	6	3	6.60	24.18	1

No pushcarts are found in these areas, and every CBE working in this area type owns a form of motorised equipment. Here the less representative option was selected, as wheelbarrows also perform primary collection, working closely with the motorised equipment to transfer the waste to a secondary collection point.

Time spent per client				
Waste collector	3 minutes			
Tricycle collector	4 minutes			
Time spent for transport	**average speed (km/h)**	**Distance RC/skip**	**Time (return) min.**	**Number of working hours/day**
Tricyle	20	8	48	6

What is more challenging is that the distance between clients might be much further, and the average time the tricycle collector spends serving clients much longer. In addition, distance to a skip, a reconstructed bin, or a transfer station is on average much more than in the other area types.

FIGURE 9: Breakdown of expenditures, Area 5

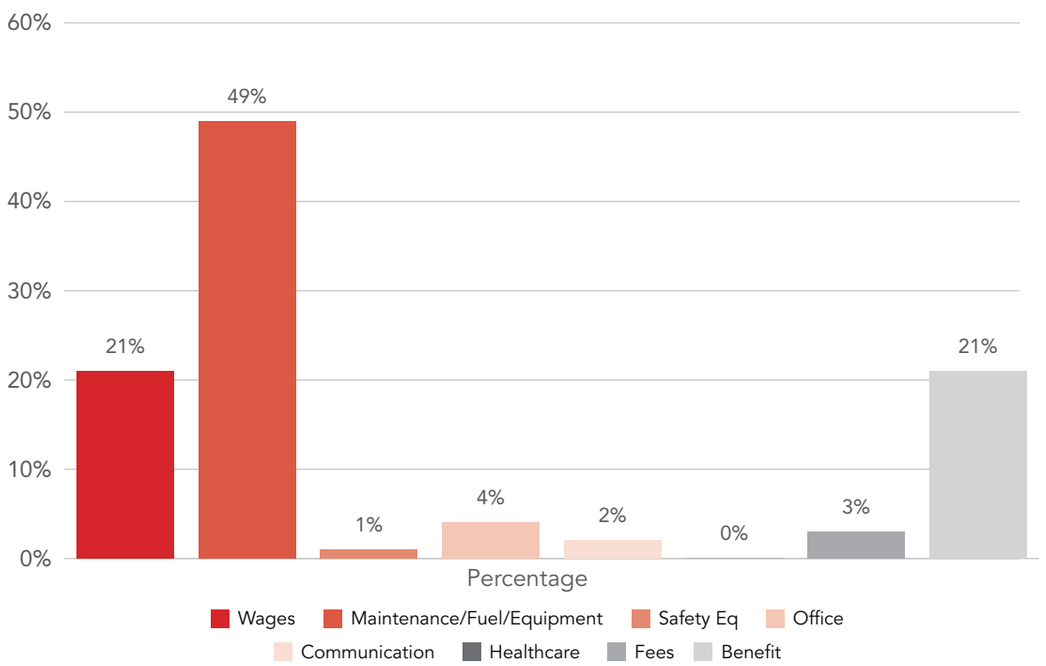


TABLE 6: Breakdown of expenditures, Area 5

	Monthly	Percentage
Wages	$ 431	21%
Maintenance/Fuel/Equipment	$ 981	49%
Safety Eq	$ 23	1%
Office	$ 71	4%
Communication	$ 38	2%
Healthcare	-	0%
Fees	$ 52	3%
Benefit	**$ 418,74**	**21%**

Maintenance and fuel consumption become a major expenditure in the business plan. Doing business in this challenging environment requires higher capital costs than the other areas, and fees paid by the client really change the benefit. Several CBEs have a much less profitable business and yet they enjoy a nice benefit.

- Based on the average size of current active CBEs and the population in these areas, 660 CBE are required to cover 50% of the population. Restructuring the service and optimising the activities are essential for the CBEs working in these areas to save on costs and invest in reliable, robust equipment. Bumpy roads need to be factored into the business plan, as tricycles have a lower life expectancy in such a challenging context.

3.6. Conclusion

The current CBE system is still profitable, with areas that require fewer clients to be profitable. The current infrastructure available to the CBEs enable business to be profitable.

The main issue is the very low number of clients that the CBEs manage on average. With their current clientele and the population estimate, here is the summary of the number of CBEs required to fully cover the areas.

TABLE 7: Number of CBEs required to cover the area, based on average number of clients

	# of CBEs required to cover the area	Approximate number of CBEs currently identified
TOTAL Greater Monrovia	2178	29
Total Zone 5	1320	8

	# of CBEs required to cover the area	Approximate number of CBEs currently identified
Total Zone 4	430	3
Total Zone 3	70	4
Total Zone 2	268	4
Total Zone 1	90	10

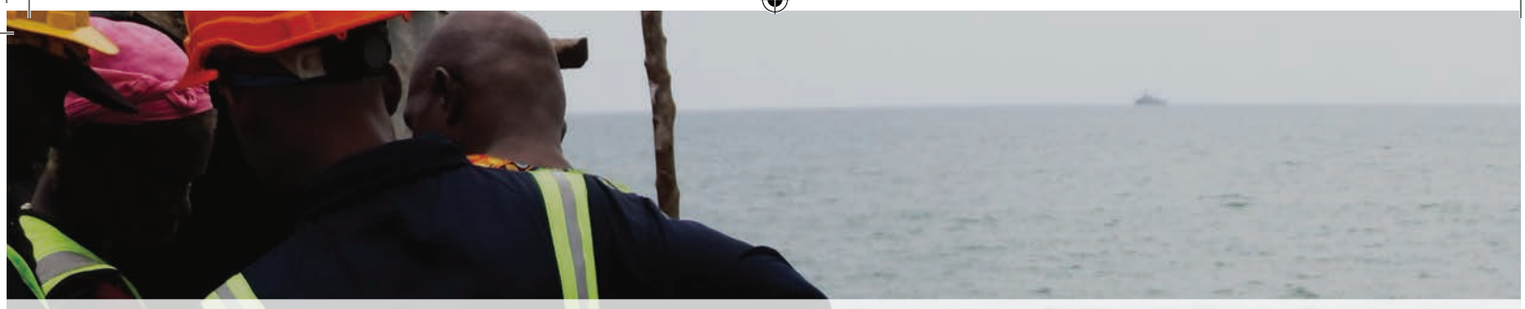
The number of CBEs required to cover the different areas is far from what currently exists, and the system seeks greater profitability and a change in collecting organisations. The next section of this report outlines models for each area with each CBE covering an increased number of clients, so the number of CBEs required to cover one area is lower than presented in Table 7.

The current population produces different types of waste. Their quantities are outlined in Table 8.

TABLE 8: Waste per type and by area in 2019*

	Total Zone 5	Total Zone 4	Total Zone 3	Total Zone 2	Total Zone 1
	kg/day				
Paper	19,642.17	7,193.84	2,582.85	9,534.07	13,550.53
Glass	2,806.02	1,027.69	368.98	1,362.01	1,935.79
Metals	2,806.02	1,027.69	368.98	1,362.01	1,935.79
Plastics	30,866.27	11,304.61	4,058.76	14,982.11	21,293.70
Special municipal solid waste	2,806.02	1,027.69	368.98	1,362.01	1,935.79
Combustible waste	39,284.35	14,387.69	5,165.70	19,068.14	27,101.07
Textiles	14,030.12	5,138.46	1,844.89	6,810.05	9,678.95
Vegetable/ putrescible	120,659.07	44,190.76	15,866.08	58,566.43	83,238.99
Miscellaneous items	47,702.42	17,470.77	6,272.64	23,154.17	32,908.44
TOTAL	**280,602.50**	**102,769.21**	**36,897.85**	**136,201.01**	**193,579.05**

**Waste characterisation from 2018 Arup report.*



4. DEMAND FOR COMPOST AND RECYCLED PRODUCTS

Demand for compost and recycled products can be determined using the results of the Feasibility Study for Vertical Expansion of CBE into recycling and composting.

There are several options for different types of waste:

- Organic matter transformed into compost;
- Plastics that can be reused or recycled;
- Glass that can be endlessly reused or recycled; and
- Paper/cardboard that can be recycled.

A SWOT analysis of the two options selected by the feasibility study, compost, and plastics, follows.

4.1. Compost

Several processes for composting exist, and there is enough market demand to consider it as an option for diversification. Some SMEs are already involved in this activity, and their existence and financial sustainability demonstrate its potential benefit.

Based on the SWOT analysis presented below, sorted collection in households is likely to work if specific compensation is given to the households. This information will be considered in the prospective CBE business models that focus on household collection.

TABLE 9: SWOT analysis for compost*

STRENGTHS	WEAKNESSES
• Separate collection done at market level with the support of some SMEs (organic matter) • High quantity of organic waste generated (mainly in marketplaces) • Competitive output price compared to chemical fertilizers • Emerging operators (organic matter, Green Cities) • In previous years, the Ministry of Agriculture and some NGOs trained farmers in how to make compost. • There is potentially high demand for compost because agriculture represents 70% of the population employed and 40% of the GDP (the World Factbook of Central Intelligence Agency, 2017).	• No separated collection of household waste. No more sorting at source implies decrease in cleanliness and a decline in prices and/or running costs • Potential market not fully effective due to farmers' lack of confidence (reluctance to adapt their agrarian practices) and competition from chemical fertilizers • Lack of production capacity among existing producers and some local experiments unsecured • Lack of space for some interested operators, resulting in remote production sites

OPPORTUNITIES	THREATS
• Possibility to collect organic waste in marketplaces easily and separately (high quantity generated and high quality, thanks to the separation at source from the other waste) • Possibility to implement separate collection at household level in exchange for compensation. CBEs would be able to implement separate collection and households would do it • Incentives, awareness campaigns, training and demonstration farms could develop the demand for farmers	• Competition from imported chemical fertilizers • Capacity of operators to develop a secure, professionally managed process to produce a high-quality product at a competitive price • Capacity to identify and collect homogenous and stable organic waste • Few CBEs are interested in collecting organic waste separately to compost it (much more interested in plastic and metal sorting)

**Feasibility Study, Costed Feasibility Models and Action Plan for Implementing Composting and Recycling Options for Primary Waste Collection in Monrovia, Paynesville, and Surrounding Townships, ICEA 2019.*

- ► High potential demand, but not effective because farmers lack knowledge of how to use organic fertilizers and adapt their agrarian practices.
- ► Sorted collection is MANDATORY to initiate the activity and is unlikely to happen in households without compensation.

4.2. Plastics

There are diverse options for plastic recycling that rely on different types of plastics. Few CBEs sort the plastic, instead washing it for reuse. One of the main reuse options for plastic collected and sorted by CBEs is reusing bottles to fill them with other liquids and sell them. More CBEs are getting involved in this business, and some have already been working in this sector. This is a growing activity that is increasingly raising concern worldwide.

TABLE 10: SWOT analysis for plastics*

STRENGTHS	WEAKNESSES
Separate collection previously done by the CBEs, thanks to sorting done by households at the source in exchange for compensation. CBEs are able to implement separate collection and households are aware enough to do it.	No more sorting at source, which decreases the cleanliness and then prices and/or running costs. **For plastic recycling:** • No local plastic bottles manufacturer to re-integrate used plastic bottles in their processing line.

STRENGTHS	WEAKNESSES
For plastic recycling: • High quantity of plastic generated (notably plastic bags, water bags, and plastic bottles) • Interest of the CBEs and emerging recycling operators (Evergreen, Green Cities, CEPWAMAR). • Support of MCC and PCC for transport (vehicles provided) **For plastic reuse:** • Informal value chain currently exists (plastic washed and sold in marketplaces).	• No industrial recycling facilities except Duraplast, which has reached the highest production capacity, and which initially focused on its own waste recycling. • Lack of production capacity among existing recyclers (Duraplast and Green Cities) and some local experiments unsecured (Evergreen and CEPWAMAR). • No bottling company with the necessary extruder. They use imported, pre-formed bottles and blow them locally. • Plastic waste purchase prices are currently very low, discouraging collectors. Duraplast has the monopoly on buying plastic waste from individuals/enterprises). **For plastic reuse:** • Small local demand • Sanitary risk due to unsecured washing operations.
OPPORTUNITIES	**THREATS**
• There is local demand for tiles and bricks from low income populations. • Demand is high for fossil fuel substitutes. • Easy to export due to the port proximity • Activities are labour intensive, which could help the high unemployment rate.	• Imported products (plastic goods, fuel, etc.) that can compete with local production • Eventual decree to ban plastic bags and sachets (intended by EPA) • Lack of land/space to implement facilities • Plastic recycling for producing fuel needs adequate equipment(to avoid toxic gas emissions dangerous for environment and employee health).

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- For Plastic Recycling: Growing demand but no industrial recycling facilities except Duraplast, which has reached the highest production capacity and initially focused on its own waste recycling, and low prices that discourage collectors.
- For Plastic Reuse: Informal value chain and small local demand, with sanitary risks due to unsecured washing operations.
- New MCC organisation may impact CBE interest (closer dumping sites for their waste)

5. IMPROVING BUSINESS MODELS

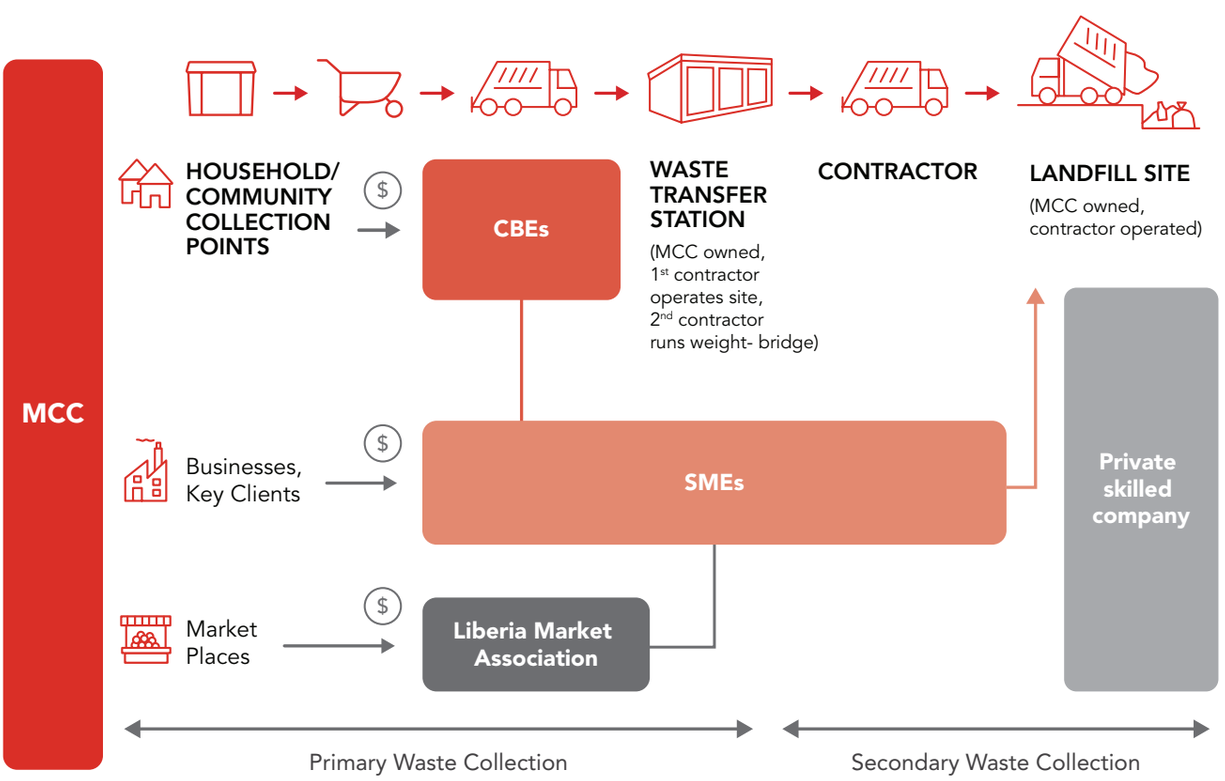
5.1. The Approach

The maturity model drafted in the second report emphasises the need to rapidly develop the structure of the CBE in order to be able to manage more clients. CBE activities are challenging because they require an adequate number of staff and enough clients to generate an acceptable profit. The figures can rise quickly and reach impressive numbers.

To earn the same income, an SME manager has to manage dozens of employees, a couple of pieces of equipment, and hundreds of clients, while a CBE targeting households has to manage almost 100 persons, equipment, and thousands of clients. The skills and strength required are much more challenging in terms of human resources and commercial activities.

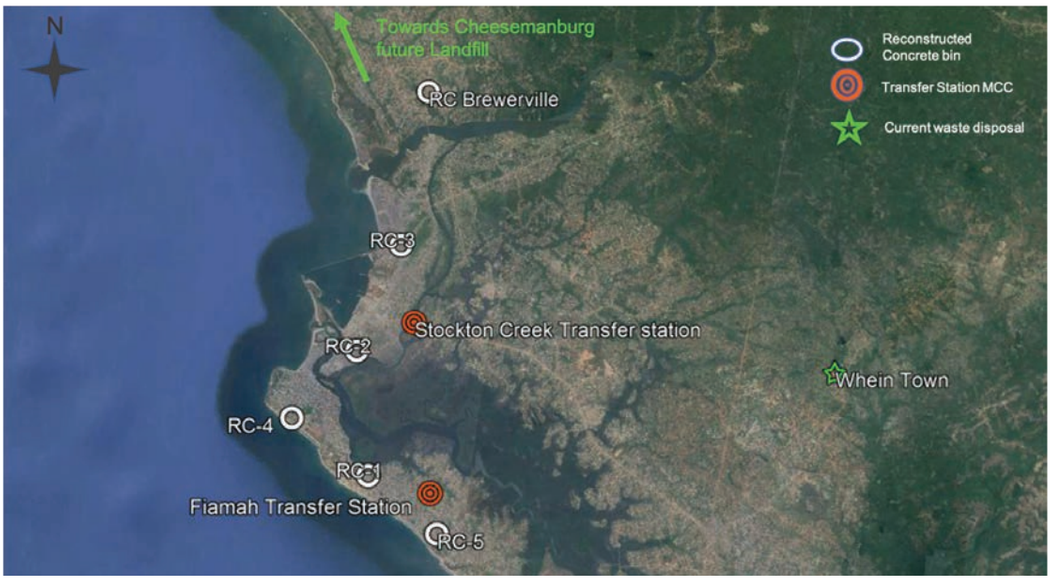
Figure 10 details these elements for different areas.

FIGURE 10: The CBE system in MCC in the future



The current trend at MCC is to remove most of the skip buckets and to ask CBEs to transfer waste directly to the transfer stations. In this situation, CBEs are actually asked to cover the entire primary collection. Figure 11 shows the remaining collection points available to the CBEs.

FIGURE 11: MCC solid waste collection and disposal infrastructure and equipment



In PCC, equipment and infrastructure remains the same, with a single transfer station identified. The system is more likely to work as described in Figure 12.

FIGURE 12: The CBE system in PCC

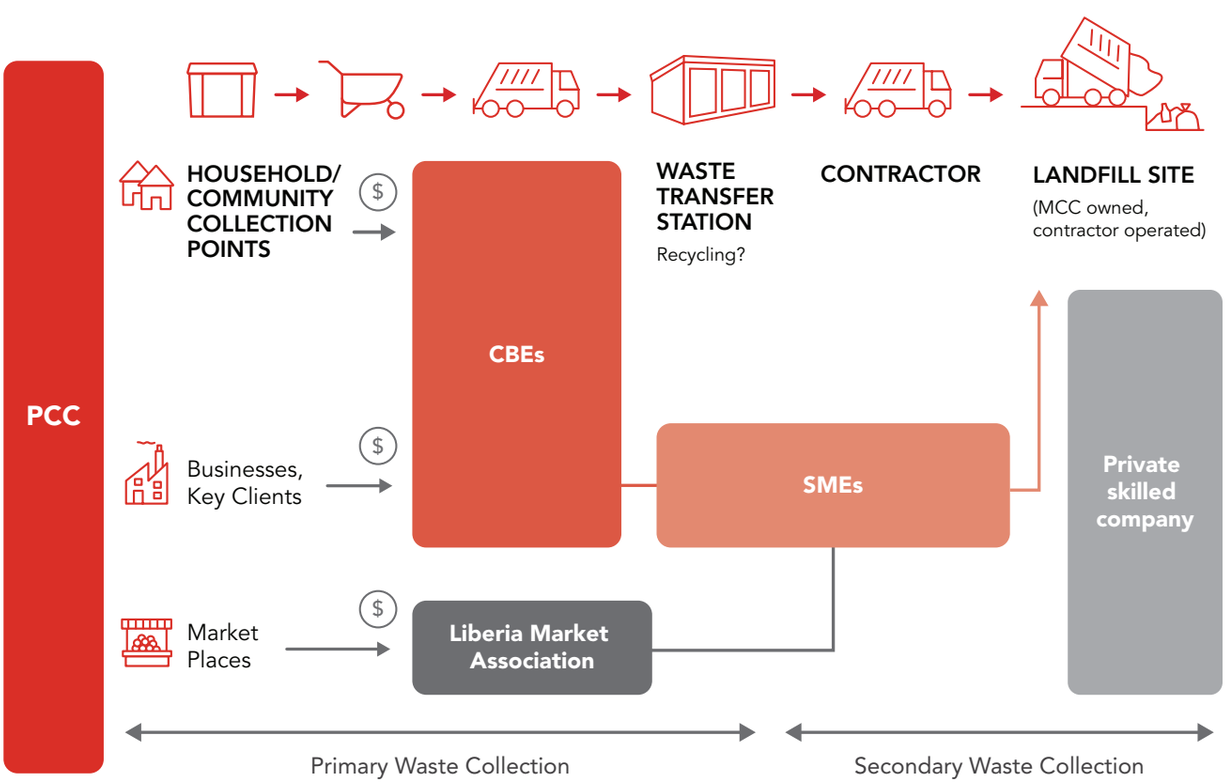
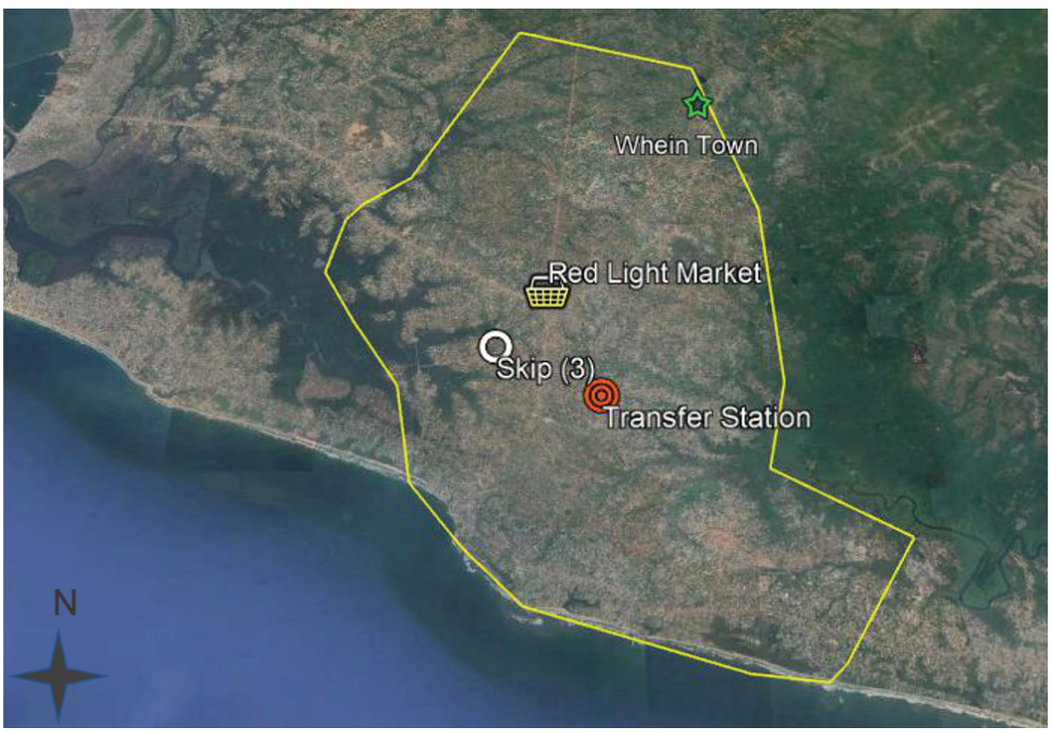


FIGURE 13: PCC solid waste infrastructure and equipment

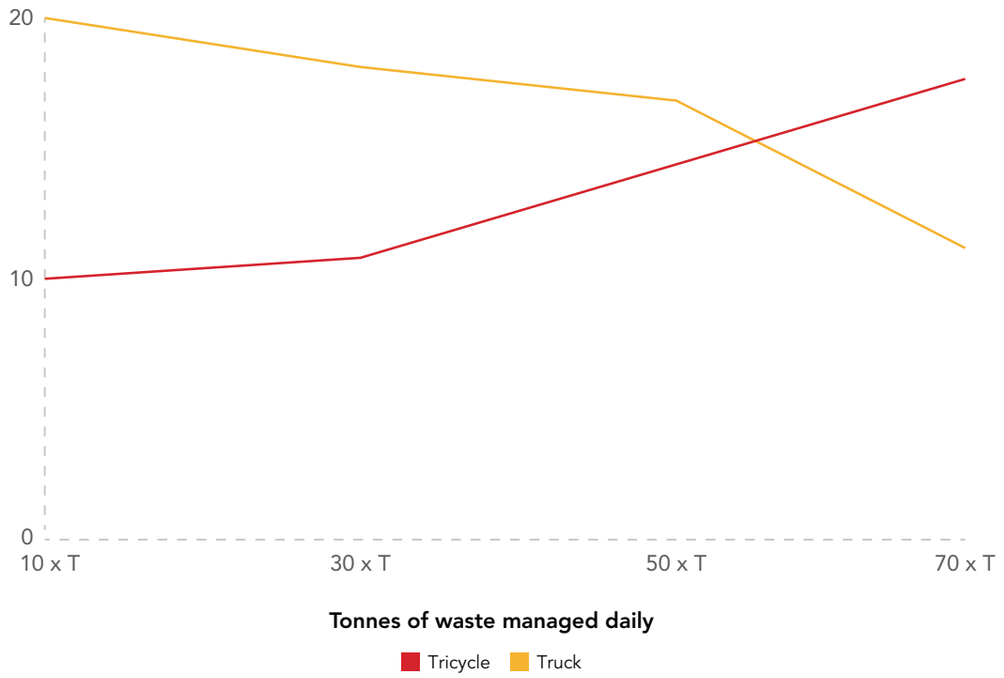


Based on this information and discussions with MCC and PCC, the business plans were drafted to be in line with a corporation's willingness to invest. Different options for motorised equipment were examined. Initially using a tricycle negatively impacts the service and investment, with a pick-up truck soon required. For transportation, the costs per ton of waste collected are shown in Figure 14, to better understand what is at stake.

For every area, the different options for motorised equipment and their impact on the business plan were considered. Different organisation of waste collection was also compared.

Improving working conditions was prioritised as much as possible. Healthcare was automatically included as health insurance. Wages were also reviewed whenever possible, and any change mentioned under each option.

FIGURE 14: Equipment optimisation



5.2. Waste Forecast 2023

The current population is producing different types of waste, and their quantities is presented in the next table for 2023. These data will be used in this chapter to determine the surface required in sorting stations for example.

TABLE 11: Waste per type and area in 2023

	Total Zone 5	Total Zone 4	Total Zone 3	Total Zone 2	Total Zone 1
	kg/day				
Paper	21,395	7,836	2,813	10,385	14,760
Glass	3,056	1,119	402	1,484	2,109
Metals	3,056	1,119	402	1,484	2,109
Plastics	33,621	12,313	4,421	16,319	23,194
Special municipal solid waste	3,056	1,119	402	1,484	2,109
Combustible waste	42,790	15,672	5,627	20,770	29,520
Textiles	15,282	5,597	2,010	7,418	10,543

	Total Zone 5	Total Zone 4	Total Zone 3	Total Zone 2	Total Zone 1
Vegetable/ putrescible	131,427	48,134	17,282	63,793	90,667
Miscellaneous items	51,959	19,030	6,832	25,220	35,845
TOTAL	**305,643**	**111,940**	**40,191**	**148,356**	**210,854**

**Waste characterisation from 2018 Arup report.*

5.3. Area 1: Increasing Fees and Customers

Area 1 is quite densely inhabited, with a good mix of small and larger businesses, as well as households. The current low recovery rate needs to be improved through a mass communication plan and strong backing from the corporations. An increase in fees is also part of the model, despite minimal evidence of a greater willingness to pay. The total number of clients reached by the CBEs is very high; skip buckets have been removed, so options for getting rid of waste are in favor of the CBE business. However, skip removal is also pushing CBEs to cover fewer areas.

The CBEs cover a distance of 6 km to the station, and each option is designed with this hypothesis.

	HH	Business
Number of clients	2500	1000
Average monthly fee	$ 2.73	$ 5.00
Recovery Rate	70%	80%
Monthly income	$ 4,777.50	$ 4,000.00
Total Monthly Income	**$ 8,778.00**	
Monthly Tonnage of waste (T.)	132	53
Total Monthly Tonnage	**186 T.**	
Monthly Volume of Waste (m^3)	484.62	193.85
Total Monthly Volume	**679.00 m^3**	

Number of working days/week	**6**
Tonnage/working day	**31 T.**
Volume/working day	**113.55 m^3**

5.3.1. OPTION 1: SERVICE IS EXCLUSIVELY MANAGED BY TRICYCLES

In this option, service is entirely managed by tricycles, with the use of pushcarts and wheelbarrows phased out or stopped all together.

FIGURE 15: Equipment required for collection and transport in Area 1, Option 1

	Percentage	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m³)
Pushcart	0%	0	0	-	-
WheelBarrows	0%	0	0	-	-
Tricycle	100%	29	15	31.00	113.55

There is an increase in recovery rate, despite voluntarily remaining below 80%. The CBEs are managing a high number of clients.

FIGURE 16: Breakdown of expenditures, Area 1, Option 1

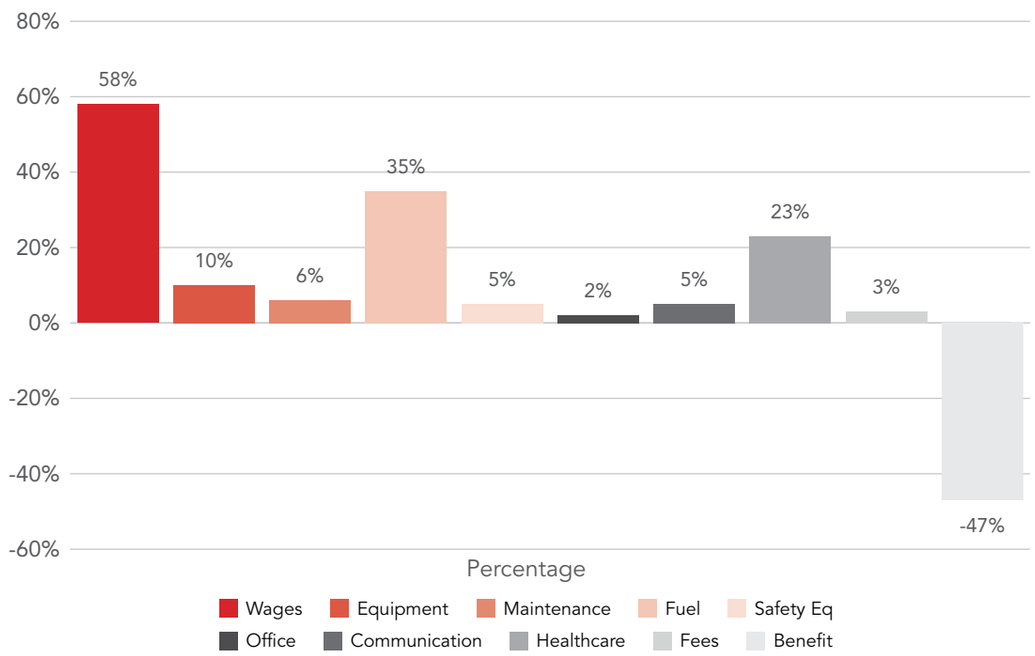


TABLE 12: Breakdown of expenditures, Area 1, Option 1

	Monthly	Percentage
Wages	$ 3,497	40%
Equipment	$ 600	7%
Maintenance	$ 350	4%
Fuel	$ 3,111.48	35%
Safety Eq	$ 167	3%
Office	$ 102	2%
Communication	$ 164	3%
Healthcare	$ 717	15%
Fees	$ 139	3%
Benefit	**$ -69.45**	**-13%**

This simulation of the business model shows that there is no benefit for the CBE, and the business is not viable.

- An initial investment of $18,000 is required for second-hand equipment, and a minimum three-year contract is necessary for their amortisation.
- In this option, 15 tricycles are required to perform the job, collecting, and driving once per day to the transfer station. To cover 100% of central Monrovia, 10 CBEs of similar size would be required to perform the job, with more than 160 daily trips to the transfer station. This option is unlikely to be sustainable.

5.3.2. OPTION 2: SERVICE MANAGED BY NON-MOTORISED EQUIPMENT AND TRANSPORTATION BY TRICYCLE

In this option, service is still achieved by non-motorised equipment, and tricycles are mainly used to transport waste to the transfer station. The reconstructed bin is still working, and its design has been amended to better tailor its use to the daily collection capacity of CBEs. Wheelbarrows are used, and fixed temporary bins are owned and used by the CBEs to facilitate the wheelbarrows' work.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to Transfer
Pushcart	80%	35	18	24.80	90.84	3
WheelBarrows	15%	13	13	4.65	17.03	9
Tricycle	5%	1	1	1.55	5.68	1
Tricyle Transport		3	3			16.00

FIGURE 17: Bin that can be easily lifted onto a wheelbarrow and transferred either by tricycle or pushcart.

In this option, the benefit is higher, and the equipment is optimised. Fuel cost has dramatically increased, and only four tricycles are required to do the job. Initial investment is therefore much lower than in option 1.

FIGURE 18: Breakdown of expenditures, Area 1, Option 2

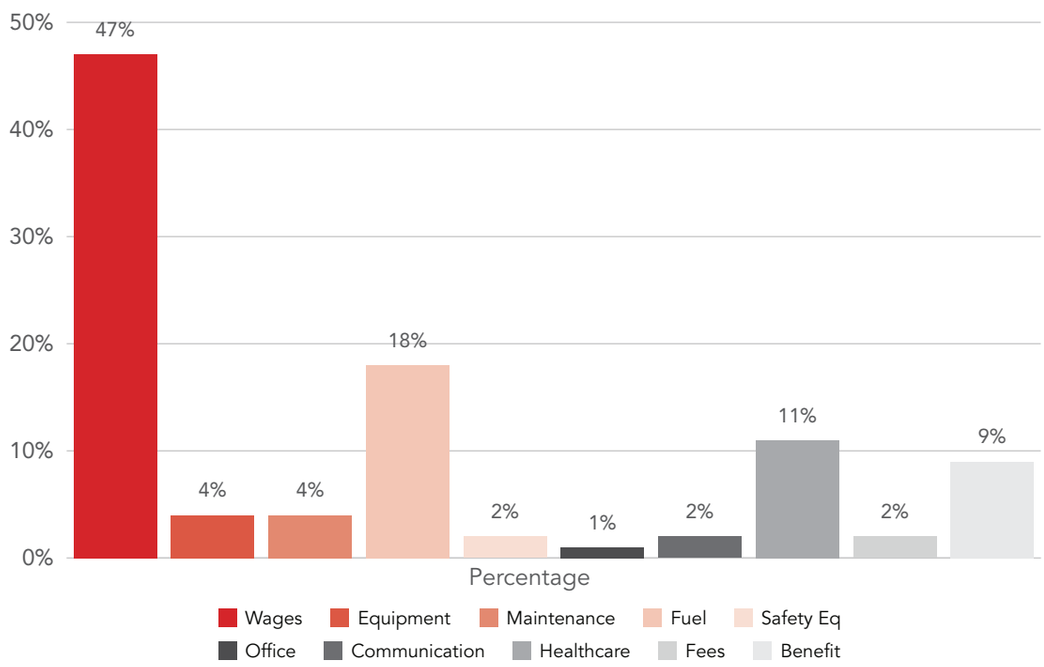


TABLE 13: Breakdown of expenditures, Area 1, Option 2

	Monthly	Percentage
Wages	$ 4,179	48%
Equipment	$ 377	4%
Maintenance	$ 403	5%
Fuel	$ 1,542	18%
Safety Eq	$ 211	2%
Office	$ 102	1%
Communication	$ 213	2%
Healthcare	$ 936	11%
Fees	$ 139	2%
Benefit	**$ 675**	**8%**

- An initial investment of US $14,000 is required for second-hand equipment, and a minimum three-year contract is necessary for their amortisation.
- In this option, 2 tricycles are required to perform the job. One will collect waste and drive to the transfer station once per day, and the other one will go back and forth to the station. To cover 100% of central Monrovia, 10 CBEs of similar size would be required to perform the job, with more than 160 daily trips to the transfer station.

5.3.3. OPTION 3: NON-MOTORISED EQUIPMENT AND PICK-UP TRUCK

In this option, most of the service is still performed by non-motorised equipment, and a pick-up truck is used for transferring waste to the transfer station.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to Transfer
Pushcart	80%	35	18	24.80	90.84	3
WheelBarrows	20%	18	18	6.20	22.71	9
Tricycle	0%	0	0	-	-	
Truck T		2	1			5.00

In this option, the CBE needs to go to the transfer station only five times per day, which is three times less than with the second option using a tricycle. The benefit is much higher and fuel consumption has been optimised. The average speed for the truck has been estimated at 10km/h because of Monrovia's congested roads. Based on the working hours required to perform the job, trucks are working full time for one CBE. This situation could be improved if the truck were able to perform most of the work at night when there is less traffic. Investment and maintenance could then be shared with an additional CBE.

FIGURE 19: Breakdown of expenditures, Area 1, Option 3

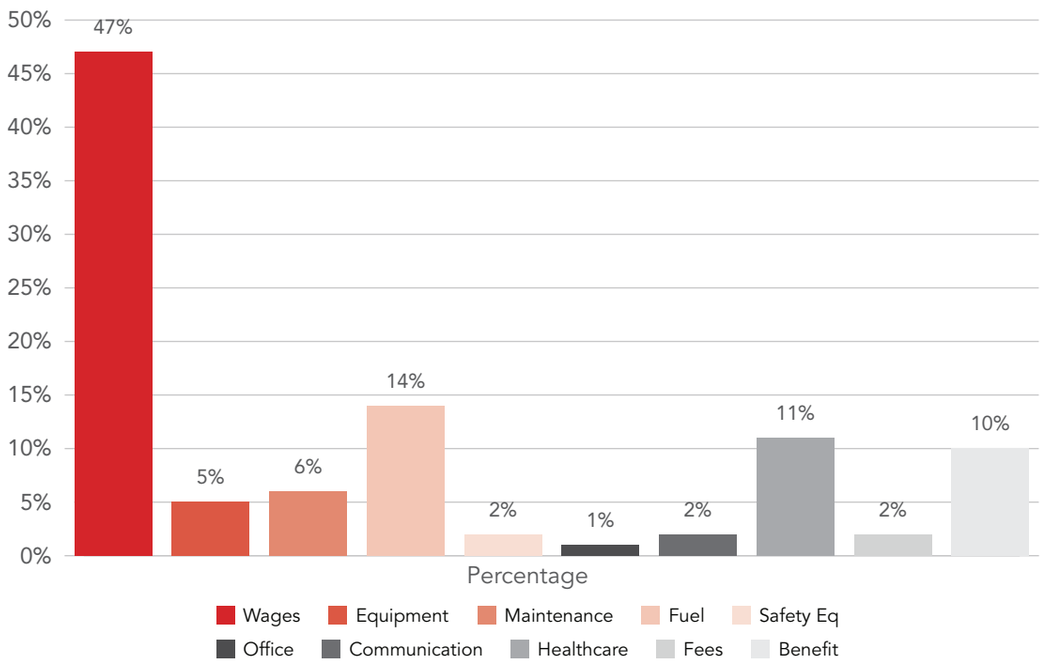


TABLE 14: Breakdown of expenditures, Area 1, Option 3

	Monthly	Percentage
Wages	$ 4,165	47%
Equipment	$ 433	5%
Maintenance	$ 483	6%
Fuel	$ 1,218	14%
Safety Eq	$ 213	2%
Office	$ 102	1%
Communication	$ 215	2%
Healthcare	$ 949	11%

	Monthly	Percentage
Fees	$ 139	2%
Benefit	**$ 860.44**	**10%**

- An initial investment of $31,000 is required for second-hand equipment, and a minimum seven-year contract is necessary for their amortisation.
- In this option, no tricycles are required to perform the job. One truck with a capacity of seven tons is used three hours per day. To cover 100% of central Monrovia, 10 CBEs of similar size would be required to perform the job, with fewer than 50 daily trips to the transfer station.

5.3.4. MEDIUM-TERM MODEL

An intermediate model highlights the intermediate step required before the CBE reaches the mature stage in terms of waste collection.

	HH	Business
Number of clients	1000	500
Average monthly fee	$ 2.00	$ 3.50
Recovery Rate	80%	80%
Monthly income	$ 1,600.00	$ 1,400.00
Total Monthly Income	**$ 3,000.00**	
Monthly Tonnage of waste (T.)	53	26
Total Monthly Tonnage	**80 T.**	
Monthly Volume of Waste (m^3)	193.85	96.92
Total Monthly Volume	**291.00 m^3**	

Fees have been increased for both households and businesses and are now close to the average that some clients are already paying. The CBE has increased its capacity and employs 32 people: four managers, seven supervisors, and one strong accountant. The CBE is much more structured.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to Transfer
Pushcart	80%	12	6	10.67	39.07	4
WheelBarrows	15%	5	5	2.00	7.33	11
Tricycle	5%	1	1	0.67	2.44	0
Tricyle Transport		0	0			7.00

The business is still profitable, and the CBE can transfer waste collected by pushcarts and wheelbarrows up to 3 km away from the area and drop it off at a secured collection point. At this stage, the **CBE does not have the capacity to drive 6 km to any of the Transfer Stations.** However, there are enough resources to better manage and control secondary collection points.

Time spent for transport	average speed (km/h)	Distance RC/ skip	Time (return) min.	Number of hours/day
Pushcart	4	0.5	15	5
WheelBarrows	4	0.2	6	1
Tricycle	10	3	36	2
Tricycle T	20	3	18	2.10

As for the longer-term options, each worker will serve more clients. The ratio of 60 clients per worker equipped with a wheelbarrow or pushcart should be reached when workers with tricycles reach 70 clients.

FIGURE 20: Breakdown of expenditures, Area 1, Option 2 (Medium Term)

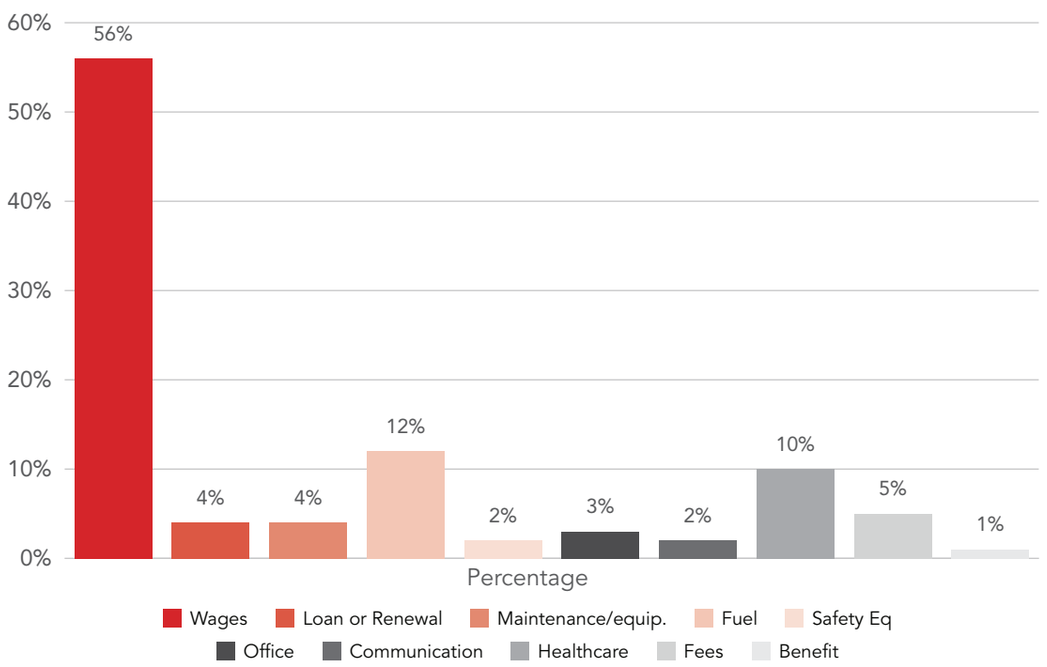


TABLE 15: Breakdown of expenditures, Area 1, Option 2 (Medium Term)

	Monthly	Percentage
Wages	$ 1,687	56%
Loan or Renewal	$ 114	4%
Maintenance/equip.	$ 130	4%
Fuel	$ 356	12%
Safety Eq	$ 70	2%
Office	$ 102	3%
Communication	$ 74	2%
Healthcare	$ 311	10%
Fees	$ 139	5%
Benefit	**$ 18**	**1%**

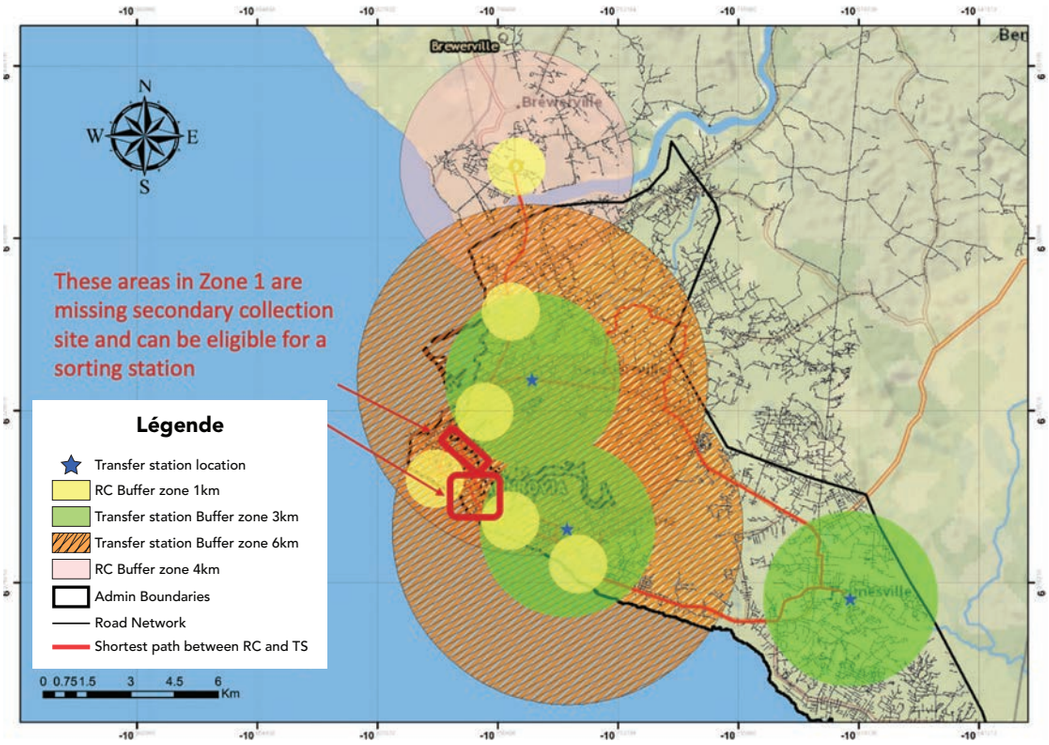
5.3.5. CONCLUSION

In Central Monrovia, CBEs can rely on non-motorised equipment to collect waste because of the roads and density of households and businesses. Less fuel is consumed, and less investment is required. The situation is even more profitable when the CBE can invest in a truck or any other motorised equipment with the capacity to carry between five and seven tons at least. The CBEs make final decisions based on their estimate of the number of clients and knowledge of the tonnage to be collected. For example, large-capacity tricycles are working in Area 1 because the main roads are good, and the capacity allows the CBEs to reduce the number of kilometers to be covered every day to the station.

In the medium term, when the CBE is structured, at least 1,500 clients should be reached and a substantial increase in fees for both households and businesses enforced. By increasing slowly every year, the CBE can reach a sufficient fee to cover expenses and drop the waste in dedicated points 3 km away from the area served.

In the longer term, the whole primary waste collection chain could be covered by CBEs that reach a critical number of customers with fees enforced at a much higher level than today. Service delivery to the transfer station is possible as long as temporary infrastructure **such as revised RC sites can be reached within 750m, and as long as the station is located at less than 6 km from the RC sites during daily collection. Without RC sites, the entire optimisation system cannot work, and the business is no longer profitable.** The lack of RC-sites is shown in the figure below.

FIGURE 21: Areas missing infrastructure and eligible for sorting stations (Zone 1)



Revised RC sites are secondary collection points used by CBEs during daytime. They are locked and secured so that they cannot be used by unauthorised workers or users outside the group of CBEs working in the areas. These infrastructures can be controlled by CBEs or by the corporations, and they can also be transformed into sorting stations.

The estimated cost for a sorting station with the capacity to sort all waste from Area 1 is about US $360,000,[3] and at least 4,200m² is required for the building. Some 23 tons of plastics could be extracted, and a percentage recycled or reused. The CBE cannot make this investment and external funding is required.

Investment in equipment for collection varies from US $14,000 to US $31,000 to reach full capacity of 3,500 clients. They are supported by the CBEs.

For better management of traffic and efficiency in waste collection, transportation is likely to be scheduled in the evening, with options for truck sharing.

During the IMPAC projects some CBEs had around 2,000 clients, and it is possible to reach this size again. However, the CBEs are advised to better structure their business first so that they can maintain such an intensive operation. The CBEs from Area 1 should reach the intermediate phase of 1,500 clients by the end of the project.

[3] Estimation based on the Feasibility Study on Costed Business Models for Composting and Recycling, conducted by ICEA, 2018.

5.4. Areas 2 and 3: Drop-off or Liquid Sanitation Service

Areas 2 and 3 are quite densely populated with a low willingness to pay. Therefore, the fees are unlikely to increase, except for businesses. Because there are more households in these areas, the business model looked at increasing the number of clients.

The CBE should be able to cover a distance of 3 km to the station, and each option has been designed with this hypothesis.

	HH	Business
Number of clients	2500	1000
Average monthly fee	$ 1.25	$ 2.73
Recovery Rate	95%	95%
Monthly income	$ 2,968.75	$ 2,593.50
Total Monthly Income	**$ 5,563.00**	
Monthly Tonnage of waste (T.)	189	76
Total Monthly Tonnage	**265 T.**	
Monthly Volume of Waste (m^3)	692.31	276.92
Total Monthly Volume	**970.00 m^3**	

Number of working days/week	**3**
Tonnage/working day	**88 T.**
Volume/working day	**324 m^3**

The service has been reduced to three days per week despite the risk of losing clients.

5.4.1. OPTIONS 1, 2 AND 3: REAL STRUGGLE TO MAKE ANY BENEFIT

Like the options presented for Area 1, Options 1, 2 and 3 are unable to make a profit unless the **transfer station is located within 3 km of the area.** In this case, the third option is the only one able to turn a profit. Investment and maintenance costs are shared with another CBE, and health insurance is not included.

The results are presented below. Beyond this limit, the CBE cannot handle daily costs.

	Percentage	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)
Pushcart	60%	21	11	26.50	97.07
WheelBarrows	40%	28	28	17.67	64.71
Tricycle		0	0	-	-
Truck T		2	1		

FIGURE 22: Breakdown of expenditures, Area 2 and 3, Option 3

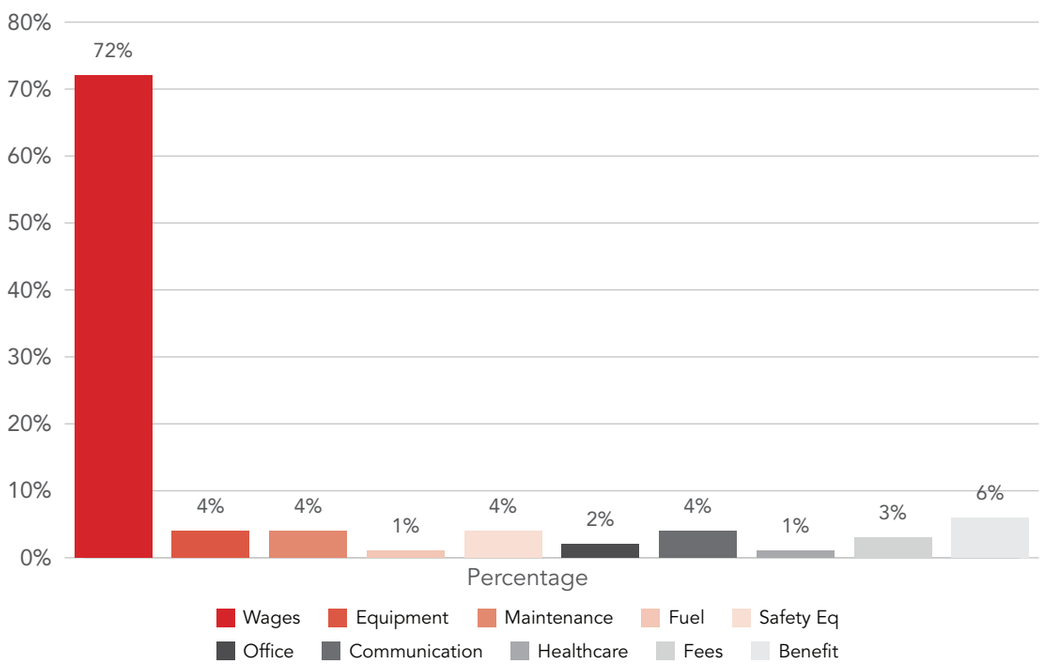


TABLE 16: Breakdown of expenditures, Area 2 and 3, Option 3

	Monthly	Percentage
Wages	$ 4,009	72%
Equipment	$ 203	4%
Maintenance	$ 222	4%
Fuel	$ 79	1%
Safety Eq	$ 199	4%
Office	$ 102	2%

	Monthly	Percentage
Communication	$ 201	4%
Healthcare	$ 79	1%
Fees	$ 139	3%
Benefit	**$ 329.32**	**6%**

CBEs working in Area 2, which is closer to the transfer station, will be able to sustain their activities due to the benefits of a related SME. A CBE targeting businesses with higher fees and working in the few lucrative areas will certainly be able to maintain its business.

In an area like West Point, where the transfer station is 6 km away, covering the costs of the primary collection will be a real struggle.

Considering the current situation CBEs face in these areas and the very low willingness to pay, the steps required to have the optimal number of clients for a viable business is unlikely to be achieved.

- An initial investment of US $22,000 is required for second-hand equipment, and a minimum seven-year contract is necessary for their amortisation.
- In option 3, one 7T. truck is required to perform the job, driving three hours per day to the transfer station. To cover 100% of these areas, about 20 CBEs of similar size would be required to perform the job, with fewer than 50 daily trips to the station.
- Such an investment for a truck that will be used very few hours per day means it will be diverted to other activities during daytime. Using it for waste collection of larger businesses is definitely an option.
- Above all, having 3,500 customers for a CBE working in these areas is unlikely unless a major change in service options is made.

5.4.2. OPTION 4: CBES OVERSEE CONTROLLED DROP-OFF POINTS

In this option, the CBEs are in charge of surveillance of controlled drop-off points and a fee is required to be able to dump the waste.

The workforce required is much lower in this case, and more revenue will be diverted to maintenance of equipment. In addition, the persons in charge of surveillance will be part-time workers and thus can split their time with another selling activity.

It is estimated that a monthly fee of **US $1.5** per household per month will be able to generate some profit.

There are several options for CBEs to implement this "drop-off point" management that should be discussed for further approval of the best option. For example, the CBEs can choose to use the same system as before, and they will only be in charge of controlling the existing drop-off points (skip buckets collected by MCC). Another option that addresses MCC's concern with removing skip buckets is the construction of several locked, secured RC sites (instead of the skip buckets) and enabling the CBEs working in these areas to control the sites and ask for a fee. Another option is to display several mobile or fixed collection points in neighborhoods with surveillance done by people involved in other business activities. These collection points would be transferred to a single RC site at the end of the day, or directly collected by the truck like towable skips.

Here is the option with fixed drop-off points displayed in a given area that enables the CBE to reach **3,500 customers**. It is also the costliest approach of the ones presented.

	Percentage	Numb. of part-time workers	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)
Drop-off points	80%	12	12	35.33	129.43
WheelBarrows	20%	14	14	8.83	32.36
Tricycle	0%	0	0	-	-
Truck T		2	1		

FIGURE 23: Breakdown of expenditures, Areas 2 and 3, Option 4

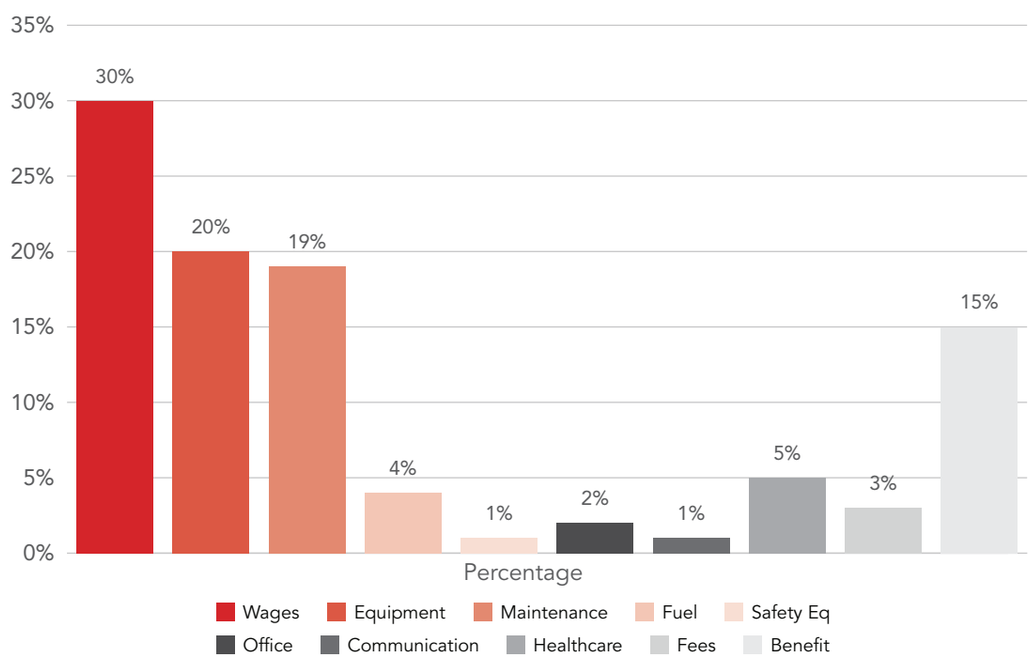


TABLE 17: Breakdown of expenditures, Areas 2 and 3, Option 4

	Monthly	Percentage
Wages	$ 1,535	30%
Provision renewal	$ 1,062	20%
Maintenance	$ 1,000	19%
Fuel	$ 170.55	3%
Safety Eq	$ 76	1%
Office	$ 102	2%
Communication	$ 77	1%
Healthcare	$ 325	6%
Fees	$ 139	3%
Benefit	**$ 696.10**	**15%**

The proportion of equipment and maintenance expenditures for these drop-off points are far higher in this option, and less wage expenditure is required to target the same number of clients.

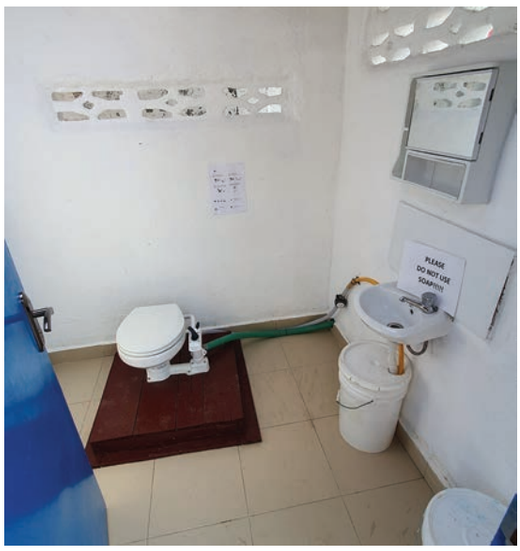
The option can be further tested with CBE volunteers in areas where collection can be easily controlled and managed. By the end of the project, the CBE is likely to reach an **intermediate stage targeting about 1,500 customers.** The same fee is targeted so far, with the final costing for the solution reviewed based on the WTP study that will be deployed in these areas.

- An initial investment of US $48,000 is required to have 12 fixed drop-off points with about 12m³ capacity.
- In option 4, one 7T. truck is required to perform the job, driving 3 hours per day from the loading areas to the station. To cover 100% of these areas, about 20 CBEs of similar size would be required to perform the job, with fewer than 50 daily trips to the station.
- The intermediary load transfer area can be optimised as a sorting station and the transfer or recycling station should be less than 3 km away.
- Such an investment for use very few hours per day means the truck is diverted to other activities during daytime. Using it for waste collection of larger businesses is definitely an option.

5.4.3. OPTION 5: LIQUID WASTE SERVICES

This option would require further investigation to be able to draft a robust business model. However, it is currently working in Kumasi, Ghana through the Clean Team business.

FIGURE 24: Clean Team toilets and services



This option is suitable for slum areas because no initial investment is required, there are regular payments for toilet services, and there is no investment loss for tenants.

- With the demand for liquid waste collection seemingly high, a liquid sanitation service could also emerge and strengthen the CBE's business activities. Further study is required to understand the potential of this option. Based on the model drafted, the six working days could be split into two different income activities.

5.4.4. CONCLUSION

Areas 2 and 3 are much more challenging with less willingness to pay and lower involvement of households. CBEs supporting the cost of waste transportation to the transfer station is not an option based on the current situation.

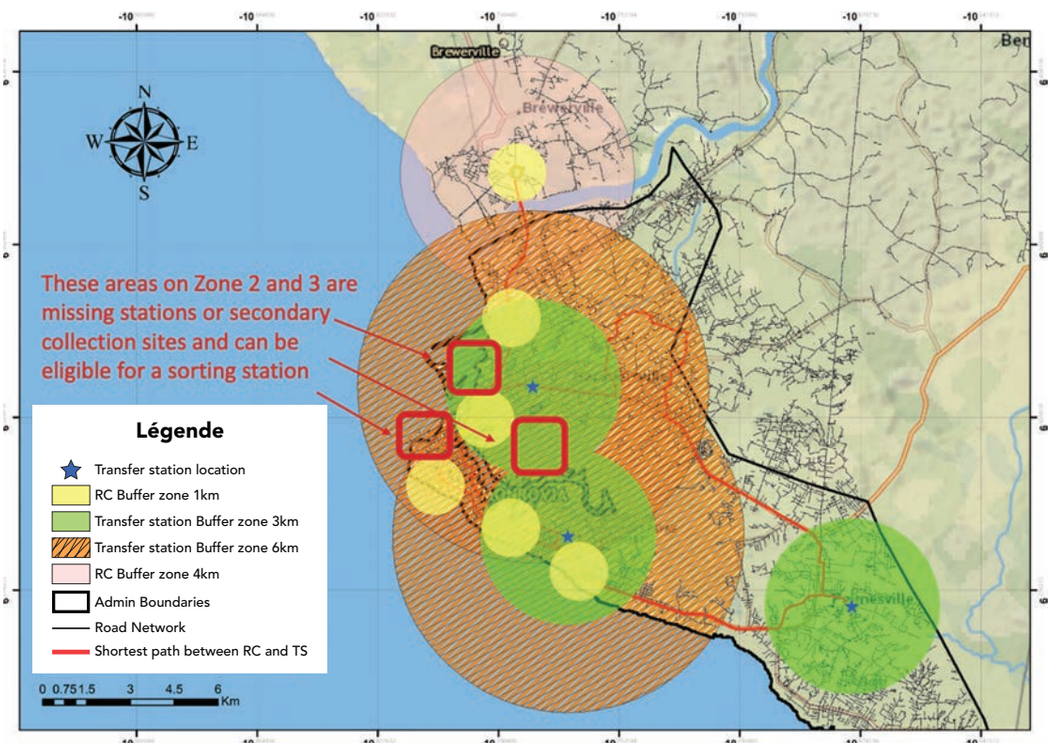
CBEs working in Area 2 can still benefit from the equipment purchased by SMEs involved in large business collection and managed by the same CEO. This is not an option for the CBE working in areas with few or no large businesses.

Stronger support for increasing customers is required. More payment and service options are likely to improve the business model. As suggested by one CBE, management of controlled drop-off points by CBEs may improve the income generated in these areas and target more people. In this case, several options for drop-off points can be studied and piloted.

These areas are missing infrastructure, and CBEs located in West Point will never have the capacity to cover the distance to the transfer station, according to MCC planification. Also, infrastructure for dumping or secondary points is needed, and there are additional infrastructure needs for implementing pilots.

The cost for implementing a sorting station in Areas 2 and 3 is about US $323,000 to sort 190 T. of waste and recycle 20T of plastics.

FIGURE 25: Areas missing infrastructure and eligible for sorting stations (Areas 2 and 3)



A sorting and recycling station in Area 2 is likely to be profitable, with several larger businesses implemented and some CBE-SMEs already involved in waste collection. The CBEs cannot support construction costs, and external funding is needed. For the pilot alone, the cost of the sorting station is estimated at US $5,000[4] to sort about 15T. of waste, with one third coming from households.

The investment in infrastructure required in these areas to start a pilot is US $48,000, and the investment in equipment is less than US $20,000, reaching 3,500 clients. Investment in infrastructure requires external funding, while CBEs can support investment in equipment themselves in areas where they are already working as SMEs, such as Area 2.

In Area 3, the lack of businesses prohibits CBEs from investing and covering the distance. External funding is needed to support full investment in the infrastructure for drop-off points, while CBEs need less than US $1,000 to invest in equipment. Transport between the drop-off points and the station would be supported by MCC.

5.5. Area 4: Structuring and Optimising

Area 4 is the "Eldorado" of current CBEs, with an increasing number of businesses starting or expanding. These areas present serious challenges to CBEs, including low secondary infrastructure, very bumpy roads, and low regulatory mechanisms. Low regulation is currently a positive aspect of Area 4, as it enables a greater business dynamic. With the number of CBEs growing, regulations will soon be required, and discussions between the CBEs and the corporations will be mandatory for a smooth implementation.

In Area 4, the targeted number of clients per CBE is lower than for the other areas, as the complexity of the system threatens the business. This figure was given by the CBEs working in Area 4.

	HH	**Business**
Number of clients	600	200
Average monthly fee	$ 6.00	$ 15.00
Recovery Rate	95%	95%
Monthly income	$ 3,420.00	$ 2,850.00
Total Monthly Income	**$ 6,270.00**	
Monthly Tonnage of waste (T.)	45	15
Total Monthly Tonnage	**61 T.**	
Monthly Volume of Waste (m^3)	166.15	55.38
Total Monthly Volume	**222.00 m^3**	

[4] Estimation based on the Feasibility Study on Costed Business Models for Composting and Recycling, conducted by ICEA, 2018.

The fees per household have slightly increased in this model, and the total number of clients targeted is around 800.

The distance to be covered by the CBE to the station is 3 km, and each option has been designed with this hypothesis.

Number of working days/week	**3**
Tonnage/working day	**20 T.**
Volume/working day	**74.48 m³**

In Area 4, the service is only three times per week without hampering a client's willingness to pay. It is important to keep this service frequency as much as possible.

5.5.1. OPTION 1: SERVICE MANAGED EXCLUSIVELY BY TRICYCLES

In this option, the service is entirely managed by tricycles, with pushcarts and wheelbarrows phased out or eliminated. There is an increase in recovery rate, despite voluntarily remaining below 80%. The CBEs are managing a high number of clients.

FIGURE 26: Breakdown of expenditures, Area 4, Option 1

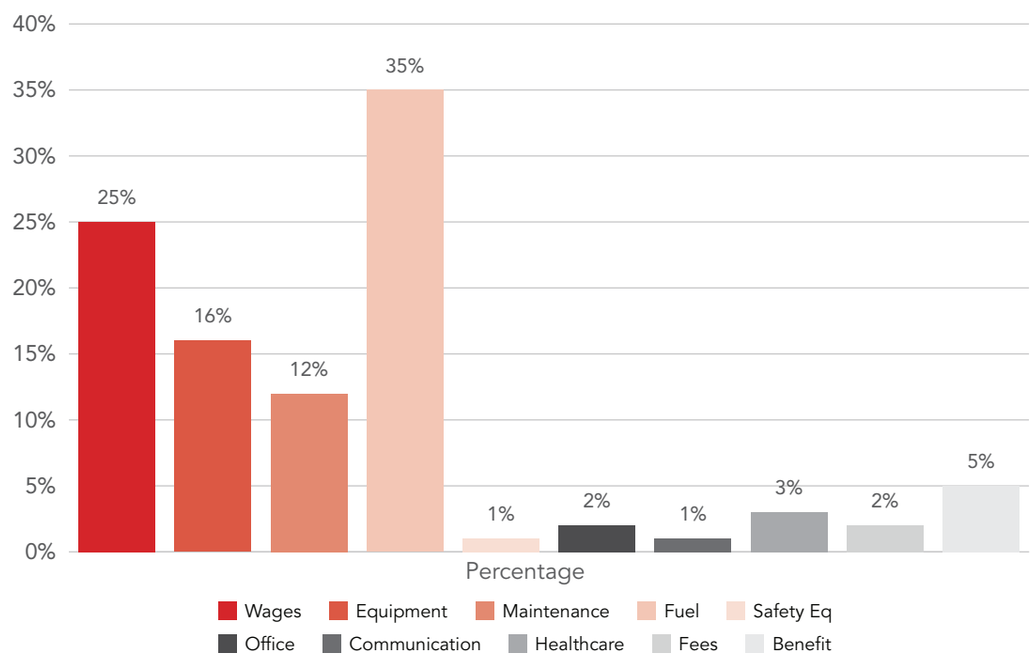


TABLE 18: Breakdown of expenditures, Area 4, Option 1

	Monthly	Percentage
Wages	$ 1,579	25%
Equipment	$ 1,001	16%
Maintenance	$ 763	12%
Fuel	$ 2,173	35%
Safety Eq	$ 36	1%
Office	$ 102	2%
Communication	$ 41	1%
Healthcare	$ 161	3%
Fees	$ 102	2%
Benefit	**$ 312.16**	**5%**

In this option, waste is transferred to a transfer station that is within **6 km**. According to the area served, additional transfer stations might be required.

Profit is substantial and the use of tricycles can be justified.

- An initial investment of US $11,000 USD is required to perform the job.
- The system is profitable if the station for waste dumping is located within 3 km of the area served by the CBE.
- No improvement in wages is possible, and the risk of having the workforce replaced can impact the recovery mechanisms.

5.5.2. OPTION 2: 100% TRICYCLES AND WAGES ++

In this option, the service is still achieved by tricycles, but the wages have been increased and doubled for waste collectors. When the CBE started the business in 2009 and after, wages for waste collectors could be as much as LRD 10,000 per month. Compared to the current situation, the wages are doubled for this position. An increase in salary can also be good motivation to improve worker recovery and efficiency. There is also less theft and less turnover. It is important that specific attention should be paid to clients in these areas. The total increase in wages in the business model can also be mobilised for other activities, such as commercial or marketing investigation/complaints and structured follow-up. This model suggests increasing wages as a bigger draw for the service, and a case study with better wages to seek diversification of workers' skills is shown below.

Wages	**Monthly wages** Unit Cost LRD	**Monthly wages** ++ Unit Cost LRD
Waste collector	4,750.0	9,500.0
Supervisor	8,000.0	12,000.0
Accountant/Finance Manager	9,000.0	18,000.0
Mechanic	9,000.0	12,000.0
Tricycle Driver	8,000.0	16,000.0

FIGURE 27: Breakdown of expenditures, Area 4, Option 2

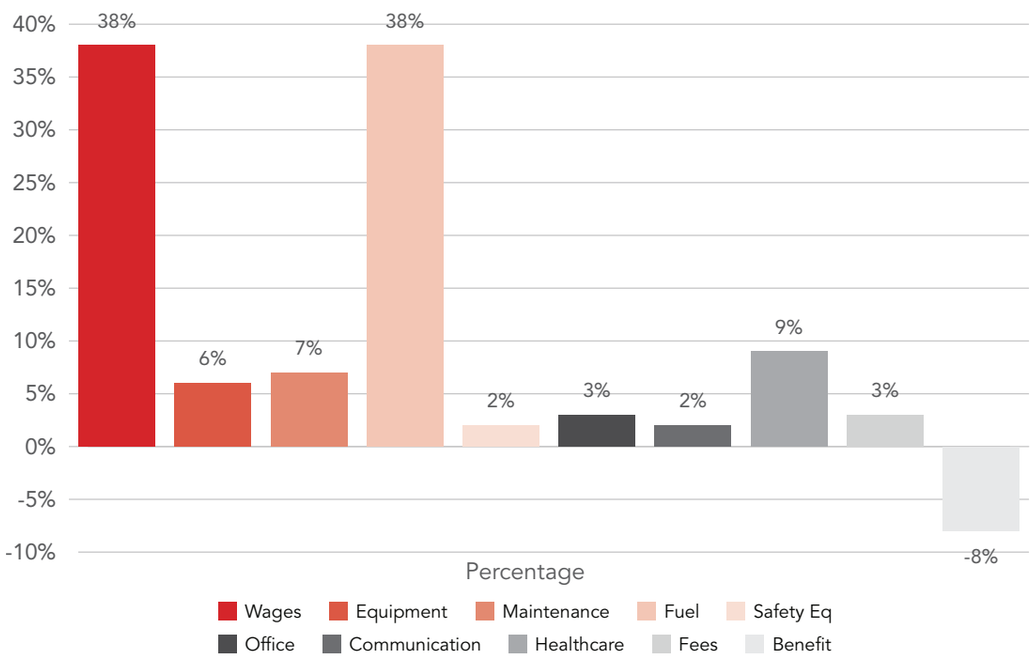


TABLE 19: Breakdown of expenditures, Area 4, Option 2

	Monthly	Percentage
Wages	$ 2,363	38%
Equipment	$ 360	6%
Maintenance	$ 420	7%
Fuel	$ 2,382	38%
Safety Eq	$ 72	2%
Office	$ 102	3%
Communication	$ 77	2%
Healthcare	$ 323	9%
Fees	$ 102	3%
Benefit	**$ 68.85**	**-8%**

In this option, the CBE is close to making a profit. If increasing current wages is a real objective of the CBE, the third option is to explore another organisation of waste collection with CBEs to divert more money to human resources and less on fuel.

- An initial investment of US $11,000 USD is required to perform the job.
- The system is not profitable and no improvement in wages is possible.

5.5.3. OPTION 3: OPTIMISING AND STRUCTURING THE SERVICE, WITH WAGES ++

As in Area 1, better organisation with a mix of wheelbarrows delivering the service can greatly optimise and strengthen waste collection.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to Transfer
Pushcart	0%	0		-	-	
WheelBarrows	40%	2	2	2.53	9.28	37
Tricycle	60%	3	2	3.80	13.92	1.0
Tricyle Transport						4.00

Pushcarts are not used in Area 4 because of the poor road quality. The only options left are wheelbarrows and tricycles. Some CBEs are already organising their operations this way; wheelbarrows are collecting waste door-to-door, while tricycles are used to transport waste on good roads. Collectors' wages have also been increased as described in Option 2.

FIGURE 28: Breakdown of expenditures, Area 4, Option 3

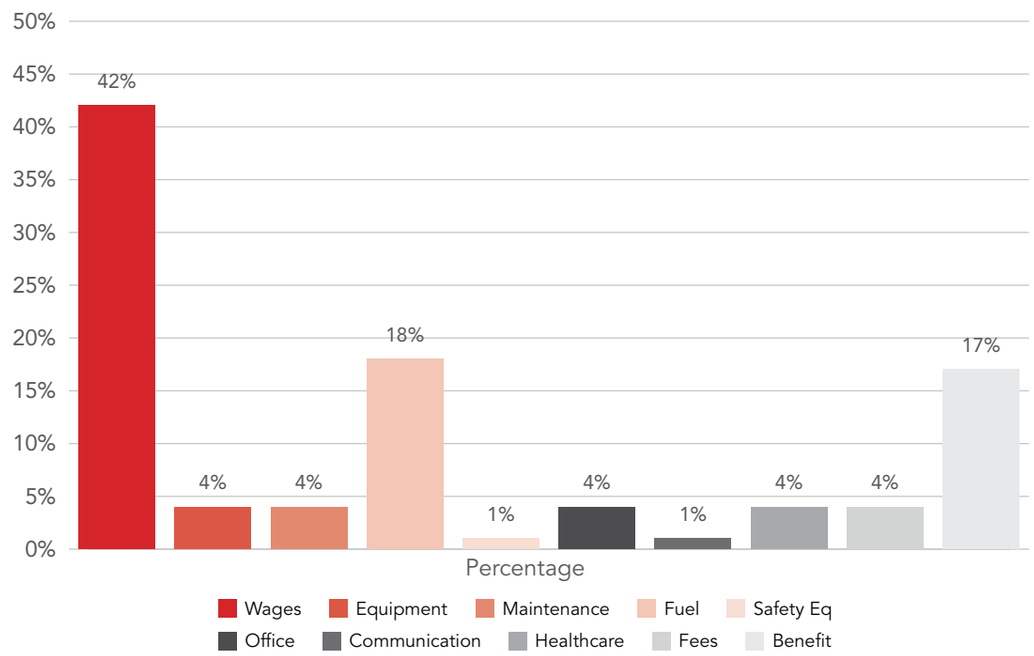


TABLE 20: Breakdown of expenditures, Area 4, Option 3

	Monthly	Percentage
Wages	$ 2,761	44%
Equipment	$ 317	5%
Maintenance	$ 393	6%
Fuel	$ 1,304	21%
Safety Eq	$ 76	1%
Office	$ 102	2%
Communication	$ 80	1%
Healthcare	$ 335	5%
Fees	$ 102	2%
Benefit	**$ 801.28**	**13%**

In this option, benefits are higher, wages are higher, and dependence on fuel is lower. It is an optimal situation.

- The CBE is making an even better profit than in option 1, and the initial investment is estimated as less than US $8,000.
- Wages are increased and the workforce is more likely to be stable and perform better.

5.5.4. MEDIUM-TERM MODEL

Before the fees can be increased to reach this amount with households, CBEs working in these areas can reach an intermediate stage.

	HH	Business
Number of clients	400	130
Average monthly fee	$ 2.00	$ 15.00
Recovery Rate	95%	95%
Monthly income	$ 3,420.00	$ 1,852.50
Total Monthly Income	**$ 2,613.00**	
Monthly Tonnage of waste (T.)	30	10
Total Monthly Tonnage	**41 T.**	
Monthly Volume of Waste (m^3)	110.77	36.00
Total Monthly Volume	**147.00 m^3**	

The model targets slightly more than 500 clients and includes a small fee increase. In this situation, it is still important for the CBE to optimise use of fuel and equipment. Thus, a high proportion of wheelbarrows are used.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)
Pushcart	0%	0	0	-	-
WheelBarrows	80%	11	11	10.93	40.05
Tricycle	20%	3	3	2.73	10.01

The CBE still has the capacity to make a decent profit. However, any change in the current balance of fuel expenses greatly impacts the business model, and the CBE should be careful.

FIGURE 29: Breakdown of expenditures, Area 4, Option 3 (Medium Term)

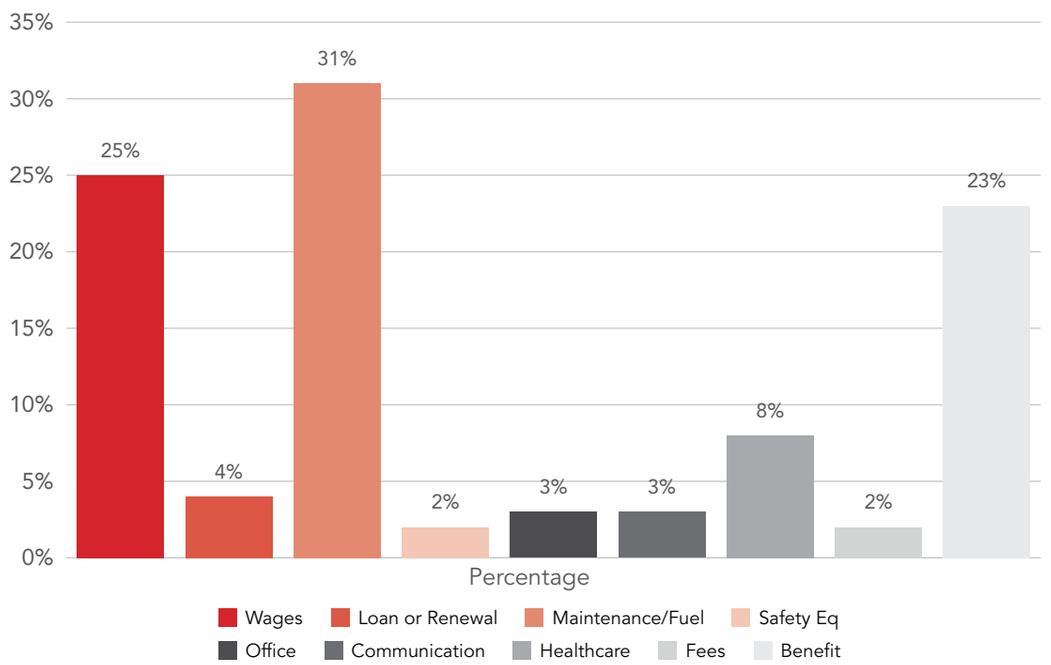


TABLE 21: Breakdown of expenditures, Area 4, Option 3 (Medium Term)

	Monthly	Percentage
Wages	$ 654	25%
Loan or Renewal	$ 111	4%
Maintenance/Fuel	$ 802	31%
Safety Eq	$ 48	2%
Office	$ 71	3%
Communication	$ 77	3%
Healthcare	$ 202	8%
Fees	$ 52	2%
Benefit	**$ 595.95**	**23%**

5.5.5. CONCLUSION

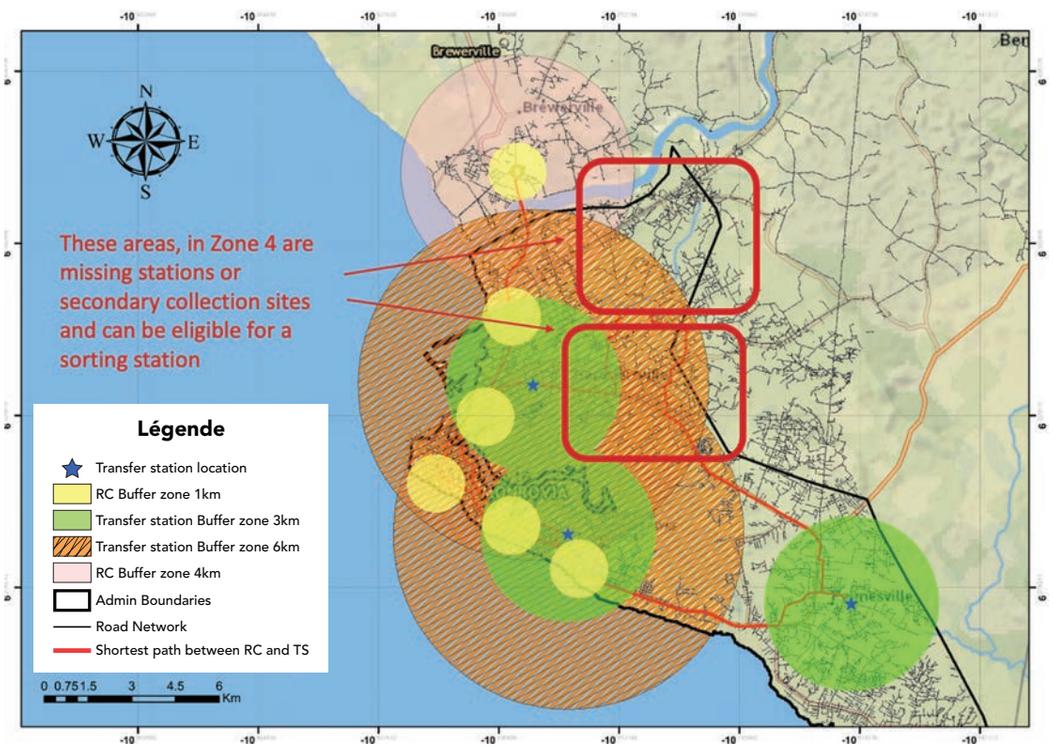
In Area 4, CBEs are already bearing most of the costs of the whole primary collection chain. Few stations or RC sites exist in these areas. There is also room for better wages for workers. Expanding the service will require a structured service with optimised activities and a good commercial approach to clients with more attention to a quality service.

These areas lack infrastructure to ease the collection work performed by CBEs, as shown in Figure 30. The RC sites currently in place in Brewerville cannot be replaced in the model, and transfer to the landfill is still performed by MCC or other companies. The CBE cannot cover this cost of transportation.

However, in Area 4 the business model has proven that RC sites located 3-6 km from the area served by the CBE still makes the business profitable. The RC sites function as a transfer station in this situation.

Additional areas lacking RC sites that could play the role of sorting stations are shown in Figure 30. The investment required in a sorting station based on the waste estimation for those areas is about US $190,000 USD to recycle or reuse 12T of plastics. This investment requires external funding. For equipment, the investment needed is US $8,000, which the CBEs can fund themselves. In this case, a station for dumping less than 6 km away is required.

FIGURE 30: Areas missing infrastructure and eligible for sorting stations (Area 4)



5.6. Area 5: Formalising, Structuring and Optimising

Paynesville is the "Eldorado" for current CBEs, with an increasing number of businesses starting or expanding. The CBEs in these areas face serious challenges, such as exceedingly low secondary infrastructure, very bumpy roads, and low regulatory mechanisms. Low regulation is currently a positive aspect of Area 5, as it enables a greater business dynamic. With the number of CBEs growing, regulations will soon be required, and discussions between the CBEs and the corporations are mandatory for a smooth implementation.

In this area, the targeted number of clients per CBE is lower than in the other areas, as the complexity of the system threatens the business. The number was provided by CBEs working in Area 5.

	HH	**Business**
Number of clients	600	200
Average monthly fee	$ 6.00	$ 15.00
Recovery Rate	95%	95%
Monthly income	$ 3,420.00	$ 2,850.00
Total Monthly Income	**$ 6,270.00**	
Monthly Tonnage of waste (T.)	45	15
Total Monthly Tonnage	**61 T.**	
Monthly Volume of Waste (m^3)	166.15	55.38
Total Monthly Volume	**222.00 m^3**	

The fees per household are slightly increased in this model, and the total number of clients targeted is around 800. The distance to be covered by CBE to the station is 6 km, and each option has been designed with this hypothesis.

Number of working days/week	**3**
Tonnage/working day	**20 T.**
Volume/working day	**74.48 m^3**

In Area 5, the service is only three times per week without hampering a client's willingness to pay. It is important to keep this service frequency as much as possible.

5.6.1. OPTION 1: SERVICE MANAGED EXCLUSIVELY BY TRICYCLES

In this option, the service is entirely managed by tricycles, with pushcarts and wheelbarrows phased out or eliminated. There is an increase in recovery rate, despite voluntarily remaining below 80%. The CBEs are managing a high number of clients.

FIGURE 31: Breakdown of expenditures, Area 5, Option 1

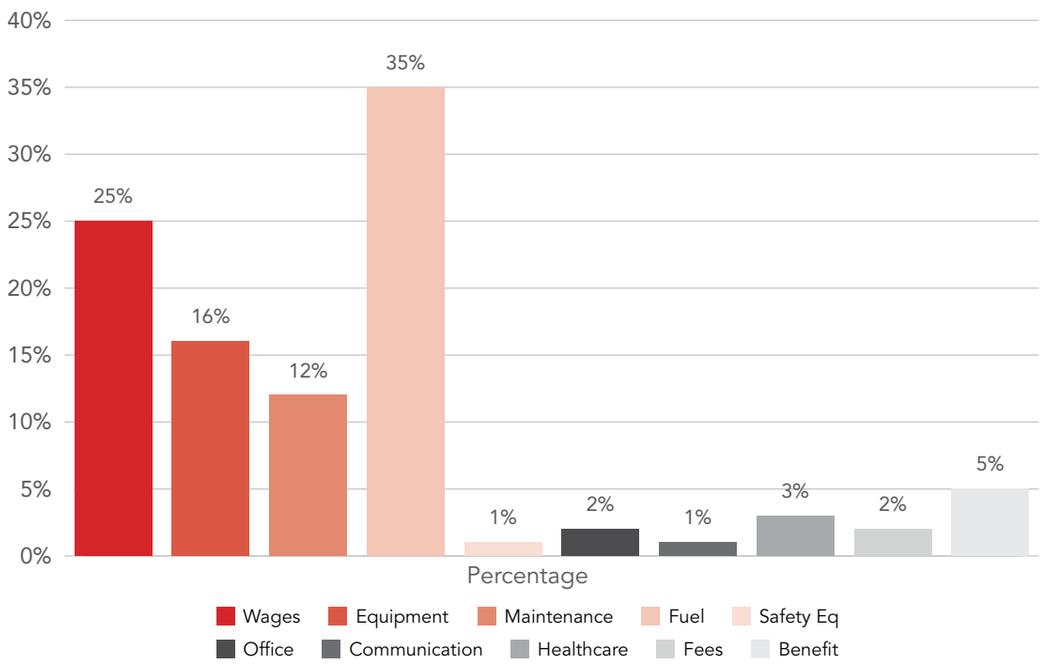


TABLE 22: Breakdown of expenditures, Area 5, Option 1

	Monthly	Percentage
Wages	$ 1,579	25%
Equipment	$ 1,001	16%
Maintenance	$ 763	12%
Fuel	$ 2,173	35%
Safety Eq	$ 36	1%
Office	$ 102	2%
Communication	$ 41	1%
Healthcare	$ 161	3%
Fees	$ 102	2%
Benefit	**$ 312.16**	**5%**

In this option, waste is transferred to a transfer station that is within **6 km**. According to the area served, additional transfer stations might be required.

Profit is substantial and the use of tricycles can be justified. In this option, nine tricycles are required to perform the job to cover 1% of the population in Area 5.

- An initial investment of US $11,000 is required to perform the job.
- The system is profitable as long as the station for waste dumping is located within 6 km of the area served by the CBE.
- No improvement in wages is possible, and the risk of having the workforce replaced can impact the recovery mechanisms.

5.6.2. OPTION 2: 100% TRICYCLES AND WAGES ++

In this option, the service is still performed by tricycles, but the wages have been increased and doubled for waste collectors.

Wages	**Monthly wages** Unit Cost LRD	**Monthly wages** ++ Unit Cost LRD
Waste collector	4,750.0	9,500.0
Supervisor	8,000.0	12,000.0
Accountant/Finance Manager	9,000.0	18,000.0
Mechanic	6,000.0	12,000.0
Tricycle Driver	8,000.0	16,000.0

FIGURE 32: Breakdown of expenditures, Area 5, Option 2

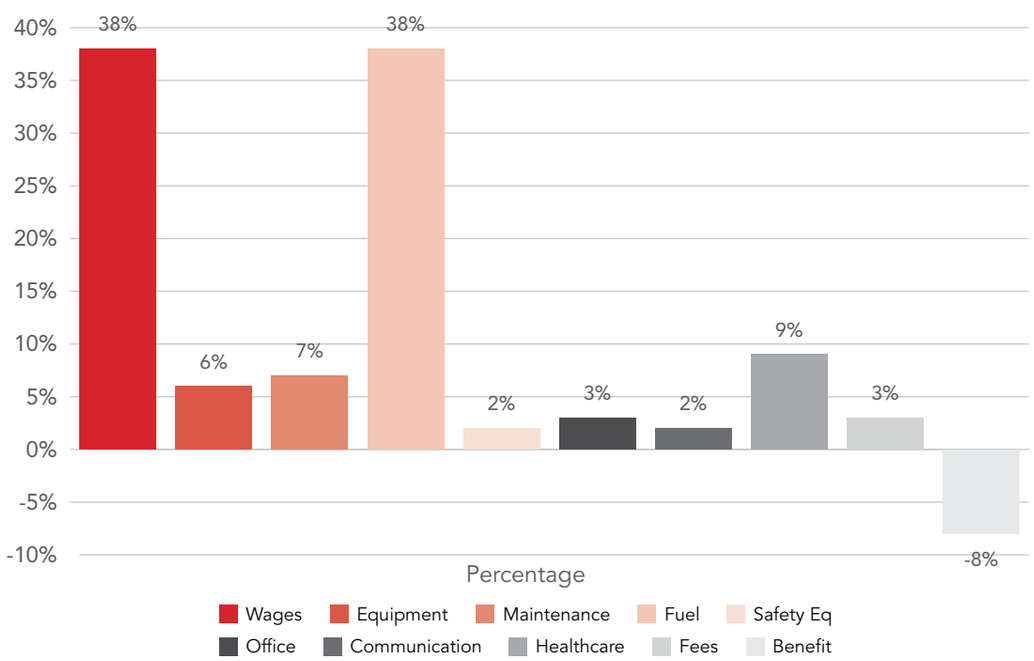


TABLE 23: Breakdown of expenditures, Area 5, Option 2

	Monthly	Percentage
Wages	$ 2,363	38%
Equipment	$ 360	6%
Maintenance	$ 420	7%
Fuel	$ 2,382	38%
Safety Eq	$ 72	2%
Office	$ 102	3%
Communication	$ 77	2%
Healthcare	$ 323	9%
Fees	$ 102	3%
Benefit	**$ 68.85**	**-8%**

In this option, the CBE is not able to benefit. If increasing current wages is a real objective of the CBE to secure its workforce and improve service delivery and recovery rate, the third option is exploring another organisation of waste collection with CBEs.

- An initial investment of US $11,000 USD is required to perform the job.
- The system is not profitable, and no improvement in wages is possible.

5.6.3. OPTION 3: OPTIMISING AND STRUCTURING THE SERVICE, WITH WAGES ++

Like in Area 1, better organization of the service with a mix of wheelbarrows delivering the service can greatly optimise and strengthen waste collection.

	Percentage of clients	Numb. of worker	Number of item	Daily Tonnage (T.)	Daily Volume (m^3)	Number of Transport to Transfer
Pushcart	0%	0		-	-	
WheelBarrows	40%	7	7	8.13	29.79	28
Tricycle	60%	11	6	12.20	44.69	1.0
Tricyle Transport			0			11.00

Pushcarts are not used in Paynesville because of the poor road quality. The only options left are wheelbarrows and tricycles.

Some CBEs are already organising their operations this way; wheelbarrows are collecting waste door-to-door, while tricycles are used to transport waste on good quality roads. The wages of collectors have also been increased as described in option 2.

FIGURE 33: Breakdown of expenditures, Area 5, Option 3

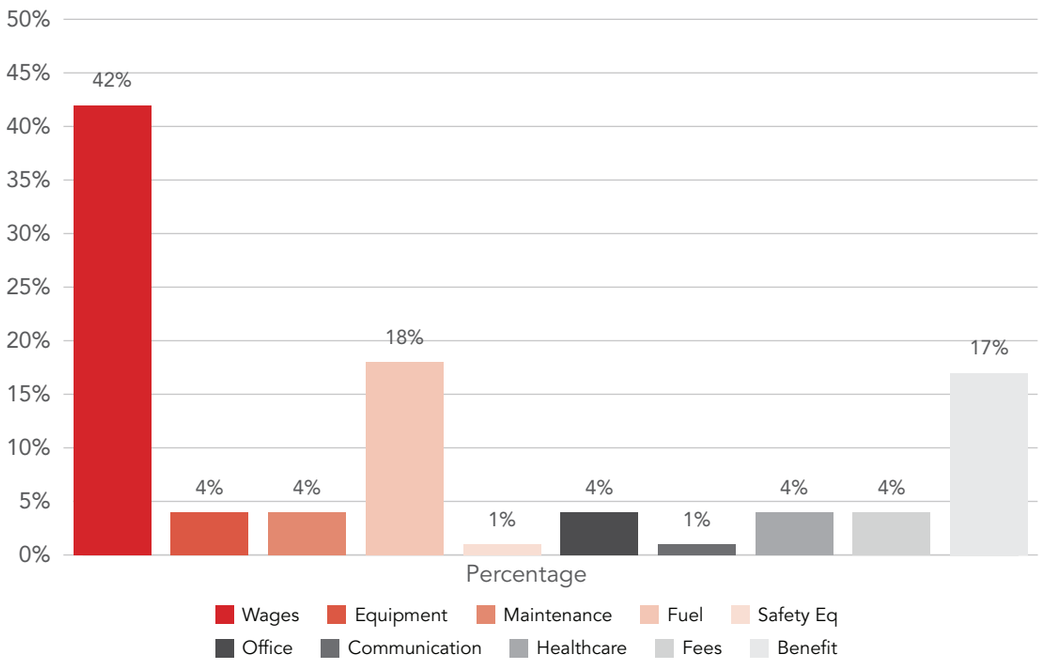


TABLE 24: Breakdown of expenditures, Area 5, Option 3

	Monthly	Percentage
Wages	$ 2,761	44%
Equipment	$ 317	5%
Maintenance	$ 393	6%
Fuel	$ 1,304	21%
Safety Eq	$ 76	1%
Office	$ 102	2%
Communication	$ 80	1%
Healthcare	$ 335	5%
Fees	$ 102	2%
Benefit	**$ 801.28**	**13%**

In this option, benefits are higher, wages are higher, and dependence on fuel is lower. It is an optimal situation.

- The CBE is making an even better profit than in option 1, and the initial investment is estimated as less than US $8,000.
- Wages are increased and the workforce is more likely to be stable and to perform better.

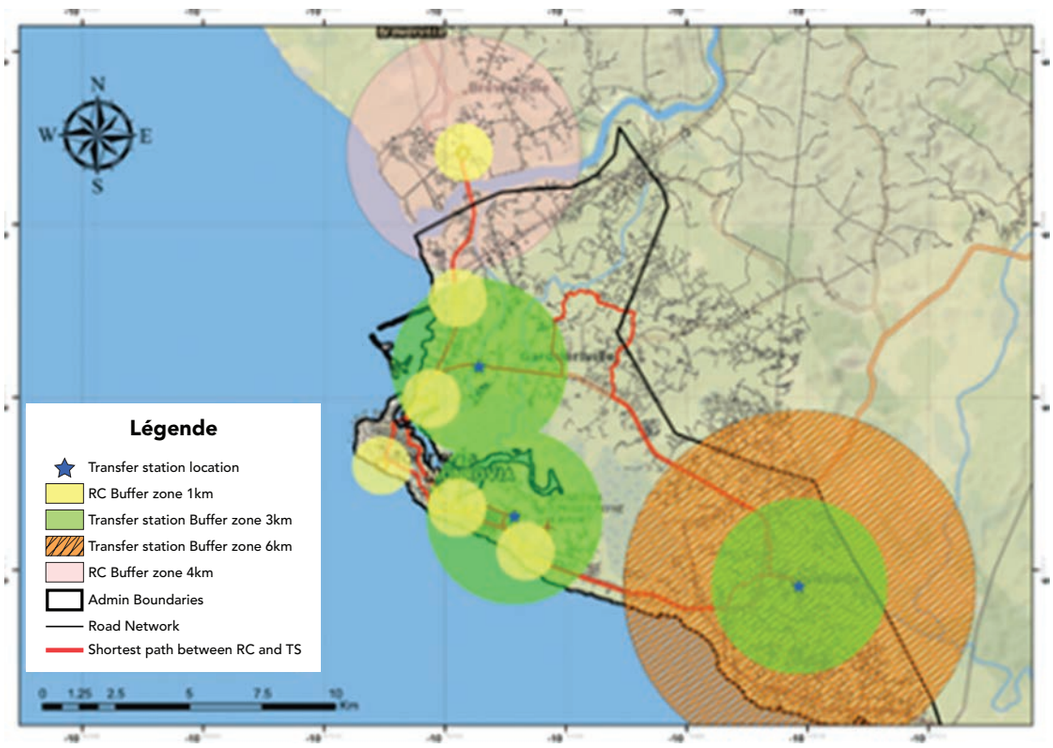
5.6.4. CONCLUSION

In Paynesville, as explained in the Diagnosis Report, the whole waste collection system lacks infrastructure, with no secondary collection points and a transfer station under construction with no budget to finish the work.

The CBEs are already bearing most of the costs of the whole primary collection chain, transferring the waste to this temporary station.

The area has a sharp increase in CBE development, and there is a proper station under construction. Thankfully, this station is located at most 6 km from the area served by CBEs to enable them to make a profitable business. The buffer zone of this station is sufficient to start with the service. There is also room for better wages for workers in Paynesville. Expansion of the service will require a structured service with optimised activities and a good commercial approach to clients with more attention to service quality.

FIGURE 34: Area covered by the current transfer station in PCC with 2 buffer zones



Because the station is currently under construction, Paynesville is a good place for a sorting station that could help the corporation and the CBEs better manage the waste collection system.

To sort one third of PCC's waste (about 100 T. per day), an initial investment[5] of US $170,000 in a sorting station is required, and 10 T. of plastics can be reused or recycled. A sufficient tonnage of plastics can justify the implementation of such a sorting station.

The investment supported by CBE in equipment is estimated around US $8,000.

[5] Estimation based on the Feasibility Study on Costed Business Models for Composting and Recycling, conducted by ICEA, 2018.

6. CONCLUSION

The CBE system is no longer a single system, and the CBEs' profitability and expansion are designed for specific areas.

The current infrastructure available to CBEs enable business to be profitable in Area 1, in some townships of Area 4, and in Area 5, despite the major lack of infrastructure in Paynesville. Investments are likely to be required in Areas 2 and 3, and in some townships of Area 4, to enable the CBEs to keep going or initiate their activity.

The major issue for CBEs is the very low number of clients managed on average. Without strengthening their collection activity, any other projects related to diversification will barely be possible.

With their estimated clientele in the business models and the population estimate, Table 25 summarises the number of CBEs required to fully cover the areas. Fewer CBEs than initially estimated with their current clientele are required, and more realistic figures are presented.

TABLE 25: Number of CBEs required to cover the area*

	# of CBEs required to cover the area	Approximative number of additional CBE required to cover the area
TOTAL Greater Monrovia	221	192
Total Zone 5	133	125
Total Zone 4	49	46
Total Zone 3	4	0
Total Zone 2	15	11
Total Zone 1	21	11

**Based on their average number of clients in the improved business model and the approximate number of additional CBE required*

Different models can be implemented, depending on the area. The use of non-motorised equipment is highly recommended to enable the CBEs to carry out waste collection. The willingness of households to pay for service is low, while the overall service needs to be optimised.

A new approach requiring CBEs to go to transfer stations is a good option to improve cost recovery for the whole waste collection chain. With adequate equipment and managerial capacities, CBEs have the potential to perform very well. The choice of equipment for transportation must be carefully considered due to the quality of roads and traffic congestion. For any options suggested in central Monrovia, corporations should consider the transportation movements of CBEs. For instance, in Central Monrovia A and B, tricycles would have to make more than 260 roundtrips to the transfer station.

Reconstructed bins in several areas of Monrovia are key to maintaining CBE activities and avoiding expenses that impact the CBEs' bottom line, such as fuel, maintenance,

and investment costs for transportation. The RC sites should be redesigned to prevent neighbors from accessing them. Regulation of these sites by the CBEs themselves could be an option; they would be in charge of cleaning the site and transferring waste to the station.

Any intervention in Area 1, except to strengthen the CBEs' capacities, is difficult considering the new MCC pilot project. It is clear that current infrastructure has to be maintained and can cover most needs, but the RC sites should be improved and secured or locked.

The situation is less rosy for Areas 2 and 3. Any additional costs for transporting waste to the transfer station would undermine the business. The CBEs can explore developing different services, such as the management of controlled drop-off points or portable toilets services. In Area 3, where CBEs are vulnerable to any change in the waste collection system, the corporation needs to consider the ramifications of removing secondary collection points.

For implementation of the pilot project and considering that Area 2 is known for having CBEs working as SMEs, the investment in infrastructure for the new system of service delivery can be mutualised and work as a sorting station. The very large business the CBE-SMEs collect in this area represents an attractive plastic supply for the station. The investment required to implement the new system cannot be borne by CBEs, and part of the funding initially allocated to sorting and recycling is likely to be diverted to the development of this pilot.

Area 4 is seen as a viable option for the expansion of CBEs' services. Higher wages for workers are also an option in this business model. However, CBEs should be prudent in the use of fuel and invest in a mix of waste collectors. By using a mix of wheelbarrows and tricycles, the CBEs can benefit, particularly in terms of the life expectancy of such equipment. Additional investments in infrastructure are required to make the system work for CBEs.

Last but not least, Area 5 faces similar challenges as Area 4. The existing infrastructure is barely working, and investments are required. Paynesville is unique, and the arrangement that can be reached in this area with one single corporation is a good argument in favor of a sorting station designed for at least a third of the waste produced. The growing business and the diversity of clients will enable the station to sort at least 20T. of plastics.

In this situation, major investment is required by municipalities or corporations to better structure the collection chain from the transfer station to the landfill.

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