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Gauteng's Waste Outlook: A Reflection

Edison Muzenda

Abstract**—**Gauteng, as the province with the greatest industrial and population density, the economic hub of South Africa also generates the greatest amount of waste, both general and hazardous. Therefore the province has a significant need to develop and apply appropriate integrated waste management policies that ensure that waste is recognised as a serious problem and is managed in an effective integrated manner to preserve both the present and future human health and environment. This paper reflects on Gauteng's waste outlook in particular the province's General Waste Minimisation Plan and its Integrated Waste Management Policy. The paper also looks at general waste generation, recyclable waste streams as well as recycling and separation at source initiatives in the province. Both the quantity and nature of solid waste differs considerably across the socio-economic spectrum. People in informal settlements generate an average of 0.16 kg per person per day whereas 2 kg per day is not unusual in affluent areas. For example the amount of waste generated in Johannesburg is approximately 1.2 kg per person per day.

Keywords**—**General waste, generation, integrated, minimisation, recycling, separation

I. Introduction

BASED on the information from Gauteng's General Waste Minimisation Plan, Gauteng generates 5.7 million tonnes of waste per annum, of which 3.4 million tonnes per annum are available for recycling and recovery from the waste stream (GDARD, 2009) [1]. As the waste in landfills decomposes under anaerobic conditions in the ground it emits methane. Waste streams deposited into managed landfills in South Africa comprise waste from households, commercial businesses, institutions, industry and from clearing of gardens and parks (DEA, 2009) [2]. Many landfills in Gauteng will reach their capacity within the next thirty years according to an analysis of landfills life span. Therefore any deviation of waste away from landfills will extend their life span, hence the need for waste minimisation and utilization [1]. Waste may be classified as general or hazardous. This paper looks at the generation and recycling of general waste which originates from domestic (households), commercial (offices, shopping centres, restaurants, warehouses etc) and industrial sectors. Table 1 shows the 2006 status of landfill sites in Gauteng according to the Gauteng Department of Agriculture, Conservation and Environment (GDACE, 2008) [3]. About 30% of the landfills are not permitted, 20% landfills have weighbridges and only 38% have recycling facilities.

E. Muzenda is with the Department of Chemical Engineering, Faculty of Engineering and the Built Environment, University of Johannesburg, Doornfontein, Johannesburg 2028, Tel: +27115596817, Fax: +27115596430, Email: emuzenda@uj.ac.za.

TABLE I
STATUS OF LANDFILL SITES IN GAUTENG

Municipality	Operational landfills	Permitted landfills	With weighbridge	With some sort of Recycling
Tshwane	8	5	1	3
Johannesburg	5	4	4	0
Ekurhuleni	6	6	6	3
Sedibeng	11	4 in process	0	4
West Rand	5	4	0	3
Metsweding	1	1	1	0
Total	36	24	12	13

II. Waste Generation and Recycling

A. Waste Generation

Waste generation rates are often considered to reflect the economic status of society. The more affluent the society the greater the waste produced per capita. Fig. 1 taken from the National Management Baseline Study (1998) indicates that Gauteng generated the highest volume of general waste 42% of the total in South Africa and had the highest capita waste generation of 2.44m^3/capita/annum. This indicates a more affluent society and can also be due to greater commercial, business and industrial development contributing to waste disposed to landfills in the province. The Gauteng preliminary State of Environment Report (SoER) indicates that the waste generated from households and requiring collection and disposal in Gauteng as roughly 146 kg/capita/annum (ranging from half that for the poorest and twice that for the most affluent). The population of Gauteng was estimated at 9 013 900 in 2003 with a population growth of 2 % since the 2001 census and a 10 % increase in waste generation per capita, as identified by the Johannesburg Status Quo Report in 2003 [4], waste generation of approximately 480 kg/capita/annum is estimated. Fig. 2 shows the amount of waste generated per province in 2005 and 2010.

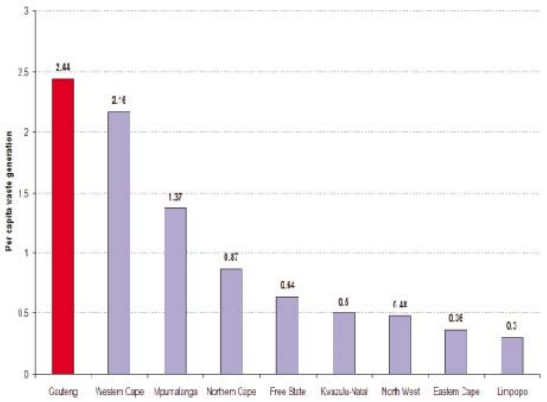

Fig. 1 Provincial per capita generation of general waste, DWAF, 1998 [5]

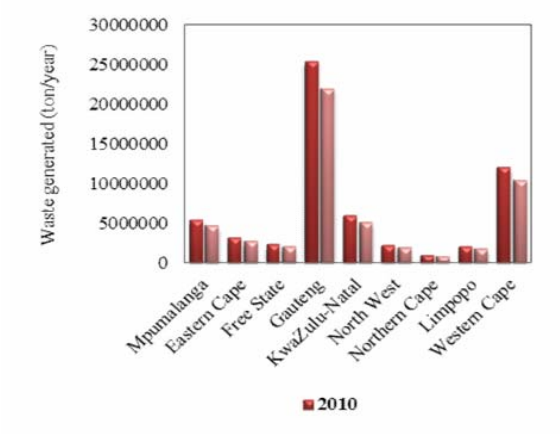

Fig. 2 Waste generated per province [6]

Table 2 shows the population distribution per province in the country for 2005, 2009 and 2010. According to Statistics South Africa, the population of Gauteng increased from 8 575 006 in 2005 to 10 531 300 in 2009 and to 11 191 700 in 2010 which is 18.20%, 21.40% and 22.40 respectively of the total population.

TABLE II
POPULATION OF SOUTH AFRICA PER PROVINCE [6]

	2005		2009		2010	
Province	Population	% of total	Population	% of total	Population	% of total
Eastern Cape	7 414 685	15.77%	6 648 600	13.48%	6 743 800	13.49%
Free State	2 995 572	6.37%	2 902 400	5.88%	2 824 500	5.65%
Gauteng	8 575 006	18.24%	10 531 300	21.35%	11 191 700	22.39%
KwaZulu-Natal	9 617 660	20.46%	10 449 300	21.19%	10 645 400	21.29%
Limpopo	5 852 802	12.45%	5 227 200	10.60%	5 439 600	10.88%
Mpumalanga	3 265 187	6.95%	3 606 800	7.31%	3 617 600	7.24%
Northern Cape	913 975	1.94%	1 147 600	2.33%	1 103 900	2.21%
North West	3 903 183	8.30%	3 450 400	7.00%	3 200 900	6.40%
Western Cape	4 466 716	9.50%	5 356 900	10.86%	5 223 900	10.45%
Total	47 004 786	100.00%	49 320 500	100.00%	49 991 300	100.00%

The available airspace on existing landfill sites in Gauteng appears to be approximately 120 million m^3, as an available lifespan of approximately 22 years. However the available landfill sites are not evenly distributed relative to waste generation location. Fig. 3 shows the annual waste volumes disposed of in the various municipalities in Gauteng with City of Johannesburg (CoJ) experiencing the largest disposal rate.

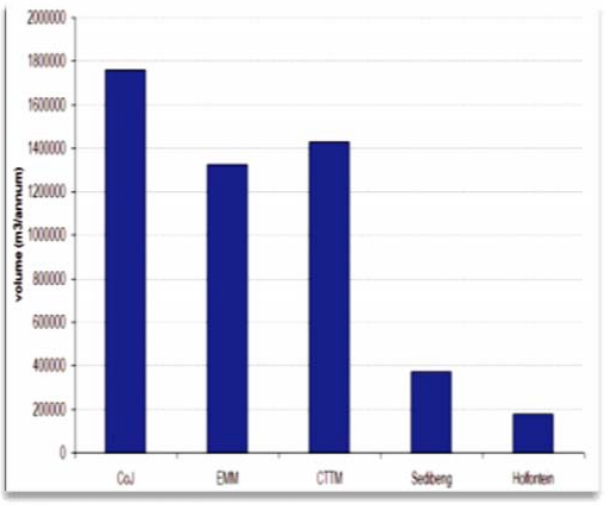

Fig. 3 Annual waste volumes disposed at landfills sites in Johannesburg, Ekurhuleni, Tshwane, Sedibeng and at the Holfontein hazardous waste disposal site [6]

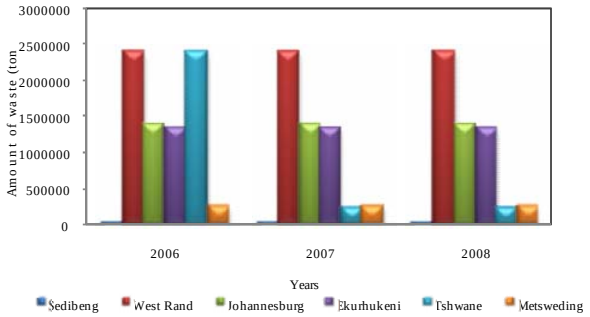

Fig. 4 Waste generated per district in Gauteng [6]

TABLE III
WASTE STREAM ANALYSES PER PERCENTAGE OF TOTAL GENERATION IN 2006 [6]

Area	Non-Recyclables (%)	Recyclables			Total %
		Organics (%)	Main Line Recyclables (PPGTT) %	Builders Rubble (%)	
Tshwane	35	20	25	20	100
Johannesburg	39	10	29	22	100
Ekurhuleni*	37	12	32	19	100
Sedibeng*	57	9	25*	9	100*
West Rand	51	18	25*	6	100*
Metsweding	44	12	14	30	100

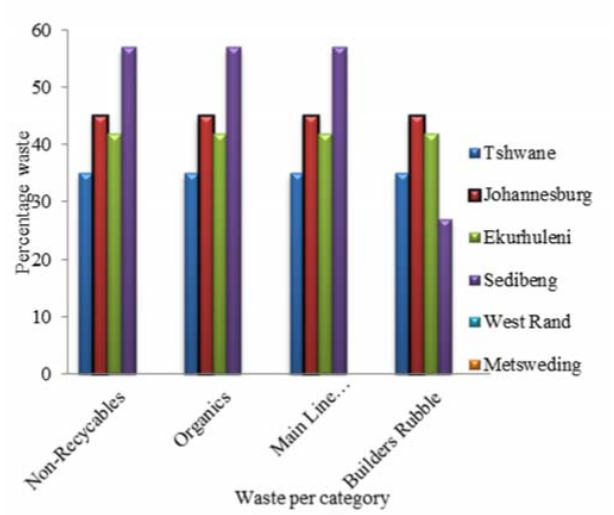

Fig. 5 Percentage waste generated per category [6]

An analysis of waste streams in Figs. 4 and 5 indicates the following: (i) The majority of general waste reporting to landfills in Gauteng is of domestic origin (ii) Organics make up between 9 and 20% of the waste streams (iii) Builders rubble makes up between 6 and 30% of the waste stream (iv) Johannesburg data indicates that 29% of the total waste stream are Main Line Recyclables (PPGTT) (v) Metsweding data indicates that 14% of the total waste stream are Main Line Recyclables (PPGTT) (vi) Data for Tshwane indicates that 25% of the domestic waste stream are Main Line Recyclables (PPGTT) (vii) Ekurhuleni data indicates that 32% of the domestic waste streams are Main Line Recyclables (PPGTT).

B. Waste Recycling

Recycling forms an integral part of the Integrated Waste Management for the protection of human health and the environment, and for meeting the goals of the Polokwane declaration (DEAT 2002) [7]. The economic viability of recycling wastes is dependent on the waste composition and its ability to be separated, or segregated, into a marketable product. Over 50 % of the general waste currently being disposed into landfills in South Africa has the potential to be recovered for recycling or re-use in particular paper, glass, beverage cans and metal (DWAF, 1998) [5], whilst present recycling in Gauteng appears to be less than 10%. It is however recognised that it is difficult to segregate waste effectively and a market for the material must exist. Short-term targets recyclables of 15-20 % could be more realistically attainable. It is noted that during the World Summit on Sustainable Development (WSSD) in Johannesburg, September 2002, daily waste generation peaked at 26 tonnes whilst approximately 76 tons of waste were recycled during the summit, and some summit venues had recycling rates of over 50%. In 2006, the following waste volumes were recycled 65%, 61%, 63%, 43%, 49% and 56 in Tshwane, Johannesburg, Ekurhuleni, Sedibeng, West Rand and Metsweding respectively.

Thus the average of waste recycled in Gauteng is 60% while the other 40% report or disposed into landfills.

TABLE IV
GAUTENG WIDE WASTE STREAM COMPOSITION [8]

Gauteng	Non-Recyclable	Organics	Main Line Recyclables (PPGTT)*[1]	Builders Rubble	TOTAL
Percentage	40%	15%	25%	20%	100%
Amount in tonnes /annum	2,292,000	859,000	1,432,000	1,146,000	5,792,900 0

Table 5 shows the volumes of waste per stream for the 6 districts in Gauteng. Based on 2006 data, Fig. 6 shows the percentage contribution of each waste stream in Gauteng.

TABLE V
PREDICTED WASTE STREAM FOR GAUTENG PROVINCE [6]

Area	Non-Recyclables	Organics	Main Line Recyclables (PPGTT)	Builders Rubble
Sedibeng	150,982	56,323	93,206	72,477
West Rand	24,666	9,202	15,227	11,841
Johannesburg	603,812	225,249	372,752	289,854
Ekurhuleni	553,630	206,529	341,772	265,764
Tshwane	972,025	362,609	600,060	466,611
Metsweding	13,622	5,082	8,409	6,539
Total	2,318,737	864,994	1,431,426	1,113,086

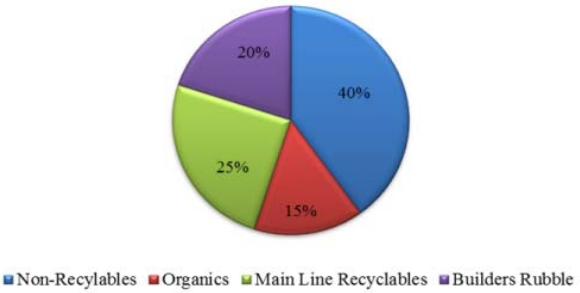

Fig. 6 Total estimated waste volume available for recovery and recycling in Gauteng [6]

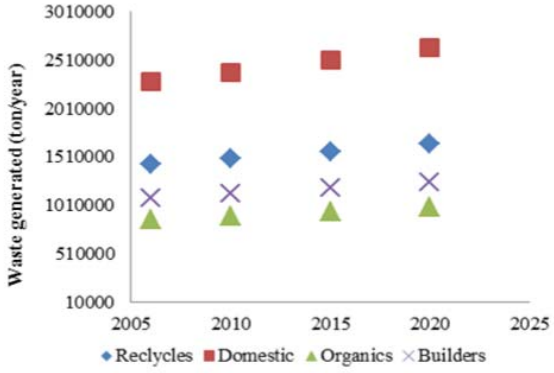

Fig. 7 Waste Generation per category [6]

Fig. 7 indicates the waste generation projection in Gauteng till 2021.

TABLE VI
TOTAL POTENTIAL WASTE RECOVERY TARGETS [6]

Time Horizon	Potential Recovery Material (t/annum)	Glass	Plastics	Paper	Tins	Tyres	Greens	Builders Rubble
2006	3,380,417	25 %	33%	57%	67 %	50%	20%	5%
2010	3,517,675	50 %	40%	65%	70 %	80%	40%	25%
2015	3,697,112	60 %	45%	70%	70 %	80%	70%	50%
2020	3,885,702	65 %	50%	70%	70 %	80%	90%	70%

There are a number of voluntary general waste recovery initiatives in the province and fall into the following general waste recovery systems (i) Recycling and garden waste drop – off centres are established in various of Gauteng's cities and larger towns where waste is separated into glass, paper/cardboard, cans, scrap metal, plastics, garden waste and other waste as delivered in separate form by the public (ii) Collection banks are used on a small scale for glass and paper (iii) Recyclable waste buy-back centres have been successfully established in lower income communities (iv) A number of capital – intensive recycling plants have been launched in Gauteng for example the Robinson Deep Waste Flow Plant in Johannesburg, the Resource Recycling Plant in Randburg and the Tshwane Recycling Cooperative. The Polokwane Declaration (DEAT, 2002) [8] on waste management in South Africa had committed to zero recyclable waste to landfills by 2012. Waste disposal including recyclables to landfill sites is growing annually. Future waste generation can be predicted using the waste generation model (1), GWMP status quo report, GDACE, 2008 [3].

$$GWG = (PP)(WG\ per\ capita)(\%\ of\ waste\ per\ waste\ stream) \quad (1)$$

Where GWG is General Waste Generated, PP is Projected Population and WG is Waste Generated

III. GAUTENG PROVINCIAL INTEGRATED WASTE MANAGEMENT POLICY

The Gauteng Provincial Government (GPG) published an Integrated Waste Management (IWM) Policy in September 2006 GDACE, 2008 [3]. The overall aim of the IWM Policy was to set out a vision, principles as well as strategic goals and objectives that the province would apply to achieve integrated and environmentally sustainable waste management in the province. The objective of the GPG was to move away from fragmented and uncoordinated waste management to IWM. This holistic and integrated approach extends over the entire waste cycle from cradle to grave, covering the avoidance, reduction, generation, collection, transport, recovery, recycling, reuse, treatment and final disposal of waste. The main emphasis being on waste avoidance and minimisation. In order to improve waste management in the province the IWM policy identified a number objectives as (i) Integrated waste management planning (ii) Identifying roles and responsibilities of national, provincial and local government (iii) Waste Information management (iv) Institutional development (v) Capacity building (vi) Funding and environmental management and of relevance to the development of a General Waste Minimisation Plan for Gauteng are (vii) Waste avoidance and substitution (viii) Waste reduction and minimisation (ix) Waste recovery and recycling (x) Waste treatment and disposal.

IV. WASTE COLLECTION AND SEPARATION

Most waste collection schemes only consider commingled waste collection and dumping. The organic share in Municipal Solid Waste mostly represents about half of the waste. Separation at source is state -of- the art in developed countries and can build the basis of improved solid waste management in Gauteng. As can be seen from Figs 8-12, recyclables are reporting at landfill sites and the delivered waste is unseparated. In this study, scavengers were seen scrambling for valuables.

Fig. 8 Waste not sorted (Landfill X 2011/10/12)

Fig. 9 Metallic and glass waste (Landfill X on 2011/10/12)

Fig. 10 Scavengers search for the valuable material (Landfill X taken on 2011/10/12)

Fig. 11 Scavengers in Landfill X taken on 2011/10/12

Fig. 12 Unseparated wastes deposited at Landfill X taken on 2011/10/12

Fig. 13 Pikitup's recycling at source project

City of Johannesburg's waste removal entity Pikitup initiated a separation at source pilot plant project in October 2009 and this started with an educational campaign in September 2009.The project was established so that residents in Parkview, Fleuhorf, Greenside, Fairland, Victory Park, Emmarentia, Linden, Bosmont, Forest town, Berario, Westcliff, Richmond, Greymont, Montroux, Mayfair, Triom and Martindale could separate various types of waste such glass and paper, making recycling easier. Each house received a clear refuse bag for recyclables such as can and bottles, an orange Mondi Ronnie bag for paper and cardboard, to add to their 240 litre black wheelie bin for wet and dry non-recyclables. The bulk of the recyclables is paper 23%, followed by glass 24%, plastic 8%, cans 4% as well as tetrapak, the packaging used for beverages and food at 1 %. A participation rate of 50% was reported, with participation in high income areas of about 78% and less than 22% for the low income.

V. Conclusion

Important issues around waste in Gauteng include (i) The increasing urbanisation in Gauteng which is leading to increasing waste generation (ii) Increasing commercial and industrial development translates to more waste being generated by residential, industrial and commercial sectors (iii) Limited waste collection in poor areas (20% of households within Gauteng do have access to weekly removal services (iv) Poor enforcement of national, provincial and municipal by laws and regulations (v) Lack of encouragement and awareness of waste avoidance, minimisation and recycling (vi) The rising oil price increases the cost of waste transportation to landfills. While many countries have moved away from disposal to landfills as the primary means of solid waste management, in South Africa the large bulk of solid waste is disposed of in landfill sites. The cost of operating these sites is increasing rapidly.

Acknowledgement

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Edison Muzenda is an Associate Professor, Research and Postgraduate Coordinator as well as Head of the Environmental and Process Systems Engineering Research Group in the Department of Chemical Engineering at the University of Johannesburg. Professor Muzenda holds a BSc Hons (ZIM, **1994**) and a PhD in Chemical Engineering (Birmingham, **2000***)*. He has more than **15** years' experience in academia. Edison's teaching interests and experience are in unit operations, multi-stage separation processes, environmental engineering, chemical engineering thermodynamics, entrepreneurship skills, professional engineering skills, research methodology as well as process economics, management and optimization. He is a recipient of several awards and scholarships for academic excellence. His research interests are in waste water treatment, gas scrubbing, environment, waste minimization and utilization, energy as well as phase equilibrium measurement and computation. He has published more than **100** international peer reviewed and refereed scientific articles in journals, conferences and books. Edison has supervised over 18 postgraduate students as well as more than 130 Honours and BTech research students. He serves as reviewer for a number of reputable international conferences and journals. He has also chaired several sessions at International Conferences. Edison is an associate member of the Institution of Chemical Engineers (AMIChemE), member of the International Association of Engineers (IAENG); associate member of Water Institute of Southern Africa (WISA) and member of the International scientific committee of the World Academy of Science, Engineering and Technology (WASET) as well a member of the Scientific Technical Committee and Editorial Board of the Planetary Scientific Research Centre. Edison is recognized in Marquis Who's Who 2012 as Engineering Educator.