

An assessment of solid waste collection model for Mogale City Local Municipality, West of Johannesburg, South Africa

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Abstract: The solid waste collection in all municipalities requires proper infrastructure and upgrading of all waste management activities. Increasingly expensive of waste collections services is associated with lack of planning by individual municipalities. While this is a fact, municipalities often find themselves in poor financial status due to mismanagement of municipal finances, and this affect waste collection services negatively where in some municipalities the services are poor and in others non-existent. At this juncture, the municipalities that are affected normally decide on another approach of providing waste collection services amongst which are the development of a new waste collection model. In line with this, some municipalities experience major shortcomings with the current models that are in place in their own area. The aim of study was to assess the waste collection models that are used in Mogale City Local Municipality. To achieve this aim, objectives were to assess the waste collection services, to review the implementation of waste collection systems and to recommend a new waste collection model for Mogale City Local Municipality. This study was conducted in Mogale City, West Rand District of Gauteng, South Africa. The total population was thirty-nine (n=39) municipal wards from which a sample size of 22 wards was drawn. Respondents were categorized into three groups of wards councillors (n=22), managers of residential complexes and shopping centres (n=51) and municipal solid waste officers (n=13). Selection of respondents was done randomly. Data were collected quantitatively and interpreted qualitatively. Data analysis of themes identified from the study categories was done separately by using SPSS version 25.0 with the assistance of STATKON (Division for data analysis within the University of Johannesburg). Findings of the study revealed that waste collection services were inconsistent owing to insufficient budget to cover waste collection services and the red tape on procurement processes. The outcomes of this study may help the Mogale City Local municipality to develop a solid waste collection model in their jurisdiction and, the development of such model may be seen used in other municipalities in Gauteng province that are experiencing the problem of solid waste collection backlogs. Findings will also be shared with the global researchers through publications and presentations in conferences. This study recommends that communities in Mogale City should all pay for waste collection services, the bureaucrats and waste management officials within the Mogale City Local municipality should budget together to prevent backlogs of solid waste collection in the study area.

Keywords: waste, waste collection model, waste management, municipal internal waste collection, municipality

Introduction

Solid waste is an integral part of human existence. In recent years, solid waste has been recorded to have been generated in large volumes in urban areas due to influx movement of people from rural area looking for employment [1]. Municipalities at all levels, that is local, district or metropolitan in various parts of the world are faced with challenges of removing waste generated by communities and many a times, because of lack of waste collection finances, municipalities fail to provide services, and this results in waste collection backlogs [2]. In South Africa, municipalities are mandated to manage solid waste and to focus more on modern waste collection services to keep abreast with improved and efficient waste collection models. Waste that remains uncollected cause environmental degradation and put the health of human beings at risk. Uncollected waste is a nuisance in all aspects

of life; it smells and attracts rodents and flies that cause diseases, it blocks drainage systems and causes floods, it gets blown away by wind and makes the environment to be unsightly [3]. Waste that is not collected leads to backlogs which in turn result in dissatisfaction of community members who do not receive services as initially planned by the municipality. Such things cause disruptions thus municipalities are always frustrated because they are not able to cope with the load of work that they must do to avoid community protests [4]. Considering all these, Mogale City Local Municipality (MCLM) is no exception, thus this study was conducted to assess the waste collection system in its jurisdiction. Several different systems exist in which various countries use to avoid or resolve environmental and health problems within their own areas. According to [5] Sweden is one of the countries that changed their waste collection model because the initial one did not work for them. Swiss did this based on their Environmental Code which states that each municipality is responsible for ensuring that waste from each household should be collected, transported to the landfills and recyclable waste items should be taken to recycling companies. Literature has shown that some municipalities in Sweden together with waste management companies design waste collection with technical and commercial competence. This model is highly rated and is very successful in rendering the highest quality of waste collection with absolutely no backlogs [6]. In Australia, indicate that some municipalities render waste removal through curbside collection rated as highly efficient. This model places focus on maintenance plan for the vehicles which then ensures that the fleet needed to render waste collection are reliable Full vehicles lease is the preferred model of waste collection for most Australian cities Local governments in some instances opt to contract collection and transportation services to the private sector [7]; [8]; [9]. The waste collection models in Australia and Sweden though not similar in many ways are however distinguishing themselves as highly efficient and effective in waste collection. Waste backlogs do not exist in both these countries because of their efficient waste collection models [10]. Local councils in the United Kingdom utilize an independent entity which has the statutory duty for collection of municipal waste. For instance, the city of London has the Corporation of London, and their service is said to be highly efficient in the city [11]. The same can be said about the Corporation of Leeds which is an entity with the statutory mandate to collect and transport waste in the city of Leeds [12].

Domestic waste in Berlin is transported away to disposal or treatment facility by public waste utilities which applauded as mostly efficient with absolutely no waste transportation disruption [13]. Unlike most cities in Germany Munich did not privatize its waste management, but instead established a municipal company which operates on a cost-recovery, rather than profit-oriented model. This is seen as the driving force behind their success and reliable waste collection [14]. Kisumu City in Kenya like many urban areas of developing countries is grappling with increasing waste generation and pollution from uncontrolled discarding of waste elsewhere in the city as well as insufficient refuse collection trucks/lorries [15]. Kisumu City makes use of the private sector who offer door-to-door waste collection services to major residential estates, schools, universities, hospitals, and business complexes. The model is deployed in areas where the residents are able and willing to pay for the services [16]. In most countries in East Africa institutions like universities, schools, hospitals, and business complexes are often serviced by private companies, which has been very efficient [17]. Literature reveals that in Ghana, there are many challenges including unavailability and inadequate haulage equipment [18]. Clearly in Ghana the internal waste collection system is not efficient and is also bedevilled by successive challenges. From the quoted sources above in the east of Africa (Kenya) and west of Africa (Ghana) waste collection is unreliable and is the main cause of illegal dumping. Therefore, municipalities are exploring more efficient collection models where cooperatives, NGOs and private sector could join efforts to improve waste collection [19]. Reports point out that the prevailing waste management practices were inappropriate, and the results were polluted natural resources including drinking water. Maseru City Council in Lesotho introduced community contracting model to improve waste collection having realized that the city council's fleet was failing the city in its resolved to render waste collection for its residents. The only challenge mentioned about this model is its sustainability regarding the capacity and the will to pay for the service by the residents [20]. Solid waste collection service is only for a limited part of the urban population since the municipalities do not have enough funds to cover all the areas in their jurisdiction [21]. Lack of budget for waste collection is hampering measures to improve the situation [22]. Continuous failure to collect waste in Zimbabwe was noted as resulting in urban dwellers indiscriminately dumping waste on available nearby open spaces. The municipal internal waste collection systems only service the formal urban settlements in their respective area of jurisdiction [23]. The extensive informal settlements that have emerged in most urban centers of Zimbabwe do not generally receive any waste collection due to frequent vehicle breakdowns as the vehicles are aging resulting in waste collection backlogs [24]. It is clear from literature review that most regions and countries in Africa such as Zimbabwe, Kenya, Lesotho, Ghana including South Africa, are all experiencing similar challenges of poor waste collection and all these countries use internal municipal collection model in their respective countries. That explains why in the country South African Local Government Association (SALGA) has responded to this challenge by commissioning a study to find a waste collection model that

can be recommended to all municipalities considering individual municipality's unique circumstances [25]. It is worth noting that the literature highlights a model which is deployed successfully in Sweden and in some few African countries. Lesotho and Kenya utilized the model wherein an area is assigned to private contractors who use their resources to render waste collection and the municipality pays for the service. It is highly successful though the model is used reluctantly since it is wrongly categorized by adversaries as privatization, thus trade unions oppose it.

City of Cape Town and City of Ekurhuleni have also deployed the model with visible eradication of backlogs in the allocated areas [26]; [27]. In RSA like in most countries, waste management is the Constitutional responsibility of local government. Municipalities are the most important interface between the residents and government in as far as waste management delivery is concerned [25]. From the survey of households conducted in 2010 in the RSA [28] noted that the residents were unwilling feed the bill for the waste collection services. Even the well-resourced metros are struggling to deal with waste collection backlogs due to nonpayment of this and other municipal services. Waste management in the municipalities of this province is responsibility of the local municipality as is the case elsewhere in the Republic. The province is estimated to be the largest producer of hazardous waste according to Mpumalanga government and that such waste is not properly disposed of. Most municipalities in the province according to [29] do not have consistent waste collection system or models in place hence their residents do not have access to basic waste collection. This province face challenges of resources to render comprehensive waste management strategy as is the case with other provinces. Waste management performance gaps and capacity constraints are singled out as the most important challenge facing the province with most of the municipalities completely unable to render reliable waste collection as observed by [30] with most municipalities waste collection fleet poorly maintained and often awaiting repairs thus negatively affecting service delivery. Western Cape equally overwhelmed by waste collection in the urban centers especially with rapid urbanization and the potential increase work opportunities in the province the municipal capacity to render refuse collection is not able to keep up with this development [31]. The most shared problems for collection systems range from budget constraints aging fleet, and staff challenges. Rapid urbanization of this province and better economic prospects burden provision of waste collection challenges [32]. In Cederberg Municipality, municipal fleet frequent breakdowns were noted as a serious challenge in the by the Western Cape government. For instance, Langeberg Local Municipality located within the Cape Winelands has no maps to show waste collection schedule routes hence unable to implement and efficient and consistent waste collection system for its residents, IWMP for the municipality has prioritize this for future implementation, which is expected to improve waste collection [33]. In 2017 Cape Metro admitted through their spokesperson and the responsible member of mayoral committee that waste backlogs are a challenge due to significant breakdowns of their vehicles, Head of Waste Management Department dated January 2019 [34]. Ekurhuleni in January 2019 conveyed a message to the local communities in Kempton and later in April to Boksburg local communities after serious backlogs hit the metro and communities delivering five different petitions to the Petitions Committee about persistent waste collection [35]. Reports dating back to 2007 specifically mention backlogs in their Integrated Development Plan of 2020 which it is alluded that they are caused by municipal vehicles breakdown, aging fleet and shortage of parts leading to significant waste collection backlogs. These service delivery challenges have created animosity between the community and the municipality, hence several and frequent public protests have been a common phenomenon [4]. The aim of this study was to assess waste collection model in Mogale City Local Municipality, West of Johannesburg, South Africa.

Methods And Tools

This study received ethical clearance from Research Ethics committee in the Faculty of Health Sciences of the University of Johannesburg. Permission to enter and conduct the study in the municipal wards was issued by Mogale City Local Municipality. The researchers considered the following ethics principles before commencing with data collection: Informed consent where respondents were informed of the aim, the nature, method of data collection and the extend of the study. Respondents were to give a consent to participate in the study and the role of researchers was explained to those willing to participate. There were no experiments or trials conducted, respondents were treated with dignity and respect, data collected for this study were not collected to harm and put the respondents at risk. The researchers allowed respondents to decide on whether they wanted to participate, none of the respondents were forced to participate and researchers informed them that they had a right to withdraw at any given time should they fell to do so. The researchers made it clear to respondents that there were no direct benefits for them from this study. Respondents meeting the selection criteria were treated with fairness. In this study, researchers remained honest and ensured that respondents trust them in the data collection and analysis. For privacy, confidentiality and anonymity, names, contact details and physical addresses of respondents were not included on the questionnaire. Data collection was employed through using developed structured questionnaires with closed ended questions to test reliability of the study. Parameters for this study include reduction of poor solid waste collection, assessment of waste collection

services, implementation of waste collection systems and new waste collection model. Respondents over the age of 21 who were able to respond to questions with ease were included in the study. This study did not include visitors who were less than 31 days in the study wards because they would not be able to provide answers to some questions. Unit of analysis for this study was Mogale City business owners, ward councillors and municipal waste management officials. Researchers used a quantitative method to collect numerical data, excel spread sheet served as a tool to record the transferred raw data from developed questions. Collected data was analysed based on the parameters of this study. A percentage was used as a tool to explain the findings of the study. During data analysis, the researchers checked for the missing data and outliers were removed while raw data were transformed using validation, editing, and coding steps. For reliability, developed questions were categorized into 4 groups and they were rated using a Likert scale format ranging from 1-5. These categories were analyzed separately. For reliability, a Cronbach's Alpha computer software was used. The researchers wanted to determine whether the study measured what it was intended to measure, and to achieve this, questionnaires were delivered to STATKON for reliability and validity evaluation.

Results

The results of this study are based on three parameters of reduction of poor solid waste collection, assessment of waste collection services and new waste collection model drawn from the aim and objectives of this study.

Reduction of poor solid waste collection

Respondents were asked to state if communities sometimes complain about poor waste collection and 30.8% strongly agreed, 46.2% agreed, 23% were neutral and there were no respondents who disagreed and strongly disagreed. On a question of whether communities have engaged in protests for poor waste collection, 61.5% strongly agreed, 23.1% agreed, 7.7% were neutral, 7.7% disagreed and there were no responses for strongly disagreed. Another question was for respondents to indicate if improved waste collection reduces waste collection backlogs, 61.5% strongly agreed, 15.4% disagreed, 23.1% were neutral and there were responses for disagreed and strongly disagreed. When they were asked if there were complaints from community members about waste collection services by private companies, 15.4% strongly agreed, 69.2% agreed, 7.7% were neutral, 7.7% disagreed and there were no responses for strongly disagreed. Another question requested the respondents to indicate if business owners sometimes complain of waste collection backlog on the services provided by private companies, 61.5% strongly agreed, 15.4% agreed, 15.4% were neutral, 7.7% disagreed and none of the respondents strongly disagreed.

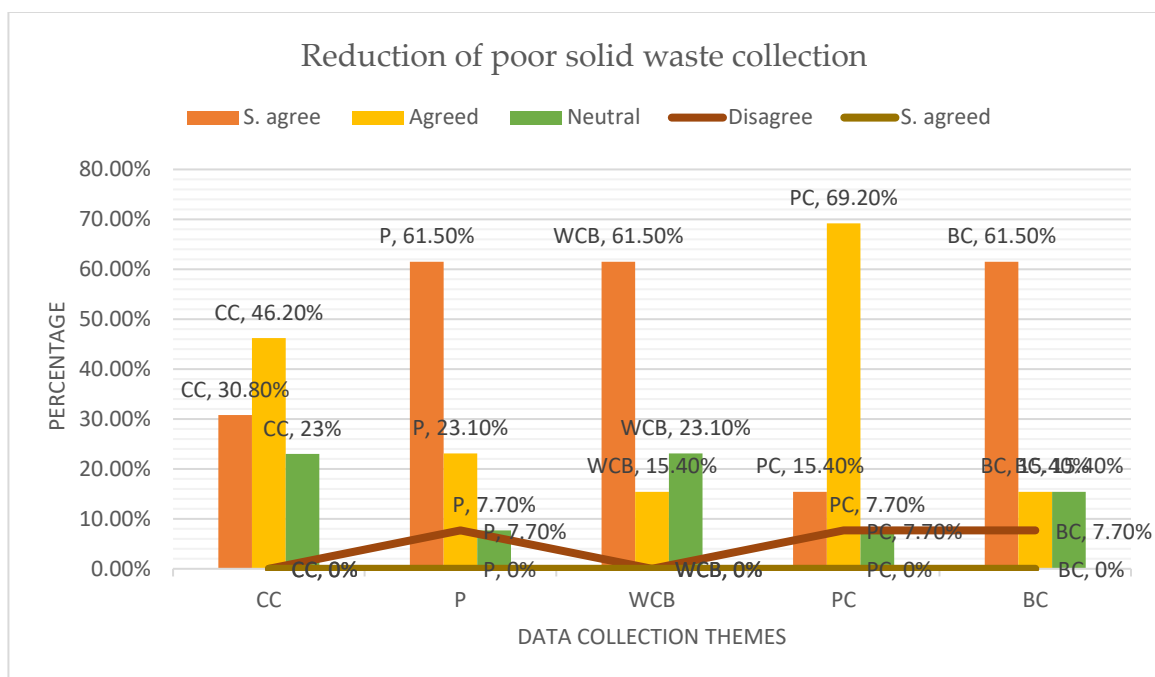


Figure 1: Reduction of poor solid waste collection

Legend

- CC= Community complaints
- P=Protests
- WCB=Waste collection backlogs
- PC=Private companies
- BC= Business owners' complaints

Assessment of waste collection services

Respondents were asked to state if waste collection in their area was satisfactory, 28.6% strongly agreed, 38.1% agreed, 4.8% were neutral, 1.7% disagreed and 26.8% strongly disagreed. Respondents were asked if refuse collection trucks operated as scheduled on a weekly basis, 38.1% strongly agreed, 33.3% agreed, 0.1% was neutral, 9.5% disagreed and 19% strongly disagreed. On the question of whether refuse collection trucks came at the same time on scheduled day, 28.6% strongly agreed, 42.9% agreed, 4.8% were neutral, 14.3% disagreed and 9.4% strongly disagreed. They were further asked to indicate if they lodge complaints to ward councillors about poor waste collection services in their area, none of the respondents strongly agreed, 9.5% agreed, 4.8% were neutral, 71.4% disagreed and the remaining 14.3% strongly disagreed. Another question was to indicate if waste collection services by private contractors were reliable, 42.9% strongly agreed, 47.6% agreed, there were no neutral responses, 9.5% disagreed and there were no responses to strongly disagreed. On the question of whether waste collection by municipal fleet was reliable, 4.8% strongly agreed, 4.8% agreed, 19% were neutral, 47.6% disagreed and 23.8% strongly disagreed.

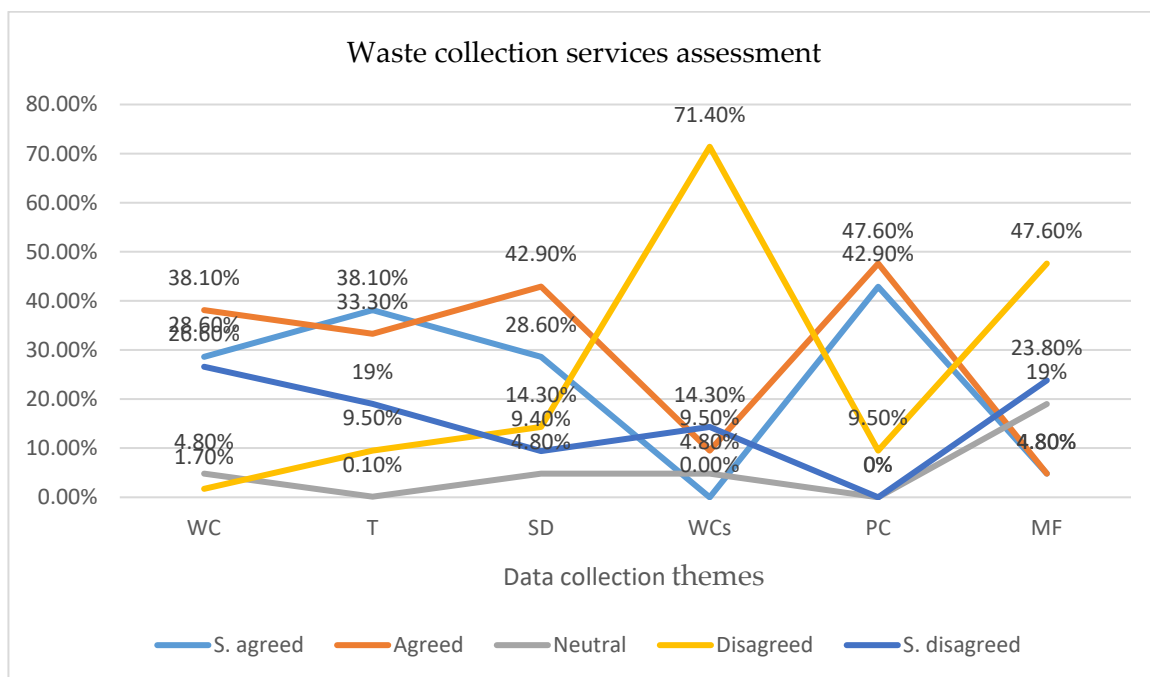


Figure 2: Waste collection services assessment

Legend

- WC= Waste collection
- T=Trucks
- SD= Scheduled days
- WCs= Ward Councillors
- PC=Private contractors
- MF= Municipal Fleet

Proposed waste collection model

Respondents were asked whether they would accept introducing a new internal waste collection model for the municipal, 69,2% of the respondents strongly agreed, and 30,8% agreed. They were asked to indicate whether they were satisfied with the current municipal waste collection services, 23,1% respondents strongly agreed, and 23,1% agreed, 19% were neutral, 20% disagreed and 15% strongly disagreed. On the question of whether private waste collection services would be ideal for the community of Mogale City, 69,2% respondents strongly agreed, and 23,1% agreed, there were no neutral, disagreed and strongly disagreed responses. When they were asked to indicate whether they believed that private waste collection services would be efficient and bring waste collection backlogs to an end, 63,1% strongly agreed, 11% agreed, 2% were neutral, 5% disagreed and 19% strongly disagreed. Another question was whether respondents would support the new model by paying waste collection services, 66% strongly agreed, 10% agreed, 8.1% were neutral, 11.9% disagreed and the remaining 4%strongly disagreed. On the question of whether private waste collection was financially viable waste collection model, 23.1% strongly agreed, 30.8% agreed, 7.7% were neutral, 7.7% disagreed and 30.8% strongly disagreed. Respondents were to indicate if the current model implemented by the municipality is prone to waste collection disruptions, 30.8% strongly agreed, 7.6% agreed, 7.7% were neutral, 46.2% disagreed and 7.7% strongly disagreed.

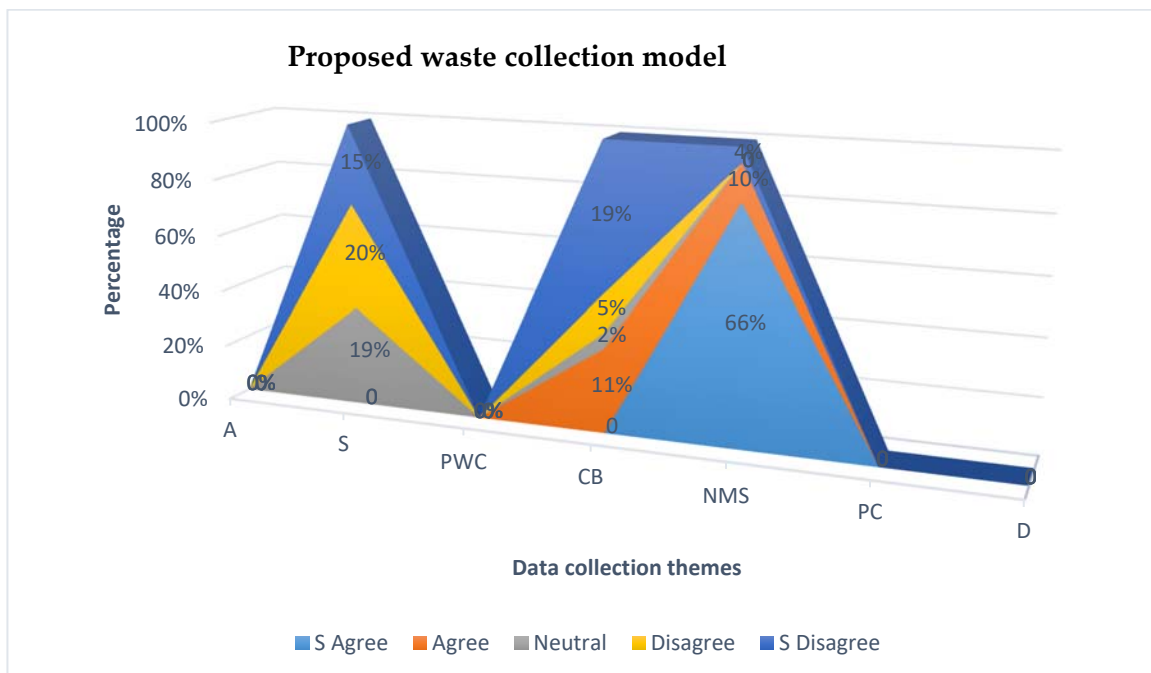


Figure 3: Proposed waste collection model.

Legend

A=Acceptance
 S=Satisfaction
 PWC= Private waste collection
 CB=Collection backlog
 NMS= New model support
 PC=Private company
 D=Disruption

Discussion

Complaints from members of the community about poor service delivery by municipalities has become a norm and municipalities do not take it serious until community members engage in unlawful protests. Municipalities wait for protest before they can attend to complaints. Sometimes protests results from injuries caused by illegal dumping where children are often seen playing with waste. Not only injuries but also diseases such as cholera, skin infections

and respiratory diseases affect people who live closer to illegal dumpsites. It seems like business owners were the most affected by waste collection backlog compared to ordinary community members. This study asserts that there would not be backlog for one reason that if people are not paying for services, then no services would be rendered, and backlog is seen in the business owners because they pay for waste collection services and yet the service rendered is poor. Waste collection services are important, and they should be consistent. There were varying responses from community members and for noting, the 71.4% of respondents who indicated that they do not lodge their complaints to the ward councillors informs this study that there are no good relationships between the ward councillors and the community that they serve. It could also be possible that such respondents do not know their councillor because they did not cast their vote for anyone during the municipal elections. It is imperative that communities and ward councillors work together to improve waste collection services. Councillors should visit community members to address them on issues of waste management that affect the communities. The 4.8% of respondents who strongly agreed that municipal fleet was reliable as against 47.6% and 23.8% who disagreed and strongly disagreed respectively, is a clear indication that community members at MCLM do not support municipal waste collection services, therefore, this study recommends private waste collection services. Findings from this study confirms that a new model is accepted and community members at Mogale City prefer private waste collection to municipal collection services because of unreliable and inconsistent services which account for waste collection backlogs. It is also evident from respondents that they would support a new waste collection model once it is introduced. Respondents differed in their answers to question, however, majority indicated that they were ready to pay for services on condition that the new model would be reliable and provide effective services in an efficient manner. It is not surprising that communities are not in full support of waste collection services delivered by the Mogale City Local Municipality. Many municipalities in South Africa are inefficient and always have waste collection backlog, thus, illegal dumping of solid waste is seen in many vacant lands. Waste collection challenges will never fate unless there are competent municipal employees at all levels from grassroots level to upper level of municipal manager and the ward councillor. Corruption in the municipalities is escalating every moment of our lives and this informs that where corruption prevails, there will always be complaints from community members, protests associated with poor service delivery and burning and looting of government property. What is painful is corrupt syndicates do not suffer the consequences of poor service delivery because they live in high class areas where waste collection services are frequent and consistent.

Conclusion

The research investigated the poor waste collection in MCLM to find lasting solutions to this persistent challenge in the city. The frequency and consistency of waste collection operations were better guaranteed in areas serviced by private waste operators. In contrast, the same cannot be said about internal municipal waste collection due to an ageing fleet, ad hoc breakdowns, sporadic labour unrest, a lack of a maintenance budget, and various causes leading to disruptions discovered during the study. Waste collection disruptions have resulted in massive and perennial illegal dumping on open spaces, creating an antagonistic relationship between the municipality and the community, resulting in sporadic public protests regarding the poor waste collection services the community was subjected to. The traditional internal municipal waste collection has been found in the literature to be inappropriate, especially as the urban areas become more populated since this model has inherent deficiencies. Developed economies of the world, such as EU countries, have long realised the deficiencies of this model and decided to explore other avenues, including private sector involvement. This shift in the approach, coupled with other modernised waste collection models, has already been well entrenched in Europe and Australia with remarkable success, resulting in efficient waste collection. The study has comprehensively investigated and analyzed the poor performance of internal municipal waste collection operations and has explored an alternative waste collection model based on various approaches for diversifying and adopting alternative waste collection models. The municipality should adopt private waste operators as an integral component of waste collection operations to boost and enhance waste collection services in areas with persistent backlogs. The municipality should also consider a lease vehicle strategy that is customized and integrated into a service-level agreement to ensure that the model is sustainable. However, it is known that though the model will ensure the availability of a reliable fleet, labour reliability will depend on the trade unions, who might decide to withdraw their labour at any time. Hence, a mechanism must be integrated into the municipal policy to eliminate uncontrolled union influence. Waste collection diversification with a hybrid waste collection model, including an internal municipal waste model, private waste collection model, and vehicle lease agreement strategy, was the most recommended model for MCLM to resolve the inconsistent and unreliable waste collection challenges. To avoid the outright private waste collection option because of the fear of price hikes; otherwise, the private sector could have a monopoly on determining the market price for waste collection services. On the other hand, the least recommended model would be the internal municipal waste collection model due to its intrinsic inefficiencies. The study advocates

a review of MCLM waste collection systems and practices and proposes a policy that will support the implementation of a shift to a new diversified waste collection model. The study also notes the lack of policy in this regard, which leaves the municipal waste collection model subject to senior management preference that may not be fully informed by research or practical facts.

The MCLM should shift from traditional internal municipal waste collection to modernize the waste collection model by adopting a more comprehensive waste collection strategy, which will integrate waste pickers, buyback facilities and private waste operators. Furthermore, the MCLM should integrate and structure the functioning of its waste collection strategy into a waste management hierarchy in such a way that a more comprehensive strategy will ensue, resulting in a robust and more pragmatic waste collection model that is sensitive to local community needs with the ability to encompass modern trends in waste management and to adapt to new technological approach. Provincial and national departments must consider reviewing domestic waste collection norms and standards, which are ten years old and can no longer direct the modern-day waste collection landscape that has undergone a major transformation over time. Divergence of waste collection models, which include opening this public service to private operators and leasing waste collection vehicles, appears to be gaining momentum in many big African cities. Therefore, the study has scrutinised not only the internal municipal waste collection model but has also undertaken a thorough consideration of various modern waste collection models in different countries that are doing well in waste collection. The need for cities in South Africa to modernise waste collection and to enhance the participation of private sector resources and technology is critical in advancing quality waste collection operations. Policy formulation in this regard, as well as strengthening waste collection models with a comprehensive strategy, as suggested in the waste management hierarchy, would go a long way to improving waste collection in MCLM.

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Informed Consent Statement: Informed consent will be obtained from all participants involved in the study.

Conflict of interest: The authors declare no conflict of interest.

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