

Mpanang'ombe, Wrixon; Mallory, Adrian; Tilley, Elizabeth

Article

Poverty, politics and plastic: Organic waste sorting in Blantyre's public markets

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Research Article

Poverty, politics and plastic: Organic waste sorting in Blantyre's public markets

Wrixon Mpanang'ombe^a, Adrian Mallory^b, Elizabeth Tilley^{a,c,*}^a University of Malawi, The Polytechnic, Private Bag, 303, Chichiri 3, Blantyre, Malawi^b Cranfield University, Cranfield, Bedfordshire, MK43 0AL, UK^c ETH Zurich, 8092, Zurich, Switzerland

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ABSTRACT

Similar to other poor countries across Africa, Malawi struggles with solid waste management (SWM). Especially considering the high proportion of organic waste, composting is a promising opportunity to tackle the problem. However, composting has had low uptake due to competing fertilizer subsidies, the perceived labour required, and a lack of training and equipment. Considering these issues, this paper presents an analysis of the political dynamics around SWM at markets in Blantyre, Malawi, and to understand how these dynamics may potentially affect the sorting of organic waste in order to improve the production of compost. We find complex systems of both formal and informal management that are deeply linked to the official political structures, creating a diverse array of actors with various vested interests. Implementing a separation program would need community engagement and long-term financial viability to ensure that the project is not abandoned as others have been. This paper contributes to understanding how the complexity of urban governance, combined with party politics, can affect the potential for introducing new models of waste management. It emphasises the importance of understanding both informal and formal management structures before designing interventions.

1. Introduction

With 2 billion tonnes of waste generated every year, of which a third is not safely managed, Solid Waste Management (SWM) is a global issue (Kaza et al., 2018). Sub-Saharan Africa is expected to have the largest increase in waste generation, yet half of the waste produced is currently dumped openly (ibid). There is a lack of data to measure the problem and insufficient infrastructure to deal with the increasing issue of plastics and waste (Jambeck et al., 2018). Sub-Saharan Africa also faces challenges in agriculture, where crop yields and fertiliser application rates are much lower than in the rest of the world (FAO, 2015; World Bank, 2018).

In urban areas in sub-Saharan Africa, SWM is usually limited to the wealthier urban areas and commercial sectors (Oyake-Ombis et al., 2015; Oyoo et al., 2011). Often, households resort to dumping or burning waste in the absence of regular, effective collection services (Oteng-Ababio et al., 2013). Plastics often end up disposed in water bodies or in sewerage systems; the clogging of which leads to increased flooding and public health risks (Jambeck et al., 2018; Oyake-Ombis et al., 2015). Considering how economic development and urbanisation often leads to increased plastic pollution (Oyake-Ombis et al., 2015), there are manifold reasons why trash is a pressing concern in developing countries.

* Corresponding author. University of Malawi, The Polytechnic, Private Bag, 303, Chichiri 3, Blantyre, Malawi.
E-mail address: tilleye@ethz.ch (E. Tilley).

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Due to political will, technical capacity, and competing priorities, waste recycling is rarely a priority for local government in many African cities (Mbiba, 2014). Whilst the informal sector plays a large role in waste management and recycling, they are often ignored or actively discouraged by governments, neglecting a potential route to increasing re-use of waste (Kasinja & Tilley, 2018; Oteng-Ababio, 2012; Scheinberg et al., 2011). One distinction between the practice of waste re-use in developing countries is that while the driver of re-use in developed countries is often environmental or social, waste re-use in developing countries is often driven by economics and the extraction of any remaining value (Scheinberg et al., 2011). As such, economic incentives are more effective than some of the non-economic incentives suggested in other countries to encourage recycling (Boonrod et al., 2015).

1.1. Organic waste and Circular Economy

Circular Economy approaches that recover organic waste for use in agriculture could contribute to solving the dual issues of waste management and agriculture (Ellen Macarthur Foundation, 2014). Increasing recycling and composting has been cited as being key to dealing with the increasing generation of organic waste globally (Boonrod et al., 2015).

Composting sanitises waste through a prolonged thermophilic phase, above 55 °C, acting as both a safe waste reuse option and an amendment that can increase soil fertility (Dumontet et al., 1999). The process of composting can also mitigate methane and carbon emissions associated with other anaerobic methods of waste disposal (McNicol et al., 2020). One risk with composting is that the compost can be seen as a low value product, meaning that the cost of production may exceed revenues from sales so detailed economic analysis of composting facilities are needed (Moya et al., 2019). Otoo and Drechsel (2018) identified a series of composting businesses and institutions but found that the capital costs required significant public funding and subsidies to ensure the sustainability of such models.

One of the challenges associated with compost-making is the presence non-degradable materials, such as plastics, that contaminate the feedstock and subsequently need to be sorted which adds labour and time costs to the process (Mallory et al., 2020; Moya et al., 2019; Otoo & Drechsel, 2018; Pattnaik & Reddy, 2010). Contamination of waste in composting projects has led to underperformance or system failure (Boonrod et al., 2015). Ergo, beyond building plants for treatment at the end of the waste cycle, there needs to be a separation at source to create a biological waste stream that is not contaminated. Achieving this often requires policy and incentive shifts to ensure separation of waste into biological streams and non-biological parts such as plastics or metals (Boonrod et al., 2015; Xu et al., 2015).

Similar to other poor countries across Africa, Malawi struggles with solid waste management. In Blantyre, urban poor communities lack access to solid waste services and often only have a communal skip (i.e. large, metal storage bin) (Manda, 2014). 70% of the waste is not collected due to the lack of vehicles (Manda, 2014). The fact that waste is primarily organic and the major role that agriculture plays in the nation's employment, should lead to a market for compost (Barré, 2014), but it is often inhibited by the lack of support at city level, a reliance on government-subsidized fertilizer, and lack of awareness. These perverse incentives are common in Malawi where there are already large subsidies for conventional fertilisers (Chinsinga, 2012; Jerven, 2014). The Farmer Inputs Subsidy Program (FISP) aims to increase maize production on smallholder farms by providing access to inputs and fertilisers. Maize is not only a staple crop but a political crop, with a narrative that maize availability translates to food security and government legitimacy (Chinsinga & Poulton, 2014; Mdee et al., 2020). There is a high level of state spending on input subsidies to ensure the maize supply, but this has led to a 'lock-in' of the agricultural sector into maize production and inorganic agriculture. The subsidy program creates a financial incentive for maize farmers to continue using inorganic NPK fertilisers, and for agro-dealers to focus on only stocking the FISP-eligible inputs (Mdee et al., 2020).

Whilst subsidies are often necessary to enable composting models to be sustainable, they are also problematic if poorly designed. Vouchers that enable the subsidized purchase of fertilisers for agricultural security and productivity have been shown to fall victim to capture by local elites, with 60 percent of distributed vouchers going to elected village officials in Tanzania (Pan & Christiaensen, 2011). Similar issues have been found in Malawi where vouchers are subject to elite capture and a method of conferring legitimacy and gaining political support (Chinsinga, 2012; Jerven, 2014; Mdee et al., 2020). The intersection of party politics, patronage and solid waste management have been observed in different cases across the global south, particularly with informal waste pickers. In Mexico, local leaders or 'caciques' often played a defining role in controlling the working conditions and right to work of different waste pickers, often in exchange for political support through voting or attending rallies (Guibrunet et al., 2017). This politicisation of waste has also been seen in India and Ethiopia (Bjerkli, 2013; Bjerkli, 2015; de Wit, 2010). In India, implementing waste management at a community level resulted in projects and contracts allotted to allies of councillors (de Wit, 2010). There are examples in other countries where governments and municipalities have looked to integrate informal providers into waste management, either through creating associations that could register as a business or through recognising and regulating their role (Paul et al., 2012; Simatele et al., 2017).

Governance structures in cities across the Global South are often hybrids composed of different institutions, providers and stakeholders with overlapping responsibilities, particularly in informal settlements (Boege et al., 2009; Kapidžić, 2018). The resulting dynamics have been shown to affect solid waste management in urban areas (Wilson et al., 2006; Adeniran & Oyemade, 2016; Sotamenou et al., 2019). Specifically, the lack of transparency and clear roles mean that vested interests are missing from policy documents, but are still key to enabling or preventing projects in solid waste management. Booth (2012), argues there is a need to work with the reality of such structures. Often, projects that fail to understand these undocumented, but widely understood interests are unlikely to be successful and often encounter resistance (Bercegol & Monstadt, 2018; Mallory et al., 2021).

Following long periods of soil degradation and widespread reliance on chemical fertilizer, there is a need for subsidies to enable composting and the use of organic waste in agriculture to gain acceptance and increase demand (Barré, 2014; van Dijk, 2008). Therefore, this work aims to understand the potential options for incentivising waste separation with the goal of achieving

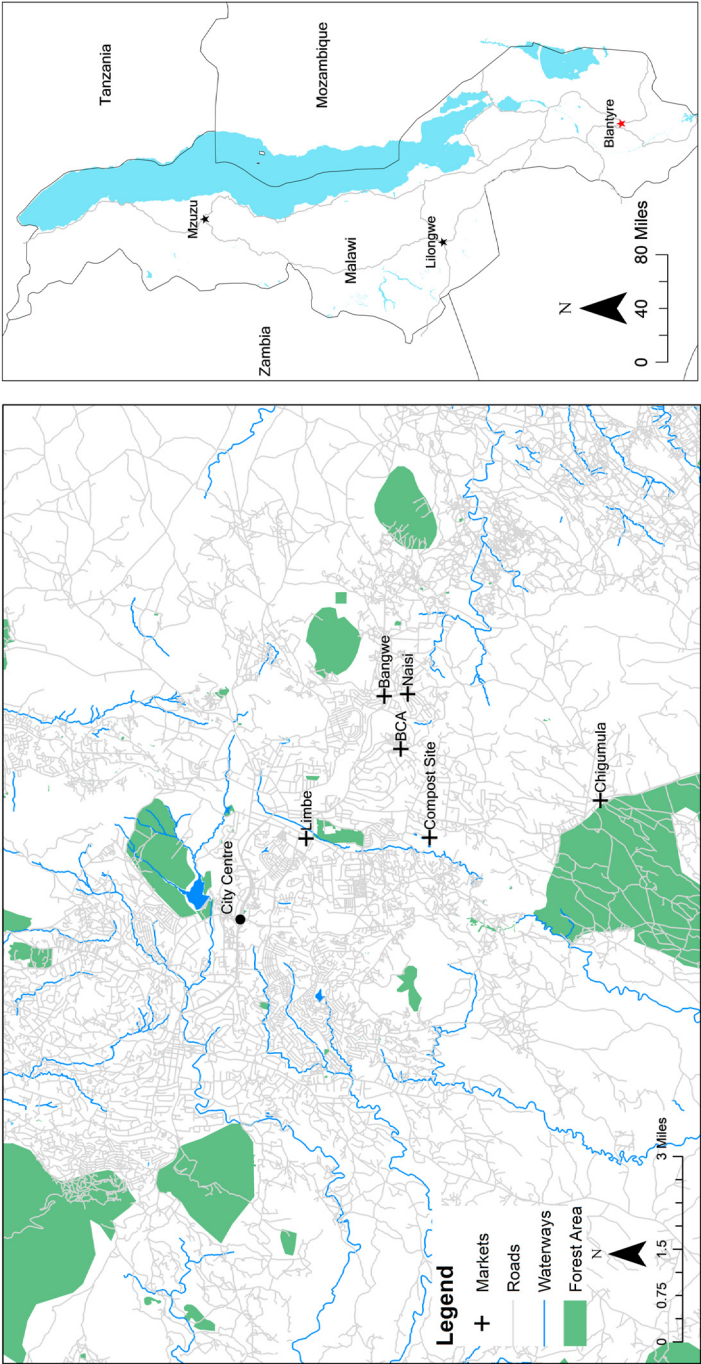


Fig. 1. Map of markets.

uncontaminated organic waste that can be used for composting. Specifically, we map the flows of solid waste from markets in Blantyre, Malawi, to understand potential areas where subsidies could be targeted to enable waste separation. We combine this waste flow analysis with an analysis of the politics of SWM in Blantyre, by mapping the array of formal and informal governance structures and how they intersect with clientalism and patronage politics, to understand possible barriers to successfully introducing organic waste sorting to increase the production of compost.

2. Methods

2.1. Case study selection

The selection of markets to study was based on proximity to the existing composting facility where organic waste from the markets could possibly be utilised if waste sorting was done at the markets. The existing composting facility in Blantyre, operated by the NGO WASTE Advisors, was selected for the case study and the markets that supplied, or could potentially supply organic waste to the facility were selected to be studied.

At the WASTE compost facility, organic waste from local markets arrives at the site, then is sorted for plastics removal, processed and stored in piles for 8 weeks, and packaged and sold to farmers in Blantyre. One of the major labour costs components is the time spent on plastic sorting. As a result, we could investigate quantitatively how providing a subsidy or payment for waste sorting at the source could influence the quality of the final product and labour costs at WASTE. The retail price is MK3,500 per 20 kg bag (retail) or MK40,000 per tonne (where \$1USD is approximately 750 Malawian Kwacha).

Blantyre City Council (BCC) is the planning authority within the area enacted as Blantyre city limits by the Malawi Local Government Act (1998, amended 2010). BCC constructs and owns Blantyre's major markets while some of the smaller markets develop organically around street trading. All markets operating within city boundaries are officially managed by BCC, which is also responsible for providing solid waste management and sanitation services at the markets. BCC provides cleaners and cleaning equipment as well as bins and waste transfer stations in the form of skips at the markets. Waste from the markets is collected by BCC and transported to the city's Mzedi dumpsite for disposal. Therefore, the markets selected for the study had to be officially recognised by BCC.

Five markets with varying sizes and management structures were selected for study and are shown in Fig. 1. (1) Limbe is the largest market in Blantyre and provides most of the organic waste for the current composting facility. (2) Bangwe is the second largest market and is closest to the current composting model site. Limbe and Bangwe markets were built and are owned by BCC. Limbe and Bangwe are directly managed by BCC although there are also informal management structures that include the vendors, and this provided an interesting case studies for how large markets are managed and whether subsidies and changes in waste management would be more difficult than smaller markets. (3) Naizi and (4) BCA are much smaller markets that developed around neighbourhood street trading. Naizi and BCA have a small, localised, vendor-run management structure; these two markets will help to illustrate the potential trade-offs between simplified management and lower waste production. (5) Chigumula is another small market, built and owned by BCC. However, BCC does not directly control Chigumula market; instead it is controlled by the vendors. Chigumula is further out of town providing a case study for more informal management setting.

2.2. Stakeholder mapping

After identifying the markets, stakeholder mapping was done through interviews using snowball sampling to identify both the formal management structures as well as informal power structures that were used to resolve conflict or change management approaches in the markets. Stakeholders within the waste management chain were also identified.

The snowball sampling started by randomly interviewing vendors and stakeholders such as market Chairs who were identified in a previous study at Limbe market (Mpanang'ombe et al., 2018). At the rest of the markets, the market Chair was approached first.

Semi-structured interviews were done with stakeholders to understand: (1) Who was responsible for waste management and the general management of markets and how the stakeholders interacted. (2) How much waste was produced and collected. (3) How the waste was handled and at what point did the waste become mixed. (4) Whether there had been previous attempts at waste segregation and what happened. And (5) at what point in the waste management chain and/or with which formal or informal management stakeholder(s) would a waste separation subsidy/incentive best be targeted.

2.3. Data collection

Data were collected from stakeholders in their place of work, i.e. on their stalls (vendors) or as they moved through the market (BCC cleaners). The interviewed stakeholders were briefed about the research and verbally asked for consent to participate and to allow the recording of the interviews.

The researchers recorded the interviews using mobile phones while also taking notes by hand. Questions were asked in both English and in the vernacular Chichewa language, while the responses were predominantly in Chichewa. There was a Chichewa speaking researcher at all interviews. After the interviews, all of the recordings were transcribed and translated into English for analysis.

There were two initial visits to each market. A round of interviews and observations were done on each visit. Stakeholder mapping was done during the first visit together with general observations of waste. Waste observations were done to determine where waste was being generated, stored and/or disposed of. These observations happened at stalls, in walkways/streets, at storage bins and at the dumping site or transfer station where a skip was positioned. In-depth interviews on market management and politics were conducted

during the first visits with the leaders of the formal and informal market management stakeholders. The management stakeholders who were not available on the first visit were interviewed during the second visit or other subsequent visits.

Observations of market cleaning and waste collection work were done during the second round of visits. In-depth interviews were done with cleaners focusing on how waste management occurred and how they understood waste sorting and recycling practices at each market. Questions on previous sorting attempts were also asked.

After the two initial visits, there were subsequent visits to four markets excluding Limbe to collect additional or missing data. These visits were delayed by three months because of Covid-19 prevention measures and the 2020 Malawi Presidential election rerun. During these visits, data were collected on stakeholders' perceptions on potential waste separation incentives and how to structure them.

3. Results

The results are broken down into the original research aims of understanding: i) the waste management in markets, ii) who is responsible for the general management of markets and waste management, iii) whether any previous separation infrastructure or sorting has been attempted, iv) perceptions of the value of waste sorting and composting and v) what these results mean for targeting a subsidy overall.

3.1. Waste management at markets

3.1.1. Waste generation and storage

The market stalls were divided into different areas: fruit and vegetables, fish, metals, plastics, dry goods, etc. The separation of market areas often meant that some areas were only producing organic or inorganic waste, theoretically making segregation easier. Organic waste -generating vendors were identified as the first stakeholders in the waste management chain. Waste generated at stalls was stored on the stall by the vendors pending collection. Vendors were responsible for their own storage containers and some had bins. Bins were not provided by BCC at any stall in all five markets. However, in Limbe market and some sections of Bangwe market, bins were provided in the walkways, which were used by vendors of nearby stalls. The bins in the walkways were also used by shoppers/passers-by.

Indiscriminate disposal into bins or waste piles was observed at all the markets. Observed waste was mostly organic mixed with plastics. Plastic bags were the most common. The waste on the stalls had the least contamination (plastics or other materials) compared to the other waste sources. The organics in the bins and open waste piles had much more non-organics than the waste on the stalls because the shoppers/passing foot traffic usually disposed of their non-organics such as plastic bags and packaging.

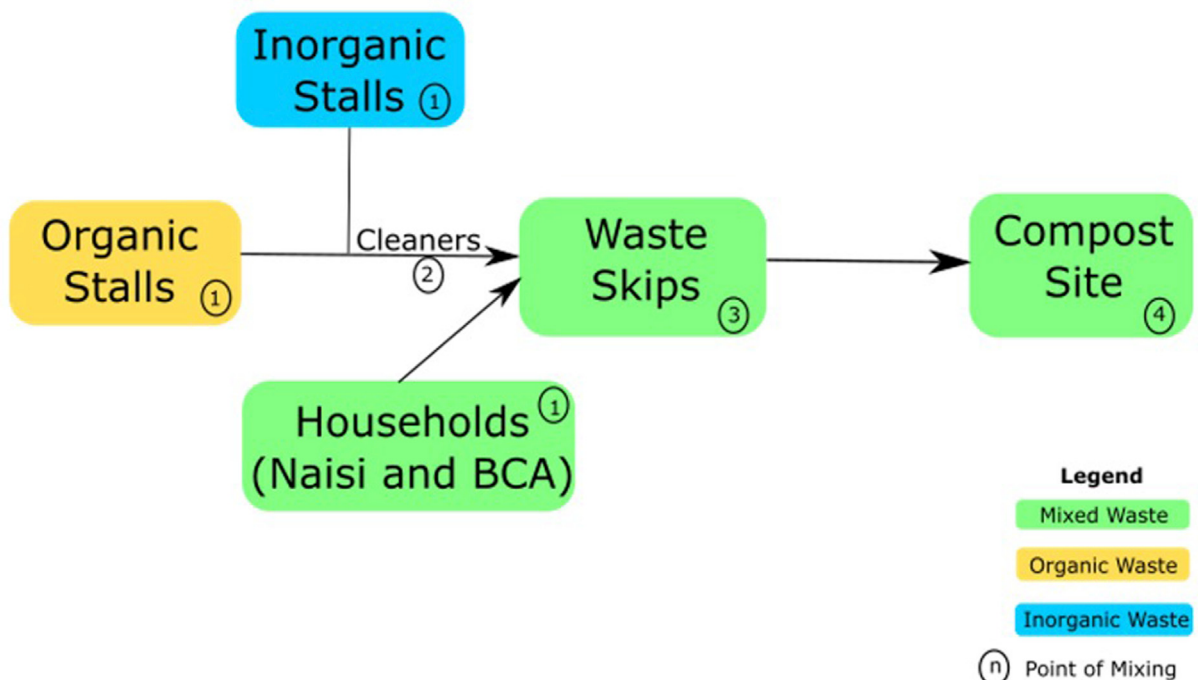


Fig. 2. Waste skip at chigumula market (author).

3.1.2. Onsite waste collection from stalls to transfer station

Cleaners (primary waste management stakeholders at the markets) collected waste from bins and open dumping piles within the market. The cleaners swept the market, emptying all bins and clearing all waste piles on stalls and in public spaces. The cleaners combined all the waste from organic and non-organic sections as they collected it (Fig. 2).

At all five markets, cleaning occurred early morning with the aim of finishing before the start of trading. The cleaners cited the need to rush to complete cleaning in time for trading as a possible hindrance if sorting was to be practiced.

'I believe it cannot be possible to be separating these wastes like that because of time, the people selling their products here wouldn't find the place clean.' (Bangwe Cleaner)

After the early morning cleaning, a second cleaning round occurred at all the markets from around 10:00AM to 3:00PM. Any waste that accumulated after the second round would be collected the following day. Cleaning occurred following the same routine from Monday to Saturday. On Sundays, there was one round of cleaning at Limbe and Bangwe while there was no cleaning at Naizi, BCA and Chigumula.

The waste collected during cleaning was transported in wheelbarrows to the transfer station at the edge of markets where it was dumped into or next to a skip. Overall, the cleaners were open to the idea of sorting waste and reported that they would do it if they were ordered to do so. At the smaller markets (Naizi, BCA and Chigumula), cleaners stated that it would also be possible to sort during cleaning if at least two skips were provided for organics and non-organics.

'We don't separate them because we only have one [skip] bin where the truck collects them together.' (Naizi Cleaner)

All of the skips at the markets had large amounts of plastics mixed in with the waste, as seen in Fig. 3.

3.1.3. Waste collection from markets

The waste from all markets with the exception at Limbe (where sometimes the trucks delivered the skip to the WASTE compost facility on request based on an agreement made between WASTE and BCC) was collected by BCC trucks and dumped at the landfill. Each skip's volume is 6 m³, and, according to estimates obtained from the compost facility, produced around 22 bags or 1.1t of compost after



Fig. 3. General Market structures. Solids line arrows point toward less power while dashed line arrows refer to direct relationships/engagement. Officially, all the cleaners from the five markets were coordinated by the Limbe Area Waste Management Officer also known as the SWM Charge-hand, a BCC officer responsible for waste collection in the study area (the whole town of Limbe and surrounding areas where all studied markets are located). The SWM Charge-hand is based at BCC's waste management office for the city's eastern areas located adjacent to Limbe Market. At Limbe, the cleaners within the trading area (responsible for points 1 and 2 in Fig. 4) formally reported to the Market Master (who communicates with the SWM Charge-hand) whilst cleaners at the skip reported directly to the SWM Charge-hand creating two layers of formal management. At Bangwe, Naizi and BCA, cleaners reported directly to the Bangwe Market Master who was supposed to communicate with the SWM Charge-hand. Chigumula cleaners did not have anyone to report to locally but were coordinated remotely by the SWM Charge-hand. The cleaners and the SWM Charge-hand were employed by BCC's Department of Health and Social Services. At Limbe and Bangwe, some of the cleaners were assigned as cleaning supervisors to lead their fellow cleaners during waste collection, however, this is not an official designation.

sorting and processing.

From observation, the waste collection across all five markets was inconsistent with the official BCC schedule. Skips at all of the markets were full/overflowing during the time of research, and collection was only observed at Limbe. During the time of research, the truck operated by BCC was broken down which may explain the limited collection of waste. At Limbe, skip collection was scheduled twice per day although cleaners reported that collection was sometimes done once a day or every other day. Collection at Bangwe was scheduled once weekly, but no collection occurred in the 12 days between the first two observation visits. At Naizi, BCA and Chigumula, cleaners had to make a collection request once the skip was full. However, the cleaners reported that collection did not occur immediately after their calls. There was no skip collection observed between the first and second visits, which was a period of 7 days at Naizi, 8 days at BCA and 13 days at Chigumula. Naizi market had a skip collected on 29th February and was full again by 12th March, suggesting a waste generation rate of about a skip every 2 weeks. A similar rate is expected at Chigumula and BCA based on the size of the markets. Waste from the five markets amounts to 99–116 m³ per week (qualitatively estimated through observations and interviews), which would correlate to 18t or 363 bags of compost.

At BCA and Naizi, additional waste dumped into the skip came from residences surrounding the market, which was dumped during market hours and non-trading hours such as at night. It was difficult to get estimates of household waste volumes coming to the skips.

3.2. Market management

3.2.1. Formal management structures

Formally, BCC has an appointed Market Master to manage each market as shown in Fig. 4. The Market Masters were employed by BCC's Department of Trade, Commerce and Industry Services and their main responsibilities are to coordinate revenue collection at markets and to register vendors to operate in the markets. Market vendors were required to pay a daily 200 MWK (\$0.27) market fee to cover BCC services including waste collection. BCC Ticket Collectors collected the market fees daily and reported to the Market Master who deposited the money into a centralised bank account managed directly by the BCC Secretariat. Market Masters were stationed at the larger markets and their jurisdiction included smaller markets further away from the centre of Blantyre. Limbe and Bangwe had resident Market Masters who were based permanently there but were also responsible for smaller markets. The Limbe Market Master was also responsible for revenue collection at Chigumula while Bangwe's Market Master was also responsible for BCA and Naizi.

3.2.2. Informal management structures

Informally, the markets were governed by Market Chairs who managed the day-to-day market welfare, resolved conflicts, and acted as a representative for all vendors' interests in their interactions with the formal BCC management structures. Sub-Chairs assisted the Chairs to lead the various sections within the markets. From the interviews, vendors regarded the Chairs as the highest authority at the markets, while the formal Market Masters were regarded as simply revenue collectors and managers of BCC staff at the markets. The Chairs and Sub-Chairs were vendors elected to their positions by other vendors within the market, with votes timed after national elections. Only members of the ruling party were allowed to contest elections for the roles.

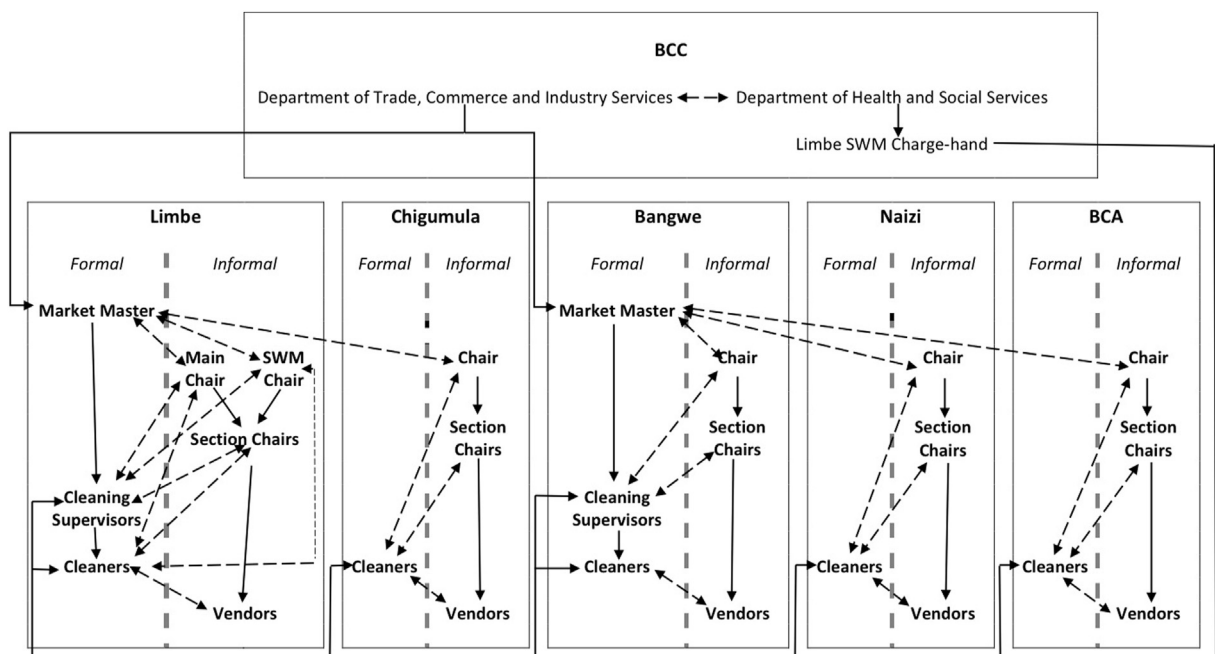


Fig. 4. Overview of waste flows with points of mixing numbered.

The terms of Chairs were said to align with the Malawi Presidential terms at all the five markets. However, exceptions occurred if the vendors had a majority in opposing the election. For example, at BCA, a new Market Chair had been elected in May 2014 after the national election. In theory, the term of the Chair should have been five years until the 2019 election, but the market was mismanaged leading to community resentment and he was displaced in 2017; elections were held for a new Chair but not along party lines.

The linking of Chair elections with national elections resulted in Chairs campaigning for their parties at markets because if their party wins, they would have a chance to retain their market leadership. Since the interviews were conducted during the campaign period of the 2020 Malawi Presidential election rerun, one interviewee at Limbe mentioned that the Chairs were going away from the market to begin campaigning for the incumbent ruling party.

From the interviews conducted, there were indications that the politicisation of the Chair roles had an effect on the market management and would subsequently affect waste management practices. The Chairs reported that they served the interests of the party with their leadership of the markets. Therefore, they usually agreed to changes that were in line with their political party agenda and they would endorse waste sorting if it would not conflict with party interests. An example was given at Limbe where the incumbent First Lady of Malawi had donated additional bins through her charity, and therefore, no other initiative would be accepted by the Chairs if it were to outshine the First Lady's initiative.

The Change of national ruling party regimes also had an impact on market management as evidenced by the disputes that followed the announcement of the 2020 Presidential election results when the incumbent President Mutharika lost to the opposition candidate Dr Chakwera. The outgoing ruling party's market leadership refused to hand over leadership to the new ruling party, which resulted in unrest at the markets—particularly at Limbe (Chitsulo, 2020). The unrest disrupted waste collection at the market.

Officially, the Chair role is voluntary and unpaid, but interviews with vendors revealed that the role had value through payments made by vendors for access. Vendors reported that to operate in the markets they were required to pay a negotiable amount to the Chairs for the right to vend. The chairs would then register the informally paid-up vendor to the Market Master for formal registration. Officially, however, in the formal procedure the vendors would simply register and get approval directly from the Market Master and begin trading.

In the interviews, cleaners reported that they are also given orders by Market Chairs on how to do their work, which they oblige to because of the Chairs' authority in the markets. The Chairs directly affected waste management at the markets through the orders. At Limbe, the vendors formed a special waste management committee, which was informally recognised by BCC. The Chair of this committee, who was also elected along political party lines, was the most influential in giving waste management directions to the cleaners.

3.3. Waste sorting knowledge, experience and potential

3.3.1. Previous sorting attempts

In the selected markets, there have been different projects and infrastructure upgrades to improve SWM. At Limbe and Bangwe, the interviewees, although not clearly recalling, said that they had witnessed or heard that some NGOs had piloted small-scale composting onsite beside the skip. They estimated that about 15 years had passed since the unsuccessful pilot projects.

Infrastructure upgrades attempted to facilitate segregation and better waste management was observed at Naizi, BCA and Bangwe. Segregation structures (a shed with 2 pits, one for organic waste and the other for inorganic waste, and a sorting area beside the pits)



Fig. 5. Waste segregation site at Naizi.

were installed at Naizi and BCA (Fig. 5). The sites were constructed in 2017 by an NGO, but according to the interviewees, the Ward Councillor of the area claims to have constructed the sorting structures and the structures are popularly known locally as the Councillor's development. The sorting structures were still unused after 2 years, and the interviewees suspected that the implementing NGO ran out of money during the duration of the project and failed to do any training or sensitization about the project. Similarly, in Bangwe, a raised waste storage facility was constructed to ease truck loading so that waste could be directly loaded onto collection trucks (Fig. 6), but it was reported to have went out of use within 5 years of opening. The storage site was abandoned fully loaded with waste because the ramp into the facility was damaged and became unpassable for wheelbarrows, and the cleaners stopped using it.

3.3.2. Engagement and understanding of waste separation

When asked questions concerning waste separation and waste re-use practices and experiences, the interviewees demonstrated a fairly limited awareness and understanding of the concepts. Although examples of waste separation initiatives were presented to aid in explaining the concepts during the interviews, the interviewees were generally unfamiliar with the idea. Translation of technical and some nontechnical terminology proved challenging. For example, there is no colloquial term for “organic waste” in the Chichewa language, and therefore descriptions of organic characteristics and examples of organic waste were used instead. Another challenge experienced while describing waste characteristics during interviews was the distinction between paper and plastics. The Chichewa colloquial term for describing plastics can be literally translated into English as ‘plastic papers’ or simply ‘papers’, therefore, whenever the term paper was mentioned during the interview it had to be contextualised to elaborate whether paper or plastic was being referred to. Nonetheless, one cleaner showed an awareness of the purpose of separating waste.

‘I know that it is important to separate different waste. This is so because some waste can easily decay and can be used as manure while other waste takes forever to decay and pollutes our environment.’ (Bangwe Cleaner)

Whilst waste was poorly managed and accumulating in sites as shown in Figs. 5 and 6, there was already some small, informal, implementation of waste re-use concepts where waste had a perceived value: local residents, and kids in some cases, were taking the harder, thicker plastic bottles from the waste and re-using them. At Limbe, an individual was observed passing through the market collecting hard plastics. The interview responses showed that where the waste value is easily obtained, the waste re-use organically emerges.

‘We have one person that comes to collect bottles to sell them afterwards.’ (Limbe Vendor)

One vendor selling cabbages at Limbe said that livestock farmers collected vegetable waste such as cabbage leaves to feed their animals instead of using the waste for composting, which can be harder to practice because it takes more time and requires better waste sorting.



Fig. 6. Waste storage at Bangwe.

3.3.3. Perceptions on incentives and subsidy structuring

All stakeholders perceived incentivising sorting as a motivation factor that could lead to successful waste separation. Cleaners expressed that they would accept incentives if offered for waste sorting, however, on the condition that their managers and employers (BCC) approved. The cleaners were sceptical about specifying a monetary or nonmonetary value that they thought would be the best incentive for sorting a skip of waste; rather, they preferred to find out how much additional work sorting would present to be able to determine the best incentive value. Nevertheless, one Market Master was not particular about the value of the incentive and would be satisfied as long as they received any incentive for supervising sorting. The Market Master, however, said that to facilitate the sorting and to avoid conflict among waste management personnel, the SWM Charge-hand, who is not based at any market but coordinates waste management, would also have to be incentivised. Vendors expressed that they would do sorting at the source if they were provided with materials such as segregation bins.

4. Discussion

4.1. Market politics

Implementing waste sorting at the markets would depend on stakeholder buy-in. BCC has to buy-in because they have the planning approval authority and they manage the markets. Although cleaners would also have to accept sorting and incorporate it into their work, they do not have the power to reject the idea as the power to decide is with BCC's Department of Health and Social Services as their employer. However, because cleaners are supervised locally by Market Masters, their department within BCC has to approve it if they are to be accountable for the sorting exercise. Therefore, internal politics between the two BCC departments may also affect whether or not incentives are offered. Furthermore, for sorting to be implemented successfully, vendors have to cooperate and their cooperation relies on their leadership, the Market Chairs, who are the most influential stakeholders because they also have control over cleaners. Political affiliations and party interests influence the Chairs' decision-making, which may have implications on the acceptability and continuity of a waste sorting program.

Abrupt national political changes such as the nullification of the 2019 Malawi Presidential election results (Chitete, 2020) would impact the market leadership politics. Sorting incentives that are only tied to roles aligned with party elections may lead to disputes, or problematic handovers at times of elections. The sustainability of interventions in such complex, politicised, dynamics is likely to be at risk around elections and subject to political shocks. Given the dearth of literature on the topic, it remains unclear whether interventions that attempt to acknowledge and work within the political complexity are more or less effective than those that are designed around the stated (rather than *de facto*) systems. The current arrangement of waste transport and use for composting does not incentivise waste separation, despite the environmental and financial cost of receiving the waste contaminated with plastic.

Regionalism in Malawian politics may have an influence on market management directly by influencing Market Chairs or indirectly through the appointments of Councillors who form the Mayoral Council that governs BCC's work. Long-term waste sorting policy needs the political will of the government. However, changes in government may result in policy change or in financial or institutional support depending on whether the city or area is the governing party's stronghold or not. For example, before the 2020 Presidential election, Blantyre was a stronghold of the ruling Democratic Progressive Party but any political leverage presented by that status was lost after the Tonse Alliance won the election, and the city became an opposition stronghold. Since the Chairs serve party interests, the change in government might imply a shift in priorities with a new market leadership but also with the Mayoral Council's direction of BCC work therefore potentially affecting the sustainability of waste sorting schemes at markets.

Considering that cleaners (and waste management in general) are directed by both formal and informal management structures, the complications in the engagement and politics between the formal and informal structures increases directly with market size and economic power. For instance, Limbe, with multiple layers of formal and informal management, is much more complicated than Naizi, BCA and Chigumula where there is a single Chair and no resident Market Master. Therefore, the risk is higher at larger markets that any subsidy or direct payment for waste management could either be subject to competition or overlapping jurisdictions affecting its success. The potential for conflict may be higher at larger markets because of the tensions between formal and informal management of the sorting scheme particularly if incentives are involved. Introducing subsidies may exacerbate local conflicts of management in the markets and could lead to changes in operation or instability.

The mixing of market management and party politics may undermine the success of any approach to waste separation. Examples of these issues already exist in Malawi, where a solid waste site was closed early 2020 by the local community and is now an ongoing legal dispute (Chirwa, 2020; Holm et al., 2021). This example shows the risk of projects that ignore informal stakeholders or local communities who still have the power to stop a project if they feel they are missing the benefits or have additional risk. Subsidies for fertiliser have been used to buy political support in Malawi (Chinsinga, 2012; Jerven, 2014), so there is a risk that a poorly designed scheme for waste separation could result in worse outcomes than the current situation. Having an output-based scheme which correlates to the percentage of waste sorted may help to avoid abuse of the system.

It is important to note that apart from political influences on market operations, there are other public policy interventions that could affect the implementation of sorting such as emergency public health measures. For example, the markets potentially faced closure or clearance in response to Covid-19 (Malikwa, 2020).

4.2. Capacity building

Stakeholder buy-in on its own cannot ensure that waste is sorted at markets without the provision of appropriate infrastructure and

expertise. The failures in previous infrastructure attempts at the markets raise the issue of continuity of sorting projects. Co-designing infrastructure and waste segregation processes with all stakeholders, particularly cleaners, along with guaranteeing the project longevity and subsidy funding as well as adequately sensitising stakeholders will be necessary if there is any potential for long-term success.

The sensitization of stakeholders such as vendors and cleaners needs to factor in that they are not familiar with waste separation concepts. Simplifying technical content will require special attention considering the language and education levels of the stakeholders. Previous waste management work involving stakeholder inputs at Limbe showed that vendors found the process complicated because the tools used were not adapted for non-experts (Mpanang'ombe et al., 2018). Therefore, contextualising the sensitization tools may aid in ensuring effective knowledge adoption of sorting schemes.

One of the major barriers to waste separation at the time of research was simply a lack of infrastructure and space. Cleaners at the market said there would not be sufficient space to separate waste, and even if they did have more space, there was only one skip at each market. In a subsidy trial looking at implementing economic and non-economic incentives to encourage the separation of waste, providing the infrastructure alone had a 19% increase in efficiency (Boonrod et al., 2015). Separation increased to 51% efficiency with economic subsidies. The positive effect of providing separating infrastructure is worth considering and it would be necessary to establish a baseline of waste sorting in an 'infrastructure-only' scenario to assess the costs and benefits of further incentives. This study found examples of waste separation infrastructure built by NGOs being abandoned and not managed correctly. Studies elsewhere in Malawi have found examples of infrastructure built by NGOs being abandoned (Mallory et al., 2019). These examples of infrastructure being abandoned and disused raise the long-term concern of how a subsidy or separation project would be maintained. In previous waste separation projects, using only infrastructure and then behaviour change was seen as a lower-cost, more sustainable approach that avoided the longer-term economic commitments of subsidies (Boonrod et al., 2015).

Whilst there was some re-use and local scavenging of thicker plastics, there was limited understanding of the benefits of waste separation for composting. A lack of understanding of waste separation and the value of organic waste, has been found in other research looking at the perception of compost and waste re-use (Mallory et al., 2020). The limited, practical engagement with composting or waste reuse means that any changes may require education or behaviour change programmes to ensure success. Non-economic incentive mechanisms such as behaviour change, education programs and encouragement were able to increase waste separation from 20 to 35% in Thailand, but economic incentives still raised the efficiency further to 51% (Boonrod et al., 2015). If economic subsidies can be sustainably provided they may be more effective considering that waste separation, recycling and re-use is often an economically-driven activity in developing countries (Scheinberg et al., 2011). Providing subsidies in a way that is sustainable and achieves the stated impacts without elite capture may be difficult considering the various challenges observed with FISP in Malawi (Chinsinga & Poulton, 2014; Mdee et al., 2020). In any trial it would at least be worth exploring the non-financial incentives such as providing the infrastructure, or providing education and training which would provide a more realistic benchmark against which the effectiveness of any payment scheme could be measured.

5. Conclusions

Overall, it would be possible to introduce waste separation to markets in Blantyre, but political, technical and social factors need to be considered carefully. The best intervention point would likely be at communal collection points, but there would be need for additional infrastructure to enable improved separation. Implementing a separation program would need community engagement and long-term financial viability to ensure that the project is not abandoned as others have been. There is a risk that any financial incentive could be subject to political capture by already politicised roles of market managers that would undermine effectiveness: output-based measures for the subsidy would avoid this. Similarly, the overlapping functions and responsibilities mean there may be an array of actors to appease and integrate into any subsidy or change of policy. Further, a baseline study on the effectiveness of separation when skips are available, and when training is provided will provide a better baseline to assess the impact of a subsidy for separation. This would inform a rigorous benefit-cost analysis of the impact of waste separation on organic waste composting and management.

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Declaration of competing interest

None.

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