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Household waste recycling behaviour in South Africa – has there been progress in the last 5 years?

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ABSTRACT
In 2010, the CSIR conducted the first national survey on household waste recycling behaviour in South Africa. To assess whether household recycling behaviour has improved over time, the CSIR conducted a second survey in 2015, five years after the first national survey. Comparing the results from the 2010 and 2015 surveys shows that the percentage of dedicated recycling households in large urban areas has almost doubled over the past five years, but remains very low at 7.2%. Households in smaller towns and rural areas lag even further behind in terms of dedicated recycling households, at only 2.6%. Of the four paper and packaging recyclables surveyed (plastic, paper, glass, metal), plastic showed the largest increase in percentage of households that recycle this material, followed by glass and metal, with paper showing the smallest growth in the number of recycling households. The data also suggest that it is easier for recycling households to recycle more (quantity and diversity of recyclables), than for non-recycling households to start recycling. The challenge is therefore to find the triggers that will shift consumers "willingness to recycle" into actual "recycling behaviour" and to then put measures and services in place to support ongoing recycling behaviour.

1. INTRODUCTION

This report presents the findings of the 2nd National Household Waste Recycling Behaviour Survey (2015) for South Africa. It builds on the national urban household recycling behaviour baseline study conducted by the CSIR in 2010 and reports on change over time.

1.1 Background to the study

Population growth, combined with increased consumption rates, economic growth, and a throw-away culture has resulted in increased waste generation. Many South African municipalities are now facing critical shortages in available landfill airspace, with some municipalities having less than 10 years of remaining airspace. This has prompted municipalities to actively seek alternative solutions to landfilling, in line with national policy, which strongly promotes the waste management hierarchy and the concept of waste as resource. However, in many South African municipalities waste management remains a low priority, resulting in the failure of waste management services and the continued dumping of waste in often poorly managed dumpsites (RSA 2000; Nhamo *et al*. 2009).

Implementation of the National Environmental Management: Waste Act (NEM:WA) (RSA 2008) requires changes in the management of waste, including municipal solid waste. Waste separation at household level needs to be implemented and the necessary municipal waste collection services put in place to support this changed waste management practice (NEM:WA Sections 7(2)*(a)*, 22(2) and 23(2)) (RSA 2008).

The National Domestic Waste Collection Standards strongly promotes separation at source as a means of diverting waste away from landfill towards recycling and recovery (RSA 2011). As outlined in Section 4.1 of the Standards, "*separation at source must be encouraged and supported in line with the relevant industry waste management plans*", with all domestic waste being sorted at source (i.e. at households) in all Metropolitan and secondary cities. The Standards also note that municipalities "… *must provide an enabling environment for households to recycle domestic waste..."* which *"…could include kerbside collection and/or well-kept drop-off centres within easy reach".* (RSA 2011:16). Furthermore, co-operation between municipalities and the recycling sector is encouraged to ensure the provision of facilities for household recycling.

The National Waste Management Strategy (NWMS) (DEA 2011) has set the goal of promoting waste minimisation, re-use, recycling and recovery (Goal 1), through the short-term (5 year) targets of –

1. diverting 25% of recyclables from landfill sites for re-use, recycling or recovery by 2016, and
2. all metropolitan municipalities, secondary cities and large towns have initiated separation at source programmes

Furthermore, Goal 4 of the NWMS, aims to raise awareness of waste management issues, through the short-term (5 year) target of 80% of municipalities running local awareness campaigns. The NWMS notes that, increasing the re-use, recycling or recovery of goods and waste materials requires "*a coordinated effort by generators of waste, including households, businesses and organisations*", and that promoting the re-use, recycling or recovery of waste materials will be achieved through, amongst others, "*nationally coordinated awareness campaigns which support separation of recyclables from the domestic waste stream at source for all households, businesses and organisations*". Municipal campaigns designed and implemented in partnership with local stakeholders, including labour, industry, civil society and NGOs, form the foundation of the strategy to create awareness about waste. While South Africa still lacks a national waste and recycling communications and awareness programme, the private sector has taken up this challenge, with material organisations such as Collect-a-Can, The Glass Recycling Company, PETCO, PolyCo and PRASA, increasingly investing in awareness and communication initiatives in an effort to raise consumer awareness of the benefits of recycling, although they remain largely disconnected.

South Africa has experienced a growth in paper and packaging recycling rates from 47.3% in 2010 to 52.6% in 2014 (PackagingSA, 2015). This has come on the back of considerable investment by the private sector in new recycling infrastructure, thereby growing local markets and increasing the demand for recyclable waste, mostly paper and packaging waste. Material organisations have invested in both collection infrastructure and recycling infrastructure, thereby growing both the supply and demand for recyclable waste. Several municipalities, in particular the larger metropolitan municipalities have put pilot separation at source initiatives in place (e.g. Johannesburg, Cape Town) thereby increasing the supply of recyclable waste. All of these public and private sector initiatives have supported the growth of South Africa's recycling economy.

South Africa's policy environment therefore creates a strong motivation to drive separation at source, to strengthen awareness and communication initiatives and resultant increased recycling behaviour amongst all generators of waste, including households.

1.2 Purpose of the study

The purpose of this study is to assess whether these policy goals, and the activities of government and the private sector, have translated into actual behavioural change at household level, specifically as it relates to the separation of recyclable waste.

The research conducted by the CSIR in 2010, soon after the Waste Act came into effect, but before separation of waste at source, as envisaged by the Act, had been widely implemented, established the baseline of urban household recycling behaviour in South Africa. The results were disappointing, with only 3.3% of urban households reporting that they "*recycle a fair amount of recyclables (paper, plastic, glass, metal and compostable materials) on a regular basis*" (Strydom 2012). This study, the 2nd National Household Waste Recycling Behaviour Survey (2015) for South Africa, aims to assess whether urban household recycling behaviour has changed in the past five years (2010-2015) and if so, how significant this change has been. In particular, to assess whether current initiatives by government and the various material organisations has had a positive impact on increasing household recycling behaviour over the past five years. The research is based on the question: "*Has the increase in paper and packaging recycling, and associated activities by recycling companies and various material organisations, prompted an associated increase in household recycling behaviour?*"

2. METHODS

The 2010 and 2015 national surveys on household recycling behaviour, conducted by the CSIR, provide valuable insight into recycling tendencies in South Africa. Not only do the survey findings provide comparable results across time and community size, but the scientifically sound and unbiased approach adopted for the surveys, allows municipalities and material organisations to benchmark their specific figures against these national results.

2.1 Research design

To measure current levels of waste recycling behaviour in South Africa, a descriptive quantitative research approach was followed (Creswell, 2003; Leedy and Ormrod, 2005). A fixed-form survey with selection of options was used to gather data within a short period of time (Babbie and Mouton, 2001). A structured questionnaire standardised the interview process by ensuring that the same questions were posed in the same way (Kempton *et al*. 1996).

2.2 Sampling

A random probability sampling method was followed which provides a sample representative of the population of South Africa and thus allows for the results of this study to be extrapolated. The study targeted a representative sample of 3 500 households in South Africa, including both urban and rural areas. To represent each sampled household, and to prevent interviewer bias, all eligible persons (i.e. males and females 15 years and older) were listed on the Kish grid from which one respondent was then selected (Kish, 1949). Only this selected person could be interviewed and substitution could only occur after three unsuccessful attempts to contact the original respondent.

Unlike the 2010 survey, which only focussed on urban households, the 2015 survey was expanded to include households in towns and rural areas (population size of less than 250 000), as well as large urban areas (metropolitan areas and cities with a population size of 250 000 or more).

2.3 Questionnaire

A selection of four sets of questions from the 2010 survey questionnaire was used for the 2015 survey. Based on lessons learnt during 2010, slight adjustments were made to questions to improve the overall survey results.

Questions used in the 2015 survey, reported on in this paper include:

Question 1 – measure self-reported recycling frequency
Question: Thinking of your household, would you say that your household separates out recyclable materials from your household waste... **Options:** 1. Never; 2. Almost never; 3. Seldom; 4. Sometimes; 5. Often; 6. Almost always; 7. Always
Question 2 – measure self-reported recycling quantities (qualitative measure of "how much")
Question: Choose the statement that best describes how much your household recycles each of the listed recyclable materials – paper, glass, metal, plastic **Options: My household recycles…** 1. *Nothing*; 2. *Very little*; 3. *Some things*; 4. *About half*; 5. *Most*; 6. *Almost all*; 7. *Everything* …of what can be recycled.
Question 3 – measure self-reported recycling collection services
Question: In your area, how are the following materials collected or disposed of: recyclable material (disposed of separately)? **Options:** 1. Pavement collection by municipality; 2. Pavement collection by private company; 3. Communal collection; 4. Informal collection; 5. Take to drop-off centre by foot; 6. Take to drop-off centre while driving past; 7. Make special trip by car to drop-off; 8. On-site disposal on own property; 9. Not recycled or collected; 10. Other; 11. I do not know.
Questions 4 - 5 – measure willingness to recycle under certain conditions
Question: How willing are you to *put* recyclables *out* separately for pavement collection at your household? **Question:** How willing are you to *take* recyclables *to* collection points e.g. drop-off or recycling centres? **Option:** One option for each question on a scale of 1-7 where: 1 is *not willing at all* and 7 is *very willing*

Note: Where applicable, the words in *italics* are used in graphs to shorten statements and simplify presentation.

2.4 Data collection

The CSIR contracted a professional survey company to conduct at least 3500 face-to-face interviews as part of their biannual national survey. The interviews were conducted in the homes of, and in the home language of, the respondents. The 2015 survey followed on the 2010 survey, which targeted at least 2000 households living in large urban areas. The final 2015 sample consisted of 3617 interviews, representing 2045 households in large urban areas and 1572 households in other towns and rural areas, from all nine provinces, including deep rural areas. The sample is representative of the South African population: all age groups and races, and equally represented by males and females. The relatively large sample sizes reduced the effect of sampling errors (Babbie and Mouton 2001, Page and Meyer 2003, Brace 2004).

All ethical requirements were adhered to. Anonymity of the respondents is guaranteed and the identity of the individual respondents cannot be linked back to the data or to their area of residence.

Although self-reported recycling behaviour, as adopted in this research, is considered to be an optimistic reflection (Eagly and Chaiken 1993; Armitage and Connor 2001), results from self-reported recycling behaviour surveys provide valuable insight into recycling tendencies worldwide and "*have implications for recycling policy and practice*" (WRAP 2015).

2.5 Assumptions

For the purpose of this study it is assumed that the paper, plastic, glass and metal components of domestic household waste is predominantly paper and packaging waste (P&P) and that any influence of non-packaging household waste on the levels of recycling frequency and quantities of recyclables materials reported would be negligibly small.

2.6 Analysis

The mean of the individual five items that made up the construct for **recycling behaviour for paper and packaging waste ($\mathbf{B_{P\&P}}$)** was calculated to derive a score per household as informed by the respondent representing each household.

The MS Excel data analysis function was used for descriptive statistics (graphs, frequency tables, the mean scores, standard deviation, etc.), and for determining measures for variability and relationships between variables (correlation and regression analyses).

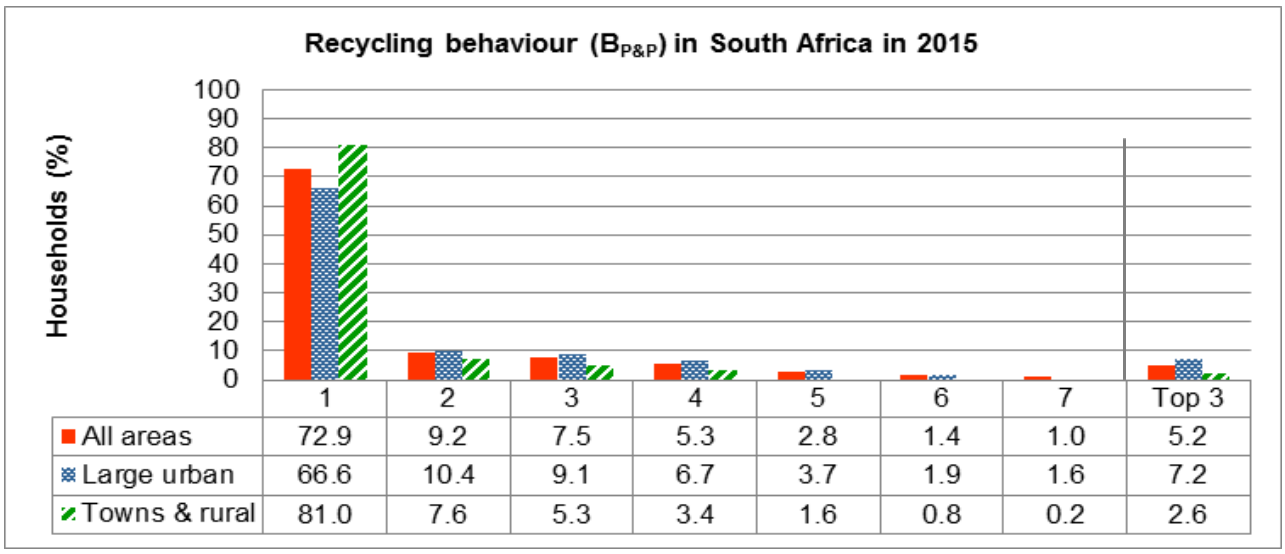
For an accurate comparison of the recycling behaviour construct over time, the 2010 dataset was re-analysed to obtain a 2010 score for $\mathbf{B_{P\&P}}$ only, selecting the identical variables used in the 2015 survey. Note should be taken that the 2015 findings from only the **large urban areas** can be compared with the 2010 results, since **towns & rural areas** were not included in the 2010 survey. However, in few instances brief mentioning is made of the 2015 towns & rural areas results, in comparison with the 2015 large urban areas.

3. RESULTS AND DISCUSSION

3.1 Recycling behaviour

The recycling behaviour ($B_{P\&P}$) of each household is calculated through averaging of five variables, namely recycling frequency (section 3.2), and reporting of how much each of four recyclable materials (i.e. paper, glass, metal and plastic) is recycled (section 3.3).

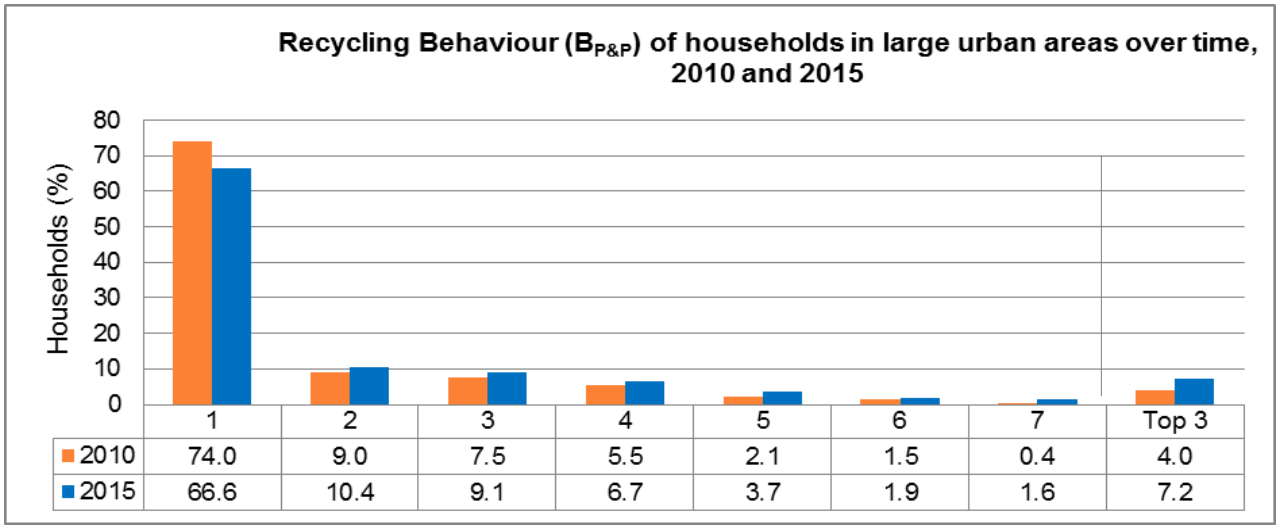
Of the total sample for the year 2015 (n=3617), 2627 respondents (72.6%) reported no recycling activity in their households ($B_{P\&P}$ score of "1") (Figure 1). Some level of recycling activity ($B_{P\&P}$ scores >1) is reported in the remaining 990 households (27.4%). Households with a $B_{P\&P}$ score of "2" would typically *almost never* recycle only *some things* of one or two types of recyclable materials. The "Top 3" represents dedicated recycling households (scores of 5-7) who *often* or more regularly recycle *most* or more of their recyclables.



	1	2	3	4	5	6	7	Top 3
All areas	72.9	9.2	7.5	5.3	2.8	1.4	1.0	5.2
Large urban	66.6	10.4	9.1	6.7	3.7	1.9	1.6	7.2
Towns & rural	81.0	7.6	5.3	3.4	1.6	0.8	0.2	2.6

Figure 1. Household recycling behaviour in 2015 as derived from a recycling behaviour construct $B_{P\&P}$, distinguishing between large urban areas (n=2045), and towns & rural areas (n=1572)

A comparison of $B_{P\&P}$ over time, 2010 and 2015, shows an increase in dedicated recycling households ("Top 3") from 4.0% in 2010 to 7.2% in 2015. While the results are still disappointingly low (<10%), the change between 2010 and 2015 reflects an almost eighty percent (79.1%) improvement for "*dedicated recycling households*".



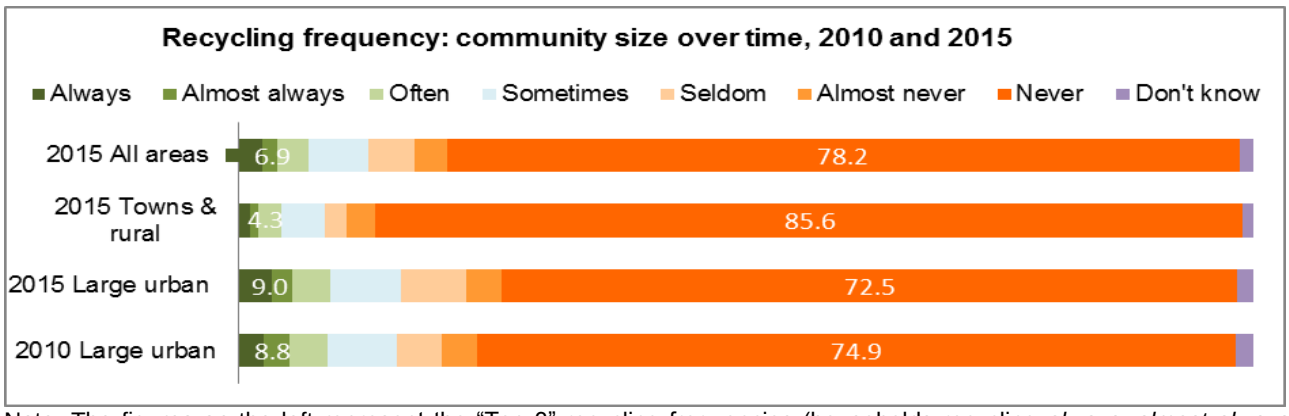
	1	2	3	4	5	6	7	Top 3
2010	74.0	9.0	7.5	5.5	2.1	1.5	0.4	4.0
2015	66.6	10.4	9.1	6.7	3.7	1.9	1.6	7.2

Where: 1 = no recycling behaviour (recycle *nothing* and recycle *never*); and 7 = maximum possible recycling activity (*always* recycle *everything* that is recyclable)

Figure 2. Comparing self-reported recycling behaviour ($B_{P\&P}$) of households living in large urban areas for years 2010 and 2015 (2010 n=2004; 2015 n=2045)

3.2 Recycling frequency

In 2015, 78.2% of all respondents in the national sample reported that their households never recycle (Figure 3). Of the respondents living in large urban areas, 72.5% indicated that they never recycle, compared to 74.9% in 2010. Smaller towns & rural areas lag behind with 85.56% of respondents from these areas reporting that their households never recycle.

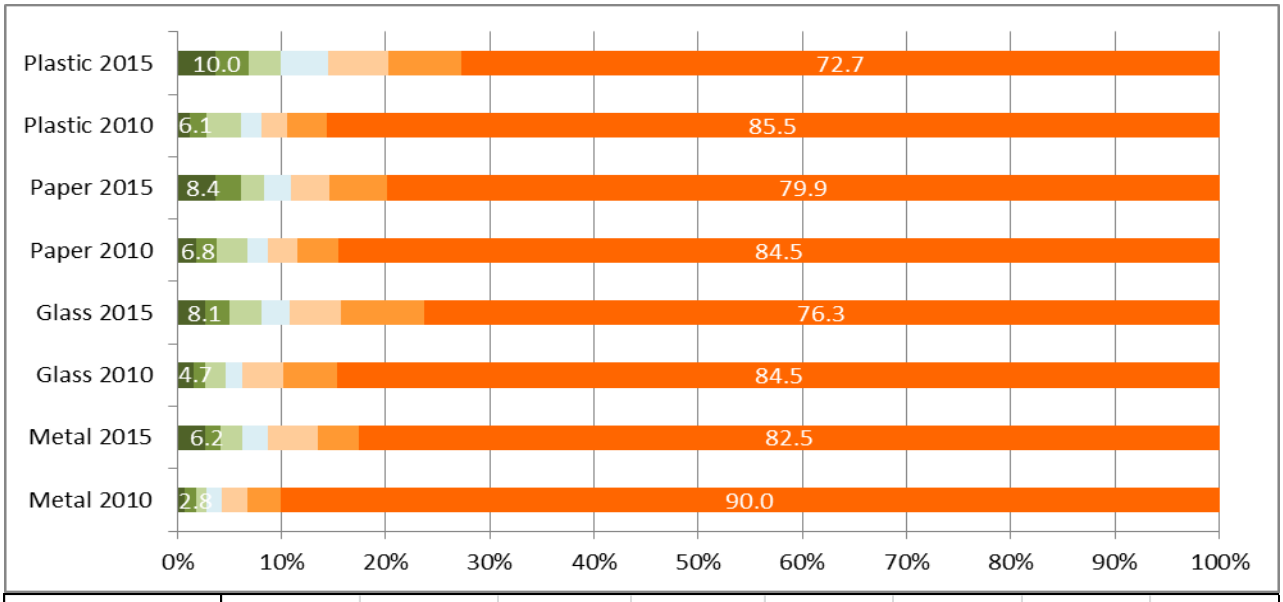


Note: The figures on the left represent the "Top 3" recycling frequencies (households recycling *always, almost always* and *often*). (2015 All areas n=3617; 2010 Towns & rural n=1572; 2015 Large urban n=2014; 2010 Large urban n=2004)

Figure 3. Comparing recycling frequency of households in different community sizes (large urban and towns & rural areas) over time (large urban areas only).

3.3 Recycling quantities

The quantities of each of the four recyclable materials (determined qualitatively using a scale of e.g. "*very little*" or "*almost all*") recycled by households living in large urban areas, is shown in Figure 4.



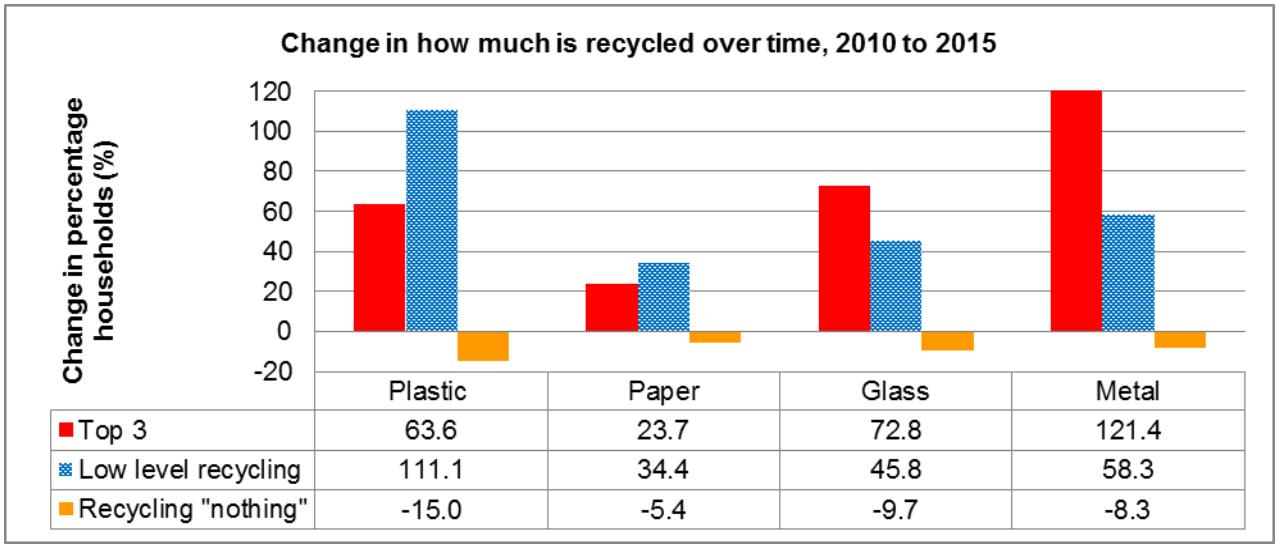
Recyclable material	Plastic 2015	Plastic 2010	Paper 2015	Paper 2010	Glass 2015	Glass 2010	Metal 2015	Metal 2010
Everything	3.7	1.2	3.6	1.8	2.7	1.6	2.6	0.7
Almost all	3.1	1.6	2.5	2.0	2.3	1.1	1.6	1.1
Most of everything	3.1	3.3	2.3	3.0	3.1	2.0	2.0	1.0
About half	4.6	2.0	2.5	1.9	2.6	1.6	2.5	1.5
Some things	5.7	2.5	3.7	2.8	5.0	3.9	4.8	2.5
Very little	7.0	3.7	5.5	4.0	8.0	5.2	4.0	3.1
Nothing	72.7	85.5	79.9	84.5	76.3	84.5	82.5	90.0
Top 3	10.0	6.1	8.4	6.8	8.1	4.7	6.2	2.8

Note: Percentages on the left in the top part of the graph represents the "Top 3" (recycling *everything*, *almost all* and *most of everything*).

Figure 4. Percentage of households indicating *how much* of each recyclable material is recycled in their households, in large urban areas and over time, 2010 (n=2004) and 2015 (n=2045).

Over the period 2010 to 2015, the percentage of households recycling *most* and more ("Top 3") of their recyclables increased for all four of the recyclable materials. Plastics shows the biggest increase in

percentage of households recycling self-reported “Top 3” quantities, from 6.1% to 10.0%, followed by glass (4.7% to 8.1%) and metal (2.8% to 6.2%). The data suggest that although paper showed a similar percentage of households recycling this recyclable material in 2010 (all quantities=15.5%), compared to glass (15.5%) and plastic (14.5%), paper does not show the same growth over time in the number of households recycling this material (Figure 5). The more than 100% change in percentage of households recycling *almost half* and less of their plastics suggests that plastic is most probably selectively recycled. This could be due to several reasons, amongst others, demand for certain types of plastic, high re-use value of certain plastic items, perceptions that many plastic types are not recyclable, and resistance to clean dirty kitchen waste before it is recycled – it is easier to just throw it in the garbage bin.



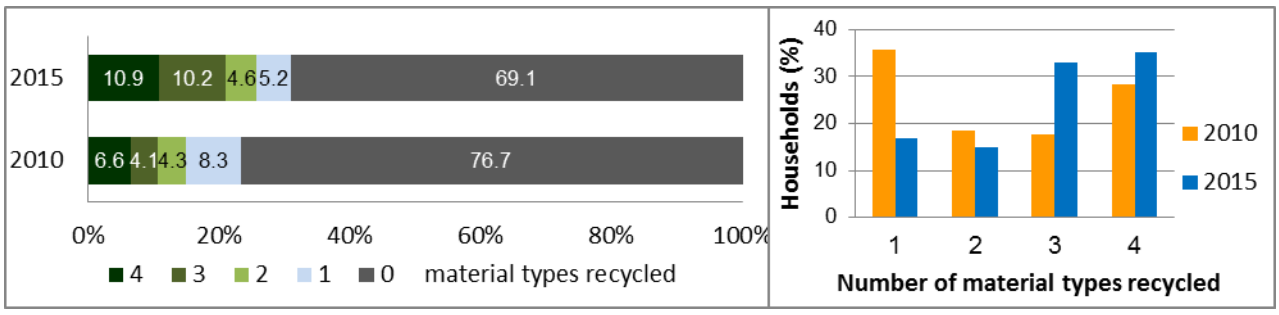
	Plastic	Paper	Glass	Metal
Top 3	63.6	23.7	72.8	121.4
Low level recycling	111.1	34.4	45.8	58.3
Recycling "nothing"	-15.0	-5.4	-9.7	-8.3

Figure 5. Change in percentage of households that indicated how much of each recyclable material is recycled over time 2010 to 2015, presented in three groups as follows: the “Top 3” which represents households recycing “*everything*”, “*almost all*” and “*most of everything*”; low level recycling which represents households recycling “*almost hal*f”, “*some things*” and “*very little*”; and, households recycling “*nothing*”.

3.4 Range of materials recycled

The percentage of households recycling one or more of the recyclable materials increased from 23.3% in 2010 to 30.9% in 2015. In 2015, 10.9% of households living in large urban areas recycled all four types of the paper and packaging recyclable materials (i.e. paper, plastic, glass and metal), and 10,2%, 4.6% and 5.2% recycled three, two and one type of materials, respectively (Figure 6a).

An analysis of only the households recycling one or more of the four recyclable materials (Figure 6b), shows that households which were previously only recycling one or two materials in 2010, are now recycling multiple materials. Households recycling four materials increased from 28.3% in 2010 to 35.3% in 2015, and households recycling three materials from 17.6% in 2010 to 32.9% in 2015. This is encouraging, as it shows that starting households off with only one material, e.g. separating out and recycling PET bottles, can soon diversify into multiple recycling materials as the household becomes familiar with waste separation practices.



a) All households b) Recycling households only

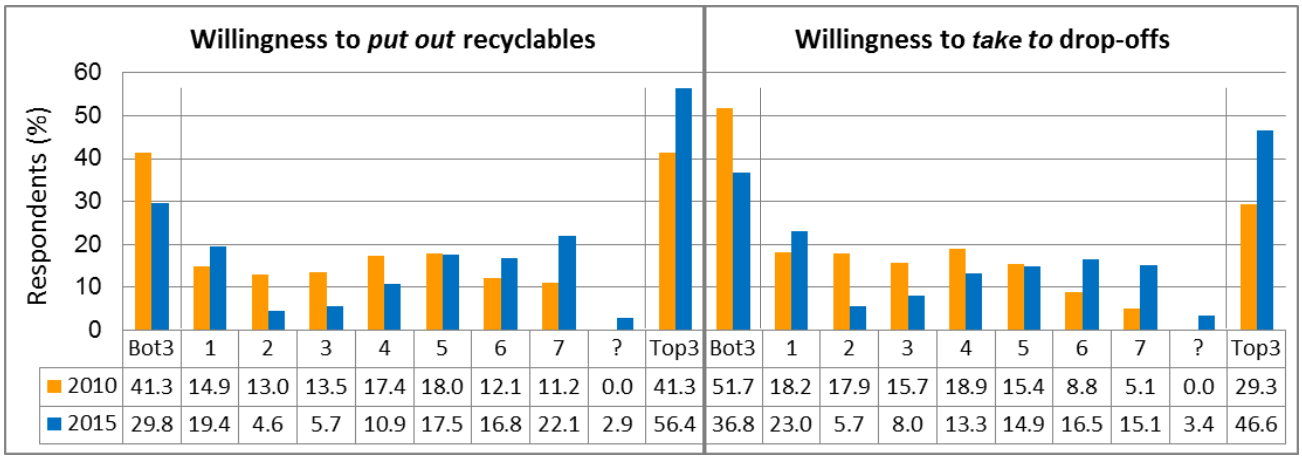
Figure 6. Percentage of households in large urban areas recycling one or more of the four recyclable materials, comparing 2010 and 2015. For (a) all households n=2004 and 2045 in 2010 and 2015, respectively, and for (b) recycling households only n=467 and n=632, in 2010 and 2015, respectively.

However, the percentages of households recycling one or two materials dropped. The households who five years ago recycled one or two materials are now recycling three or four, but not enough non-recycling households started to recycle one or two materials to replace those now recycling more material types. Over the five-year period, the overall increase in households that recycle is less than ten percent (7.6%). This suggests that households experience a barrier preventing them from starting to recycle.

3.5 Willingness to recycle

Since 2010, households have become more willing to put recyclables out separately from their residual waste for kerbside collection. The percentage households willing to put out recyclables for kerbside collection increased from 41.3% in 2010 to 56.4% in 2015, as depicted in the "Top 3" (sum of scores 5 - 7 on a 7-point scale, with 7 representing *very willing*) (Figure 8). Willingness to take recyclables to drop-off points also increased, from 29.3% in 2010 to 46.6% in 2015.

Households that are unwilling to put out recyclables for kerbside collection (sum of the bottom 3, 1-3 on the scale, with 1 representing *not willing at all*) have become more willing to do so between 2010 and 2015. But, interestingly, a fairly large percentage (19.4%) in 2015 are *not willing at all* (1 on the scale) to put out their recyclables. The percentage of households *not willing at all*, increased over the five-year period (from 14.9% to 19.4%). The data show a similar resistance to taking recyclables to drop-off centres; the percentage of households *not willing at all* increased from 18.2% to 23.0% in 2015. This could be the result of households observing and disapproving of failing systems such as irregular, discontinued and ill-maintained recycling services and infrastructure, which caused them to lose faith that separation at source can work in South Africa.



	Bot3	1	2	3	4	5	6	7	?	Top3	Bot3	1	2	3	4	5	6	7	?	Top3
2010	41.3	14.9	13.0	13.5	17.4	18.0	12.1	11.2	0.0	41.3	51.7	18.2	17.9	15.7	18.9	15.4	8.8	5.1	0.0	29.3
2015	29.8	19.4	4.6	5.7	10.9	17.5	16.8	22.1	2.9	56.4	36.8	23.0	5.7	8.0	13.3	14.9	16.5	15.1	3.4	46.6

Figure 8. Willingness of households to put recyclables out separately at kerbside for collection (on the left and Willingness to take recyclables to drop-off centres (on the right), over time 2010 and 2015.

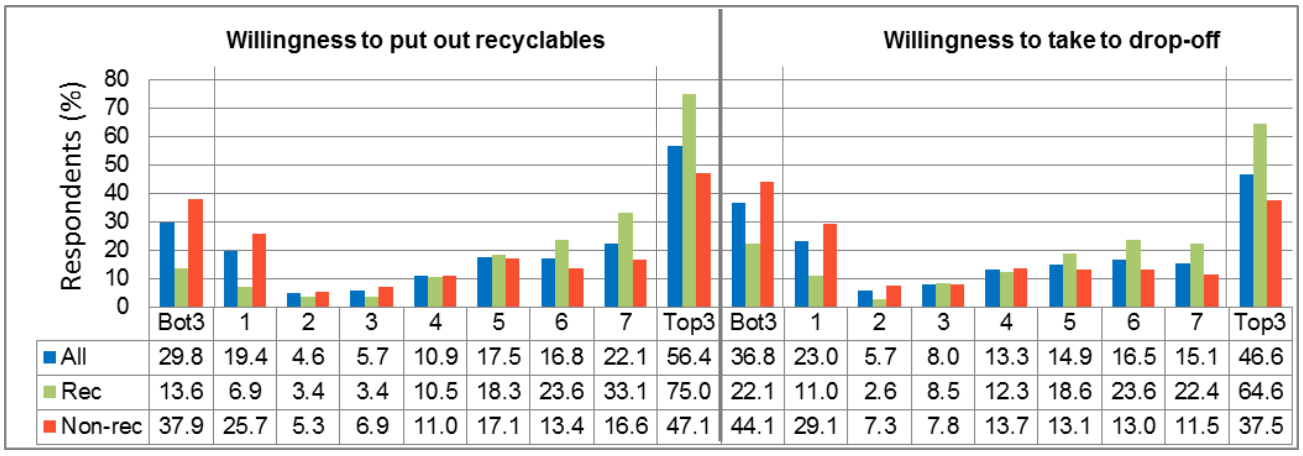
Considering the responses from representatives of both recycling and non-recycling households in large urban areas, 75% of the recycling households showed willingness ("Top 3") to *put* their recyclables *out* separately from residual waste at their kerbsides, compared to only 47.1% of the non-recycling households (Figure 9). The lower end of the willingness scale ("Bottom 3") for *putting out* recyclables for kerbside collection adds up to 13.6% and 37.9% for recycling and non-recycling households, respectively.

Almost two thirds (64.6%) of the recycling households showed willingness ("Top 3") to *take* their recyclables *to* drop-off points, compared to only 37.5% of the non-recycling households. The lower end of the willingness scale ("Bottom 3") for *taking* recyclables *to* drop-off points adds up to 22.1% and 44.1% for recycling and non-recycling households, respectively.

A high percentage of non-recyclers have indicated a willingness to separate recyclables for both kerbside collection (25.7%) and drop-off (29.1%). This suggests that these households are ready to recycle should they have access to a recycling service. The data also suggest that although a larger percentage of households would be willing to recycle should they have a kerbside collection for recyclables (current recycling and non-recycling households), a proportion of the current recycling households might prefer to continue to use their current drop-off service, opposed to receiving a kerbside collection for recyclables.

To what extend the current non-recyclers that indicated that they would be willing to put their recyclables out separately at kerbside, would in fact recycle, should they be serviced with a kerbside collection scheme,

cannot be confirmed. It should be kept in mind that intention to act does not necessary lead to the action being performed (Armitage and Conner 2001).



	Bot3	1	2	3	4	5	6	7	Top3	Bot3	1	2	3	4	5	6	7	Top3
All	29.8	19.4	4.6	5.7	10.9	17.5	16.8	22.1	56.4	36.8	23.0	5.7	8.0	13.3	14.9	16.5	15.1	46.6
Rec	13.6	6.9	3.4	3.4	10.5	18.3	23.6	33.1	75.0	22.1	11.0	2.6	8.5	12.3	18.6	23.6	22.4	64.6
Non-rec	37.9	25.7	5.3	6.9	11.0	17.1	13.4	16.6	47.1	44.1	29.1	7.3	7.8	13.7	13.1	13.0	11.5	37.5

Figure 9. Willingness of recycling and non-recycling households living in large urban households (2015) to put out recyclables separately at kerbside (on the left) and to take to drop-off centres (on the right).

A comparison of willingness to put recyclables out for kerbside collection between large urban areas and towns & rural areas shows that the difference between these two sub-groups is negligibly small (see full report for details).

4. CONCLUSION

While the full research report provides considerably more detail, this paper has shown that an increasing number of households are starting to recycle their household waste, although at a slower pace than envisaged given the current policy environment and the activities of the public and private sectors. Although the number of households that show dedicated recycling activity (recycling a fair amount of recyclables on a frequent basis) almost doubled between 2010 and 2015, from 4.0% in 2010 to 7.2% in 2015, it remains disappointingly low at less than 10%. In spite of these low household recycling behaviour rates, the South Africa's paper and packaging recycling sector continues to grow. This is due to a large and productive informal sector, which is estimated to collect 80-90% of all paper and packaging recycled in South Africa.

Recycling frequency has also not changed much over time. Households in towns and rural areas lag behind as far as recycling behaviour (recycling frequency and recycling quantities) is concerned, leaving room for improvement in communication efforts, service provision for recyclables and innovation to combat transport difficulties and costs to larger centres.

Results show an increase in households in 2015 recycling three or four recyclable materials compared to 2010. Of concern is the lack of "newcomers" to recycling, i.e. those recycling one or two types of recyclable materials only. This could be an indication of a hurdle to overcome – a barrier either on the side of households (e.g. lack of will or attitude to recycle or lack of awareness) or on the side of the service providers (e.g. no service or infrastructure for recyclable collection, or not communicating the availability of services).

Although not a guarantee for change in behaviour, a willingness of households to recycle holds promise for positive future household recycling trends. Action such as communication and awareness campaigns are needed to change attitudes and perceptions of the almost 20% of households that indicated that they are not willing at all to put their recyclables out at kerbside for collection at their households, as well as to shape the attitudes and perceptions of those that indicated that they *don't know*. The challenge is to change willingness of households into actual recycling behaviour.

This 2015 study has provided a very good, and particularly useful comparison with the first national baseline of post-consumer recycling behaviour in large urban areas of 2010. Continued monitoring of household recycling behaviour against this baseline will be highly relevant to the implementation of waste diversion strategies in South Africa, in particular municipal separation at source programmes and the planned Extended Producer Responsibility for Paper & Packaging.

In addition, opportunities for further investigation are recognised, amongst others, the following:

- An understanding of the municipal challenges in supplying a reliable waste separation at source service. These challenges might differ between urban and rural areas, and, understanding which recycling facilities would be best supported in which areas would enable municipalities to establish recycling facilities of choice, which would be supported by the local community;
- An understanding of household challenges in participating in recycling initiatives; how these challenges might differ between urban and rural households; in particular the barriers households have to overcome to start to recycling, which might be strongly imbedded in perceptions; and how to encourage continuous recycling behaviour (e.g. regular feedback); and,
- Communication strategies should be developed for better flow of information between government, the waste sector and households to ensure information-based policies and instruments are in place and to empower government and industry to send out a clear recycling message to all South Africans, e.g. how to communicate to and what information should be communicated to households on how to recycle. Focussed recycling awareness creation programmes should be based on sound evidence-based practices to create an enabled recycling nation.

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REFERENCES

Armitage CJ and Conner M (2001) Efficacy of the Theory of Planned Behaviour: A meta-analytic review. *British Journal of Social Psychology*, 40, 471-499.

Babbie, E. and Mouton, J. (2001). *The Practice of Social Research,* Oxford University Press, Oxford.

Brace, I. (2004). *Questionnaire Design. How to Plan, Structure and Write Survey Material for Effective Market Research,* Kogan Page, London.

Cresswell, J.W. (2003). *Research Design: Qualitative, quantitative, and mixed method approaches*, 2nd ed., Sage Publications, London.

DEA (2011). National Waste Management Strategy, November 2011, Department of Environmental Affairs, Republic of South Africa.

Eagly AH and Chaiken S (1993) *The Psychology of Attitudes*. Harcourt Brace and Company, Orlando.

Kempton W, Boster JS and Hartley JA (1996*) Environmental Values in American Culture*, The MIT Press, The Massachusetts Institute of Technology, Cambridge.

Kish, L. (1949). A procedure for objective respondent selection within the household. *Journal of the American Statistical Association*, 44, 380-387.

Leedy, P.D. and Ormrod, J.E. (2005). *Practical Research: Planning and Design*, 8th ed., New Jersey, USA: Pearson Prentice Hall.

Nhamo, G., Oelofse, S.H.H., Godfrey, L. and Mvuma, G. (2009). WasteCon '08 Workshop Report: Unpacking Governance Opportunities and Challenges for Integrated Municipal Waste Management in South Africa. CSIR report No CSIR/NRE/PW/IR/2009/0034/B.

Page, C. and Meyer, D. (2003). *Applied Research Design for Business and Management,* McGraw-Hill, Sydney.

Republic of South Africa (2000). White paper on integrated pollution and waste management for South Africa. A policy on pollution prevention, waste minimisation, impact management and remediation. Government Gazette Vol. 417, No.20978, 17 March 2000. General Notice 227 of 2000.

Republic of South Africa (2008). *National Environmental Management: Waste Act 2008* (Act No. 59 of 2008).

Republic of South Africa (2011). Addressing Challenges with Waste Service Provision in South Africa, National Domestic Waste Collection Standards. Government Gazette No. 33935, 21 January 2011, pp12-23.

Strydom, W.F. (2012) The continued quest to better recycling behaviour. *Proceedings WasteCon 2012, East London International Convention Centre, East London, 9-12 October 2012.*

WRAP (2015). *Banbury, 3Rs: recycling knowledge, attitude and claimed behaviour 2015*. Prepared by Phil Downing, Roisin Jones and Alex Plumb, Project code: RAK008-001, www.wrap.org.uk