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Formalization of Informal Waste Pickers' Cooperatives in Blantyre, Malawi: A Feasibility Assessment

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Abstract: Poor road networks, inadequate financial resources and low levels of political will mean that many developing countries, especially their unplanned settlements, struggle with solid waste management. Recently, Informal Waste Pickers (IWPs) have been incorporated into waste management cooperatives by formalizing their operations as a strategy to improve the quality and efficiency of waste management in such areas. This study was conducted in Zingwangwa, an unplanned settlement in Blantyre, Malawi, to understand whether the formalization of IWPs into cooperatives could be effective and/or accepted as a way of managing Municipal Solid Waste in unplanned urban settlements in Malawi. Thirty-four IWPs in Zingwangwa were identified and interviewed using a structured questionnaire; personnel from the Blantyre City Council and middlemen were interviewed as key informants. We determined that IWPs experience challenges in all dimensions of their lives: low material prices with exploitative price fluctuations, negative public perception and a lack of transportation are a few of their struggles. Furthermore, a fear of decreased income, conflicts during proceeds sharing, free riding behaviors and an attachment to their independence mean that IWPs are unlikely to form a cooperative on their own though some would be willing to join if a third party initiated the formalization process.

Keywords: solid waste; recycling; Africa; informal economy; poverty; urbanization; cooperatives

1. Introduction

Three billion people worldwide lack municipal solid waste management services [1]. Rapid urban growth, inadequate enforcement of, poor urban planning/design and corruption have contributed to the growth of slums and unplanned settlements in African cities [2–4]. As a result, 62% of urban populations in Sub-Saharan Africa live in slum areas characterized by uncontrolled, informal spatial developments with little or no access to basic services such as water, sanitation, energy, or waste management systems. Surprisingly, methods and approaches to properly service and manage the unplanned urban settlements have remained somewhat poorly assessed by urban development researchers throughout the continent [5–7].

Limited waste collection and treatment have contributed to air, water and land pollution [8]; unmanaged waste is responsible for harboring and spreading communicable diseases such as cholera and malaria that have claimed lives of millions [9–11]. Indeed, the full value costs (health, environment, etc.) of poor Municipal Solid Waste Management (MSWM) are normally higher than the financial costs

of MSWM [12]. Conventional waste management systems have mostly failed in unplanned urban areas of developing countries where poor road networks limit the speed and agility of waste collection trucks [13,14]. Given the failure of adopting solutions from less urbanized, richer nations, the informal systems that already exist warrant examination [15].

Twenty million people worldwide depend on waste picking as a livelihood while thousands more depend on recycling materials from waste for their livelihoods [15,16]. Improved waste collection and recycling rates through the formalized involvement of IWPs could help achieve many of the Sustainable Development Goals, especially those related to health, the environment and cities (SDGs 3, 6, 8, 11, 12, 14, 15) [3]. However, there is no certainty in how best to work with Informal Waste Pickers (IWPs) to improve their income, working conditions and efficiency in a sustainable, safe, and equitable way: cooperatives may be one such solution.

City councils are responsible for MSW collection, transportation and disposal at designated dumping sites [17] and despite their various efforts to increase solid waste collection in Malawi, the quantity of solid waste collected is still small compared to the solid waste generated [18,19]. The situation is even worse in unplanned settlements, where absent and/or haphazard solid waste collection leads to environmental hazards in the form of air pollution from burning, direct contact and vermin [11,20].

Approximately 42% of households in urban areas of Malawi dispose of waste in pits dug within their plots, while 12% throw waste on the road-side, nine percent throw waste on the river-side and nine percent use community skips (dumpsters) [21]. As there are no properly designed sanitary landfills, waste collected by cities is dumped in the designated open dumpsites [22]. Blantyre City Council (BCC) only manages to collect 59,130 tons of the total out of 259,570 tons of waste generated annually [18,23–25]. The city authorities are meant to provide skips in unplanned settlement areas but only one or two skips are allocated for a settlement with thousands of households [18,22]. The skips remain uncollected for weeks, sometimes months due to vehicle shortages or neglect. Garbage from the skips overflows, or residents burn the waste in skips to create more space [22]. In the four cities (Lilongwe, Blantyre, Zomba, and Mzuzu) of Malawi, waste is collected once a week, but only from planned settlements (formal areas) [21].

IWPs (sometimes called scavengers) are individuals, groups and/or micro-enterprises that collect, sort, process and transform recyclable materials but are not financed or recognized by the solid waste authorities [26–28]. Through their activities, IWPs reduce the amount of waste disposed at dumpsites and reduce the use of virgin materials needed for manufacturing [29,30]. However, IWPs are ostracized and rarely recognized for their contribution [11]. The concept of formalization is fairly new to most African countries (Egypt, Kenya, South Africa and Tunisia have had some success but not full policy formulation) though there is a longer history of success in Central and South America [31–35]. As such, little is known about the businesses and lives of IWPs, especially in Africa [35,36]. In Nicaragua, waste pickers earn between \$1.50–\$2.00 per day, while in more developed countries like Mexico, India and Brazil waste pickers earn more than \$7.00 a day [31]. Even if many IWPs are not poor in terms of their incomes (i.e., since they generate more than \$1.25 per a day [37], the job itself is strenuous and risky, exposing them to pathogens, sharp objects, toxic chemicals and rabid animals among other hazards [31,38].

Following the “strength in numbers” theory, cooperatives can help waste pickers to acquire the physical tools, scales of economy and political rights that they may not otherwise be able to obtain individually. Specifically, groups of workers can combine their incomes to purchase or rent storage and cleaning facilities that would allow for bulk sales and potentially higher incomes; large holdings of specialized materials give cooperative members increased bargaining power [39]. Coordinated jurisdiction coverage and haulage costs are optimized and redundancies reduced [19,26].

Once recognized, cooperatives may be eligible for various types of insurance and government-sponsored protection [40]. Ideally, the pickers would be guaranteed to earn a salary and shielded from the worst societal opprobrium/stigma [41,42]. Formalization (with an administration

and an address) makes the members traceable to other stakeholders that may help with cooperative development: a virtuous cycle. Perhaps most importantly, cooperatives would be able to influence government and public opinion, leading to expansion, further rights, and ultimately acceptance [43]. Formalization of sales and labour may result in taxation, which is another way in which IWPs can contribute to a city's SWM strategy and country development [28].

It has become increasingly evident that incorporating existing informal recycling systems into the operations of formal MSWM can bring significant benefits [36]; however, there have been few successful examples, especially in Africa. In order to formalize informal recycling within formal MSWM systems an investigation of informal trade by IWPs to devise ways of managing the formalization is required. It was the aim of this research to determine the economics, challenges and opportunities of informal waste pickers in Blantyre, Malawi with the goal of assessing the feasibility of a waste pickers' cooperative.

2. Materials and Methods

The research was conducted in the Zingwangwa Township in Blantyre, Malawi. Zingwangwa is a largely unplanned settlement area in the south of Blantyre. Zingwangwa is unique because, not only is there a large number of IWPs operating in the area, but because it is surrounded by high and medium income settlements where IWPs also recover materials. Figure 1 is map of Blantyre showing the location of Zingwangwa.

The majority of domestic waste consists of organics, plastics, metals and glass [18]. Since organic collection and processing is difficult, the research focused on the next two most abundant wastes categories: plastic and metal. We know of no other type of recycling in Malawi; glass cannot be recycled within the country (apart from artisanal uses) and is not worth exporting. To our knowledge, there are no facilities for the recycling or recovery of e-waste, toxic waste (e.g., batteries, solvents, etc.), or other forms of specialized waste.

Because there is such a paucity of information about the IWP population and their operations in Malawi, a snowball sampling method was used. With no prior population data, the method allows for sampling without a predetermined sample size. IWPs were approached and interviewed upon observing them recovering materials from the streets, households and open dumps. The first waste pickers to be found and interviewed were asked to provide information (names or places) on how to find other IWPs who recover material in Zingwangwa. In this way, the new IWPs whose information was provided were contacted and they again were asked to provide/identify others working in the same area [45]. The process was repeated until saturation was reached (forty-two informal waste pickers), i.e., there were no referrals that had not been previously interviewed. Though we cannot be certain about the total population, we are highly confident that, at the point of saturation, we had contacted every IWP working in Zingwanga.

Data were collected using a structured questionnaire that was administered to the IWPs by the researchers. Before they were interviewed, all subjects gave their informed (written) consent for inclusion before they participated in the study. Thirty-four IWPs were interviewed; eight of the IWPs that were approached declined to be interviewed.

Key informant interviews with two middlemen and an official from Blantyre City Council responsible for MSWM were conducted to understand how best waste pickers cooperatives could be integrated with the city council's MSWM strategy.

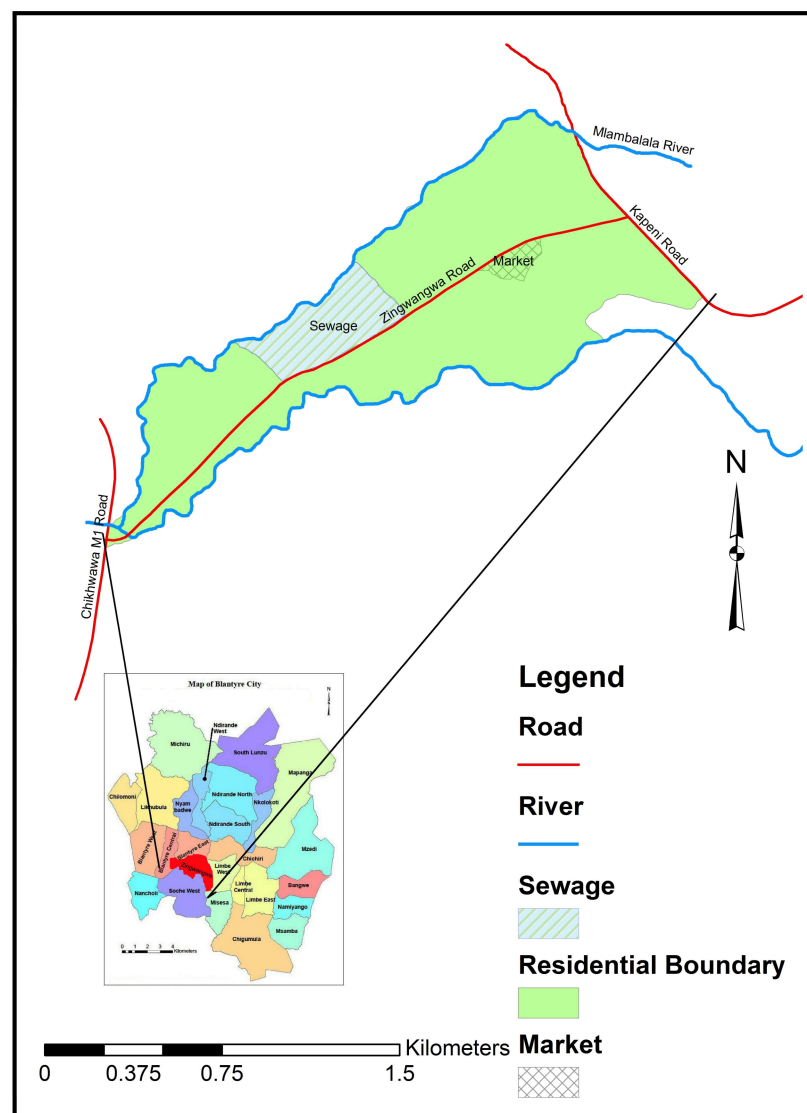


Figure 1. Zingwanga Township in Blantyre (adapted from [44]).

3. Results

3.1. Sales

Twenty-one percent of IWPs who were interviewed recover only metals, 53% recover only plastics, while 26% recover both plastics and metals. The majority of IWPs collect plastics (polyethylene terephthalate (PETE), high-density polyethylene (HDPE), low-density polyethylene (LDPE), etc.) because plastics are the second most common type of waste disposed in urban areas of Malawi [18]. There were few IWPs who recover only metals, because valuable metal waste is scarce.

3.1.1. Plastics

Middlemen and industries buy different types of plastics based on the type of products they manufacture. Despite needing different types of plastics, most plastics are bought at the same price, though dyed/colored plastics are bought at a lower price than other plastics. Most plastic recycling industries do not buy or recycle common plastic bags because a variety of polymers and other materials such as metals, paper, pigments, ink and adhesives are used during manufacturing [46]. However, there were two respondents who said there is an industry in a different part of Blantyre (Limbe) that

buys dyed plastic bags at Mk30 per kilogram. Low prices for dyed plastics prevent waste pickers from recovering them. The mean price for plastic recyclables was Mk184 per kilogram; the mode and median were both MK150. Therefore, despite having a higher mean price, the majority of IWPs sell their plastic materials at a price less than the mean price. Table 1 is a summary of recyclable plastic prices.

Table 1. Prices of plastic recyclables.

Mean Price (Mk/Kg)	SD	Mode	Median (Mk/Kg)	Min Price (Mk/Kg)	Max Price (Mk/Kg)	N
184	64	150	150	100	350	27

Note: 1000 Mk = approx. \$1.50 US.

3.1.2. Metals

The price of metals is determined by the buyers (middlemen and industries). Each type of metal has a different price depending on the buyer. Price is the most influential factor when it comes to IWPs' preference for which metal to recover. For example, steel is abundant yet only 16% of waste pickers recover it. Steel is priced at Mk30 per kilogram by one of the middlemen where most IWPs sell metal scraps. The middleman said that aluminum is the most recycled metal due to its price (K450 per kilogram) and availability. Aluminum is commonly available because the majority of household utensils, such as pots, are made of aluminum. Copper and lead are priced higher than aluminum but are not recovered by many because of the scarcity. Specialization in recycling a single type of metal is not common: pickers recover metals largely based on the market price. All IWPs who recover scrap metal recover and sell aluminum, 88% of them recover copper, 56% recover lead, 50% recover brass and 31% recover steel. There are some IWPs who recover and sell all types of metals bought by middlemen while some specialize in recovering a selected type of metal scraps based on their price and availability. Table 2 shows mean prices for scrap metals.

Table 2. Industry and middlemen prices of metal scraps.

Metal Type	Industry Pricing (Mk/Kg)	Middlemen Pricing (Mk/Kg)
Aluminum	650	450
Copper	-	1500
Lead	-	750
Brass	-	800
Steel	80	30

Industries offer better prices than middlemen. However, 79% of waste pickers sell to middlemen because middlemen do not set minimum weight limits (one tonne) and they buy diverse types of scrap metals. The majority of waste pickers cannot manage to recover and store metals of the same type long enough to reach the minimum limit required by the industries. IWPs normally sell recovered metals on a daily basis, soon after recovering it, in order to get food for the day; storing, without other sources of finance, would prevent them from buying food/other essentials.

3.2. Quantities

3.2.1. Plastics

Material recovering starts from the moment an IWP leaves their residences to the time they return. By the end of the day, the IWPs from Zingwangwa have recovered material from over five settlements (i.e., their own areas on the way to Zingwangwa). Apart from recovering from dumpsites, IWPs informally buy plastic waste from shops and industries. Workers reserve plastic waste (e.g., packaging)

for an IWP and ask for some money in exchange. The money does not necessarily represent the actual value of the quantity recovered; the payment is more like a bribe, although the quality of plastic is usually of high quality, dry, and not contaminated so is worth paying for. On average, one IWP can recover nine kilograms of plastic material per day (Table 3) depending on which strategies he or she employs.

Table 3. Quantity of plastic and metal recovered.

	Mean (kg/Day)	SD	Median (kg/Day)	Min (kg/Day)	Max (kg/Day)	N
Plastic	9	5	8	3	20	27
Metal	10	8	9	2	30	16

Clearly, IWPs remove a substantial amount of plastics (up to 20 kg/day) from the waste stream: a quantity that would otherwise have been disposed into the environment or dumpsite. Cumulatively, IWPs may recover tons of plastic waste per day from Blantyre; however, given the fact that this study was located in one highly active area of collection, it is neither appropriate nor feasible to extrapolate the results to the whole city.

3.2.2. Metals

Metal scraps are not as common as plastics. IWPs in the metal recycling business recover materials from garages, metal workshops, bottle stores and dump sites. Apart from recovering metal scraps from dumpsites, 67% of IWPs buy metal from households. Households store valuable metal scraps in order to sell them to intenerate waste buyers. IWPs who solely depend on recovering waste from dump sites miss the opportunity to get high quality metal scraps, which are only available from households and require financial capital (i.e., cash in hand) to purchase, which makes metal recycling a more difficult sector to enter. On average, a single waste picker can recover 10 kg of metals a day (Table 3).

3.3. Costs

3.3.1. Transport

None of the IWPs in Zingwangwa reside there: they all come from unplanned settlements that are more than five kilometers away. Negative perceptions by society likely cause the IWPs to recover materials in settlements that are far from their residences where they are less likely to be recognized. By extension, there are likely IWPs who reside in Zingwangwa but prefer to recover materials in other locations; these people were not captured in our sample. Although they live far away, 80% of IWPs walk to Zingwangwa. Walking has benefits for the IWPs: firstly, it helps them to save money on transport costs. Secondly, walking enables IWPs to recover valuable materials along the way. On average, IWPs walk for an hour and up to three hours to reach Zingwangwa. Some IWPs use public transport: transportation costs include both the money paid by IWPs to travel to and from Zingwangwa and the cost for transporting the materials to the point of sale.

On average, the total transportation costs for IWPs who use public transport was Mk846 per day: Mk407 is the transport cost to and from a waste picker's residential area and Mk439 per day during material recovery and to where they sell materials (Table 4). IWPs who buy materials from shops, industries and households are normally the ones that use transport. Such pickers are well established in the business and have accumulated enough capital to buy clean and sorted waste, which requires more travel than those IWPs that collect waste in a more haphazard way.

Table 4. Material recovery costs.

	Costs	Mean Cost Mk/Day	Median Mk/Day	SD	Min Cost Mk/Day	Max Cost Mk/Day	N
Plastic	Transport ¹	407	400	134	250	700	7
	Transport ²	439	500	206	200	700	8
	Cleaning	70	60	21	50	120	15
	Bribes	308	275	120	200	500	6
Metal	Transport ²	439	500	206	200	700	8
	Transport ¹	407	400	134	250	700	7
	Cleaning	0	0	0	0	0	0
	Bribes	344	300	195	100	700	9

¹ Transport cost from a waste picker's residential area to Zingwangwa; ² Transport cost during material recovery and to where they sell materials.

3.3.2. Cleaning Costs

Recovered plastic materials are cleaned using water from rivers that are close to where materials are either recovered or sold. Since river water is a free, natural resource, there is no cost paid for the cleaning water. However, plastics contaminated with fats, oils and organic substances require detergents to be cleaned. Waste pickers use one tablet of soap for a minimum of two days to clean contaminants. On average, waste pickers spend Mk70 per day for cleaning (Table 4). Costs for cleaning metal are negligible as IWP's use hammers to separate different metals that may be attached together and to reduce the volume of bulky metal scraps. Metals may also be burned to remove plastic or paper that may be attached.

3.3.3. Bribes

Small bribes, kick-backs or incentives are paid to shop attendants, industrial workers and individuals who collect and reserve materials for IWP's to collect at a fee. It is unclear if the business owner is complicit in this practice or not; from their perspective, having the waste removed may decrease their own waste disposal costs. On the other hand, owners may not be aware that the company is, in effect, losing money to industrious employees who take the business of recycling into their own hands. We estimated the cost of bribes to be Mk300 per day for plastics and Mk344 for metal recyclables (Table 4).

3.4. Profitability

On average, IWP's in the plastic recycling industry make a profit of Mk392 per day, which is way below the minimum wage for Malawi at Mk962 per day [47]. Despite the fact that the majority of IWP's walk, transport costs represent 70% of the costs, while bribery consumes 25% and cleaning five percent. If IWP's are to benefit from plastic recycling, interventions have to focus on mechanisms to reduce transport and bribery costs (Table 5).

Table 5. Plastic recycling balance sheet.

Materials		Income		Costs		Profit
Quantity (Kg/day)	Value (Mk/kg)	(Mk/day)	Transport ^{1,2} (Mk/day)	Soap (Mk/day)	Bribes (Mk/day)	(Mk/day)
8.74	184	1608	846	70	300	392

¹ Transport cost from a waste picker's residential area to Zingwangwa; ² Transport cost during material recovery and to where they sell materials.

IWPs who recover metals generate an average profit of Mk2490 per day (Table 6), which is Mk2098 higher than the profit generated by IWPs in the plastic recycling business. Higher profits in metal recovery can be attributed to the fairer pricing mechanisms (discussed below). Table 6 shows the economic analysis of metal recovery business by IWPs.

Table 6. Metal recycling balance sheet.

Materials		Income	Costs			Profit
Quantity (Kg/Day)	Value (Mk/kg)	(Mk/kg)	Transport (Mk/day)	Soap (Mk/day)	Bribes (Mk/day)	(Mk/day)
10.25	359	3680	846	0	344	2490

3.5. Markets

3.5.1. Plastics

At the time of the research, there were five main buyers for plastic recyclables: three industries and two middlemen. There is a seasonal increase in the number of buyers for plastic recyclables, and because the research was conducted in January and February, the time when markets for plastic waste were out of season, there were only five buyers (we discuss market and price fluctuations below). Industries buy plastic based on the type of plastic they produce. Starplex Industry only buys plastic recyclables that are made from high-density polyethylene (HDPE) and low-density polyethylene (LDPE) in order to manufacture plastic household utensils. Atomic Industry buys plastic bottles and containers made with polyethylene terephthalate (PETE); the industry produces packaging containers to sell to food and beverages producing companies. Rainbow Industries buys different types of plastic recyclables including LDPE, HDPE and PETE. They produce different types of materials such as household utensils and packaging materials.

On the other hand, middlemen buy all types of plastic except for dyed plastic bags. There is a competition for bottles made with PETE, especially drinking water bottles, between IWPs and thobwa sellers (a Malawian fermented beverage made from maize, millet or sorghum flour) who reuse PETE water bottles directly for packaging their product.

3.5.2. Metals

There are four buyers for metal: two industries and two middlemen. Sixty-eight percent of IWPs sell their metal recyclables to one middleman known as Jack (names have been changed). IWPs sell the recovered metals to Jack because he offers better prices, buys a variety of metal, does not cheat with the scales and is close to where the waste pickers recover materials. Only 21% of IWPs sell the recovered materials to industries because they accept a limited range of metal types and set high minimum weight limits that are difficult for IWPs to achieve.

An interview with a middleman revealed that metals such as lead, aluminum, copper and brass are not recycled in Malawi. The recovered metals are exported to either South Africa or Tanzania where they are recycled. Steel is sold to industries that recycle steel within Malawi such as Agrimo Industries. Steel is not exported because steel scraps do not attract high prices, and exporting steel would mean losses for the exporter.

3.6. Challenges and Opportunities

IWPs in Zingwangwa face challenges in all dimensions of their lives. Waste pickers were asked what they would ask from the mayor of Blantyre, and the main challenge they face in their business. The responses to both questions were similar, varying only slightly in terms of their ranking. The limited list and repetition of responses indicate that the IWPs have simple, but clear wishes. The results are summarized in Tables 7 and 8.

Table 7. Requests for the mayor.

Request	Percentage of Responses
Capital	67%
Transportation	21%
Nothing	6%
Personal Protective Equipment (PPE)	3%
Lobbying for waste categorization at source	3%

Table 8. Main challenges

Main Challenges	Percentage of Responses
Transport	28%
Price fluctuations	21%
Negative public perception	18%
Capital	18%
Lack of Personal Protective Equipment	12%
Lack of cleaning facilities	6%

Both questions revealed that a lack of capital, a lack of affordable transportation, negative public perceptions, a lack of PPE and a lack of waste categorization at the source were common problems. These challenges are discussed further in the sections below.

Most waste pickers wish to work as itinerant waste buyers or as middlemen. Waste that is stored and sold by households is clean and already separated: IWP can skip both the searching and cleaning processes that are hazardous and tedious. Therefore, capital becomes a necessity for IWPs who wish to buy the best materials from households, shops, and industries or employ other people to collect waste on their behalf. Capital may also be used to buy a bicycle or push cart for carrying heavy/bulky recyclables so that transportation is faster, cheaper and easier.

There is no established price for plastics. The price may change at any time of the day or season depending on the demand for the recyclable and availability of the materials: IWPs cannot adequately plan for, or manage, their income.

One IWP elaborated that at one of the industries, plastics are bought at different prices within a day. IWPs that are not well recognized or have large amounts of waste to sell are offered high prices. IWPs that are well known (regular) by the personnel at the industry are offered lower prices. The regular IWPs are considered as vulnerable customers without other selling options and hence, are offered lower prices. Higher prices are offered to irregular IWPs or those with large amounts of plastic as a way of enticing them to sell to the industry. When the plastic industry has enough materials to produce for the day, the prices are reduced. The prices tend to fluctuate from Mk150 to Mk250/Kg.

Price fluctuations are also seasonal due to changes in demand for plastic products on the market. There are two seasons when the prices are high: during harvest season and during the onset of the rainy season.

Farmers from the rural areas are the major buyers of plastic products in Malawi. Farmers generate income from the sale of agricultural products during the harvest season. This is the time when farmers buy plastic utensils for household use. Traders purchase plastic products to sell for cash or exchange for various farm commodities, which increases demand for plastic products. In order to meet the demand, plastic manufacturers need to buy more raw plastic from the IWPs. Therefore, plastic manufacturing industries raise the prices and open several outlets to buy sufficient quantities. Once the harvesting season is over, production is scaled down and prices are lowered.

During the onset of the rainy season, there is again a high demand for the plastics needed to waterproof grass-thatched roofs. Outside of these two seasons, the prices remain low for about eight months of the year. Prices for recyclable metal materials normally remain the same and are not affected

by seasonal demand. The difference in scrap metal prices is based on the type of metals: copper, brass, lead and aluminum are bought at high prices (Table 2).

Transport is one of the major challenges faced by IWPs in Zingwangwa. Only two modes of transportation exist for IWP: walking and the use public transport i.e., minibuses. Only 24% of IWPs use public transport to get to Zingwangwa. IWPs who use vehicles only use them to travel from their residential areas to Zingwangwa and then from where they sell material to their homes. All the IWPs walk during collection; they transport the materials on foot and carry them to where they are eventually sold.

One of the major reasons IWPs sell their products to specific middlemen and industries is because of the proximity of the buying industry or middleman to places where the IWP collects and cleans the recovered materials. Forty-four percent of the respondents said they sell their products to a particular industry because it is close to where he or she recovers material despite having other buyers who offer better prices. Table 9 shows the reasons IWPs sell recyclable materials to middlemen and industries.

IWPs walk for an average of 68 minutes and up to 150 minutes walking to Zingwangwa; this does not include the time they spend walking during the day (Table 10). At the end of the day, the IWPs have no desire to walk even further to sell the recovered materials. Therefore, they are likely to sell to the nearest market despite the fact that other markets may offer better prices; IWPs must constantly make tradeoffs between walking, paying for transport and achieving the best market price. Table 10 shows the time taken for IWPs to walk from their homes to Zingwangwa and Figure 2 is a map of Blantyre indicating the spatial variation of settlements where IWPs reside.

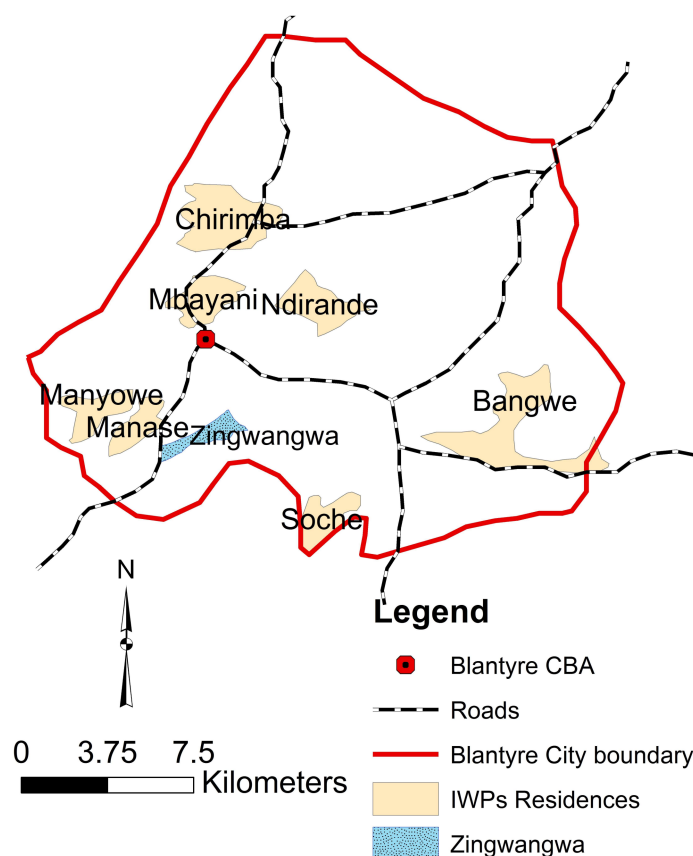


Figure 2. Map of Blantyre City showing settlements where waste pickers reside. (Source: Kasinja)

Table 9. Reasons for a choice of buyers.

	Only Place	Price	Proximity	Familiarity
Reason (%)	26%	44%	44%	6%
N	9	15	15	2

Table 10. Time spent walking to Zingwangwa.

Mean Time (Minutes/Day)	Median (Minutes/Day)	Mode (Minutes/Day)	Minimum (Minutes/Day)	Maximum (Minutes/Day)	N
68	60	60	30	180	34

Due to the fact that the materials are bulky and heavy and are contaminated with smelly organic materials, recovered materials are not allowed on public transport, and as such, IWPs carry the materials in bags on foot. One of the respondents complained that due to a lack of transport, he loses money when he finds a large quantity of scrap in the field but can only manage to collect a few pieces to sell; the remaining scrap materials are gone when he returns to the same place the next day. Table 11 shows the main transportation challenges that waste pickers face.

Table 11. Main transportation challenges.

Challenges	Percentage of Responses
Walking long distances	34%
Expensive	20%
Material not allowed	19%
Bulky materials	16%
Other	11%

3.6.1. Public Perception on Waste and Waste Pickers

IWPs complained that the public does not understand the benefits of their operations and the role that they play in facilitating recycling and waste management. The public has a negative perception towards their operations and to waste itself. Eighteen percent of IWPs identified insults from the public as a main challenge (Table 8). Note, however, that this does not represent the total percentage of waste pickers who are subjected to insults. Many IWPs may be suffering from the same but 18% selected negative public perception as their single greatest challenge.

One IWP complained that sometimes he is chased or denied from collecting valuable items from bins for no reason despite the fact that those denying him have no use for the waste; materials that could have been recycled are dumped or burned. If the public had a positive perception of waste and IWPs it would be easier for IWPs to collect more waste especially the clean and well-sorted waste and generate more income.

3.6.2. Personal Protective Equipment (PPE)

Among all the IWPs that were interviewed, only one had industrial gloves. Not all IWPs understood the dangers of working without PPE. When asked why they recover waste without PPE, 15% of the respondents responded that they never thought of using PPE, 27% did not think it was necessary to wear or use PPE because they do not recover materials from places that can endanger their life. However, 68% of IWPs understood the need for PPE in their business but did not use it because it is expensive and would cut further into their profits.

3.6.3. Cleaning Facilities and Storage

The study indicated that 71% of IWP in the plastic recycling business clean the recovered waste before selling it; intenerate waste buyers who buy wrapping materials from packaging bales in shops do not need to wash the plastics because they buy clean materials. If the recovered plastic materials are delivered for sale without being cleaned and dried, buyers return them. Sometimes, uncleaned plastics are bought at a reduced price, up to Mk50 less than normal price. Drying plastic during the rainy season was identified as a challenge especially when it is raining or humid all day. Materials that remain unsold represent a potentially crimping blow to the financial health of an IWP.

Given that 80% of the sewage produced by industry and residents flows into the rivers around the city untreated [18], and that 88% of waste pickers use river water to wash their materials, much of the water is likely contaminated. The use of river water exposes waste pickers to health hazards that cause both chronic (exposure to heavy metals) and acute (infections) health effects. Cleaning facilities and areas to dry and store the cleaned materials would assist IWPs in obtaining the highest price possible while limiting their exposure to contaminated water.

3.7. Waste Management Cooperatives

The informal nature of waste pickers, i.e., the fact that they are lone actors with low social status, makes them vulnerable in many aspects of their business. If IWPs were to organize themselves into cooperatives, some of the challenges they experience in their operations could be resolved or minimized.

Specifically, a cooperative-run warehouse would allow waste pickers to sort, clean, compress, pack and store materials to be sold when the prices are high. Furthermore, larger quantities of material would give them more bargaining power to avoid or reduce price gouging. For example, in Brazil, waste pickers formed a cooperative, managed to buy a waste compressing machine and built a store room where bales of compressed recovered plastic materials were warehoused to be sold to industries after making proper negotiations for better prices [10].

Working as a cooperative may enable IWPs to generate income from multiple sources such as door-to-door collection and recyclables sales [31]. Income generated from a door-to-door collection could be diverted to cooperative development therefore enabling waste pickers to buy transportation and PPE while earning income from the sales of recyclables. Cooperatives, rather than individuals, are more likely to attract well-wishers' and other stakeholders' attention and contributions [48]. For example, in Pune, India, waste pickers were provided with funds for handcart maintenance, uniforms, gloves, insurance and other necessary requirements by the city council after they formed a cooperative and formalized an agreement to work with the council on collection [46].

Waste pickers need a cleaning facility that enables them to clean recovered materials using affordable potable water, during any type of weather and without exposing them to health hazards. It is almost impossible for a single IWP to have such a cleaning facility. Waste pickers in Brazil managed to acquire cleaning facilities through resource mobilization and external support as a result of working as a cooperative [28].

Generally, the public has a low opinion of IWPs and considers them to be of low social standing [33]; data in Table 8 showing the importance of public perception corroborates this claim, despite a lack of perception data from the Blantyre public. As such, the reputation of waste pickers may be enhanced by the cooperative status: the public considers the roles and responsibilities of the cooperative and not the individual employees therefore minimizing the negative public perception. To build better relationships and improve source separation, cooperatives may collect waste for free from households that categorize waste and charge a fee to households that do not categorize waste. The approach could encourage categorization of waste among residents, reduce the burden of cleaning waste (as contamination is reduced through waste categorization) and minimize negative public perception.

3.7.1. Organization of Informal Waste Pickers

We determined that 91% of IWPs operate their recycling business alone; those who do not, work in pairs. When asked what they would do if asked to join a cooperative, 48% of the IWPs responded that they would join the group right away, 30% responded that they would continue working alone and 21% responded that they could wait to see if there is progress so they can decide whether to join or not.

When asked why they would join right away, the majority (44%) responded that they want to increase their income. Most of the waste pickers explained that working as a group may help to recover large volumes of recyclables. Some added that working as a group may also increase the spatial coverage for material recovery, which would increase income. All the explanations were centered on income rather than other benefits, such as bargaining power.

Those who responded that they would prefer to continue working alone cited conflict prevention during money sharing, profit reduction and being accustomed to work alone as reasons for not joining the group. In terms of profit reduction, some respondents explained that not all IWPs recover the same quantity of materials and working as a group might therefore mean sharing the proceeds with those who do not contribute equally. Those who responded by saying that they are used to working alone said they like their independence, are proud to earn what they deserve and they do not want to depend on others or wait for someone's decision in their business.

Despite the documented benefits, waste management cooperatives are not perfect. Formalization in Belo Horizonte, Brazil, actually turned waste recycling into an attractive business, which created increased competition, which in turn caused the waste management cooperatives to fail because they had over-estimated their income and were unable to recover investment costs [29]. Leadership and financial management are difficult for any organization, but have been identified as especially difficult for newly formalized cooperatives in India, Brazil and China [30,31].

The IWPs who want to wait want to make sure that the group is serious and there is no free riding behavior (members being lazy deliberately because there are some hard working members amongst them) or conflicts during proceeds-sharing. Table 12 shows responses for waste pickers' interest to work as a group and their reasons.

Table 12. Interest in working as a cooperative (left) and reasons (right).

Interest to Work as a Group		Reason	
Response	Percentage	Reason	Percentage
Join right away	48%	Increase income	44%
		Used to work alone	24%
Continue alone	30%	Prevent conflicts	18%
		Reduce profits	3%
Wait to see progress	21%	Free riding	12%
		Prevent conflicts	18%

3.7.2. The City Council's Stand on Formalization

Formalization could take various forms within the City's mandate to manage solid waste. One way would be to incorporate IWPs into the municipality's operation through a memorandum of understanding whereby waste pickers work under a contractual agreement and are added to the municipal payroll [31]. For example, research from Malawi has shown that communities in both planned and unplanned urban settlement are willing to pay for waste collection services [24]. Formalized cooperatives could therefore be dispatched by the City Council to work within appropriately targeted communities to both collect trash and separate recyclables. Fees paid to the city could help subsidize the transport and IWP salaries, though in reality, this set-up is rare

because of resistance from workers within the formal sector who fear job loss and while IWPs may struggle with increased responsibilities and a lack of flexibility and freedom [31].

More common is a parallel system in which cooperatives are given access to waste in MSW facilities or tasked with collecting recyclables along certain routes while the council continues to collect trash [49]. By working as a parallel structure, fears of job loss and other political interferences are limited; the cooperative would only supplement the council's operations by managing waste in areas not accessed by the council. The latter, rather than full inclusion would likely be a better way to incorporate IWPs in MSW management in a Malawian context.

The person responsible for solid waste management (the Cleansing Officer) at the Blantyre City Council, was interviewed to understand the City Council's stand on formalization of IWPs into waste pickers' cooperatives. The Cleansing Officer revealed that the Council understands the positive roles played by IWP. The Council also accepts its failure to manage solid waste in unplanned settlements in Blantyre. The Cleansing Officer mentioned poor road conditions and insufficient trucks and skips as the major challenges to universal collection coverage. The Council is willing to work with any organization or group, including cooperatives, which aim at managing municipal solid waste. However, the Council cannot facilitate the formulation of a municipal solid waste management cooperative because such activities are not within the mandate of the City Council.

Cooperative activities such as sorting, cleaning, storage and/or composting require land. Understanding that IWPs may not be able to purchase land during the early stages of the cooperative activities, the Cleansing Officer clarified that it is not within the mandate of the Council to provide land for such activities.

4. Conclusions

Recycling by IWPs in Malawi has the potential to grow and improve the lives of both residents and the pickers themselves if the way forward is managed carefully. There is a large market for both plastic and metal despite the fact that market for plastic is seasonal. Furthermore, as this was a cross-sectional study, we have no indication about the persistence of these markets over time or consequences on the prices should the number of buyers diversify and/or change. However, given that most buyers appear to be operating at a national level, it is unlikely that changes in South African or Asian demand would have any short-term effects on the small Malawian market. Buyers take advantage of IWPs' low social status and the informal nature of their business by imposing exploitive prices that fluctuate at any time of the day. Metal recycling industries set high minimum limits for buying scrap metal that IWPs cannot manage to achieve within a few days while working alone.

Financial capital is required to purchase transport equipment such as push carts and bicycles, buy PPE, construct or buy storage facilities and buy detergents for cleaning so that they can reach better buyers, generate greater volumes to avoid cases of market fluctuation, attract high prices and protect themselves from health hazards. Currently, it is almost impossible for individual waste pickers survive on what they make let alone save for future investments.

In theory, cooperatives enable waste pickers to have improved bargaining power for better prices, lobby for storage facilities, collectively sell larger quantities when prices are high, and develop strategies to bring in disperse sources of materials (waste picking, door-to-door waste collection, and contracts with City Councils). Finally, a cooperative would enable IWPs to gain public trust and support to improve their dignity.

However, based on our research, and despite numerous financial, logistical and personal challenges, there is limited interest in joining or starting a cooperative, though the 48% of respondents that are interested would make for an ideal pilot. These few willing IWPs could, with the assistance of a third party (e.g., NGO or branch of City Council) be organized first, and their example would provide a convincing incentive for more to join. Due to the novel concept of a "cooperative", the advantages of the organization would have to be clearly communicated and more importantly, demonstrated. Successful formalization could be set as a benchmark for other IWPs in unplanned settlement areas.

Eventually, if successfully implemented, the City Council could outsource waste collection services to the best performing waste management cooperatives.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2071-1050/10/4/1149/s1>. Original data set and questionnaire.

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