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Review

The Escalation of Informal Settlement and the High Levels of Illegal Dumping Post-Apartheid: Systematic Review

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Abstract: Illegal disposal of solid waste is a significant issue in many parts of the world, particularly in urban areas. Because of unprecedented urbanization, these areas are crowded, putting pressure on the already inadequate municipal services such as waste management. As municipalities fail to provide adequate and effective waste management services, the expansion and proliferation of informal settlements contribute to the problem of illegal dumping. Apartheid spatial planning produced environmentally unsustainable cities characterized by glaring disparities in municipal resource allocation, disturbingly inefficient transportation systems, and widespread urban insecurity. Therefore, this study examines how the expansion of informal settlement at an unprecedented rate contributes to illegal dumping post-apartheid by conducting a systematic review. Using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines, a literature search from 1994 to 2023 was conducted in the field of waste management. The review focuses on three key aspects: (1) factors that contribute to illegal dumping in townships; (2) waste management laws during apartheid and post apartheid; and (3) waste collection system in townships and spatial planning. South Africa's inequality is a major contributor to environmental degradation. The situation was exacerbated by efforts to prevent urban migration and forcefully remove black people from cities; apartheid ideology justified the dormitory-like nature of urban townships. In the South African context, the literature reveals that there is a research gap in the application of technologies and effective waste management plans to keep up with the growing number of informal settlements. Furthermore, despite progressive environmental policies, implementation has been ineffective. This study offers valuable evidence on the spatial and temporal dynamics of informal settlements, addressing both the location and time aspects. A robust government-led Community Participation in Solid Waste Management program is required immediately.

Keywords: collection system; poor service delivery; waste generation; waste management; inequalities

Citation: Grangxabe, X.S.; Maphanga, T.; Madonsela, B.S.; Gqomfa, B.; Phungela, T.T.; Malakane, K.C.; Thamaga, K.H.; Angwenyi, D. The Escalation of Informal Settlement and the High Levels of Illegal Dumping Post-Apartheid: Systematic Review. *Challenges* **2023**, *14*, 38. https://doi.org/10.3390/challe14030038

Academic Editor: Susan Prescott

Received: 8 August 2023
Revised: 7 September 2023
Accepted: 8 September 2023
Published: 11 September 2023

1. Introduction

Urbanization in developing-world cities has accelerated significantly over the last 50 years [1]. Urbanization in the developing world causes the expansion of existing slums as well as the formation of new ones. During the 1990s, the urban population in low-income countries increased by one-third [2,3]. Moreover, informal settlements in developing nations such as Algeria, Uganda, and South Africa are not immune to the proliferation of illegal waste disposal near access roads and pathways [4–7]. Illegal dumping occurs

for a variety of reasons, but one of the primary causes is population growth coupled with an increase in informal settlements, which results in a rapid expansion of settlements [8]. Consequently, a large influx of people into cities results in inadequate and unaffordable housing; migrants are forced to build and reside in informal settlements on vacant land without access to basic services [9]. It is for this reason that rapid population growth and economic expansion have posed significant challenges to the waste management system, especially in developing nations [10,11]. Niyobuhungiro and Schenck [12] report that the majority of pollution in developing countries is a result of inadequate waste management systems and the proliferation of informal settlements. According to Chaudhary et al. [13], this is due to the fact that in developing countries, waste management systems do not keep up with the changes in societal consumption patterns (lifestyle change) and infrastructure development.

Population growth and living standards increase waste generation, with low-income countries expected to generate over three times more waste by 2050 and five times more by 2025 [14,15]. In the African context, the literature indicates that urban governments in many African countries are facing severe problems with the management of solid waste [16]. The sporadic and rapid growth of urbanization in Africa has led to environmental issues that include illegal waste dumping in the informal settlements of the urban areas. These issues have been reported in other developing countries such as Venezuela, whereby Cook [17] stated that the informal squatter settlement, also known as spontaneous settlement, is juxtaposed with formal housing delivery systems, highlighting its significant role in addressing inadequate basic services within impoverished communities. Hence, the literature has shown a correlation between communities of high unemployment and illegal dumping [18]. Subsequently, in these areas, illegal dumping also decreases the aesthetic value of the land. Illegal dumping occurs for many different reasons depending on the geographic area, socioeconomic status, infrastructural development, and perception, just to name a few. Pellow [19] recognizes illegal waste dumping as a global phenomenon. In some parts of the world, illegal dumping of waste occurs despite the government rendering waste management services as per the legal framework of sustainable development goals.

South Africa is no exception to these issues of illegal dumping which are attributed to rapid urbanization and the increase in informal settlements around cities. But what is unique is that three hundred years of colonialism have resulted in widespread poverty and inequality which still exist to date. By separating people from their land and confining them to marginally productive "homelands", apartheid [7] as the final wave of successive colonial segregationist and land-grabbing policies impoverished millions of rural people and precipitated a major ecological crisis [20]. Apartheid spatial planning generated environmentally unsustainable cities with glaring disparities in municipal resource allocation [21], disturbingly inefficient transportation systems, and widespread urban insecurity [22]. Consequently, the majority of urban poor and low-income households continue to reside in apartheid-era dense urban peripheral settlements. With the demise of the legal framework that supported the apartheid state, numerous non-white South Africans were able to relocate to previously white-only employment areas. It highlights poverty as a significant factor in environmental degradation in South Africa. The 'cultural effervescence' that accompanied South Africa's transition to a new democracy was sparked by several significant environmental issues, including the importation [10] and disposal of toxic waste, air and water pollution, the negative effects of mining on the environment and human health, and calls for land restitution and redistribution [23].

The emergence of an environmental movement in post-apartheid South Africa required redefining the environment, articulating the discourse of social [24,25] and environmental justice, and developing a rights-based understanding of democracy [26,27]. Beginning in the 1990s, an alternative environmentalism has emerged in South Africa [28,29]. It emphasises the importance of linking the struggle against social injustice and the exploitation of people with the struggle against environmental abuse by drawing on the ideologies of 'environmental justice' and green policies [30,31]. Prior to the 1990s, the prevailing view

of environmental issues in South Africa was an authoritarian conservation viewpoint [16]. The South African government has adopted rendering waste management services as a reactive mechanism to counter present and foreseeable improper waste management issues [31]. However, despite the adoption and application of these waste management services; the current government is still confronted with significant environmental management issues of illegal dumping, especially in the urban areas. Research has discovered that waste management solutions adopted from well-developed countries are often not suitable for developing countries [32–34]. Therefore, the issue of illegal dumping in developing countries has been prevalent for decades despite adopting waste management services. According to research by K'akumu and Olima [35], Baloy et al. [36], and Wickes [37], apartheid laws were implemented to impose spatial segregation, policies for the management of white municipalities, and restrictions on the inflow of black people to reduce the financial burden borne by prosperous white municipalities of maintaining black areas that were disadvantaged.

In order to curb illegal dumping, it is necessary to comprehend the patterns and trends of indiscriminate illegal waste dumping. Glanville and Chang [28] suggest that understanding the complex distribution patterns of illegally disposed waste and the range of economic, environmental, and social factors influencing this occurrence is of paramount importance in trying to address this issue. This is attributable in part to the geographical challenges of servicing low-income communities, where road access can be limited, settlement density is high with poor spatial planning and layout, and illegal land tenure complicates or prohibits the delivery of waste collection services [38,39]. Numerous African nations are currently grappling with the predicament of inadequate waste collection services, primarily impacting the waste management system in informal settlements [40–42]. The presence of this phenomenon can be observed in townships and rural regions, where the incineration of waste is a prevalent approach employed to mitigate the volume of waste produced. The aforementioned outcomes arise due to the absence of waste collection services being provided. The majority of solid waste produced in informal settlements remains uncollected, accumulating in significant quantities along roadsides and open areas due to the absence of waste management services [43]. The disparity in service delivery between regions is another factor contributing to the problem. Kallel et al. [44] and Jimoh et al. [45] have shown that irregular collection of waste in informal settlements causes environmental problems in the long term. Waste management is crucial for sustainable environmental control, with Agenda 21 stating that inadequate handling can have immediate and enduring consequences for the environment and human well-being. However, developing nations' responses to these hazards remain contradictory. An enhanced understanding of informal development may, therefore, be a key to future success in its effective management. This article paper examines how the mushrooming of informal settlement at an unprecedented rate contributes to illegal dumping post apartheid.

2. Research Methodology

2.1. Search Strategy

Post-apartheid informal settlements and high levels of illegal dumping were the subject of a systematic review conducted for the purpose of gaining a comprehensive understanding of the concept. This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting checklist [46]. Plan, identify, and evaluate studies to extract and synthesize data from the literature [47], ensuring the objectivity, transparency, and reliability of research. PRISMA assisted in the selection of the relevant literature and report for this systematic review. For the purpose of this study, a total of 104 review articles were examined. Using the global databases, the authors were able to identify potentially pertinent records. As depicted in Figure 1, a data set was recognized, and the database search yielded 104 records. The authors selected to utilize four distinct databases, including Semantic Scholar (11), Google Scholar (61), Sage (10), and Scopus (22). Using the reference manager software EndNote 21, the data

were stratified and analysed during data processing. EndNote 21 assisted in removing duplicates, labelling, and grouping the papers according to their subgroups. During the duplicating process, five records were removed prior to screening, and one duplicate was manually removed from the five duplicates.

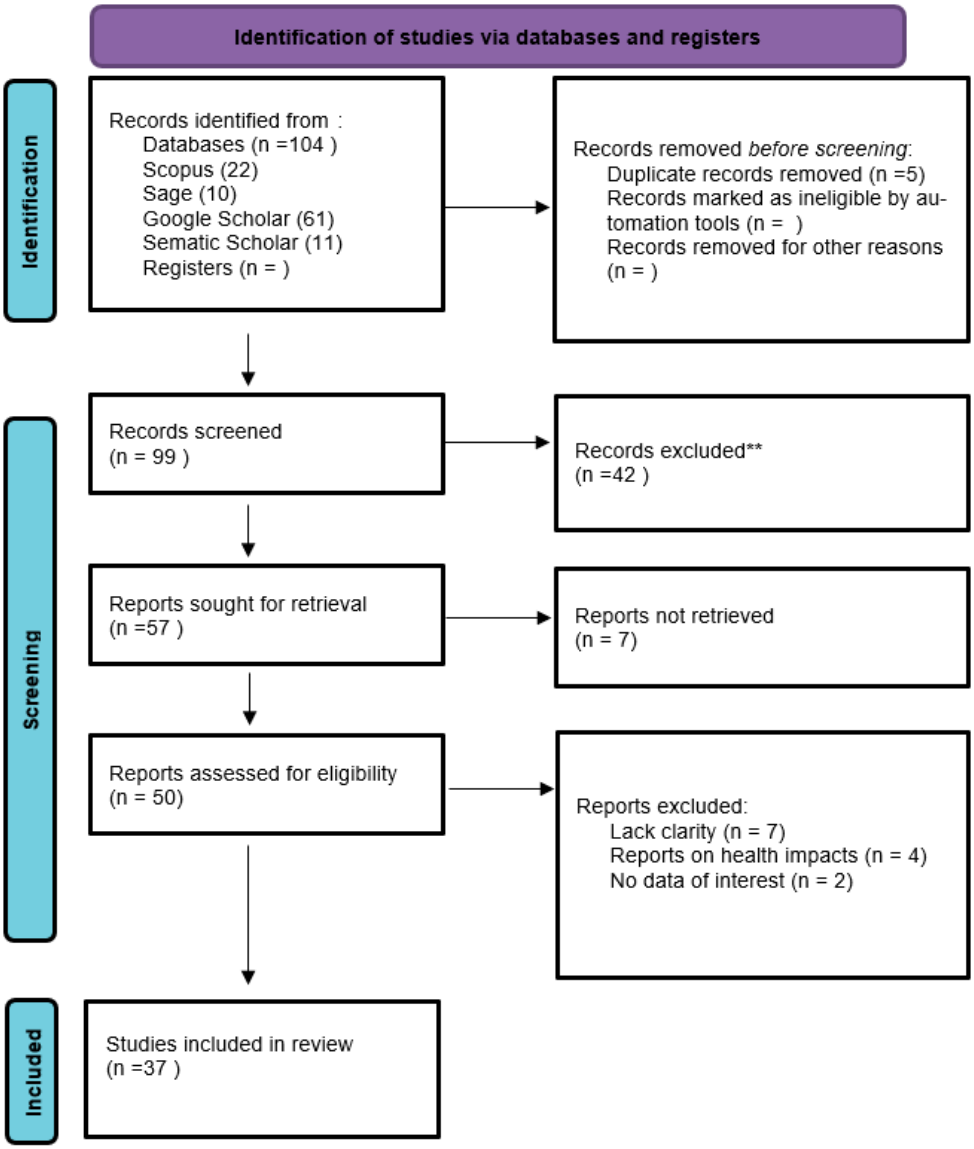

Figure 1. Demonstrates the procedure for selecting studies from the four largest databases. This procedure adheres to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines [48].

2.2. Data Extraction and Selection of Studies

Despite containing the keywords in their titles and/or abstracts, 42 records were excluded during the screening process because they were irrelevant to the study and lacked relevant data. Two authors of this review performed relevance checking, which consisted of reading the titles and abstracts; disagreements were resolved by consulting the third author for accuracy checking. Data extraction from the included studies was performed by two reviewers at the full-text reading stage, following the exclusion of irrelevant studies; the full report of publications considered eligible for inclusion by either author was obtained and independently assessed, and as a result, 50 studies were retrieved and assessed for eligibility reports, while 7 were excluded because full papers could not

be retrieved. Finally, 50 publications were included in the analysis, and the full texts of the remaining 50 reviews were carefully screened, resulting in the exclusion of 13 reviews that did not meet the eligibility criteria for a variety of reasons, including a lack of relevant data, poor quality, or being outside the scope of the research. While the current study anticipated that there would be studies outside these search terms that may reveal pertinent information about illegal dumping and informal settlement, the usage of specific search terms such as "illegal dumping of waste" without making mention of "informal settlement" was carefully eliminated as a means of a control procedure. This exercise was undertaken to maximise the quality outcome of the review.

3. An Overview of the South African Township Population

Townships are congested neighbourhoods in or around urban areas, particularly in South Africa [49]. To understand why illegal dumping occurs and/or why waste management services may be challenged in these areas, it is important to consider the estimated and actual population size of townships. The number of townships in South Africa has experienced a substantial increase, reaching an estimated total of 532, as compared to the previous count of 76 major townships. These townships are home to approximately one-quarter of the country's population, as reported by Chaudhary et al. [13]. While studies by Ferronato and Torretta [50] suggest that half of the South African population lives in townships, market researchers are increasingly attempting to comprehend the changes in living conditions. The World Bank [15] estimates that up to 50% of South Africa's urban population resides in townships and informal settlements, which house 38% of the country's working-age population but nearly 60% of it is unemployed. Yet, compared to what statistics South Africa reported, the population density is significantly higher. According to a study by Zweig [49], it is typical for South African households living in formal low-cost houses to permit backyard residents on their property in order to make money [49]. The implication is that, although Stats SA [51] reported that there are 3.3 people in each household on average, this number excludes those who live in their backyards, and suggests the actual number of residents is much higher.

There are a high number of individuals living in shacks and 28% of shack family units experience congestion [12], whereas a household is considered overcrowded if there are more than two people per room. Despite being connected to the prevalence of indiscriminate dumping in areas that are socially disorganized, communities that are socially disorganized have substantial inequality, socioeconomic hardship, deteriorating public order, and criminality [37]. According to research, townships' ineffective and inefficient waste management is a result of a lack of adequate rubbish removal services [24], inadequate facilities [21], and a lack of law enforcement or punitive measures. The limitation of access to property ownership, education, and some necessary services caused the afflicted groups to feel unworthy [52].

STATSSA Community Survey 2007 released statistics giving the number of households in informal settlements for different provinces [53]. Since the last survey, South African cities have been growing which is exacerbated by rural-to-urban migration which leads to an overall urban population growth, particularly in provinces with more employment opportunities (see Table 1). These marginal shacks house the majority of the South African vulnerable population. As seen in Table 1, there are 452,581 informal households (shacks) in Gauteng and 51% of the Gauteng entire population relies on the municipality to collect their refuse. However, a more recent report stated that there are approximately 867,147 shacks in the Gauteng province [54].

Table 1. The number of shacks by province and refuse collection for all residents in each province. Source: [53].

Provinces	Number of Households in Shacks	Refuse Collected by Municipality	References
KwaZulu-Natal	140,961	65%	Adeniran and Shakantu [6]
Limpopo	44,099	12%	Sethunya and Mlambo [10]
Western Cape	110,062	76%	Niyobuhungiro and Chenck [12]
South Africa	1,214,236	51%	Chaudhary et al. [13]
Mpumalanga	86,261	37%	Todes and Turok [22]
North West	146,143	56%	Zweig et al. [49]
Free State	108,906	64%	Schenck et al. [55]
Eastern Cape	101,702	41%	Mngomezulu and Mbanga [56]
Gauteng	452,581	51%	Kubanza and Simatele [57]
Northern Cape	23,521	38%	Viljoen et al. [58]

4. Impact of Overpopulated Townships on Waste Management Strategies

Municipal solid waste (MSW) management is a significant environmental issue in emerging nations; in South Africa's expanding townships and cities, this issue is particularly visible [38]. Improper management is linked to a variety of issues, including risks to residents that harm the environment and public health. In South African townships, trash is disposed of carelessly while most locals are unaware of or unconcerned with the negative repercussions on the environment and human health [55]. Due to an overpopulation of informal settlements, illegal dumpsites are increasing in size and number with time. The vast issues left behind by the apartheid ideology were difficult for the newly democratically elected government to comprehend, according to various studies [7,59]. The magnitude of wasteful urban sprawl has become obvious as a result of the range of informal, unplanned developments that have occurred in cities due to local councils' incapacity or unwillingness to manage [26]. Additionally, due to the subpar level of waste management in these unofficial township communities, trash mismanagement has become pervasive in these places and is visible in the majority of townships in South Africa.

According to the 2009 South African General Household Survey [60], there were fewer freestanding shacks and more houses built about 1940. However, a shift was observed around 1990. In 1994, it was predicted that at least 150,000 new households, or slightly more than half a million people annually, would live in unofficial housing every year [61]. In the post-apartheid era, strategic spatial planning has made an effort to encourage more compact and integrated cities as well as to address historical patterns of inequality.

5. Waste Management Laws during Apartheid and Post-Apartheid

Significant changes have been observed in waste management in South Africa following the conclusion of apartheid. Before 1994, local towns were generally responsible for waste management, and there was minimal national legislation as indicated in Table 2. Thus, many communities lacked the resources or capacity to effectively manage waste, resulting in significant environmental contamination and public health problems [62]. In the post-apartheid era, the government of South Africa realized the need for a more organized and sustainable waste management strategy [63]. The National Environmental Management Act of 1998 provided a legislative framework for waste management, which included the establishment of a National Waste Management Plan to guide national, provincial, and local policy and planning. One of the primary objectives of this policy was to promote the polluter pays principle, which holds those who generate waste accountable for its appropriate management and disposal [64]. This has resulted in the development of numerous pieces of legislation and incentives to promote waste reduction, recycling, and appropriate disposal, such as waste management incentives and recycling goals [65]. Furthermore, legislation and other measures are introduced to ensure that the environment is conserved and protected for future generations and that the present generation lives

in a clean [66] and healthy environment (sustainable development) [39]. This is evidence that waste management in South Africa post apartheid has been governed by means of a number of pieces of legislation, including those mentioned in Table 2 but not limited to. Therefore, in recent times, in contrast to the apartheid era, it is stated that waste management in South Africa has been well coordinated, although funding remains a challenge due to the stagnant economy and lack of political appetite in some instances [10]. This has subsequently resulted in key issues, including inadequate waste collection services for a large portion of the population, illegal dumping, and unlicensed waste management activities.

Table 2. Pieces of legislation guiding the South African waste industry.

Legislation Acts List	
Environmental Conservation Act 73 of 1989	Intended to provide for the effective protection and controlled utilization of the environment and matters incidental thereto.
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National Water Act 36 of 1998	To provide for fundamental reform of the law relating to water resources, to repeal certain laws, and to provide for matters connected therewith.
National Environmental Management: Waste Act 59 of 2008	Reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation.
Air Quality Act 39 of 2004	This act regulates air quality and provides measures for the prevention of pollution and ecological degradation.
National Waste Management Strategy	A legislative requirement of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), the "Waste Act". The purpose of the NWMS is to achieve the objectives of the Waste Act. Organs of the state and affected persons are obliged to give effect to the NWMS.

6. Areas That Are Considered to Be Hotspots of Illegal Dumping

Illegal dumping and waste management is a challenge in most municipalities in South Africa. Illegal dumping has become an unavoidable consequence of lifestyles and daily living. Regardless of the high occurrence and the significance of risks associated with illegal dumping, most countries do not have proper illegal dumping prevention plans [67] and South Africa is no exception to this issue. Furthermore, an increase in overall waste production in an informal settlement is proportional to the increase in illegal dumping of waste, which results in an increasing number of illegal dumping spots. Therefore, according to Pellow [19], it is not easy to stop illegal dumping on a spot after it has occurred, especially if the spot or area is not effectively monitored because it can easily attract more dumping of waste. It has been identified that the lack of a well-planned and regulated waste management system in townships is a key driver of dumping waste illegally [21]. A Freetown informal settlement was identified that community bylaws against illegal dumping are in place but fail to be enforced because waste is dumped mostly at night and there is no one default hotspot used.

However, Polasi [67] highlighted that the challenges of waste management in the City of Johannesburg have been caused by a lack of regular waste removal which is the main driver of the occurrence of dumped waste in open spaces. According to Naidoo [68], the national solid waste legislation policies and strategies do not complement local government practices and procedures, which leads to a lack of efficiency and challenges to sustainable solid waste disposal. It was found that in Ethekwini, the community believes that once they voted for a party, the winning party is obligated to provide and monitor everything,

even collecting the rubbish that is illegally dumped [25]. This has become a challenge, particularly in informal settlements, where environmental problems arise from household solid waste management [69]. Waste problems normally originate from uncollected waste at the household level. Furthermore, the ever-increasing human population is becoming a huge problem in the world, as the increase in population means an increase in consumption, which equates to a high generation of solid waste, especially in developing countries where the economy is emerging.

Evidence of this is largely seen in townships and rural areas where the burning of waste is a method used to reduce waste being generated, since the collection of waste services is not rendered as expected, and such a practice produces greenhouse gases that cause air pollution [40–42]. Most of the solid waste generated in the informal settlements is left uncollected in large heaps along the road and in open spaces since there is a lack of waste management services [43]. This uncollected waste normally gets scattered all over the place and this waste finds itself in water bodies and grazing lands, just to name a few. For example, the KwaZulu-Natal province has been hit by floods recently; this flood swept the illegally dumped waste and uncollected waste to the coastal shore and riverbanks like a thick blanket, suffocating the marine life [70]. It is therefore important that waste is collected from all rural communities as efficiently as possible and disposed of in controlled disposal facilities. South Africa faces many challenges in the waste management sector especially at the municipal level, whereby personnel taking charge of the waste are not trained for that skill [71–73]. Also, inadequate waste management knowledge among the community members contributes to the already existing problem. The illegal disposal of waste affects waste management and the environment in terms of health risks, visual impact, and odours, among other factors.

7. Discussion

7.1. Spatial Distribution and Waste Collection Constraints in the Townships

For the majority of South Africa's population, legislation from the apartheid era led to insecure land rights and a housing shortage. Beginning with the removal of individual land ownership rights for black Africans, spatial segregation policies progressed to prevent black, coloured (mixed race), and Indian/Asian South Africans from living in well-located areas (which were exclusively reserved for white South Africans [63]. On the outskirts of cities, the majority of South Africa's population resided in black-only townships. The failure of the apartheid state to invest in the development of housing and municipal services in these townships led to unprecedented housing shortages, overcrowding, and the emergence of informal settlements trend shown in Figure 2. The post-apartheid state has yet to address the legacy of apartheid spatial planning, despite constitutionally mandated land reform measures. Black South Africans are disproportionately confined to urban outskirts in dense and poorly serviced settlements, have very low home-ownership rates, and sometimes reside in peri-urban areas that make no sense outside of the apartheid context; this is illustrated in Figure 2. In 2011, between 1.1 and 1.4 million households, or between 2.9 and 3.6 million people, were residing in informal settlements in South Africa, according to conservative estimates (See Figure 2). Given the instability of tenure in informal settlements and the transient nature of residence in these areas, the actual number is likely to be significantly higher [74].

These issues are particularly pressing in informal settlements and inner-city "slum" structures. Due to a severe lack of affordable housing, many poor and low-income households have been forced to live in South Africa's expanding informal settlements [62]. The National Housing Code of South Africa defines informal settlements by the following characteristics: illegality and informality; inappropriate locations; limited public and private sector investment; poverty and vulnerability; and social stress [39,75]. Due to segregation, a lack of social services, such as waste collection, has made the residents of these areas more susceptible to illegal dumping [74]. Numerous negative environmental and social consequences have resulted from this illegal dumping. The national policy for the provision

of basic refuse removal services to indigent households, which is typically found in low-income communities, requires municipalities to provide weekly refuse collection services to households, even if they cannot afford the service (shown in Table 2). However, due to the issue of overpopulation, service delivery frequently falls short of the community's requirements; this was because many people started migrating to urban areas to access opportunities that they never had (shown in Table 1). The township, which contains a mixture of informal and formal settlements and has a population of approximately 350,000, has become a dumping ground for surrounding businesses over the years [26]. For example, the population size of Alexandra township in Gauteng is diversely reported. The 2011 census revealed that 180,000 people occupied an area of 6.8 km^2 with a population density of approximately 26,000 per km^2. Comparatively, Sandton, which is adjacent to Alexandra township, was found by the same study to be home to approximately 220,000 people on a land area of approximately 144 km^2, or approximately 1500 people per km^2 [39,76,77]. One person in Sandton occupies the same amount of space as seventeen people in Alexandra township. The systems and stereotypes that are perpetually reproduced and maintained in township overcrowding exist only at the apex of the apartheid social and political order.

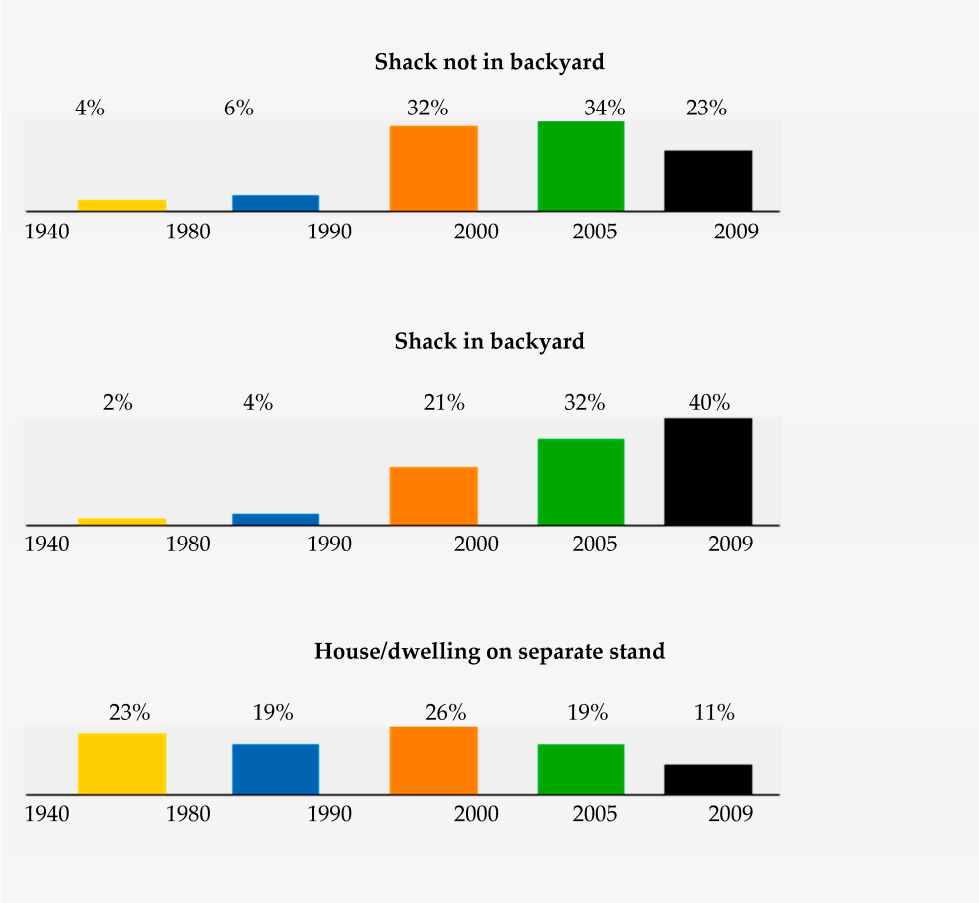

Figure 2. Changes in dwelling from 1940–2009 (Source: [59]).

7.2. Challenges Faced by Municipalities in the Rendering of Waste Collection Services in Townships

Municipalities in South Africa are confronted with numerous obstacles that impede their capacity to implement new legally compliant solid waste management techniques that are compatible with policy objectives [78]. These municipal challenges in South Africa include a growing population, increased consumerism, and urbanization, which has led to an increase in solid waste production (trends shown in Figure 2). These obstacles strain the system's capacity to collect, treat, and dispose of solid waste (Table 1). In informal

settlements, solid waste problems are exacerbated by the death of basic facilities and services, particularly the absence of adequate roads and housing [16]. Informal settlements are densely populated neighbourhoods comprising communities residing in self-built shacks under traditional or informal land tenure and houses constructed without proper planning [2]. Waste management practices in informal settlements are diverse, rigorous, and unique. The strategy for waste disposal in such communities is a complex aspect of waste disposal management. In particular, when it comes to the delivery of services, for nearly 15 years, from 1980 to 1995, cities were left to grow, invade, and develop without much direction or purpose [79]. It draws attention to the belief that communities lacking in social cohesion and cooperation are to blame for littering. This belief is perceived as a reaction to and a representation of the corrupt and callous government's failure to provide enough services and care. Apartheid left an irreparable effect on the majority of South Africans, who were trained to rebel against the state; as a result, minor offences like littering and dumping have persisted into the democratic era despite the country's democratic transition. According to Schenck et al. [55] and Chaudhary et al. [13], the transition from the apartheid era did not adequately address the people's engrained behavioural patterns. The cooperative governance department presented the State of Local Government Report (SLG) to parliament in August 2021. The report indicates that 64 out of 257 municipalities are dysfunctional. The correlation between governance and political oversight failures is one of the primary factors underlying the increase in dysfunctional municipalities. If the government of South Africa is to reverse the trend of dysfunction in the public service, particularly at the local level, a radical shift toward habits that foster a culture of care and interdependence is required.

In the past, waste management in South Africa was disorganized and underfunded. According to Nahman and Godfrey [80], key issues include insufficient waste collection services for a large portion of the population, illegal dumping, unlicensed waste management activities (including unpermitted disposal facilities), lack of airspace at permitted landfills, insufficient waste minimisation and recycling initiatives, lack of waste information, lack of legislation regulation and enforcement, and, indeed, limited waste-related legislation in the first place. Local governments are responsible for implementing waste removal, storage, transportation, and disposal services [81,82]. South Africa's national waste collection standards acknowledge varying levels of service delivery based on the practicability and cost-effectiveness of a given geographic region. This is partly due to the geographical challenges of servicing low-income communities, where road access can be limited, settlement density is high with poor spatial planning and layout, and illegal land tenure complicates or prohibits the delivery of waste collection services [82]. The disparity in service delivery between regions is another factor. Due to the possibility of bin theft, some households elect not to place their municipally supplied bin out for collection [83]. They resort to illegal dumping despite having access to regular collection services from the municipality.

According to the literature search, a variety of informal, unplanned elements developed in townships as a result of a lack of compliance and enforcement capacity. Sometimes this was because local councils were unable or unwilling to govern, which resulted in an excessive population and a high demand for services. Since 1994, the South African government has been under tremendous pressure to provide its population, particularly at the local level, with appropriate housing, basic services, infrastructure, jobs, and a clean, well-maintained environment [31]. According to research, the apartheid regulations were intended to reduce the financial burden placed on rich white towns to maintain underprivileged black regions [74]. As a result, the new administration had difficulty providing services to all citizens. Yet, South Africa and its neighbouring nations, like Namibia, continue to face a severe issue with the delivery of services in low-income communities [13,24]. Particularly in South Africa, the history of the country has left the informal areas with narrow streets and the majority of low-income households frequently allowing backyard squatters to live on their property to generate income. As a result, there is more waste

produced because the municipal wheelie bin cannot hold as much waste as more than three households on one plot, which forces people to dump in public areas.

According to the Waste Management Act of 2008, the Government of South Africa's strategy for waste management involves building capacity and launching national awareness-raising initiatives to encourage waste recycling in all urban and rural settlements across the entire nation. Nevertheless, the proliferation of rules and laws has actually made it more difficult to execute recycling because the industry is now so tightly regulated that new laws with stringent standards must be passed before the recycling economy can expand. The rules' emphasis on preventing pollution rather than reducing it and how trash should be managed is one of the gaps found [16]. The lack of sufficient funding for informal recycling enterprises and social exclusion causes a backlog in infrastructure development, and waste management in the townships is given low priority. Mbambo and Agbola [84] see a core issue as the absence of waste awareness combined with the invisible importance assigned to waste management as a municipality function. South Africa uses the paradigm of integrated pollution and waste management policy modernization for post-apartheid environmental governance. Currently, South Africa is rapidly facing population expansion, due to increased migration from neighbouring countries, and expansion in economic growth. This population expansion has led to an increased amount of waste being produced therein and around most urban areas, especially in informal settlements [6,52]). In addition to overpopulation in most informal settlements, inadequate municipal solid waste (MSW) management services and a lack of adequate enforcement policies of policies and regulatory frameworks are significant issues that have led to the encouraged illegal dumping of waste in most developing countries.

8. Conclusions

Multiple studies have identified indiscriminate dumping as a serious environmental problem and emphasised its prevalence. Nonetheless, research into the causes of littering in South African townships revealed that the country's historical position has had a significant influence on contemporary attitudes toward littering, dumping, and problematic urban structures. It was discovered that the influx of people from other provinces into the metropolitan area had a significant impact on the amount of garbage produced. Despite the fact that the municipality is required by law to remove waste, it has been demonstrated that numerous stakeholders play a crucial role in ensuring the efficacy of the current waste management systems. Local governments, corporations, and other organizations must commit immediately. Ineffective and unreliable waste collection services contribute to environmental pollution caused by waste practices such as burying, burning, or dumping waste near residential areas. Illegal dumping is particularly pervasive in developing nations. While descriptive studies on illegal dumping are plentiful, few investigate the actual dynamics of household illegal waste dumping using large-scale spatial-temporal data and innovative analytic tools. This is because of the limited availability and high demand for land. Local waste collectors should, therefore, be involved in the search for innovative solutions to this issue, such as the formation of clubs that collect recyclable waste in each region. In addition, organizations should educate the broader community about illegal waste dumping through meetings and workshops, with a focus on the negative effects of waste on the environment and the zero-waste initiative, which teaches people to avoid producing waste entirely and to reuse and recycle instead. Funding will be required to ensure that this information reaches every community. Even if bylaws have been enacted to address issues such as litter, dumping, and problematic buildings, the municipality must continue to adequately enforce them. It is necessary to develop and implement strategies for managing consequences. This will send a clear message to those who disobey the regulations. The government should always make clear to residents that illegal dumping is prohibited and that there are consequences for violators. Residents must also be aware that they cannot dispose of debris from construction projects on their property. Every open

space in the townships has been turned into a dump. To ensure practical implementation, the municipality must also assess the bylaw penalties.

Author Contributions: Conceptualization, X.S.G., T.M. and B.S.M.; methodology, X.S.G., B.G. and T.T.P.; software and data curation, B.G., K.C.M. and K.H.T.; writing—original draft preparation, X.S.G. and T.M.; writing—review and editing, K.C.M., K.H.T., D.A. and T.T.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: This paper does not contain any studies involving human participants or animals performed by any of the authors.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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