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Informal Waste Recovery and Recycling: Alleviating Poverty, Environmental Pollution and Unemployment in Douala, Cameroon

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Author's contribution

The entire work from design, writing of the first draft of the manuscript was performed by the author LOM. Author LOM conducted quantitative surveys and interviews, performed the analysis and read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: The aims of this research paper is to investigate the role of the informal waste recovery and recycling sector in Douala, Cameroon in alleviating poverty, environmental pollution and unemployment.
Study Design: The design consisted of a survey of 72 randomly picked waste pickers involved in the recovery and recycling of four waste fractions: scrap metals, plastics, bottles and papers and cardboards.
Place and Duration of Study: PK 12 "Genie Militaire" landfill operated by HYSACAM,at Douala, Cameroon, between October 2012 and December 2012.
Methodology: The methodology consisted of two parts: a quantitative survey using random sampling and qualitative interviews designed to add depth and detail to the survey results. Participant observation, site visits and literature review from international journals and reports were carried out.
Results: The study reveals that poverty trends in Cameroon is higher in the rural than in the urban areas, a major cause of rural– urban migration. In Douala, a real migration hub for the unemployed, the recovery and recycling of four waste fractions; scrap metals, plastics, bottles, papers and cardboards was found to be very profitable. This is because, the minimum wage of Cameroonians, 746 FCFA (US$ 2) per day was found to be lower

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than the daily income, 1000 FCFA–1500 FCFA (US$ 2.90–US$ 3.3) of the informal waste sector workers at the Douala landfill. Besides improving the livelihoods of the waste pickers, the amount of waste at the landfill is reduced hence mitigating environmental pollution. This is in line with the Millennium Development Goals (MDGs) on poverty reduction and environmental sustainability.

Conclusion: In an attempt to put waste pickers on the map, the study recommends alliances based on best practices found in other countries as well as the government to design programmes that will guarantee health, safety, identification and the creation of veritable markets for waste products.

Keywords: Informal waste sector; recovery; recycling; poverty; pollution; landfill.

1. INTRODUCTION

The increasing quantities of municipal solid waste (MSW) in some Cameroonian cities can be linked to the rapid population growth, urbanization and rural–urban migration. This has resulted in environmental pollution, diseases and poverty. The urban populations in developing countries grow by more than 150,000 people every day [1]. According to country report, Cameroon had an average annual population growth rate of 2.2% with 30.4% of the population living on less than $2 a day [2]. With such a growth rate, a major challenge facing the Douala urban council is the collection, treatment and disposal of this waste. In this regard, the Douala urban council contracted these services to a private company HYSACAM, French acronym for “Hygiène et Salubrité du Cameroon”. HYSACAM started its activities in Douala in 1969.

HYSACAM currently handles municipal solid waste collection, treatment and disposal in the towns of Douala, Yaoundé, Bafoussam, Limbe, Kribi, Garoua, Maroua, Ngoundere, Bertoua, Ebolowa, Buea, Sangmelima/Meyomesala, Bangante, Bangou as well as Niamey (Niger), Monrova (Liberia) and Ndjamena (Chad). Despite their involvement both nationally and international in providing employment, alleviating poverty, improving public health and sanitation and reducing environmental pollution, there is still the issue of uncollected waste. Even with a capacity of 50,000 tonnes of MSW collected and treated daily in Cameroon, with about 6000 waste bins and 500 skips, it is still not a solution to the MSW problem in Cameroon. This insufficiency has encouraged informal waste recovery and recycling activities by waste pickers sometimes described as “scavengers” who often sit apprehensively alongside formal ‘modern’ waste management systems [3]. In the presence of such trepidation, the livelihoods of many families depend on the recovered and recycled products from landfills.

Research on informal waste management suggests that, it is only by understanding, acknowledging, incorporating informal waste workers into new ways of delivering improved services may sustainable solutions be found with regards to increasing levels of resource recovery and a more safe and sound livelihoods [4,5,6].

Delivering improved waste services can only be achieved when genuine partnerships and alliances are formed. These alliances have been very instrumental in improving livelihoods of waste pickers in several studies of many developing countries [7,8,9,10].

This paper presents the results of informal waste recovering and recycling using the PK10- "Génie Militaire" landfill in Douala as case study. Data from the case study area indicates that besides improving the livelihoods by alleviating poverty and unemployment of the waste pickers, the amount of waste at the landfill is reduced hence mitigating environmental pollution.

1.1 The Waste Management Strategy for Cameroon

The main objective of the waste management strategy for Cameroon [11], is safeguarding the wellbeing of its citizens through the efficient management of waste in the national territory while the specific objective focuses on improving solid waste management practices by providing easy access to the collection of wastes in the urban and semi urban areas; the sustainable management of all hazardous waste produced from households, hospitals and other establishments; putting in place measures that will encourage the active participation of the informal waste sectors e.g. of non governmental organizations and individuals in the sustainable management of MSW; the promotion and reinforcement of international cooperation on the transboundary movement of hazardous wastes and the use of appropriate treatment methods including recycling. In the strategy, recycling is considered as an efficient way of waste management with its prolonged benefits from resources conservation and indirect energy saving from avoiding raw material exploitation. Recycling operations have become one of the primary strategies for waste management worldwide because they are viewed as among the most valuable techniques for reducing the amount of municipal solid waste disposed at landfill sites [12], as well as a strategy for poverty reduction as indicated in the poverty reduction strategy paper for Cameroon [11].

1.2 Socioeconomic Situation

Douala is Cameroon's economic capital. It has a population estimated at over 2 million, almost 11 percent of the country's population, growing at an annual rate of 5%, compared to a national average growth rate of 2.2% [13]. Despite the fact that Douala has earned its place among those cities chosen for the New Partnership for Africa's Development (NEPAD), it faces some major development problems that are preventing it from fully assuming its role as a development center for Cameron and the Central African Sub-Region. These problems include poverty, which affects about 13 percent of the city's households and unemployment, which affects about 27 percent of the city's labour force [13]. The waste management strategy for Cameroon (2007–2015), highlights the role played by the formal and informal waste sectors in alleviating poverty through job creation and reducing environmental pollution.

1.3 Poverty Reduction Strategy Paper (PRSP)

Predictions made by the PRSP for Cameroon shows an average GDP growth of about 6% per annum over the next 15 years, with the informal sector as the main actor providing income for 20% of the labour force [11]. In the context of Douala, the Poverty Reduction Strategy as approved by the Government relates to the urban environment with the sole objectives of mobilizing all actors in order to bring about a significant improvement in the management of the city's environment and quality of life. This is in line with the MDG 7: Ensuring environmental sustainability and the MDG 1: Reducing extreme poverty and hunger. Table 1 illustrates the poverty trend for Cameroon.

Table 1. Cameroon poverty trend in % (2001 - 2007)

	2001			2007		
	PO	**P1**	**P2**	**PO**	**P1**	**P2**
National	40.2	12.8	5.6	39.9	12.3	5.0
Area of residence						
Urban	17.9	4.3	1.6	12.2	2.8	1.8
Rural	52.1	17.3	7.7	55.0	17.5	7.2
Douala						
Urban	10.9	2.1	0.7	5.5	0.9	0.2
Rural	13.3	2.7	0.9	5.9	1.0	0.2
Region						
Adamawa	48.4	15.4	6.4	53.0	14.5	5.4
Centre	48.2	15.0	6.6	41.2	9.5	3.1
East	44.0	15.4	6.7	50.4	15.7	6.2
Far North	56.3	18.8	8.2	65.9	24.6	11.2
Littoral	35.5	10.1	4.2	31.1	7.7	2.7
North	50.1	15.5	6.4	63.7	21.0	8.6
North ‐West	52.5	20.9	10.7	51.0	16.6	6.8
West	40.3	11.1	4.2	28.9	6.6	2.3
South	31.5	7.4	2.4	29.3	7.4	2.7
South ‐West	33.8	10.5	4.5	27.5	6.9	2.5

Source: Adapted from [11]

1.4 Growth and Employment Strategy Goals

The latest national employment survey of the informal sector by the National Institute of Statistics indicates that the expanded unemployment rate among young people aged 15‐35 is about 13%, while under-employment was 71.9% – 54.4% in urban areas and 79.2% in the countryside [11]. The poverty severity index (P2) calculates poor household expenditure distribution on the basis of average poor household expenditure. P1 is the relative average difference between the poverty line and the average poor household expenditure. It determines the revenue distribution or household expenditure on the basis of 100% equal distribution [11]. The quantitative or income-based technique uses data from basic food and non-food needs from three Cameroon household surveys (ECAM 1, 2 and 3) conducted all over the country in 1996, 2001 and 2007 [11,14]. These surveys did not only help to evaluate the level of poverty and the living conditions of households in Cameroon, but also highlighted trends within the structure of realization of the first PRSP in 2003.

1.5 Informal Waste Recovery and Recycling System in Douala

Waste recovery and recycling of MSW in Cameroon is unregulated. The interaction of different actors of the informal waste sector e.g. waste pickers; itinerant waste buyers; middlemen and small enterprises at landfills, waste dumps, skips, and street dumps gives the onlooker a negative impression about the system. Despite this, the environmental component of reducing the amount of waste material to be sent to the landfill cannot be underestimated. Considering the large quantities of scrap metals (ferrous and non ferrous), glass bottles, plastic bottles, paper and cardboards (Table 2 and Plate 1), recovered and recycled makes the entire system an important contributor in reducing environmental pollution, combating unemployment and alleviating poverty in Douala. Plastic bottles are

pelletized; scrap metals are transformed into aluminum pots by blacksmiths at Ndokotti and leather waste into leather shoes at Congo Market. From interviews, only a small proportion of plastics and scrap metals are recycled in Douala, with a greater proportion being exported to Nigeria, endowed with bigger market.

Table 2. Major recovered materials (kg) at PK10- "Génie Militaire" landfill

Material	Quantity
Ferrous metals	8,435
Non ferrous metals	4,618
Glass bottles	5,132
Plastic bottles	5,824
Paper and cardboard	4,316
Total	28,325

Source: Field survey, 2012

Plate 1. Recovered plastics and scrap metals at PK10- "Génie Militaire" landfill
Source: Field Study, 2012.

1.6 PK10-"Génie Militaire" Case Study

The landfill at PK10-"Génie Militaire" in Doulala operates under a contract signed in 2003 between HYSACAM and the Douala municipality for MSW collection, transport and dumping. HYSACAM will continue dumping MSW in the landfill site until 2015. The PK10 landfill is located 10 km away from the Douala city centre and receives domestic and commercial waste at an average rate of 280,000 tonnes per year. It is about 25 meters deep with a surface area of 63 hectres, with approximately 10 hectres is used to date [15]. According to [15], 1,500,000 tonnes of waste have been disposed in the PK10 landfill between 2003 and 2008, while another 3,200,000 tonnes are estimated to be dumped until the end of 2015 (Table 4). In the absence of a landfill gas recovery and flaring system MSW is dumped into cells by successive layers of 70 cm, with 20 cm cover material [15] and directed to specific deposition areas with controlled scavenging and fires. It includes (i) cover material (ii) mechanical compacting and (iii) leveling of the waste. Table 3 and shows the annual amount and composition **(pj)** of waste received at the landfill.

Biotecnogas values were obtained at the landfill during on-site visit by evaluating the volume of waste in it and applying a conservative compaction ratio of 0.85t/m^3. Previously collected waste was inferred proportionally while future waste was computed by applying a 5% yearly increment with Douala's demographic growth taken into consideration. The landfill will stop receiving waste in 2016 [15].

Table 3. Waste composition at the PK10- "Génie Militaire" landfill

Waste type j according to the on-site visit report	Waste type j according to UNFCCC categories	Proportion in %
Paper and cardboard	Pulp, paper and cardboard	1.87
Textiles	Textiles	2
Wood	Wood and wood products	1.5
Garden	Garden, yard and park waste	9
Alimentary	Food, food waste	55
Other	Glass, plastic, metal, other inert waste	30.63
TOTAL		100

Adapted from [15]

Table 4. Annual waste streams at the PK10 landfill (in tonnes)

Year	Total	Wood and wood products	Pulp, paper and cardboard (other than sludge)	Food, food waste, beverages and tobacco (other than sludge)	Textiles	Garden, yard and park waste	Glass, plastic, metal, other inert waste
2003	33,435	502	625	18,389	669	3,009	10,241
2004	122,606	1,839	2,293	67,433	2,452	11,035	37,554
2005	122,255	1,834	2,286	67,240	2,445	11,003	37,447
2006	174,782	2,622	3,268	96,130	3,496	15,730	53,536
2007	174,773	2,622	3,268	96,125	3,495	15,730	53,533
2008	245,534	3,683	4,591	135,044	4,911	22,098	75,207
2009	247,333	3,710	4,625	136,033	4,947	22,260	75,758
2010	259,700	3,896	4,856	142,835	5,194	23,373	79,546
2011	272,685	4,090	5,099	149,977	5,454	24,542	83,523
2012	286,319	4,295	5,354	157,475	5,726	25,769	87,700
2013	300,685	4,510	5,622	165,349	6,013	27,057	92,085
2014	315,667	4,735	5,903	173,617	6,313	28,410	96,689
2015	331,450	4,972	6,198	182,298	6,629	29,831	101,523

Source: Adapted from [15]

According to [15], the on-site visit report were based on conventional amendment of HYSACAM's historical data, which took into account the controlled scavenging actions occurring on the landfill site, with a manual selection by about 100 scavengers who collect approximately 25% of paper/cardboard. The "alimentary" category was assimilated to the United Nations Framework Convention on Climate Change (UNFCCC) "food, food waste"

category, “wood” into “wood and wood products”, “paper and cardboard” to “pulp, paper and cardboard”, and other wastes to “glass, plastic, metal, other inert waste” (Table 3).

The amount of organic waste type $\mathbf{jW}_{j,x}$ was calculated by multiplying the total amount of municipal waste received at the landfill site in year $_{x}\mathbf{W}_{x}$ by the corresponding waste fraction $\mathbf{p}_{j}$ of the waste type **j**.

2. MATERIALS AND METHODES

To examine and identify trends in informal recovery and recycling activities of waste pickers at the PK 12 “Genie Militaire” landfill operated by HYSACAM, a study was undertaken in Douala between October and December 2012. The methodology consisted of two parts: a quantitative survey using random sampling and qualitative interviews designed to add depth and detail to the survey results. Of the 72 waste pickers randomly picked during the survey period (October to December 2012), only 45 accepted our invitation to participate representing 62.5%. Of this, there were 33 male’s (73.3%), 4 females (8.9%) and 8 youths (17.8%) between ages 15‑19. Information gathered included, gender; income status of the waste pickers; waste types; market challenges and environmental benefits.

Interviews were conducted in French, English and in Pidgin languages to follow up ideas, probe responses and investigate motives and feelings of the waste pickers for clarity. To get a complete picture of the market chain for scrap metals, plastics and bottles (most preferred waste fractions), 5 itinerant buyers were interviewed. To evaluate the relationship between HYSACAM and the waste pickers, two landfill operators were interviewed. An official of the Douala urban council responsible for waste management operations was contacted for information on partnerships or alliances between HYSACAM and the waste pickers. The interviews were recorded with a tape recorder, transcribed and analyzed.

Two types of quantitative analysis were conducted:

1. Descriptive analysis to sum up data sets and show contribution and approaches taken by waste pickers regarding the different waste fractions;
2. The exploratory method was used to compare and contrast the different motivations for waste picking and the preference for particular waste types.

A detailed review of literature from international journals, government documents as well as project and activity reports of the Douala urban council and HYSACAM was carried out. Site visits were undertaken to meet and dialogue with waste pickers, to have an on the spot view of the manner in which the preferred waste fractions are being recovered and recycled, and to understand the barriers and success stories. The five main waste categories mentioned in Table 2, were weighed daily in all the week days with a hand scale and the information recorded in a note book.

There were limitations in sample size, 4 females (8.9%) and 8 youths (17.8%), which is relatively small compared to the population size of the study area. Due to the fact that waste pickers were chosen at daytime, it was not tested if it excluded those who visited the landfill only in the evenings. This is a common scenario with women who visited the landfill in the evenings after their daily household chores. There were also limitations in the interviews conducted in French, English and in Pidgin. It was not tested whether these methods of verbal communication influenced participant’s choices of the recovered wastes.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Status of Waste Pickers and Itinerant Buyers

As indicated in Table 1, poverty rate was higher in the rural than the urban areas. This is a major cause of rural urban migration in Cameroon as exemplified by Douala annual growth rate of 5%, compared to a national average growth rate of 2.3% [13]. These categories of migrants have a low or no academic background and without skilled manpower often choose waste picking as a veritable option for income generation and livelihood. This is quite similar to other cities e.g. in Bangalore, itinerant buyers were only rarely recent migrants from rural areas and had often done other jobs before choosing this occupation [16]. Interview results indicate that all the 45 interviewees had no educational background and had never been involved in any formal job. They were either school dropouts at the elementary level or had never been to school. The male waste pickers indicated they were married with many children, a major contributing factor to household poverty in Cameroon.

3.2 Market for Recyclates

To ensure waste management options reflect the costs of environmental damage, waste markets must be created and market prices for non-renewable raw materials must reflect their full economic and environmental cost [17,18]. It is on this basis that [19], puts much emphasis on the importance of market development programmes as part of integrated waste management in the UK. This is gathering great impetus in the UK and Europe. And according to [20] ‘‘the identification and development of new markets for recycled goods and materials should be taken forward as a priority measure’’. The development of markets for recycled materials is key in ensuring that recycling is economically and environmentally viable. Recycling is about putting materials back into productive use in the economy, whether through re-use or re-manufacture, thus closing the loop [19]. Notwithstanding, there are a number of barriers to market development for recyclates, and these have different impacts on the flow of different materials through to their end markets. See Table 5 below for the key materials that WRAP has targeted: those for which the most significant market failures have been apparent.

Table 5. Barriers to market development for key materials

Material	Inadequate collection infrastructure	Quality sourcing problems	Limited reprocessing capacity	End products – need for standard/ specification/ Procurement barriers	Need for alternative markets
Paper	X	X	X	XX	XX
Plastics	XXX	X	XXX	XX	XX
Glass	X	XX	XX	X	X
Wood	XXX	XXX	XXX	XXX	XXX
Compost	XXX	XX	XXX	XXX	XXX

Supply chain Key: x = minor barrier, xx = major barrier, xxx = very significant barrier
Source: Adapted from [21]

In Cameroon, because of market barriers, waste pickers and buyers are not able to support potential markets for recovered or recycled products. Table 2 and Plate 1 highlights recovered waste fractions with scrap metals, plastics and bottles high in the scale of preference for pickers and buyers. The fact that Itinerant buyers collect only clean source separated materials, adds value to it before it is passed over to small and then big dealers with a subsequent increase in the profit margin. In Douala 1Kg of scrap metal is sold to the itinerant waste buyer for 100 FCFA, less than US$0.5 and to middlemen at 200 FCFA, less than US$1 and to dealers of small enterprises at 500 FCFA (US$1). However, the prizes vary with source, with waste recovered from high income residential areas selling at a higher price when compared to waste from landfills, street dumps or low income residential areas.

This research work identified a similar trend regarding barriers for market development of key materials like paper, plastics and glass as shown in the UK study [21]. In addition to the significant barriers for wood and compost as enumerated in Table 5, is the fact that within the context of Cameroon, there is little or no market for compost or wood. Notwithstanding, market development programmes as part of integrated waste management in the UK is a typical case of transfer of best practices from the North to the South with particular reference to Cameroon, which can be replicated in countries within the Sub-region.

3.3 Relationships between Waste Pickers, HYSACAM and the Douala Urban Council

The relationship between waste pickers, HYSACAM and the Douala Urban Council is one of tolerance, because the HYSACAM authorities have in the past tried to prevent trespassing to no avail. Waste pickers are found at any time of the day scavenging through the rubbish. The situation would have been under control if the landfill had a fence. In the absence of a fence, it becomes difficult to monitor the boundaries. An official of the landfill indicated that there is controlled scavenging and HYSACAM acknowledges the positive role played by the waste pickers in the recovery of usable items. The relationship is also one of caution because the scavengers have no legal status and pay no taxes to government treasury or the municipal council. Based on this, there exists no partnership or an alliance between the waste picker's, HYSACAM and the Douala urban council.

3.4 Impacts of Waste Recovery and Recycling on the Environment

Pollution problems carry implicitly a conception of sustainable development, which combines "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs" [22,23]. Chapter 21 of Agenda 21, the Rio Declaration on Environment and Development, highlights the environmentally sound management of solid wastes, which includes maximizing environmentally sound waste recovery, reuse, recycling and disposal. Improvements to the natural environment are considered in combination with improvements in the quality of life in the urban habitat. Solid waste management studies undertaken within this structure usually deal with the contributions various actors can make to improve environmental performance as well as contribute to urban livelihood strategies. These include contributions by [24,25,26,27,28] regarding relationships between actors in the informal waste sector and environmental benefits such as: recycling materials saves energy, water and generates less pollution than obtaining virgin materials (Table 6). In addition, scavenging reduces the amount of wastes that need to

be collected, transported and disposed of at landfill (Tables 3 and 4), thus reducing air pollution from dump trucks, and extending the life of dumps and landfills [29].

Table 6. Environmental benefits from substituting secondary materials for virgin resources

Environmental benefits	Aluminum	Steel	Paper	Glass
Reduction of Energy Use	90-97	47-74	23-74	4-32
Reduction of Air Pollution	95	85	74	20
Reduction of Water Pollution	97	76	35	--
Reduction of Mining Wastes	--	97	--	80
Reduction of Water Use	--	40	58	50

Source: Adapted from [29]

3.5 Livelihood from Waste Recovery and Recycling at the Douala Landfill

The growing interest at the landfill is on scrap metals, plastics, glass, paper and cardboards. More than 90% of the waste pickers interviewed indicated that they earn a daily income of 1000 FCFA–1500 FCFA (US$2.90–US$3.33). Surveys on the living conditions of households in Cameroon using the quantitative or income-based approach (ECAM 1, 2 and 3) were conducted nationwide in 1996, 2001, and 2007. These surveys did not only help to assess the level of poverty and the living conditions of households in Cameroon, it also highlighted trends within the structure of execution of the first poverty reduction strategy paper in 2003 [11].

The poverty severity index, which measures the inequalities among the poor, was 5% (1996), 12.8% (2001) and 12.3% (2007),[14]. The most recent national survey on employment and the informal sector by the National Institute of Statistics in 2010, found that the expanded unemployment rate among young people aged 15‑35 stood at close to 13%, while the level of under-employment was 54.4% in urban areas and 79.2% in the countryside [14]. In Cameroon, the poverty line in 2007 stood at 269,443 FCFA (US$769) per adult equivalent per year as against, FCFA 232,547 (US$ 664) in 2001. Therefore a household was considered poor in 2007 if on average an adult in this household lives on less than 269,443 FCFA (US$769), per year or 746 FCFA (US$ 2), per day or 22,380 FCFA (US$60) per month. This indicates that the minimum wage of Cameroonians is lower than the daily income 1000 FCFA–1500 FCFA (US$2.90–US$ 3.3) of the informal waste sector workers at the Douala landfill. Since this is greater than (US$ 1), it is in line with the MDGs 1; on poverty reduction [30,31,32].

Waste picking at the Douala landfill is not a gendered occupation because both men and women of child bearing ages were involved. However, this was not the case with street waste picking where only men were involved. The gender bias was due to the long distances to be covered from one public skip to another with many women not able to make it. Despite gender stereotypes, the problems faced by waste pickers in Douala are the same irrespective of the place of activity. The waste pickers at the landfill as well as those

scavenging at public skips or street corners faced similar heath problems with skin rashes as the most common. The absence of personal protective equipments exposes these workers to mosquito bites. Other reported cases included cough from the dust as well as snake and scorpion bites. The pickers are often oblivious of the dangers they face but are economically tied to continuing the occupation when they do [33,34].

Waste pickers all over the world have their livelihood threatened by conservative approaches of MSW transformation. The livelihoods approach has been seconded in various UN conferences [35], as a strategy in achieving poverty reduction. [36] gives evidence from different places such as Bangkok, Thailand, where waste pickers were "formally" denied access to waste from the disposal site but allowed to "continue picking under the condition that they sell only to that company, at even lower prices" and Dar es Salaam, Tanzania, where a large private waste collector investment concession collecting waste from downtown hotels threatened a women´s group that wanted to collect plastic bottles from one hotel causing the group to withdraw. In another study involving privatization processes in South Africa, [37] highlights the case of the Metsimaholo municipality's attempts to formalize recycling on the Sasolburg landfill and its negative impacts on the livelihoods of the waste pickers. In another case study "evacuation" of spaces where the waste pickers work, as they were "swept out" to the periphery with persecution by the authorities and the police, confiscation of material and criminalization of the activity [38].

3.6 Measures to Enhance the Livelihoods of Waste Pickers

The first step to overcome poverty and secure the livelihoods of informal waste sector worker is to be organized [39]. Best practices have been identified in several countries were waste pickers have been organized in cooperatives, associations, companies, unions, and micro-enterprises [40]. Some are even forming "women only" organizations to better address gender stereotypes although the scope and strength of these organizations of waste pickers varies across countries [41,42]. The advantages of forming organizations includes capacity building, access to funding opportunities, livelihood protection such as stable monthly income, integration in solid waste systems resulting in improvements in working conditions, access to housing benefits or access to credit for house purchases and/or improvements [41,42,36,40]. Using Douala as an example, an active national organization, ARC, of 100-200 members was formed in 1996 with 134 men and 30 young women members which now covers Yaoundé. A general assembly meets once monthly and a permanent bureau meets weekly. The major concern of the waste pickers is that the local authority is bureaucratic and difficult to negotiate with. Members contribute 1000 FCFA (US$2) each for the running of ARC and 6000 FCFA (US$12) to a fund for hard times. ARC identifies large entrepreneurs for pickers to sell to e.g. SOCAVER for glass; SIPLAST, POLYPLAST, SOFAMAC and SICA for plastic waste [43].

Other benefits that can be got from alliances include socio-economic and ecological sustainability, public health aspects, cleaner urban neighbourhoods, financial viability, reduced volumes of disposed waste through recycling, re-use and composting, and employment creation for predominantly poor people [7]. Alliances between local authorities, waste traders and waste pickers, small and medium sized enterprises and large-scale enterprises are generally not easy because of their unofficial status and the number of units involved. The ambiguity of such informal activities is at odds with the enforcement of rules and regulations (including sanitary codes and health standards) and could make effective sanctions in cases of malpractice difficult to enforce [7]. Notwithstanding, some alliances have been created in some countries with positive results (Table 7).

Table 7. Selected case studies depicting alliances

Country	Type of alliance	Main objectives	References
Manila, the Philippines	Public–private partnership	Private waste firms are authorized to finance, build and operate the service for an agreed period and terms before being transferred back to the local government	[9]
	Large scale enterprises – local authorities – small scale enterprises	Micro-enterprise development (dealers and itinerant buyers). They organise co-operatives for collection, street sweeping, and recycling in densely populated areas.	. [9]
	NGOs – waste buyers – traders in waste materials	The Metro Manila Council of Women Balikatan Movement (MMWBM), an NGO, implemented a recycling programme by forming co-operatives of itinerant waste buyers and junk shops, providing loans, and searching for suppliers and markets.	[9]
Chennai (Madras), India	Local authorities – NGOs – waste pickers	Clean and Green Madras City project, rehabilitated street children by paying them through NGOs to take care of cleaning, maintaining the streets and the sale of recyclable materials.	[44]
	CBO – waste pickers	Exnora International, a comunity-based voluntary organization created community–private alliance and incorporated local rag pickers for sweeping and collecting and named them Street Beautifiers. Exnora obtained bank loan, bought a tricycle cart for their activities, and provided protective clothing and equipment. The collected garbage is segregated and all the materials are sold to dealers for recycling.	[7,44]
	(a) waste pickers, itinerant buyers – dealers; (b) dealers – wholesalers	Financial assistance provided for the security of poor urban waste pickers and itinerant buyers.	[7,44]
Lima, Peru	Local authorities – NGOs – small-scale enterprises	To forge close relationship between a local community and micro-enterprises. The community receiving the service not only supervises and contracts out to the micro-enterprises, but also pays them directly as the waste is collected.	[7]
Bamako, Mali	A national alliance of waste pickers called Cogiam	Municipal waste collection	[10]

Pretoria, South Africa	South African Waste pickers Association (SAWPA)	SAWPA helps resolve issues between waste pickers, management and municipalities including access to landfills and opposition to privatization	[10]
India	Alliance of Indian Waste Pickers (AIW) and GAIA (Global Alliance for Incinerator Alternative)	Protests against incineration, and an end to 'waste-to-energy' projects backed by the CDM (Clean Development Mechanism) and direct access of grassroots communities for a Green Climate Fund (GCF)	[10]
Managua, Nicaragua	The Waste Pickers' Association of Bogotá (ARB)	Networking of waste picker representatives from Central American with South American countries, discuss challenges faced by Red Lacre waste pickers , particularly, the closure of dump sites, and to better organize into cooperatives or associations	[10]
Brazil	National Movement of Waste Pickers in Brazil (MNCR)	Overcome threats to waste pickers and equal gender representation.	[10]
Daker, Senegal	Local authorities – NGOs – waste pickers	Djom waste pickers at Mbuessmbues landfill in Daker works in partnership with Enda NGO and the local government. Enda provides funding while the local government intends to build a material recovery facility	[10]
Accra, Ghana	Union of waste pickers	Organizes waste pickers of the Sarbah and Ablekuma landfills in Accra for official presentation to the waste management authorities	[10]
Douala and Yaounde, Cameroon	NGO – waste pickers	An active national movement of waste pickers (ARC) identifies large entrepreneurs for waste pickers to sell to e.g. SOCAVER for glass; SIPLAST, POLYPLAST,SOFAMAC and SICA for plastic waste	[10]
Maputo, Mozambi–que	Local industries – waste pickers	RECICLA buys plastic recyclables and makes plastic pellets for local industry and Fertiliza co-op makes compost, provide compulsory literacy classes in addition to technical training.	[10]
Antanana–rivo, Madagascar	NGO – waste pickers	Working with environmental NGOs e.g. Enda, to create national organizations to research on waste pickers. E.g. Plafcco, in 2010	[10]

A large scale pioneering and well-organized waste recovery reuse and recycling operation is run by the Zabbaleen, a group of over 50,000 people traditionally involved in the trade of waste collection and processing. They recover and/or recycle between 70% and 80% of all collected plastics, metals, glass, paper and other components of the waste stream. In addition, they produce fertilizer in the process of organic waste composting and raise pigs which are fed on garbage on a commercial scale. To sustain their waste processing operation, the Zabbaleen design and manufacture various types of machinery at their own production facilities. Other African countries could profit from the Zabbaleen experience by importing their know-how and competitively priced waste processing equipment [45].

4. CONCLUSION

1. Despite the fact that waste pickers in Douala are often marginalized, this study has identified the positive role played by them in the recovery and recycling of MSW. Besides being an income generating activity for the unemployed, waste pickers have reduced the amount of waste at landfills or waste that has to be transported to landfills thus mitigating environmental pollution, a positive contribution in the attainment of the MDGs. Notwithstanding, they need recognition as partners of development and support from the authorities of the private waste sector like HYSACAM and other stakeholders e.g. the municipal authorities and the government.

2. The informal waste recovery and recycling in Cameroon like in other developing countries has many challenges, an important aspect investigated in this work. Some of these challenges include no access to markets, loans and formation of cooperatives, alliances or partnerships with other stakeholders. The market chain in the informal waste recovery and recycling sector is very unpredictable as they are being manipulated by some educated and knowledgeable itinerant buyers, middlemen and small enterprises. This is a very common scenario at the Douala landfill where more than 90% of the waste pickers are illiterates.

3. The government of Cameroon should organize educational seminars and workshops for waste pickers to better understand not only the market trends but the dangers involved in scavenging. Majority of waste pickers don't see the need for personal protective equipments or vaccinations. The Ministry of Public Health should work in a holistic manner alongside the Ministry of National Education and the Ministry of the Environment, Nature Protection and Sustainable Development in designing programs that will improve on their livelihoods.

4. The Government should also educate the population regarding their perception of waste pickers resulting from the fact that they have no formal status. The process of formalizing their status is complicated due to administrative bottlenecks hence; it is not easy forming veritable association. This is the main reason why only a few groups exist in Cameroon. A change of public perception will remove in the mindset of the public as well as the male waste pickers all aspects of harassment especially on women and physical assaults on itinerant buyers for mistaken identity as thieves in some neighborhoods.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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