

Recycling Behavior of Students at a Tertiary Institution in South Africa

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Abstract— Universities are regarded as having similar characteristics to those of a small town due to their large population involved in waste generation. Solid waste generation is one of the major challenges within universities because of lack of proper waste management facilities, insufficient knowledge of solid waste impacts and limited information about recycling – resulting in low recycling participation. This study investigated the recycling behavior of students at the University of Johannesburg. A total of 635 respondents completed a self-administered questionnaire. The results show that even though 91.5% of respondents noticed recycling bins on campuses, only 30.7% recycled. This behavior is contradicting their attitude towards recycling where 72.9% strongly agreed recycling is good and 70.1% that recycling is useful. Attitudes and moral norms influence recycling participation but only 25.8% of respondents strongly agreed that it would be wrong not to recycle and 42.1% that it is everybody's responsibility to recycle. Providing more recycling bins on campus was suggested by 52% of respondents to increase recycling participation.

Keywords—Recycling behavior, attitude, moral norm, waste separation at source.

I. INTRODUCTION

Solid waste management has been major concern for many countries worldwide and over last decades it has received tremendous attention because of the unavoidable challenges associated with it. The increase in population together with economic activities contributes to an increase in waste produced that needs to be collected, transported and disposed [1]. The disposal of waste happens on the environmental surface through landfill dumping and burial or combustion, all of which results in impacts associated with it [2]. These impacts not only affect the environment but also humans and animals. If waste is not properly managed, it can cause irreparable damage. Therefore, it is important that solid waste should be managed in a sustainable way to reduce the effects of it on the environment and human health [3].

Recycling is a process of collecting previously used materials to re-process, re-built and re-use them [4]. There are various benefits associated with recycling, from economic, environmental and social advantages. Some economic gains happen whereby agriculture, industries and administration save

money by re-using their resources or recycling them [5]. Social gains involve converting solid waste into potential energy sources that can sustain societies in various ways, while environmental benefits are the reduction of pollution and conservation of natural resources [6].

Universities has a special role to play in the development of young people – they are the future policy- and decision makers. Universities therefore play an important role in the development of responsible and sustainable behavior of students. Reference [7] argues that one of the best ways to deal with solid waste within universities is to change students' behavior towards solid waste and increase recycling participation. This study therefore investigated the recycling behavior of students at the University of Johannesburg. It determined the difference between attitude towards recycling and moral norm of recyclers and non-recyclers, reasons for not participating in recycling and the measures UJ can provide to increase recycling participation.

II. LITERATURE REVIEW

The overall waste produced in the year 2012 was 1.3 billion tons globally [8] and has increased to 2.01 billion tons in 2016 and is expected to grow to 3.4 billion tons by 2050 [9]. It is estimated that only 33% of solid waste produced is recycled [10]. Some of the main factors of the rapid waste production includes the transition of large amount of people into urban areas and economic growth, which improves quality of life and increases production and consumption of goods [11]. Other factors such as population growth, mismanagement of waste from individual households, large industrial and manufacturing organizations, as well as lack of recycling are also contributing towards an increase in waste generation [12]. Universities are regarded as having similar characteristics to those of a small town, due to their large population involved in different waste generation systems [13].

A. Recycling at tertiary institutions

Solid waste generation is one of the major challenges within universities because of lack of proper waste management facilities, insufficient knowledge of solid waste consequences and limited information about recycling leading to large waste production [14]. Although some institutions may have their own waste departments, the issue of collection, sorting, characterization and recycling is not sufficiently attended to. Based on various studies conducted within higher learning institutions, it is evident that there is a lack of waste management awareness as well as reduced understanding of

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factors influencing the rate of recycling, which then affects student recycling attitudes and intentions [7].

In a study conducted by [15] in the Malaysian University's student hostel area, only 40.6% of the students correctly identified the local authority responsible for solid waste management. Furthermore, they found that 42.4% of student were aware that the waste will be sent to landfill. After the implementation of a waste separation program, students' awareness of the program increased from 69.1% to 75% and participation from 38.7% to 44.1% over a period of three months [15]. Reference [16] in their study on recycling behavior of students at the Avcilar Campus of Istanbul University (Turkey) found that 43% of respondents separated paper and cardboard for recycling, whereas 40.8% of glass and 52% of metal cans were not recycled or reused. The recycling rates for glass and paper at Rhodes University (South Africa) were reported by [17] as 42% and 61% respectively.

Previous studies also explored the attitude of students towards and drivers of recycling. No significant difference between the genders and participation in recycling were found by [16] – they reported that 45% of female students and 40% of male students contributed to recycling. Contrary to this, [18] found that gender played a significant role in recycling participation. The top three drivers for participation in the waste separation program in the Malaysian University's student hostel area were proper education about the benefits of waste separation (79%), recyclable waste sold for extra income (78.9%) and recycling facilities near housing areas (78.3%) [15]. On the other hand, the top three discouraging factors were laziness (85.5%), not many fellow students are doing it (80.6%) and the lack of recycling facilities (79.4%).

Previous experience in separating waste for recycling was found by [18] to be a key factor in separating waste for recycling. They found respondents with more than five years' experience in recycling exhibited a positive attitude towards recycling and expressed the greatest intention to continue participating in recycling. This finding is supported by [19] that concluded that an individual's past experience towards recycling positively influenced willingness to participate in recycling.

Behavioral attitude, moral obligation and behavioral control were identified as significant drivers and predictors of recycling participation amongst students [7], [19]. Reference [7] found that behavioral attitude and moral obligation were the strongest predictor of campus recycling intention. In their study [19] concluded that an individual's attitude and awareness towards the environment are largely subjected to the moral values of their own society and consequently influence their response to recycling. Associated with the moral norm is the social norm – that refers to perceived social pressure to separate waste for recycling. Social norm was found by [7] as another important determinant of recycling participation.

Convenience in participating in recycling (perceived behavioral control) has been identified by previous studies as an important factor influencing recycling participation [20], [21], [22]. Perceived behavioral control can be regarded as person's perception of how easy or difficult it is to separate waste for recycling [23]. Both [7], [19] concluded that perceived

behavioral control significantly predicted recycling intention. Reference [19] found that though convenience and cost of recycling were important determinants of recycling behavior, the time commitment to recycle was the most decisive factor that influenced respondents' willingness to participate in recycling.

B. Waste generation and recycling at UJ

The University of Johannesburg (UJ) started recording the amount of waste generated on all campuses in 2011. From a high of 4 838.5.2 tons of waste in 2011, UJ has managed to reduce the waste generated to 1 858.5 tons in 2019 [24]. The amount of waste recycled differs from year to year. The lowest recycling rate was recorded in 2011 with 188.7 tons (3.9% of total waste) recycled. The waste recycled increased to 34.8% (539.7 tons) in 2014. The following three years saw a decrease of recycled waste and only 19.6% (456.7 tons) of waste was recycled in 2017. Since then the waste recycled increased to 33.7% (625.3 tons) in 2019 and is the latest figure available [24]. Although UJ has managed to reduce the waste generated in its operations, the average recycling rate since recording has started is 21.9%.

A more in-depth analysis of the 2019 recycled waste figures shows serious concern. Of the 625.3 tons of recycled waste, garden waste constituted 407 tons (65.1% of waste recycled). This was followed by glass (7.5%), white paper (6.9%), cardboard (6.6%) and corn paper (5.2%). Other waste recycled are plastic, metal cans, fluorescent tubes, scrap metal, wet waste and fat. The lowest recycling figure was recorded for e-waste with a contribution of only 0.5% of total waste recycled [24].

Reference [13] is of the opinion that universities cannot afford to ignore the environmental impacts caused through their operations. Universities therefore have a moral and ethical obligation to engage in environmentally sustainable behavior. Universities in developed countries has made great progress in waste management but developing nations and their universities face various challenges in the proper management of waste [25]. The barriers of waste management in developing nations identified in the literature include the high cost of waste management, population growth, inequality, insufficient financial resources, increased complexity of waste streams and lack of waste data [26], [27], [28], [29], [30]. As a university in a developing nation, UJ reported similar barriers, namely the expanding nature of the campuses, increasing student numbers as well as cost containment pressures [24].

Reference [7] state that to reduce solid waste production and increase recycling at universities, a careful behaviour analysis should be implemented. However, it is well noted in the literature that for a recycling program to be successful depends on the involvement of people [16], [31], [32], [33]. Very limited research is available on the recycling and pro-environmental behavior of South African students. Reference [17] investigated energy use and recycling and [34] pro-environmental behavior of students – both studies at Rhodes University. This study therefore is the first step to determine what the recycling behavior is of students at UJ and what drivers might influence their recycling participation.

III. STUDY AREA AND METHODOLOGY

A. Study area

The University of Johannesburg has four campuses located in different parts of the metropolitan area of the City of Johannesburg. Auckland Park Kingsway Campus is the seat of administration and governance of the university, as well as the largest and most populated campus of all. The campus is located on Kingsway Road in the suburb of Auckland Park. The second campus is Auckland Park Bunting Road Campus, which is located on Bunting Road, Auckland Park. The Doornfontein Campus is the third campus located within the central business district of Johannesburg and the last campus is the Soweto Campus based in Soweto in the south western parts of Johannesburg.

The university comprises a built-up area of about 45 000 square-meters on all campuses [24]. Buildings consist of different facilities such as lecture rooms, micro-laboratories, libraries, sports facilities, auditoriums, campus and health clinics, student residences as well as student cafeterias and shopping centers. In total, UJ can accommodate over fifty thousand students on the different campuses.

B. Methodology

This study is a mixed method research which is the process of integrating qualitative and quantitative research to address research purpose of study questions [35]. A self-administered questionnaire was used that contained questions on general demographic information such as age, gender, faculty and campus of the respondents. The survey asked students their level of agreement on statements regarding recycling using a five-point Likert scale and their recycling behavior on campus.

Data were collected when South Africa was under lockdown Level 4. Therefore, social media, email and sms were used to invite students to participate in the study. An online platform was used for the survey and a total of 735 responses were received. An important question in the survey was if a respondent participated in recycling (yes/no), and if not answered, removed. A total of 635 questionnaires were analyzed for this study. Data were exported into a spreadsheet and analyzed using descriptive statistics by means of graphs and tables. The comments provided in the open-ended question on what UJ can do to increase recycling participation were analyzed using content analysis. Content analysis is an analytic method used to determine the frequency of certain words and phrases and using a coding frame to generate measurements from qualitative data [36], [37], [38]. Key words and phrases were used to identify textual elements and served as a basis for counting frequency of occurrence as suggested by [36].

IV. RESULTS AND DISCUSSION

A. Recycling participation and reasons for not recycling

Less than a third (30.9%) of respondents separated waste for recycling. Reasons for not separating waste should be investigated in recycling programs so that planners could use such information to adapt the program. The 69.1% that did not participate in recycling were asked reasons for

non-participation. The two main reasons for not participating in separating waste were 'I do not have time to sort out recyclables' (32.5%) and 'I do not have space to store the recyclables' (28.4%). This was followed by more information that is needed on what is recyclable or not (26.3%) and recycling is too much effort (23.5%). Only 3.6% of respondents indicated that recycling is 'not my problem'. The findings are in agreement with the most consistent reasons given in other studies for non-participation in recycling. The two main reasons are that recycling is too time-consuming [39], [40], [41] and lack of space to store recyclables [39], [41], [42], [43].

B. Attitudes towards recycling

Four statements tested recyclers and non-recyclers' attitudes towards recycling using a five-point Likert scale (Table 1). Both recyclers and non-recyclers overwhelmingly indicated that 'recycling is good' with 78.6% of non-recyclers and 91.3% of recyclers agreeing or strongly agreeing with this statement. 'Recycling is good' also attracted strong support with 83.1% of recyclers and 70.7% of non-recyclers strongly in agreement. 'Recycling is rewarding' is the attitude that scored the lowest level of agreement of the four. Less than half (48.7%) of non-recyclers and about two-thirds (67.2%) of recyclers indicated that they strongly agreed with this statement. 'Recycling is responsible' was the attitude that showed the biggest difference between recyclers and non-recyclers – with 78.9% of recyclers and 58.1% non-recyclers in strong agreement.

TABLE I: ATTITUDES TOWARDS RECYCLING

Statement	Recyclers (%)	Non-recyclers (%)
Recycling is good		
Strongly disagree	0.0	9.6
Disagree	0.0	0.9
Neutral	0.5	1.4
Agree	13.3	16.2
Strongly agree	86.2	71.9
Recycling is useful		
Strongly disagree	0.0	9.6
Disagree	0.0	0.7
Neutral	0.5	2.5
Agree	16.4	16.5
Strongly agree	83.1	70.7
Recycling is rewarding		
Strongly disagree	0.0	8.7
Disagree	1.5	1.7
Neutral	7.2	11.0
Agree	24.1	29.9
Strongly agree	67.2	48.7
Recycling is responsible		
Strongly disagree	0.0	8.8
Disagree	0.5	1.7
Neutral	2.0	6.9
Agree	18.6	24.5
Strongly agree	78.9	58.1

Findings of previous studies showed that if individuals exhibit a positive attitude towards waste separation at source, such individuals participate more in recycling [21], [44], [45]. The results in Table 1 indicates a positive attitude of both recyclers and non-recyclers towards recycling.

C. Moral norm

Moral norms are the moral obligation or responsibility a person feels to perform recycling [46], while [47] describe it as personal or moral norms that are internalized rules that prescribe what behavior is considered right or wrong. Recycling requires the effort and time of individuals. Therefore, [48] argues that recycling participation is rather a moral than economic behavior.

Three statements were used to determine respondents' moral obligation to separate waste for recycling (Table 2). Again, the results show that there are not significant differences between respondents that recycled and those that did not participate in recycling. The statement that elicited the largest difference was 'it would be wrong of me not to recycle'. For recyclers 69.9% and non-recyclers 56.4% were in agreement or strongly agreed with this statement. The reuse of items recorded almost the same level of agreement – with 71.9% of non-recyclers and 75.9% of recyclers agreeing and strongly agreeing. More than three-quarters (76.6%) of non-recycling respondents and 84.5% of recyclers felt that everybody should share the responsibility to recycle.

TABLE II: MORAL NORMS

Statement	Recyclers (%)	Non-recyclers (%)
It would be wrong of me not to recycle		
Strongly disagree	7.2	8.5
Disagree	9.8	8.3
Neutral	13.0	26.8
Agree	34.2	33.1
Strongly agree	35.8	23.3
I feel I should not waste anything if it could be used again		
Strongly disagree	6.7	9.1
Disagree	3.1	5.5
Neutral	14.3	13.5
Agree	29.7	34.8
Strongly agree	46.2	37.1
Everybody should share the responsibility to recycle		
Strongly disagree	6.7	8.1
Disagree	2.1	2.1
Neutral	6.7	13.2
Agree	30.6	37.5
Strongly agree	53.9	39.1

Respondents showed overall a strong moral obligation towards recycling. Compared with their attitude towards recycling, lower levels of agreement were observed for their moral obligation. However, despite positive attitudes and a strong moral norm towards recycling, the majority (69.1%) of respondents do not participate in recycling.

D. Measures to increase recycling participation

An open-ended question asked respondents what UJ can do to increase recycling participation. A total of 632 (99.5%) of respondents completed this part of the questionnaire. This can be regarded as an excellent response rate to an open-ended question [49]. Table 3 shows the main eight measures suggested by respondents. The provision of more recycling bins (52%) was the top suggested measure to increase recycling participation. The results of previous studies showed that individuals will actively engage in recycling when more facilities are provided [50], [51], [52], [53].

TABLE III: MEASURES TO INCREASE RECYCLING

Measure	Frequency	Percentage
Provision of bins/stations	327	52.0
Projects & campaigns	89	14.1
Awareness	72	11.4
Education on benefits	60	9.5
Incentives or rewards	53	8.4
Information	44	7.0
Posters	25	4.0
Student involvement	15	2.4

Although respondents are mostly aware of the current recycling bins on campus, there were comments to increase the size of the bins or provide recycling stations, make it more visible, regularly empty the bins and provide bins were students gather and 'on every corner' on campus. Some comments of students about the current recycling bins:

"I know working in a lab we hardly leave so it would be inconvenient to walk to a small recycling bin which is hardly ever emptied and try and recycle there."

"Sometimes people, like myself, don't recycle because the recycling bins are not everywhere around me and they are just in one area which could be far from wherever I am at that particular time."

"Distribute more recycling bins around campus as there's only a few bins available, the bins have to be a lot bigger than they currently are."

Projects and campaigns to promote the recycling program (14.1%) and raising awareness about the program (11.3%) were also suggested by respondents. Some respondents commented that UJ should put notifications on the online platform used by students and lectures to students about the program and the benefits of recycling. In the study conducted by [15], a short five-minute class presentation was identified as the most effective method to increase recycling participation amongst students. They concluded that direct confrontation by means of a class presentation is more effective than the use of social media in promoting a recycling program under students. Awareness about recycling and recycling programs were found by [51], [54] to effectively promoted the participation in the separation of waste at source. The lack of awareness of the recycling program at UJ came to the fore in the following comments:

“Recycling bins are present on campus, but we never hear anything mentioned about recycling or recycling projects. UJ should make an effort to get the word out there to its students.”

“I really think that UJ should work on actually just trying to get students to use bins in the first place. Being on APK for 10 years has shown me that students feel as though THEIR trash is someone else’s problem.”

The provision of rewards or incentives were suggested by 8.4% of respondents. Such rewards or incentives ranged from monetary rewards, a points system to a ‘wall of fame’ for students that regularly participate in recycling. Rewards and incentives are measures often suggested by researchers to increase recycling participation [55], [56], [57].

References [44], [58], [59] found that knowledge on where, what and how to recycle greatly enhanced recycling behavior. Information on how to participate in recycling on campus was suggested by 7.0% of respondents. Previous studies also showed that there was no notion of responsibility of individuals to find information regarding recycling [43], [44]. It is therefore necessary to provide the necessary information to students – as one student commented:

“Educate us about recycling because many students don't really know about it, they know that it's there, but they don't know how to go on about doing it.”

V. CONCLUSION

With around a fifth of waste recycled on average, there is still much that can be done to improve recycling at UJ – especially since 65.1% of waste recycled was garden waste. With approximately 50 000 students, large amounts of packaging, metal cans, white paper and electronic and electrical equipment are consumed on the different campuses. Less than a third of students participate in recycling and mostly because a lack of time and space to sort and store recyclables.

Reasons for not participating in recycling should be investigated in recycling programs so that planners could use such information to adapt the program. The results of this study provided information that can assist in increasing participation in recycling at UJ. Even if students are willing to recycle, they found it inconvenient to do so and UJ should take note of this. Respondents showed positive attitudes and strong moral norms towards recycling but unfortunately it did not result in positive environmental behaviour. Measure to increase recycling were identified and the provision of more recycling bins and awareness about the recycling program were the most recommended measures by respondents.

REFERENCES

- [1] Asefi, H., Shahparvari, S. & Chhetri, P. 2020. Advances in sustainable integrated solid waste management systems: Lessons learned over the decade 2007-2018. *Journal of Environmental Planning and Management*, 14(3):1-26. <https://doi.org/10.1080/09640568.2020.1714562>
- [2] Umar, U.M. and Naibbi, A.I. 2020. Analysis and suitability modeling of solid waste disposal sites in Kano metropolis, Nigeria. *Geocart International*, doi: 10.1080/10106049.2019.1655796.
- [3] Marshall, R.E. & Farahbakhsh, K. 2013. Systems approaches to integrated solid waste management in developing countries. *Waste Management*, 33(4):988-1003. <https://doi.org/10.1016/j.wasman.2012.12.023>
- [4] Pakpour, A.H., Zeidi, I.M., Emanjomah, M.M., Asefzadeh, S. & Pearson, H. 2014. Household waste behaviours among a community sample in Iran: An application of the theory of planned behaviour. *Waste Management*, 34:980-986. <https://doi.org/10.1016/j.wasman.2013.10.028>
- [5] Ku, S.J., Yoo, S.H. and Kwak, S.J. 2009. Willingness to pay for improving the residential waste disposal system in Korea: A choice experiment study. *Environmental Management*, 44(2):278-287. <https://doi.org/10.1007/s00267-009-9325-5>
- [6] Thormark, C. 2000. Including recycling potential in energy use into the life-cycle of buildings. *Building Research and Information*, 28(3):176-183. <https://doi.org/10.1080/096132100368948>
- [7] Largo-Wight, E., Bian, H. & Lange, L. 2012. An empirical test of an expanded version of the theory of planned behavior in predicting recycling behavior on campus. *American Journal of Health Education*, 43(2):66-73. <https://doi.org/10.1080/19325037.2012.10599221>
- [8] Borthakur, A. & Govind, M. 2018. Public understandings of E-waste and its disposal in urban India: from a review towards a conceptual framework. *Journal of Cleaner Production*, 172(1):1053-1066. <https://doi.org/10.1016/j.jclepro.2017.10.218>
- [9] Kaza, S., Yao, L., Bhada-Tata, P. & Van Woerden, F. 2018. *What a waste 2.0: A global snapshot of solid waste management to 2050*. World Bank Urban Development Series. Washington, DC: World Bank Group. <https://doi.org/10.1596/978-1-4648-1329-0>
- [10] Banerjee, S. & Sarkhel, P. 2020: Municipal solid waste management, household and local government participation: A cross country analysis. *Journal of Environmental Planning and Management*, 63(2):210-235. <https://doi.org/10.1080/09640568.2019.1576512>
- [11] Al-Khatib, I.A., Monou, M., Abu Zahara, A.S.F., Shaleen, H.Q. & Kassinos, D. 2010. Solid waste characterization, quantification and management practices in developing countries. *Journal of Environmental Management*, 91(5):1131-1138. <https://doi.org/10.1016/j.jenvman.2010.01.003>
- [12] Hoorweg, D., Bhada-Tata, P. & Kennedy, C. 2013. Waste production must peak this century. *Nature*, 502:615-617. <https://doi.org/10.1038/502615a>
- [13] Kassaye, A.Y. 2018. Contemporary institutional solid waste management practices of Haramaya University, eastern Ethiopia. *African Journal of Science, Technology, Innovation and Development*, 10(2):219-238. <https://doi.org/10.1080/20421338.2018.1443412>
- [14] Okeniyi, J.O. and Anwan, E.U. 2012. Solid wastes generation in Covenant University, Ota, Nigeria: Characterisation and implication for sustainable waste management. *Journal of Materials and Environmental Science*, 3(2):419-424.
- [15] Bashir, M.J.K., Jun, Y.Z, Yi, L.J., Abushammala, M.F.M., Abu Amr, S.S. & Pratt, L.W. 2020. Appraisal of students’ awareness and practices on waste management and recycling in the Malaysian University’s student hostel area. *Journal of Material Cycles and Waste Management*, 22:916-927. <https://doi.org/10.1007/s10163-020-00988-6>
- [16] Balkaya, N. & Bilgin, A. 2019. University students’ recycling behavior and attitudes toward the disposal of solid waste. In *Recycling and reuse approached for better sustainability*. Edited by Blalkaya, N. & Guneyusu, S. Cham: Springer. https://doi.org/10.1007/978-3-319-95888-0_4
- [17] Mtutu, P. & Thondhlana, G. 2016. Encouraging pro-environmental behaviour: energy use and recycling at Rhodes University, South Africa. *Habitat International*, 53:142-150. <https://doi.org/10.1016/j.habitatint.2015.11.031>
- [18] Kashyap, R. & Iyer, E. 2015. Attitudes and behaviors of college students in regard to the environment and recycling. In *New meanings for marketing in a new millennium*. Edited by Moore, M & Moore, R. Cham: Springer. https://doi.org/10.1007/978-3-319-11927-4_24
- [19] Ahmad, M.S., Bazmi, A.A., Bhutto, A.W., Shahzadi, K. & Bukhari, N. 2016. Students’ responses to improve environmental sustainability

- through recycling: Quantitatively improving qualitative model. *Applied Research Quality Life*, 11:253-270.
<https://doi.org/10.1007/s11482-014-9366-7>
- [20] Nguyen, T.T.P., Zhu, D. & Le, N.P. 2015. Factors influencing waste separation intention of residential households in a developing country: Evidence from Hanoi, Vietnam. *Habitat International*, 48:169-176.
<https://doi.org/10.1016/j.habitatint.2015.03.013>
- [21] Corsini, F., Gusmerotti, N.M., Testa, F. & Iraldo, F. 2018. Exploring waste prevention behaviour through empirical research. *Waste Management*, 79:132-141.
<https://doi.org/10.1016/j.wasman.2018.07.037>
- [22] Strydom, W.F. 2018. Applying the theory of planned behavior to recycling behavior in South Africa. *Recycling*, 3(43). doi: 10.3390/recycling3030043.
<https://doi.org/10.3390/recycling3030043>
- [23] De Groot, J. & Steg, L. 2007. General beliefs and the theory of planned behaviour: The role of environmental concerns in the TPB. *Journal of Applied Social Psychology*, 37(8):1817-1836.
<https://doi.org/10.1111/j.1559-1816.2007.00239.x>
- [24] UJ (University of Johannesburg). 2020. *University of Johannesburg Annual Report 2019*. Available from: https://www.uj.ac.za/about/Documents/Annual%20reports/UJ_AnnualReport2019.pdf.
- [25] Coker, A.O., Achi, C.G., Sridhar, M.K.C. & Donnet, C.J. 2016. Waste management practices at a private institution of higher learning in Nigeria. *Procedia Environmental Sciences*, 35:28-29.
<https://doi.org/10.1016/j.proenv.2016.07.003>
- [26] Guerrero, L.A., Maas, G. & Hogland, W. 2013. Solid waste management challenges for cities in developing countries. *Waste Management*, 33(1):220-232.
<https://doi.org/10.1016/j.wasman.2012.09.008>
- [27] Pujara, Y., Pathak, P., Sharma, A. & Govani, J. 2019. Review on Indian municipal solid waste management practices for reduction of environmental impacts to achieve sustainable development goals. *Journal of Environmental Management*, 248(2019):109238.
<https://doi.org/10.1016/j.jenvman.2019.07.009>
- [28] Zhou, B., Sun, C. & Yi, H. 2017. Solid waste disposal in Chinese cities: An evaluation of local performance. *Sustainability*, (9):2234.
<https://doi.org/10.3390/su9122234>
- [29] Filho, W.L., Brandli, L., Moora, H., Kruopienè & Stenmarck, A. 2016. Benchmarking approaches and methods in the field of urban waste management. *Journal of Cleaner Production*, 112(5):4377-4386.
<https://doi.org/10.1016/j.jclepro.2015.09.065>
- [30] DEA (Department of Environmental Affairs). 2018. *South Africa State of Waste Report – Second draft report*. Available from: <http://sawic.environment.gov.za/documents/9066.pdf>.
- [31] Anderson, B.A., Romani, J.H., Wentzel, M. & Phillips, H.E. 2013. *Recycling behaviour among urban South Africans: The role of race and social status*. Population Studies Center Research Report No. 1-790.
- [32] Bom, U.B., Belbase, S. & Lila, R.B. 2017. Public perceptions and practices of solid waste recycling in the city of Laramie in Wyoming, U.S.A. *Recycling*, 2(3):11.
<https://doi.org/10.3390/recycling2030011>
- [33] Xiao, L., Zhang, G., Zhu, Y. & Lin, T. 2017. Promoting public participation in household waste management: A survey based method and case study in Xiamen City, China. *Journal of Cleaner Production*, 144:313-322.
<https://doi.org/10.1016/j.jclepro.2017.01.022>
- [34] Thondhlana, G. & Hlatshwayo, T.N. 2018. Pro-environmental behavior in student residences at Rhodes University South Africa. *Sustainability*, 10:2746.
<https://doi.org/10.3390/su10082746>
- [35] Guetterman, T.C. & Fetters, M.D. 2018. Two methodological approaches to the integration of mixed methods and case study designs: A systematic review. *The American Behavioral Scientist*, 62(7):900-918.
<https://doi.org/10.1177/0002764218772641>
- [36] Byrne, D. 2017. How do I analyze and interpret qualitative data? *Project Planner*. doi: 10.4135/9781526408570.
- [37] Hsiu-Fang, H. & Shannon, S. 2018. Content analysis. In *The SAGE encyclopedia of education research, measurement, and evaluation*. Edited by Frey, B.B. Thousand Oaks: SAGE Publications. doi: 10.4135/9781506326139.
- [38] Maier, M.A. 2018. Content analysis: Advantages and disadvantages. In *The SAGE encyclopedia of communication research methods*. Edited by Allen, M. Thousand Oaks: AGE Publications. doi: 10.4135/9781483381411.
- [39] Banga, M. 2011. Household knowledge, attitudes and practices in solid waste segregation and recycling: The case of urban Kampala. *Zambia Social Science Journal* 2(1):26-39.
- [40] Owusu, V., Adjei-Addo, E. & Sundber, C. 2013. Do economic incentives affect attitudes to solid waste source separation? Evidence from Ghana. *Resources, Conservation and Recycling*, 78:115-123.
<https://doi.org/10.1016/j.resconrec.2013.07.002>
- [41] Czajkowski, M., Kądziela, T. & Hanley, N. 2014. We want to sort! Assessing households' preference for sorting waste. *Resource and Energy Economics*, 36(1):290-306.
<https://doi.org/10.1016/j.reseneeco.2013.05.006>
- [42] Mbida, B. 2014. Urban solid waste characteristics and household appetite for separation at source in Eastern and Southern Africa. *Habitat International*, 43:152-162.
<https://doi.org/10.1016/j.habitatint.2014.02.001>
- [43] Babaei, A.A., Alavi, N., Goudarz, G., Teymouri, P., Ahmadi, K. & Rafiee, M. 2015. Household recycling knowledge, attitudes and practices towards solid waste management. *Resources, Conservation and Recycling*, 102:94-100.
<https://doi.org/10.1016/j.resconrec.2015.06.014>
- [44] Barr, S., Ford, N.J. & Gilg, A.W. 2003. Attitudes towards recycling household waste in Exeter, Devon: Quantitative and qualitative approaches. *Local Environment*, 8(4):407-421.
<https://doi.org/10.1080/13549830306667>
- [45] Jekria, N. & Daud, S. 2016. Environmental concern and recycling. *Procedia Economics and Finance*, 35:667-673. 7th International Economics and Business Management Conference, 5-6 October 2015. doi: 10.1016/S2212-5671(16)00082-4.
- [46] Botetzagias, I., Dima, A. & Malesios, C. 2015. Extending the theory of planned behavior in the context of recycling: The role of moral norms and of demographic predictors. *Resources, Conservation and Recycling*, 95:58-67.
<https://doi.org/10.1016/j.resconrec.2014.12.004>
- [47] Schwartz, S.H. 1977. Normative influences on altruism. In *Advances in Experimental Social Psychology*, Vol. 10:221-279. Edited by Berkowitz, L. New York: Academic Press.
[https://doi.org/10.1016/S0065-2601\(08\)60358-5](https://doi.org/10.1016/S0065-2601(08)60358-5)
- [48] Chan, L. & Bishop, B. 2013. A moral basis for recycling: Extending the theory of planned behavior. *Journal of Environmental Psychology*, 36:96-102.
<https://doi.org/10.1016/j.jenvp.2013.07.010>
- [49] O' Cathain, A. & Thomas, K.J. 2004. "Any other comments?" Open question on questionnaires – a bane or a bonus to research? *BMC Medical Research Methodology*, 4:25.
<https://doi.org/10.1186/1471-2288-4-25>
- [50] Latif, S.A., Omar, M.S., Bidin, Y.H. & Awang, Z. 2013. Analyzing the effect of situational factor on recycling behaviour in determining the quality of Life. *Journal of Asian Behavioural Studies*, 3(8), 37-46.
- [51] Wang, Z., Dong, X. & Yin, J. 2018. Antecedents of urban residents' separate collection intentions for household solid waste and their willingness to pay: Evidence from China. *Journal of Cleaner Production*, 173(2018):256-264.
<https://doi.org/10.1016/j.jclepro.2016.09.223>
- [52] Meng, X., Tan, X., Wang, Y., Wen, Z., Tao, Y. & Qian, Y. 2019. Investigation on decision-making mechanism of residents' household solid waste classification and recycling behaviors. *Resources, Conservation and Recycling*, 140:224-234.
<https://doi.org/10.1016/j.resconrec.2018.09.021>
- [53] Struk, M. 2017. Distance and incentives matter: The separation of recyclable municipal waste. *Resources, Conservation and Recycling*, 122:155-162.
<https://doi.org/10.1016/j.resconrec.2017.01.023>
- [54] Roustia, R. & Bolton, K. 2019. Chapter 8 – Sorting household waste at the source. In *Sustainable resource recovery and zero waste approaches*:105-114. Edited by Taherzadeh, M.J., Bolton, K., Wong, J. & Pandye, A. Amsterdam: Elsevier.
<https://doi.org/10.1016/B978-0-444-64200-4.00008-6>

- [55] Koford, B.C. Blomquist, G.C., Hardesty, D.M. & Troske, K.R. 2012. Estimating consumer willingness to supply and willingness to pay for curbside recycling. *Land Economics*, 88(4):745-763. <https://doi.org/10.3368/le.88.4.745>