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The Readiness of Small, Medium and Micro Enterprises to Participate in Waste-Management Activities within King Cetshwayo District Municipality

Sigoga C. Mkhwanazi

School of Social Sciences, College of Humanities, University of KwaZulu-Natal, Durban, South Africa
Email: Sigoga.dm@gmail.com

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Abstract

The growing amount of municipal solid waste represents not only an environmental problem but also an economic growth opportunity within communities through reuse and transformation of the waste material. Small, medium, and micro-enterprises (SMMEs) can contribute to this waste economy through employment creation, resource recovery, and income-generating activities. However, SMME readiness to participate sustainably in waste-management activities remains constrained by limited financial resources, inadequate infrastructure, skills shortages, weak institutional coordination, and restricted access to markets and technology. This study investigated the readiness of SMMEs to participate in waste-management activities within the King Cetshwayo District Municipality (KCDM), KwaZulu-Natal, using the Circular Economy (CE) approach as its conceptual framework. This study used a mixed-methods strategy, combining quantitative and qualitative data to analyse enterprise readiness, enablers, and barriers to CE participation. The study administered questionnaires to 127 SMME owners/managers in the identified target group. Meanwhile, interviews were held with 10 municipal government officials, including one Local Economic Development Official and one waste management/environmental affairs official from each of the five local municipalities. The results show that SMME readiness is still inconsistent, where SMMEs showed understanding of the economic benefits associated with waste but had no capability to advance from collecting and recycling to more complex CE activities. Some of the constraints include lack of finances, inadequate infrastructure, insufficient technical skills, regulatory barriers, poor coordination among institutions, and lack of recycling markets. Kruskal-Wallis test revealed a statistically significant difference on the perception of income or fi-

nancial gain depending on the household income category (H= 13.411, df = 4, p = 0.009). The study findings indicate a need for investment in infrastructure for recycling, training of SMMEs, coordination among institutions, financial incentives, and promotion of CE practices. The study indicates that KCDM has the potential to exploit waste management as an economic development strategy, but SMME involvement will be contingent on coordination of financial, technical, infrastructural, institutional, and market factors.

Keywords

Circular Economy, SMMEs, Municipal Solid Waste Management, Local Economic Development, King Cetshwayo District Municipality

1. Introduction

Rapid increase in generation of municipal solid waste has now become an environmental, economic and governance issue, especially for developing nations where waste collection, waste treatment, waste recycling and waste disposal practices are still unequal. Currently, global generation of municipal solid waste has been estimated at over two billion tonnes per year, with poor waste management causing environmental pollution, health hazards, and loss of recoverable resources [1]. But waste is now being increasingly considered as an environmental problem as well as an economic resource that can help in recycling, material recovery, business establishment, and employment creation [2].

Small, medium, and micro-enterprises (SMMEs) are important contributors to employment, income generation, innovation, and local economic activity in South Africa [3] [4]. Internationally, small and medium-sized enterprises constitute approximately 90% of businesses and account for more than half of employment [5]. Their participation in the waste economy can therefore provide opportunities for enterprise development through waste collection, sorting, transportation, recycling, reuse, repair, and material recovery. Nevertheless, participation in these activities requires more than access to waste materials. Financial resources, managerial capacity, appropriate technology, infrastructure, regulatory support, reliable markets, and institutional coordination influence whether enterprises can enter and remain viable within the waste economy [6] [7].

The above issues become pertinent especially in the King Cetshwayo District Municipality (KCDM), where unemployment is high, and there is a lack of economic development amid inadequate waste collection and disposal, recycling, reduction, and illegal dumping control facilities [8].

While these deficiencies represent service-delivery challenges, they may simultaneously create opportunities for SMMEs to participate in waste-related economic activities. Despite the policy recognition of both SMME development and waste as an economic resource, limited district-specific empirical evidence exists on whether local SMMEs are sufficiently prepared and supported to participate

sustainably in the waste economy. This study therefore examines waste management as a local economic development opportunity for SMMEs in KCDM, with particular attention to enterprise readiness, enabling conditions, and opportunities for sustainable participation.

2. Literature Review

2.1. Participation of Small, Medium, and Micro Enterprises in the Waste-Management Industry

Small enterprises received limited and racially unequal government support during apartheid. Black-owned and Black-controlled enterprises were particularly disadvantaged by restrictions on economic participation, access to property, finance, markets, training, and business infrastructure. The democratic government's *White Paper on the National Strategy for the Development and Promotion of Small Business in South Africa* recognised this historical neglect and established a national policy framework for small-enterprise development [9].

The National Small Business Act 102 of 1996 subsequently established institutional arrangements to promote and support small businesses. These measures sought to expand economic participation, employment, income generation, entrepreneurship, and the development of Black-owned enterprises. The important change in national policy came after the transition to democracy, especially with the White Paper in 1995 and the Act in 1996.

SMMEs have a role in economic development, creation of jobs, innovation, and providing goods and services. However, the role cannot be seen as an automatic process. The success and development of SMMEs rely on managerial skills, access to funds, infrastructure, technology, markets, networks, regulation, and the economic climate. If SMME failure rates are high, then employment and incomes will be limited in the absence of these factors [6].

The waste management industry provides opportunities for SMMEs involved in collection, transport, sorting, recycling, repair, reuse, composting, cleaning, waste brokerage, and processing of secondary materials. Waste will not need to go to the landfill, while secondary materials can be reintroduced into the production chain. [10] link the development of small enterprises with circular economy practices in African countries; however, their research cannot be used as evidence of a government programme in South Africa.

Growing population, urbanisation, industry, and changes in consumption patterns increase the need for waste services. Municipalities may involve SMMEs in responding to this demand, but participation requires suitable procurement systems and compliance with environmental, occupational-health, business, and municipal requirements. Small enterprises should not be treated merely as inexpensive substitutes for adequately resourced municipal services.

Section 152 of the Constitution of the Republic of South Africa, 1996 identifies the promotion of social and economic development as an objective of local government. Section 153 calls on municipalities to organize and administer their sys-

tems of administration, finance, and planning with due regard for the needs of the community and the advancement of social and economic development [11].

The *White Paper on Local Government* describes developmental local government as government committed to working with citizens and groups to meet social, economic, and material needs and improve quality of life [11]. LED forms part of this developmental mandate, but municipalities cannot create sustainable enterprises through policy statements alone.

Local business opportunities can emerge from municipal waste management agreements, recycling programs, source separation, designated collection centers, and material recovery facilities. This would involve economic viability based on the term of the agreement, financial conditions, material prices, transportation expenses, availability of equipment, and sufficient quantities of recyclable materials. The enterprise development goals need to be aligned with the operational and market requirements.

2.2. Awareness and Understanding of Waste Management in South Africa

The waste management systems of several developing nations have limitations, including poor planning, limited source separation, inadequate collection, illegal dumping, and inadequate recycling and treatment facilities [12]. The legislation governing waste management in South Africa is relatively developed, but poor municipal delivery remains a limitation. Waste pickers frequently undertake the sorting that households and businesses did not perform before collection. This arrangement contributes to material recovery but transfers much of the labour and risk to informal workers.

Awareness programmes should explain how waste must be separated, stored, collected, transported, recycled, treated, and disposed of. They should also identify the services available in a particular community. Generic campaigns have limited value when households lack separate containers, reliable collection, authorised drop-off points, or confidence that separated materials will remain separate during collection.

Municipal officials and councillors also require continuing training concerning the waste-management hierarchy, integrated waste management planning, municipal bylaws, tariffs, waste information, procurement, licensing, and compliance. Institutional weaknesses may arise from staff shortages, turnover, vacancies, insufficient technical expertise, inadequate budgets, and weak coordination.

The *National Waste Management Strategy* 2020 promotes waste prevention, source separation, reuse, recycling, recovery, EPR, public awareness, and waste-picker integration [2]. The strategy does not independently establish every kerbside collection or drop-off facility. Municipalities and producer-responsibility organisations must translate its objectives into appropriately funded and locally suitable systems.

Source-separation programmes have to consider the distinctions between metropolitan, urban, peri-urban, informal and rural areas. A source-separation pro-

gramme that is suitable for weekly collections from a densely populated suburb may not work in a sparsely populated rural area. Factors like collection frequency, storage capacity, transportation, income, density of population, available markets and informal recovery programs should all factor into the design of such programmes. The waste pickers have good knowledge about the recyclable materials, where to collect from, who to sell to and prices. It will help if they are involved in designing source-separation systems, but this cannot deny them access to recyclables. In the past, waste pickers have been known to endure stigma, exclusion, poor working conditions, and lack of recognition for their role in recycling [13] [14]. Increased awareness alone cannot address the problem of inadequate waste management. Sustainable improvement demands that there should be education of the public, infrastructure, collection, and segregation of waste at the source, among other steps. Public involvement works best when the information provided to them becomes actionable.

2.3. Challenges Experienced by SMMEs in Waste Management

South Africa continues to suffer from problems such as high unemployment, poverty and economic inequalities. These factors promote informal economies like recycling. Waste picking provides income to people who may have limited access to formal employment, but waste pickers are frequently exposed to stigma, unsafe conditions, unstable prices, and exclusion from municipal planning [13].

Waste pickers should not automatically be described as SMMEs. While some work independently as informal workers, others come together to form cooperatives or formal businesses. The confusion between the two might conceal disparities in terms of legality, capabilities, income levels, and working environments.

Waste-management SMMEs experience internal and external constraints. Internal constraints may include limited managerial competence, inadequate financial management, weak record-keeping, insufficient technical knowledge, poor marketing, and limited familiarity with regulatory requirements. External constraints may include restricted access to finance, unsuitable premises, inadequate infrastructure, crime, unstable material prices, costly transport, delayed municipal payments, complex procurement requirements, and limited access to recycling markets.

Research across micro-, small, and medium-sized enterprises identifies inadequate finance, education, training, experience, and technical knowledge as recurring barriers to effective waste management [15]. South African SMME research similarly associates business failure with weaknesses within enterprises, unfavourable operating environments, and insufficient understanding of enterprise requirements at different stages of development [6].

A township or rural enterprise may function under conditions that differ from those in which enterprises situated in well-developed urban and industrial areas function. Poor road networks, unstable electricity supply, lack of internet connections, longer transport distances, poor collection facilities, and lack of access to

processing facilities raise the cost of doing business. Tenders by municipalities may also exceed the capabilities of recently founded enterprises.

Information and communication technology could be useful in billing, documentation, planning of routes, communication with customers, and marketing; but information and communication technology alone cannot fix problems like poor infrastructure, lack of money, poor facilities, or unstable demand.

The waste industry in South Africa is faced with service delivery disparities as well. Census 2022 indicated that 66.3% of the population had weekly refuse collection services [16]. The extent of collection services differs greatly between rural and informal towns compared to more developed urban areas. Such backlogs provide a chance for local collection firms to flourish; however, it might be difficult for them due to low household income levels, dispersed settlement, and long distances covered. Shortage of vehicles, old fleets, rising costs of fuel, lack of personnel, poor road conditions, transfer problems, and shortages of facilities where refuse could be disposed of legally or recovered might affect the process of collection. This leads to littering, dumping, burning of refuse, and leakage of garbage into rivers, drainage, open land, and other environments. The extent of each challenge has to be known based on local data and not assumptions from studies done in other countries.

Participation by community members is also important. Households and companies might be unwilling to segregate waste due to uncertainty in collection, lack of adequate space for segregation, or due to mixing of segregated waste during transport. Municipalities, therefore, need to link their awareness campaigns with reliable service provision and easy access to segregation facilities. The informal waste collectors need to be included in the municipal systems through dialogue, recognition, access to segregated waste, safety gear, sorting facilities, and appropriate agreements. Formalisation needs to benefit them without imposing restrictions that would disqualify them from such processes.

Addressing the challenges facing waste-management SMMEs will require collaboration among the municipality, government, the private sector, financing, infrastructure, training, procurement processes, payment of bills, and material markets. Performance of the enterprises should be measured on their ability to survive, create employment, generate income, deliver services, conform to requirements, and divert waste.

3. Theoretical Framework

3.1. Circular Economy Theory

The circular economy model has emerged as a reaction to the linear system of resource extraction, production of goods, consumption of goods, and disposal of the generated waste. It aims to minimize extraction of new resources, avoid waste generation, prolong the life of products and materials, and gain value through maintenance, repair, reuse, refurbishing, remanufacturing, recycling, and other types of recovery activities.

It has been characterized as an economic model, a set of policies, a production system, and a sustainability strategy. However, it does not constitute an elaborated theory with established propositions. Still, it provides concepts that may be used for research of material flows, waste management, company models, and resource efficiency. Thus, this study uses it as a theoretical framework.

Circularity goes beyond recycling. Waste prevention, material reduction, durability, maintenance, repairing, reusing, and refurbishing typically have higher value compared to the processing of materials after products have been turned into waste. Recycling is still significant; however, it ranks lower in the hierarchy due to material degradation, energy input, and material loss in the process of each processing cycle [17].

The circular economy literature tends to differentiate between biological and technical cycles. Biological materials can cycle back into nature as long as they are clean and handled properly. Technical materials, like metal, plastic, and parts produced for machinery, must cycle into other uses via repairs, reuses, reconditioning, remanufacturing, and recycling. This distinction is not an indication that all materials can cycle endlessly without environmental impacts.

Circularity necessitates shifts across product/service lifecycles. Designers affect the durability, reparability, choice of materials, and disassembly process. Producers affect the production techniques and take-back options. Consumers affect the utilization, maintenance, and separation of products. Municipalities affect local collection and planning, while waste pickers and companies recycle/recover materials. The recyclers and manufacturers affect the return of secondary materials into production.

This framework is important for waste management since it considers discards as potential resources but emphasizes the avoidance of waste. Circularity can be facilitated by cities through source separation, designated collection sites, material recovery facilities, composting, procurement, education, and cooperation with businesses and waste pickers. The applicability of the interventions will depend on the waste streams, settlements, infrastructure, funding, and markets within the locality.

In SMMEs, the use of circular practices may provide scope in the areas of collecting, repairing, reusing, composting, recycling, product redesign, and making products out of recycled materials. Such businesses will be able to offer their services in the community, provide employment, and supply materials to other industries. Success of such firms will depend on availability of raw materials, proper technology, business skills, funding, space, transportation, and reliable markets.

The circular economy concept is especially pertinent to developing countries with municipal budget constraints where waste pickers manage to collect a large amount of materials; nevertheless, policies aimed at the circular economy that have been elaborated for industrialized economies cannot be adopted without taking into account infrastructure, poverty, informality, labour conditions, governance, and service delivery backlog peculiarities. The policies for recycling formal-

ization may exclude the waste pickers if they are not elaborated with their participation. The framework is also linked with the SDGs. Waste minimization and resource efficiency correlate especially with Goal 8 on decent work and economic growth, Goal 11 on sustainable cities and communities, and Goal 12 on responsible consumption and production.

Circular practices may help achieve these goals, yet the contribution should be shown rather than presumed. In KCDM, the framework deals with the waste flow within households, businesses, municipal services, informal recovery, recycling firms, disposal sites, and secondary-material markets. It assists in identifying where materials are lost, contaminated, dumped, or buried and where enterprises could retain or recover value.

The selection of the circular economy framework is, therefore, informed by three considerations. First, it supplies principles for analysing waste prevention, material circulation, and resource recovery. Second, it connects waste-management practices with potential enterprise and employment opportunities. Third, it encourages analysis of the institutional relationships required amongst municipalities, SMMEs, waste pickers, producers, communities, and material buyers.

The triple bottom line and circular economy are complementary. Circular economy identifies processes that could minimize waste and keep value in materials; the triple bottom line measures its economic, social, and environmental impacts. While a recycling program can be circular in nature, it could be unsustainable economically, socially, or environmentally. This comprehensive approach avoids taking circularity as an indication of sustainability.

3.2. Criticism of the Circular Economy Theory

The circular economy has attracted significant policy, industry, and scholarly interest, yet its feasibility and contribution to sustainability have been debated. Criticisms concern definitional ambiguity, uncertain theoretical status, physical limits, economic-growth assumptions, rebound effects, implementation barriers, unequal power, and insufficient attention to social justice.

The concept encompasses many definitions and strategies. [18] identified substantial variation amongst 114 definitions, while the later analysis of 221 definitions confirms that no single interpretation has become universal [19].

Definitional flexibility enables the concept to be applied in different contexts, but it can also produce inconsistent objectives. One organisation may describe improved recycling as circularity, while another may require product redesign, reduced consumption, and system-wide changes. Without clearly defined boundaries and indicators, circular-economy claims may become difficult to evaluate [20] maintain that the circular economy has diffuse boundaries, uncertain theoretical premises, and structural implementation barriers. They warn that technological and economic perspectives will predominate in circular economy projects when power relationships, distribution, work, consumption, and political decision-making are neglected. Perfectly closed material flows are physically impossi-

ble. Material is lost, contaminated, melted, or deteriorated in the process of use and recycling. Energy is used in collection, transportation, cleaning, and recycling, and virgin material might still be necessary to replace lost material and ensure its quality. It is necessary to limit the circulation of hazardous material. Circular economy, therefore, should be viewed as reduction and deceleration of resource flows [21].

The relationship between circularity and economic growth is also contested. Circular-economy initiatives often promise continued economic growth alongside reduced resource extraction and environmental harm; however, efficiency gains may be offset when lower costs increase production or consumption. This rebound effect may reduce or reverse anticipated environmental benefits. Increased recycling does not necessarily compensate for continued growth in total material consumption.

As identified by [22], the circular economy tries to bridge the relationship between economic development and the health of the environment, although its social aspect is poorly developed. Employment generation alone does not equate to social sustainability; the nature, quality, safety, and distribution of employment have to be taken into consideration.

Circular economy policies might exclude vulnerable groups where the materials and markets available for the informal sector are moved to the formal sector. While mechanization would increase the effectiveness of the processing, it would decrease employment opportunities. EPR programs might centralize power among big companies and producer responsibility organizations.

There is considerable difficulty in implementation in the case of SMMEs. The circular economy approach could demand finances, innovation, technology, design of new products, expertise, information, certification, reverse logistics, and cooperation in the supply chain. Smaller companies may not have all of these available to them and may be unable to take the risk of investing where the benefits are uncertain. Financing, technical help, infrastructure, and market access, consequently, are required for involvement. Cooperation is also problematic. The materials need to travel from the source through collectors, processors, manufacturers, and purchasers, each with its own task and financial interest. The municipality and the regulators have to coordinate planning, licensing, procurement, enforcement, and information.

The circular economy can even be invoked as part of a marketing strategy in the absence of meaningful operational changes in the company. The business can produce a recyclable product while at the same time increasing overall material throughput or using waste disposal methods that cannot recycle the product. Circular claims must, hence, be justified through information on waste reduction, material throughput, recycling efficiency, energy consumption, emissions, labour practices, and end destinations.

Circular solutions cannot replace other measures needed in manufacturing and consumption. Recycling will not solve the problem of material throughput, planned

obsolescence, toxic products, inequity, and poor municipal services. Circular solutions need waste reduction, durability, repair systems, good manufacturing practices, renewable energy, public infrastructures, regulatory action, and changes in consumption.

While these criticisms do not make the framework unfit for the study, they provide the necessary criteria for its application. The study does not assume that every recovery activity is sustainable or that circular practices automatically create inclusive economic development. However, it analyses the impact of local infrastructure, finance, market, institutions, regulation, and socio-economic factors on the viability and ramifications of circular waste practices.

The inclusion of the triple bottom line with the circular economy enhances the analysis. Circular-economy principles help identify material and operational opportunities, while the triple bottom line requires assessment of financial viability, social inclusion, worker well-being, and environmental performance. The integrated framework, therefore, enables the study to investigate how SMMEs can participate in waste management without assuming that circularity or enterprise creation is inherently sustainable.

4. Methodology

The paper adopted a post-positivist research paradigm and a convergent mixed-methods design to investigate how waste-management practices affect small, medium and micro-enterprises (SMMEs) and local economic development (LED) in the King Cetshwayo District Municipality (KCDM). Post-positivism recognises an independently existing reality while acknowledging that knowledge of social phenomena is provisional and subject to limitations in observation and interpretation [23] [24]. This philosophical orientation supported the integration of empirical measurement with context-specific accounts of waste-management practices, municipal support and SMME development.

The study comprised two participant groups. The quantitative component targeted SMME owners/operators involved in waste collection, handling, separation, recycling, recovery, transportation and related activities across the five local municipalities of the KCDM. From a sampling frame of 438 eligible operators, 127 completed questionnaires were obtained. The sampling frame was structured based on the five municipalities in the area, where each municipality formed a geographical stratum. The attained quantitative sample included 73 respondents in the municipality of uMhlathuze, 36 respondents in uMfolozi, seven respondents in uMlalazi, one respondent in Mthonjaneni and 10 respondents in Nkandla. While there were respondents in all five municipalities, they did not correspond to the proportions of the municipal population. The attained sample accounted for about 29.0% of the sampling frame that was established. The quantitative results are presented relative to the population of 127 respondents that completed the survey. The qualitative component comprised 10 municipal officials, with one local economic development official and one waste-management/environmental-

affairs official purposively selected from each municipality. The selection criteria included municipal responsibilities, awareness of the waste management system, involvement in LED and environmental management, as well as experience of dealing with SMMEs involved in waste management.

Enterprise eligibility criteria in the quantitative phase of the research were associated with enterprise engagement in activities related to waste generation within the scope of the research, which include waste collection, management, sorting, recycling, recovery, transportation and others. The study targeted owners/operators of SMMEs within the geographical area of the five KCDM municipalities.

The data collection process entailed the use of structured questionnaires, semi-structured interviews and document analysis. The questionnaire was aimed at identifying the characteristics of enterprises; waste management activities, municipal support, regulatory compliance, operational constraints and economic impact. Interviews, on the other hand, focused on institutional processes, regulatory requirements, municipal support and possible SMME involvement.

The quantitative data were analysed using descriptive statistics, Shapiro-Wilk tests, Spearman's rank-order correlations, Kruskal-Wallis H tests, and chi-square tests of independence, along with appropriate effect-size measures. The qualitative data from interviews and documents were thematically analysed through coding, categorization, and theme development [25] [26]. Subsequently, these data sets were compared for convergence, complementarity, and divergence [27]. Reliability, validity, and qualitative trustworthiness were ensured through standardised processes, triangulation, and an audit trail. Ethical approval, informed consent, confidentiality, voluntary participation, and data security were maintained in the process.

Quantitative results were obtained using self-reported data provided by 127 SMME owners/operators, who had not verified their reported waste management practices. The second problem is related to the sampling frame, which consisted of 438 operators. This frame might have overlooked some informal or unregistered enterprises. Third, qualitative results were obtained based on the perspectives of ten municipal officials, rather than from individual SMMEs.

5. Results Presentation

5.1. Descriptive Statistics for Scale Variables

Descriptive statistics were calculated before the inferential analyses were conducted. Six study variables and one ordered background variable were coded using ordinal response scales. The effects of waste management plans on business operations and policy framework effectiveness were measured on 1 - 5 scales. The scales used to measure government involvement, business preparedness, waste management programme efficiency, and economic improvement/livelihood improvement are 1 - 4 scales. The years of experience in the waste management business were classified into four ordinal categories. **Table 1** below shows the frequency, mini-

mum/maximum values, means, standard deviation, skewness, and excess kurtosis.

Table 1. Descriptive statistics for the study variables.

Variable	n	Minimum	Maximum	M	SD	Skewness	Excess kurtosis
Effects of waste management plans on business operations	126	1	5	4.47	0.86	−1.75	2.74
Policy framework effectiveness	125	1	5	4.14	1.23	−1.27	0.39
Government support for SMMEs	127	1	4	3.31	0.90	−0.97	−0.23
Business readiness to participate in waste management	127	1	4	3.72	0.65	−2.61	6.57
Waste management programme effectiveness	124	1	4	3.16	0.97	−0.91	−0.27
Livelihood or financial improvement	123	1	4	3.34	0.76	−0.88	0.06
Years in the waste management business	127	1	4	2.31	0.98	0.32	−0.88

Note. The effects of waste management plans on business operations were scored from 1 (very negative) to 5 (very positive). The effectiveness of the policy framework was rated on a scale of 1 (not effective) to 5 (very effective). Ratings for government involvement, business preparedness, effectiveness of the waste management program, and improvement in livelihood/financial status were measured on a scale of 1 to 4 based on the response anchors provided in the survey. Years in the waste management business were assigned codes of 1 (less than 1 year); 2 (1 - 5 years); 3 (6 - 10 years); and 4 (greater than 10 years).

5.2. Tests of Normality

Shapiro-Wilk tests were done to evaluate whether the distribution of variables is normally distributed [28]. In each test, the null hypothesis was that the concerned variable is normally distributed. The result of significance at $p < 0.05$ provided evidence against this hypothesis. See Table 2 below.

Table 2. Shapiro-Wilk tests of normality.

Variable	N	W	p	Normally distributed?	Analytical implication
Effects of waste management plans on business operations	126	0.663	<0.001	No	Non-parametric analysis
Policy framework effectiveness	125	0.720	<0.001	No	Non-parametric analysis
Government support for SMMEs	127	0.745	<0.001	No	Non-parametric analysis
Business readiness to participate in waste management	127	0.483	<0.001	No	Non-parametric analysis
Waste management programme effectiveness	124	0.784	<0.001	No	Non-parametric analysis
Livelihood or financial improvement	123	0.771	<0.001	No	Non-parametric analysis
Years in the waste management business	127	0.867	<0.001	No	Non-parametric analysis

Note. W = Shapiro-Wilk statistic. Statistical significance was assessed at $\alpha = 0.05$. The sample size for each test reflects the number of valid responses for the relevant variable.

All seven variables show statistically significant results using Shapiro-Wilk ($p < 0.001$). Hence, all null hypotheses of normality were rejected for each of the seven variables. The findings support the skewness seen in six variables, as shown in Table 2. Nonparametric tests became the main approaches to be used for statistical inference [29] [30]. Both Spearman's rank-order correlation coefficient and Kruskal-Wallis H test were selected as the main tests. Pearson correlations were reported as supplementary analyses. Spearman's correlations are emphasized because of the ordinal nature of the variables and their non-normal distributions.

5.3. Spearman Rank-Order Correlation Analysis

The Spearman's rank-order correlation coefficient was used since the data were ordinal and not normally distributed. Spearman's rank-order coefficient tests the strength and direction of the relationship between ranked variables [29]. The results are shown in Table 3.

Table 3. Spearman rank-order correlation matrix.

Variable	1	2	3	4	5	6	7
1) Effects of waste management plans	—	0.521***	0.126	0.278**	0.043	0.261**	−0.041
2) Policy framework effectiveness		—	0.166	0.114	0.206*	0.287**	−0.014
3) Government support			—	0.273**	0.221*	0.005	−0.030
4) Business readiness				—	0.243**	0.267**	−0.004
5) Waste management programme effectiveness					—	0.132	−0.119
6) Livelihood or financial improvement						—	0.137
7) Years in waste management							—

Note. ρ denotes Spearman's rank-order correlation coefficient. $p < 0.05$; $p < 0.01$; $p < 0.001$. All tests are two-tailed.

Theme 1: Restricted readiness and capacity to adopt circular economy practices

Participants described differing levels of readiness amongst SMMEs. Some enterprises demonstrated awareness of waste-to-value opportunities and moderate preparedness; however, financial constraints, inadequate infrastructure, insufficient technical skills, fragmented institutional coordination, and environmental constraints restricted practical adoption. Most enterprises remained in a transitional phase between awareness and implementation.

Subtheme 1.1: Differing levels of preparedness to adopt circular economy practices

The participants indicated different degrees of readiness of the SMMEs. While some firms were aware of the potential for waste-to-value conversion and had some degree of preparedness, they were limited by factors such as lack of finance, infrastructure, skills, institutional coordination, and environmental considerations.

> Our enterprise is moderately prepared to adopt CE practices in waste management. We have basic waste collection systems and some recycling initiatives, but comprehensive circular processes, such as material recovery, product redesign, and supplier collaboration, are limited. Staff awareness and technical skills in circular practices need strengthening. Financial and technological resources present challenges, and regulatory guidance is sometimes unclear, slowing adoption. Despite these gaps, there is potential to improve efficiency, reduce operational costs, and create new value streams by better segregating waste, partnering with recycling firms, and integrating sustainable practices into procurement and production processes. Commitment and planning are key to progress (P3).

Participant 9 provided insights into slow municipal improvement but noted the requirement for structured help and training:

> As a municipality, we are making progress, but we are not fully where we need to be yet. Through the LED unit, we engage with communities and small businesses to introduce ideas around recycling and reuse; however, more structured support, training, and coordination with the waste management unit is still needed to fully adopt CE practices (P9).

Participants 2 and 8 described low levels of preparedness:

> I feel that it is not yet prepared to adopt CE practices in waste management because there are still gaps that need to be filled. As mentioned above, local businesses still have limited access to information and training. Our municipalities still lack the practice of Batho Pele principles, and once that is obtained, preparations to adopt such practices can be maintained (P2).
>
> The entrepreneur's readiness to adopt CE practices in waste management is very low; it is limited only to the collection of recyclables and selling to well-developed and sustainable companies. The adoption rates for manufacturing, consumer goods and technology sectors have not started as yet, despite high ambitions; many SMMEs are still in an infant stage (P8).

Participant 10 maintained that many enterprises recognised the value of waste but lacked the licences, technology, and processing capacity required to implement CE practices:

> Local enterprises are highly prepared in terms of identifying value. Most "wastepreneurs" in KZN already understand that waste is a resource. Knowledge of waste streams. Many enterprises are "halfway there" regarding the formal requirements of a CE. Most have basic company registrations (CIPC), but they often lack the Waste Management Licences or Environmental Authorisations required to scale up from collection to actual processing (like pyrolysis or chemical recycling). This is where the biggest gap exists. Adopting a CE isn't just about moving trash; it's about transformation. To be "CE-ready", an enterprise needs more than a bakkie. They need pelletisers,

industrial composters, or glass crushers (P10).

The above statements prove that readiness is still inconsistent because awareness of the potential value of the waste does not necessarily imply capability.

Subtheme 1.2: Constraints affecting readiness

Financial limitations, insufficient infrastructure, and skills deficiencies emerged as critical barriers to SMME preparedness. Participant 1 referred to

> "Under-budgeting and inadequate required expertise; Inadequate cooperation from the local communities and stakeholders; Disjointed collaborative efforts; and Stakeholders" (P1).

Participant 5 identified "Limited resources, financial or infrastructure, lack of awareness or buy-in from stakeholders, inadequate waste segregation or collection systems and limited access to recycling markets or technologies" (P5). Participant 8 described

> "Insufficient local recycling technology and waste management infrastructure limit full functionality, particularly for emerging SMMEs. High upfront investments for new technologies and a shortage of circular skills in the workforce create significant obstacles" (P8).

Participant 3 described financial, infrastructural, regulatory, market, behavioural, and coordination constraints:

> Barriers to implementing sustainable waste management strategies include limited funding for infrastructure, technology, and training, which restricts the capacity to adopt new practices. Skills gaps amongst personnel hinder the efficient implementation of recycling, recovery, and CE initiatives. Inconsistent policies, unclear regulations, and bureaucratic delays create uncertainty. Insufficient collection, sorting, and processing infrastructure limits operational effectiveness. Weak collaboration amongst local government, communities, and private-sector actors impedes coordinated action. Market constraints, such as low demand for recycled materials, challenge business viability. Cultural and behavioural factors, including low community awareness and participation, further impede the adoption of sustainable waste management practices (P3).

Participant 10 talked about capital costs, machinery, maintenance, distance of transport, cost of fuel, and value of some wastes being too low:

> The most immediate hurdle for any SME in the waste sector is the cost of entry versus the volatility of returns: High capital expenditure (CAPEX). Sustainable waste management requires more than just collection; it requires processing. Machines such as plastic pelletisers, glass crushers, or industrial composters are expensive and often require specialised maintenance, which is hard to find in rural areas like Nkandla or Mthonjaneni. Logistics and Fuel Costs: In a sprawling district like KCDM, the cost of transporting heavy, low-

> value waste from remote points to a central processing hub in Richards Bay often exceeds the value of the waste itself (P10).

Nepotism and selective access to information were mentioned by Participant 2 as ethical and administrative constraints:

> The practice of engaging in nepotism and selectively withholding critical information from certain businesses, while providing it to others to expedite their applications, constitutes a serious breach of ethical governance. Such conduct undermines the principles of fairness, transparency, and equal opportunity that are fundamental to responsible administrative decision-making. It not only compromises the integrity of institutional processes but also creates an uneven competitive environment that disadvantages eligible enterprises and erodes stakeholder trust in the organisation's credibility and accountability (P2).

Participant 10 argued that although most organizations understood the importance of waste, they did not have the necessary licenses and technology to incorporate CE into their processes:

> One of the main challenges is the lack of coordination between departments, especially between LED and the waste management unit. We also face challenges such as limited resources, a lack of equipment for SMMEs, and low levels of formalisation amongst community businesses. Many people are already doing waste-related activities, but they are informal and not fully supported (P9).

This shows that constraints like financial, infrastructural, administrative, institutional, market, and skills limit the ability of SMMEs to engage in sustainable waste management activities.

Subtheme 1.3: Awareness and training amongst enterprises

Participants indicated that their knowledge and training on sustainable waste management were low to moderate. Participant 1 reported variation in awareness: "It varies; some of them are fully aware, whereas some are not; hence, we are not rolling out awareness programmes" (P1).

Participant 2 reported few instances of any formal training program on sustainable waste management:

> The level of awareness and training amongst SMMEs in Mthonjaneni Local Municipality regarding sustainable waste management practices appears to be generally low to moderate. While the municipality runs programmes aimed at supporting SMMEs such as the LED SMME Materials Support Programme, which provides equipment and tools to small enterprises, there is no evidence of structured training specifically focused on sustainable waste management, recycling, or circular-economy practices in publicly available municipal notices and reports (P2).

Participants 9 and 6 mentioned poor awareness levels, lack of training, and unfavourable views towards waste:

> The level of awareness is still low. Many SMMEs are involved in waste-related activities, but they lack proper training and understanding of sustainable practices. As the municipality, we try to engage them during community meetings and workshops, but more focused training and awareness programmes are still needed (P9).

Participant 6 explained awareness as

> "Very low; they also need to rid their mentality of the stigma associated with waste" (P6).

Participant 8 maintained that

> "Many SMMEs are aware of the environmental issues and basic 3R practices (Reduce, Reuse, Recycle) but struggle with more advanced concepts like circular economy practices, extended producer responsibility, and life cycle management" (P8).

Participant 10 made a distinction between recognizing the value of waste and the skill necessary to form sustainable industrial businesses:

> In assessing the level of awareness and training amongst SMMEs in the King Cetshwayo District (KCDM), the current landscape can be described as 'High Awareness, Low Technical Mastery'. While most local entrepreneurs understand that waste has value, there is a distinct gap in the formal training required to turn that value into a sustainable industrial business (P10).

Theme 4 suggests that SMMEs are not adequately ready to embrace CE. While awareness is gradually growing, lack of finances, insufficient infrastructure, weak institutional coordination, limited information access, and inadequate technical knowledge hinder implementation. Continuous and comprehensive support is needed for enterprises to be able to move beyond simple recycling to CE operations.

6. Discussion

Readiness of small, medium, and micro enterprises and participation in the circular economy

The quantitative results reveal a very high level of self-declared readiness among SMMEs. Out of the total number of respondents, 93.7% claimed to be somewhat ready, and 81.1% stated their full readiness to participate in waste management initiatives. These are only self-declared results; they do not confirm on their own whether the enterprises had enough resources to participate in such programs in the long term. As for the qualitative results, the participants were quite willing to be engaged in waste management and CE processes, but their operational readiness was constrained due to lack of infrastructure, finances, tech-

nical expertise, and markets. Most of the enterprises operated at the level of collecting materials, rather than recycling, producing goods out of recycled materials, and manufacturing.

It thus becomes clear that the integration of the results reveals a difference between entrepreneurial intention and ability to operate. If one feels ready to operate, he or she must be aware of opportunities present and be willing to engage with them. Sustainable engagement will be dependent on financial, infrastructural, marketing, technical, regulatory, and other factors. Research on South African SMMEs also provides information on factors which have an effect on their resilience, survival, and growth [31]. In terms of recycling enterprises in the Greater Kokstad Municipality, finance, infrastructure, markets, machinery, and institutional support are some of the important aspects of enterprise sustainability [32]. Research on waste management systems also considers infrastructure, governance, participation, and integration of waste activities as requirements for transition to a CE [33].

The difference between perceived readiness and operational readiness means that entrepreneurial intentions are not sufficient for ensuring sustainable involvement in the waste economy. Finance, technical education, infrastructure, institutional guidelines, and market development need to transform willingness into capability on the part of municipalities and other institutions. The results presented here are consistent with CE theory because circular economy transitions rely on infrastructure, technical expertise, market organization, and institutional involvement. In addition, these results are consistent with triple bottom line theory, because business sustainability depends on economic, environmental, and social performance. The difference between the quantitative and qualitative results means that readiness does not guarantee participation in CE activities.

7. Recommendations

These findings suggest that there is a need for improvement in the role played by SMMEs in the waste economy in terms of capacity building, finance, and institutional coordination. Training should be offered in municipal, educational institutions, and private organizations that will cover areas such as technical skills, management, finance, regulations, operations, and circular economy competencies. The government and development partners should make available financial tools such as grants, low-interest loans, equipment financing, incubators, procurement, and innovations in recycling. Furthermore, municipalities should coordinate themselves better within the various institutions including the private sector, NGO's, education, and communities.

8. Conclusion

The study concludes that the SMMEs operating within the KCDM have awareness of the economic benefits associated with the practice of waste management but lack the conditions necessary to put this awareness into practice in terms of the

Circular Economy. Improvements in financing, infrastructure, expertise, access to markets, and coordination will be necessary in order to improve the conditions under which the SMMEs can operate.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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