

Plastic waste management in South Africa

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Abstract

The presence of unwanted waste can constitute a threat on a global scale. This is because waste negatively affects human health, wildlife, marine ecosystems and the environment. Plastic wastes pose serious problem to the environment. This burden is evident in South Africa due to lack of plastic waste solutions as about 10% get recycled. From reliable studies, up to 34.1% of South Africans are subject to open burning, illegal dumping and picking in order to sell plastics to buy back centres. Picking boost the income for poorer communities. The rapidly increasing population has underscore the need for municipalities to provide effective waste management in growing communities. Apart from the increasing need for effective waste management, limited government interventions and legislations can limit waste management. This paper attempts to review the current state of both private and public waste management practices in South Africa. This highlights the current initiatives and methods of waste management as well as the gaps in each initiative. The study use literature review and case study approach to analyse the major issues and the effect of growing population on the subsisting waste management system. The results highlight suggestions that promises significant benefits in transforming and improving the existing management practices.

Keywords: Plastic waste, environment, management practice, improvement

1. Introduction

Plastic wastes are undesirable materials of plastic origin found within the natural environment. The presence of these unwanted materials negatively affects human health and wildlife, these dangers are attributed mostly to plastic waste (City of Westminster, 2020). The presence of plastic waste is a global

issue. This includes the continuous struggle of plastic pollution that South Africa (SA) has been fighting (O'Brien & Thondhlana, 2019). This is also evident in the 8 billion plastics bags consumed in the country yearly- an average of 30kg to 50kg of plastics used per person each year (Muller, 2019). South Africa has witnessed considerable economic growth in recent times (O'Brien & Thondhlana, 2019). Jambeck, et al. (2018) opine that countries with rapid growing economies battles to keep up with the increasing need for waste management. The growth in the use of plastics in SA can be attributed to; population growth, economic development, season change, lifestyle and consumption patterns (Ayeleru, et al., 2018). Plastic materials have become attractive to the consumer due to its characteristics such as; its durability, lightweight material, low cost and its strength (Babayemi, et al., 2019). Plastic pollution in South Africa has been found to be more troublesome in the Ocean, rivers as well as other marine eco systems (Rensburg, et al., 2020; Ayeleru, et al., 2020; Witteveen, et al., 2017). The presence of plastic waste in marine eco systems can be attributed to a lack of infrastructure required to limit pollution (Jambeck, et al., 2018). The Recycling industry in South Africa is led mostly by informal activities such as, pickers who collect plastics from trash (Rensburg, et al., 2020). Other recycling facilities include buy back centres which target low income groups, this allows the pickers as well as community members to sell their recyclable materials to these centres (Friedrich & Trois, 2016). Other stakeholders that take part in driving plastic recycling include; municipalities as well as private organizations (Oyekale, 2018). This is accompanied by other waste management practices such as; illegal dumping, unlicensed waste management activities, landfill, open burning and incineration (Adenuga, et al., 2020; Nahmana & Godfrey, 2010).

The global issue of plastic waste has created pressure on countries to implement more efficient plastic waste management practices, this in light of the exponential growth of the worlds population (Ayeleru, et al., 2018). In order to reduce the impacts of these plastics, in 2003 the South African government introduced a levy on plastic bags purchased in stores (O'Brien & Thondhlana, 2019). However the introduction of the levy was found uncessfull in decreasing pollution (Rensburg, et al., 2020). The first African country to implement this levy was Mauritiana which was followed by Botswana, both initiative were found to be a succes (O'Brien & Thondhlana, 2019; Jambeck, et al., 2018). The failure in the South African governments ability to effectively deal with the plastic pollution issues could be due to, a lack of skills in waste management and a lack of waste management facilities (Ayeleru, et al., 2020). The SA population has grown unprecedentedly in the past decade, thereby impacting the country's waste production and waste management (Simatele, et al., 2017). Ayeleru et al. (2018) posits that the issue of plastic waste can be alleviated through recycling and using the recycled plastics as raw materials. Further contribution have been made by Nahmana and Godfrey (2010). The authors maintain that enabling environment ought to be created in communities in order to improve plastic waste management. This includes infrastructure as well as creating awareness (Nahmana & Godfrey, 2010). Research has indicated that South Africa has a growing plastic recycling industry (Plastics SA, 2019). Plastic recycling can be divided into primary recycling, secondary recycling (also known as mechanical recycling), tertiary recycling and quaternary recycling (Kumara et al., 2011). South Africa is among the biggest mechanical recyclers in the world according to a study conducted by Plastics SA, (2019). The increasing population, increasing consumption of plastics, growing economy as well as inadequate waste management facilities at a national level highlights the need for a focus on developing an effective waste management system most especially for plastics.

Only few detailed studies on the plastic waste management practices in South Africa have been conducted. Therefore, this study aims to add to the ongoing conversation by identifying probable gaps through a careful literature review and case study process and making suiting suggestions to up the ante. A field study was conducted at company "Z" which is an independent, private recycling organization. This organization sources plastic waste from larger organizations and processes the plastics through secondary recycling. Upon recycling completion, it is sold back to clients as raw materials. In light of

the context above, this study aims to analyse the plastic waste management practices within South Africa. It highlights the most popular trends, the policies as well as regulations used within the waste management industry.

2. Methodology

This paper aims to highlight the current state of waste management practices within South Africa. The aim was achieved through the use of both quantitative and qualitative data. The research focused mostly on qualitative primary data which was based on journals published between the years 2016- 2020, as well as government policies and regulations based on waste management. The data was collected based on, the topic of the paper, the date of publication and the objective of the study. The literature assisted in breaking down the current practices in waste management as well as highlight the centre of interest in this study. Secondary data used in this study was sourced from a field study conducted at company “Z”. The information collected provided a background as to how private recycling organizations operate in relation to government legislations. The information collected from the organization was collected through observation as well as an interview with the factory manager. The data collected from the case study organization was based on the production process of recycling. The combination of the case study and literature resulted in a presentation of how plastic waste management techniques, policies and procedures affect the recycling industry in South Africa.

3. Data analysis

Inappropriate disposal of plastic wastes poses as a high risk due to the release of toxic substances. As highlighted above the most common plastic waste management practice in South Africa include; landfilling, recycling, pickers, buy back centres, municipal waste management, illegal dumping, open burning and waste management by private organizations. This section is divided into three parts. The first part aims to breakdown the waste management practices most common in South Africa, the second part of this section breakdown the government regulations, legislations and efforts implemented in terms of alleviating the waste management issue and the third section aims to analyse the growth of the population and its relation to waste management.

4. Waste management practices

4.1 Landfill

Landfill has been found to increase pollution levels and cause potential health issues, due to the toxins released into the environment as part of the degradation process. The highest rates of pollution caused by landfilling is prevalent in developing countries (Palos et al., 2019). In South Africa 98 million tonnes of waste is taken to landfill yearly (Tomita, et al., 2020).

4.2 Recycling

Recycling is the most environmentally safe technique for waste disposal, particularly for plastics (Al-Maaded, et al., 2012). Of the total waste collected in South Africa only 43% is processed through recycling (Plastics SA, 2019). Of that 43%, only 10% of plastic waste is recycled (Tomita, et al., 2020). Plastic recycling comprises of primary recycling, secondary recycling tertiary recycling and quaternary recycling. Each of these techniques are suitable for different plastics types (Kuik, et al., 2016).

4.3 *Pickers and informal recyclers*

Individuals that take part in picking include 48% of low income community members in urban areas (Simatele, et al., 2017). These are the major contributors in the recycling industry however, they focus mainly on steel and cardboard not plastic (Simatele, et al., 2017; Rensburg, et al., 2020).

4.4 *Buy back centres*

Buy back centres target low income groups. These facilities allow individuals to sell their recyclable materials to these centres for recycling and receive payment for these items (Friedrich & Trois, 2016).

4.5 *Dumping*

This is an illegal act of dumping waste in open areas. This is done usually by individuals who do not have access to efficient waste management. In some instances, community members dump their waste in designated dumping sites within their own capacity.

4.6 *Open burning*

Open burning consists of piling up waste and burning it in a secluded area. This is most common in rural areas and other areas where residents do not have access to waste management.

4.7 *Municipal waste management*

Research has indicated that the most evident issues in waste management are most evident at the municipal level (Adenuga, et al., 2020). Municipal waste management includes refuse removal in communities by the municipalities.

4.8 *Private associations*

Private waste management organizations are organisations that aim to assist with dealing with the waste issue in South Africa. Some of these associations include, SAPRO (South African Plastics recycling organization), National recycling forum, and the recycling organization in South Africa. Apart from these associations other organizations operate as recycling facilities. One of these is company "Z". This organization is one of the many recycling firms which are governed by the South Africa's waste legislations however they operate independently. Based on the information collected on observation it was found that the organization does not receive any financial assistance from the South African government and their processes are not regulated by any external regulator.

4.9 *Government initiatives*

Government has articulated very useful regulations to cater for management of substances that can lead to ill health or mortality, many of which are waste materials (Government gazette, 4 April, 1973). The intent is to effect separation of such substances or mandate outright prohibition. Government also expends reasonable resources to regulating waste management in order to provide a sustainable environment vis-a-vis ecological development (Government gazette, 10 March 2009, In: Adenuga, et al., 2020). The gazette includes effecting standardization of regulatory policies for managing waste, as well as ensuring that waste management practices are properly licenced amidst appropriate control measures. The policies are not exhaustive. Table 1 highlights parts of the legislations in regulating the waste management industry. The list of these acts does not include all of the waste acts however, it has been summarized by highlighting the most impactful Acts, with the most important being the WASTE Act, 2008 (Act No. 59 of 2008).

Table 1 Government policies and regulations on waste management

Policy/ Regulation	Aim	References
“Environment Conservation Act (Act 73 of 1989)”	“A competent authority may in respect of any protected natural environment establish a management advisory committee for the control and management of a natural environment”.	Environment conservations act
“Municipal Systems Act (Act 32 of 2000)”	“To provide for the core principles, mechanisms and processes that are necessary to enable municipalities to move progressively towards the social and economic uplifting of local communities”. “To ensure universal access to essential services that are affordable to all”.	Government Gazette, 20 November 2000
“Municipal Structures Act (Act 117 of 1998)”	“To provide for the establishment of municipalities” and determine municipality categories.	Local government municipal structures Act
“The National Environmental Management Act (Act 107 of 1998)”	“To provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance”. “To provide for certain aspects of the administration and enforcement of other environmental management laws”.	National environmental management act.
“National Environmental Management: Waste Amendment Act, 2014 (Act 26 of 2014)”	“To compile an industry waste management plan; to establish a pricing strategy”. “To establish the Waste Management Bureau; to provide for the determination of policy and the Minister’s oversight in relation to the Waste Management Bureau”.	Government gazette 2 June 2014
“Municipal Financial Management Act 2003”	“This act states that municipalities must provide municipal services on a cost effective and equitable basis”	Adenuga, et al., (2020)

4.9.1 Population analysis

Research indicates that, waste generation has been found to increase proportionally due to the exponentially increasing population size. The pressure caused by the increasing population has been felt on a global scale (Adenuga, et al., 2020; Ayeleru, et al., 2018). Currently the South African population has been estimated to be 58,78 million, based on the 2019 mid year population statistics (Department of Statistics South Africa, 2019). Figure 1 below highlights the increase in South Africa's population and figure 2 highlights the growth in plastic recycling in South Africa. Based on the two charts it can be concluded that both trends follow an exponential increase. However an accelerated approach is required in meeting waste management demand.

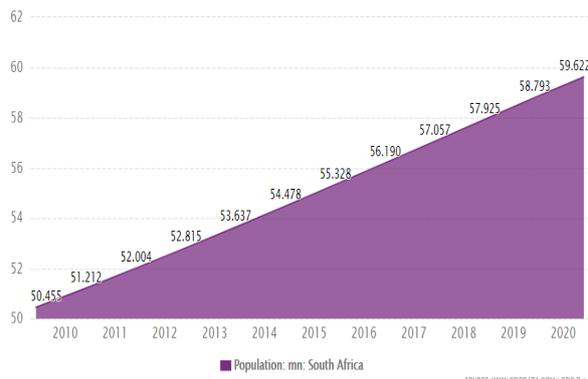


Figure 1 South African Population Statistics Source: CEIC, (2020)

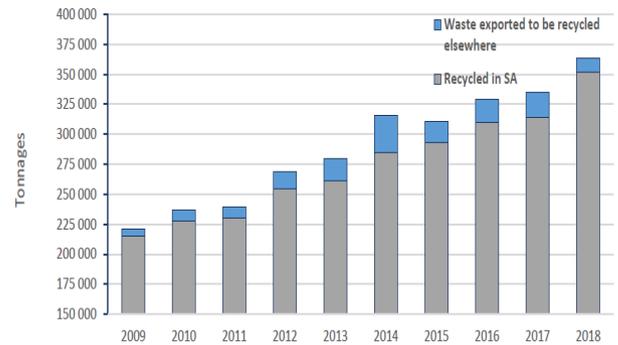


Figure 2 Plastic recycling trends in South Africa. Source: Plastics SA, (2019)

5. Results and Discussion

Based on the results of a survey conducted in 2018, 34.1% of South Africans did not have access to proper waste removal facilities (Plastics SA, 2019). This means there is 34,1% of South fricans who take part in either illegal dumping, open burning, picking or they are part of the private associations.

As it has been highlighted that 43% of plastics is recycled in South Africa the rest of the 57% of plastics is their taken for landfill, burned or absorbed into the countrys marine systems and other environments. Figure 3 highlists the government and private interventions in terms of plastic waste management in South Africa. This highlights that there is minimum intervention from the South African government.

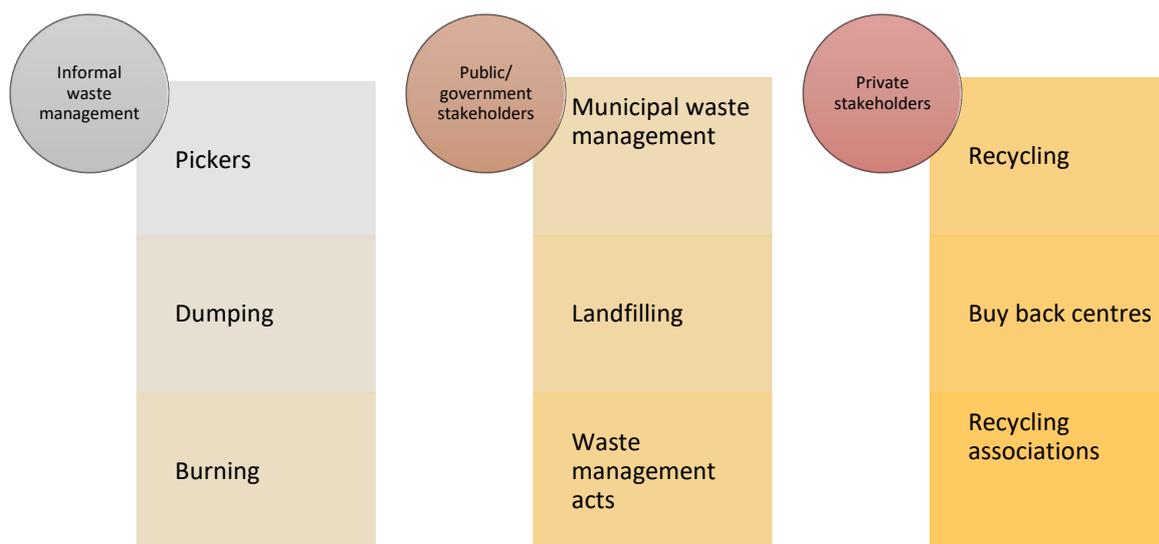


Figure 3 Summary of waste interventions

5.1 Gaps in the South African plastic waste management system.

Research indicates that there has been little research conducted in South Africa on the management of electronic waste, neither does government legislation include these forms of waste (Borthakur, 2020). In light of the recent outbreak of the Corona virus, research indicates that the increased use of face masks, face shields and gloves pose as a threat to the South African waste management system (Sharma, et al., 2020). Therefore an effective waste management technique is required in order to effectively deal with a surge of plastic waste in situations such as these. Based on the data collected in this study, the following gaps have been highlighted:

1. Gaps in the South African Waste management system

- 1.1 There has been little attention paid to waste management in rural areas.
- 1.2 There is Inadequate waste collection available for a large proportion of South Africans.
- 1.3 There are insufficient recycling initiatives for low income communities.
- 1.4 There is a lack of regulation and education in the waste management system.
- 1.5 There is no evidence of financial assistance being provided to informal traders.
- 1.6 No government association has been established in order to alleviate illegal waste management.
- 1.7 With many stakeholders taking part in waste management, the management of waste in South Africa has been inadequately coordinated. There is no regulating body that ensures that waste management as a whole is conducted effectively.
- 1.8 There is a lack of facilities and skills in the waste management industry.
- 1.9 Having many waste management Acts creates loopholes which allow for unethical behaviour.

5.2 Recommendations

The issues with plastic waste management in South Africa are significant, from the point of view of this study. The study makes the following recommendations as a way of mitigating the noted challenges:

1. There should be a robust infrastructural improvement in the waste management industry in South Africa. The improvement should be such as to meet all needs of the waste management industry. Plastic waste consumes electricity the most, as opposed to other resources. Therefore, the electricity provided should be reliable and affordable. In order to meet this need, waste management organizations could focus on installing efficient energy saving equipment, equipment to measure energy consumption or solar energy.
2. More focus should be on creating more initiatives for waste management in the rural and isolated areas. For example, temporary waste centres could be created where waste could be stored. The waste can later be collected on a weekly basis for recycling, to take place in the urban areas. Alternatively, subsidies for pickers and low level income South Africans could be provided in order to develop the waste management sector in these areas. Both these options provide empowerment and skills development of individuals and businesses operating in these communities.
3. Other forms of waste management should be provided to plastics that are difficult to recycle. On a national level, exporting plastic wastes to countries where plastics are used as a raw material could be implemented as a form of plastic disposal. Another form of waste management is carbonization. However, this is a more expensive method.
4. As the populations is increasing, an accelerated approach to waste management should be applied. A regulatory body could be put in place in order to regulate the waste management industry. This will create formality and ensure all the stakeholders in the waste management industry are taken care of in terms of providing funds and education on waste management processes for informal traders. This regulatory body should also regulate health and safety in terms of waste management,

particularly in the rural areas. This is to ensure that the waste is disposed efficiently and safely without affecting community members.

5. As the population is increasing and more communities are developing, priority should be given to waste management during development.
6. The waste management acts should be summarized and more focused on one goal which should be made clear to society. This should eliminate any misunderstanding and allow regulatory bodies to monitor organizations more effectively.
7. On a business level, all recycling organizations could play a role in improving plastic waste management in South Africa by improving their own recycling processes. For example, improvement in efficient production planning and investing in efficient labour and equipment. This is to allow for more efficient recycling and recycling a larger quantity of plastics.
8. Forms of awareness for the entire nation focusing on the most efficient waste management practices should be implemented. This can eliminate all inefficient waste management practices.
9. All future planning on waste management should be done based on future projections on the population and improvement of technology.

Conclusion

This paper has reviewed the current state of plastic waste management in South Africa, government legislations, public and private interventions as well as the effect of the escalating population on the plastic waste management in South Africa. This paper has provided a comprehensive review on the common techniques of waste management and interventions. It has been highlighted that the increasing population and increasing consumption of materials has created a burden on the waste management system particularly on municipalities. Therefore, current legislations and interventions are no longer as effective as before in meeting the waste management needs in South Africa. This is evident in the low recycling statistics and the percentage of South Africans that do not have access to safe waste management practices. Improvement on waste infrastructure, educating South Africans, and increasing availability of waste services is indeed necessary in improving the state of waste management in the country.

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Biographies

Ms UB Khangale is a Master's degree candidate with the University of Johannesburg, Faculty of Engineering and the Built Environment, Department of Quality and Operations Management. She obtained her National Diploma in Operations management in 2017 and her Btech in Operations Management in 2018. In 2015 she became a recipient of the dean's honours roll as a form of recognition of exceptional achievement from the University. During the course of her studies, Ms Khangale worked as a helpdesk consultant then later joined Shell Downstream South Africa as part of the project implementation team, focusing on operational excellence. During her employment at Shell she obtained a qualification in Business Analysis. Her research interest include Production planning and control, Inventory management, product and process design, and lastly layout strategies.

Dr Paul A. Ozor obtained a bachelor's degree (B.Eng) in Mechanical/Production Engineering at Enugu State University of Science and Technology, Nigeria in 2001. He worked as project manager with some engineering companies before proceeding to Department of Mechanical Engineering, University of Nigeria Nsukka (UNN), where he specialized in Industrial Engineering and Operations Management. He obtained both Masters and PhD degrees in 2008 and 2015, respectively from UNN. Dr Ozor is a winner of the prestigious TWAS-DST-NRF fellowship to University of Johannesburg, South Africa, and had been awarded the Association of Common Wealth Universities (ACU) early career scholarship in 2014. His research interests include Industrial Operations modelling, Quality management, Systems Analysis, Reliability Engineering, with special emphasis on Maintenance, Failure mode effects and criticality analysis (FMECA), Safety and Risk assessment (SRA) as well as Environmental influence modelling. Dr Ozor has over fifty peer reviewed publications and has visited countries in North America, Europe, Asia and Africa on research grounds.

Professor Charles Mbohwa is a Professor in the Faculty of Engineering and the Built Environment, University of Johannesburg. He obtained B. Sc. Honours in Mechanical Engineering in 1986 from Department of Mechanical Engineering, University of Zimbabwe, Harare, Zimbabwe, where he is currently serving as a Pro Vice Chancellor. He later bagged M. Sc. in Operations Management and Manufacturing Systems in 1992, with a distinction from Department of Manufacturing Systems Engineering, University of Nottingham, UK. He obtained PhD in Engineering (Production Systems focusing on Energy and life cycle assessment) from Tokyo Metropolitan Institute of Technology, Tokyo, Japan in 2004. Professor Mbohwa is an NRF-rated established researcher. In January 2012 he was confirmed as an established researcher making significant contribution to the developing fields of sustainability and life cycle assessment. In addition, he has produced high quality body of research work on Southern Africa. He is an active member of the United Nations Environment Programme/Society of Environmental, Toxicology and Chemistry Life Cycle Initiative, where he has served on many taskforce teams. He has published over 350 research articles in leading international Journals. Prof Mbohwa had been keynote speaker in many international conferences despite supervising many postgraduate students and playing host to several postdoctoral fellows.