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## SOCIO-ECONOMIC FACTORS ASSOCIATED WITH SACHET WASTE COLLECTION IN KANO METROPOLIS, NIGERIA

### ABSTRACT

*Sachet water is widely consumed in Nigeria because of its affordability and convenience, but its single use plastic packaging contributes to urban waste management problems. At the same time, informal collection of recyclable plastics provides an income generating activity for urban residents. This study examines the socio economic factors associated with willingness to participate in sachet waste collection and the level of daily gain obtained from the activity in Kano Metropolis, Nigeria. The study used cross sectional survey data collected in 2026 from respondents across four purposively selected Local Government Areas of Kano Metropolis. A total of 291 questionnaires were received, of which 290 complete observations were used for the regression analysis. A binary logistic regression model was estimated for willingness to participate, while an ordered logistic regression model with robust standard errors was estimated for daily gain, classified as low, moderate and high. The participation model was statistically significant based on the joint Wald test ( $\chi^2(10)=48.04$ ;  $p<0.001$ ; pseudo- $R^2=0.1362$ ). Relative to farming, Islamic students had 11.77 times the odds of reporting willingness to participate (95% CI: 3.510-39.476), while respondents in other occupations had 5.64 times the odds (95% CI: 2.159-14.714). Respondents aged 16-20 had 4.60 times the odds of willingness relative to those below 15 years (95% CI: 1.907-11.080), while the 26 years and above group had 2.64 times the odds (95% CI: 1.028-6.775). The gain model was statistically significant based on the joint Wald test of the explanatory variables ( $\chi^2(10)=66.61$ ;  $p<0.001$ ; pseudo- $R^2=0.0942$ ). Age 21-25 was associated with 2.51 times the odds of being in a higher gain category ( $p=0.040$ ), while age 26 years and above was associated with lower odds (OR=0.19;  $p=0.001$ ). Primary education was marginally associated with higher gain (OR=1.55;  $p=0.094$ ), whereas secondary education was not statistically significant (OR=2.47;  $p=0.101$ ). Gender was not statistically significant in either model. The proportional odds assumption was not rejected (Wald  $\chi^2(6)=5.10$ ;  $p=0.531$ ). The findings indicate that sachet waste collection is both an environmental recovery activity and an informal livelihood activity whose participation and returns varies across socio economic characteristics. The study recommends designated collection points, predictable buying arrangements, support for collector cooperatives and practical skills development to improve the safety and economic returns of informal sachet waste collection.*

**Keywords:** *sachet waste; waste picking; willingness to participate; socio-economic factors; informal recycling; Kano Metropolis.*

## 1. Introduction

Managing plastic waste is now a major issue around the world, as plastics are extremely durable and are widely used for a short time and then thrown away. In urban areas of developing countries, this challenge is exacerbated by the lack of infrastructure for collection, separation and recycling, growing rapidly with the increasing demand. The plastic and sachet water consumption in Nigeria is of particular interest due to the persistent lack of reliable drinking water in Nigeria. Evidence gathered recently confirms that sachet water is very popular and has led to environmental degradation due to blocking of drainage, causing flooding and pollution by micro plastics (Okagbue et al., 2026). Recent evidence identifies discarded sachets as a contributor to drainage blockage, flooding and environmental pollution, while the wider Nigerian plastics economy continues to face important end of life management gaps (Donuma et al., 2024; Ezeudu et al., 2024; Okagbue et al., 2026; Ukpene, 2024). The problem therefore extends beyond waste disposal to the question of how discarded materials can be recovered and returned to productive use. Recycling can reduce the quantity of material sent to disposal sites, conserve resources and create income and employment opportunities. In this process, informal waste collectors and pickers perform an important recovery function even though their activities are often poorly recognized within formal waste management systems. Evidence on sachet waste also suggests that incentive based collection arrangements can encourage the return or recovery of used sachet bags (Nathaniel et al., 2012).

Kano Metropolis provides an important setting for examining the relationship between informal waste recovery and livelihoods. Nabegu (2008) documented an organized but predominantly informal plastic waste recovery system in Kano involving street collectors, scavengers, waste management personnel and traders. Economic motivations, including limited alternative employment opportunities, were important to participation. Nabegu (2009) further showed that plastic recovery operates within social and institutional relationships linking sources of recyclable materials with markets. More recent evidence also indicates that recovered plastics move through networks involving collectors, intermediaries and recycling firms (Ezeudu et al., 2024). Muktar (2011) reported that 30% of the 60 scavengers interviewed in Kano were aged 15 years or less. A later study of informal waste pushers in Kano also documented the involvement of underage youths in waste collection activities (Saleh & Marzuki, 2023). These studies establish that the presence of younger participants in informal waste recovery is not unprecedented in Kano. The informal nature of waste collection has both economic and social implications. Waste picking can provide income and livelihood support, but collectors may also face occupational hazards, stigma and weak institutional protection. Evidence from Nigeria indicates that informal waste workers can be exposed to injuries and other occupational risks while simultaneously contributing to waste recovery and household livelihoods (Dada et al., 2023; Goodman et al., 2020; Nzeadibe & Anyadike, 2012; Solaja et al., 2024).

Despite the growing literature on plastic waste and informal recycling in Nigeria, limited empirical attention has been paid specifically to the socio economic determinants of sachet waste collection in Kano Metropolis. Sachet waste is a distinct component of the urban plastic stream because it is generated through widespread single use consumption and is typically low value, lightweight and dispersed across households, streets, markets and drainage environments. These characteristics may make the decision to participate in its collection different from the decision to engage in other forms of waste recovery. Moreover, willingness to participate and gain from waste collection represent two

related but distinct dimensions of the activity: factors associated with being willing to partake in waste collection may not necessarily be the same factors associated with receiving higher returns.

This study also differs from earlier Kano based studies, which primarily examined the organization of informal plastic recovery, the relationships among collectors and other actors, and the economic motivations underlying scavenging activities (Nabegu, 2008; Nabegu, 2009; Muktar, 2011). Rather than describing the informal recovery system alone, this study empirically studies the socio economic characteristics associated with willingness to participate and also those associated with the level of daily gain from sachet waste collection. This study therefore provides a clearer understanding of participation and economic gain within the informal sachet waste recovery activity.

The study contributes to the informal recycling and livelihood literature by linking participation and returns to observable socio economic characteristics within a circular economy context. From a policy perspective, the findings provide evidence for designing interventions that recognize informal collectors as participants in urban resource recovery. In particular, the results will inform policies concerning accessible collection points, predictable purchasing arrangements, collective organization, skills development and occupational safety. The study therefore moves beyond viewing sachet waste solely as an environmental problem and considers the economic incentives and livelihood conditions that shape its recovery.

### 1.1 Objectives of the Study

Willingness to participate refers to a respondent's showing interest or is eager to engage in sachet picking, while gain refers to the respondent's reported daily monetary return from waste picking.

The broad objective is to examine the socio economic factors associated with sachet waste collection in Kano Metropolis. The specific objectives are to:

determine the socio economic factors that influence willingness to participate in sachet waste collection in Kano Metropolis; and determine the socio economic factors influencing the level of gain from sachet waste collection in Kano Metropolis.

The study tests the following null hypotheses:  $H_{01}$ : socio economic characteristics are not associated with willingness to participate in sachet waste collection; and  $H_{02}$ : socio economic characteristics are not associated with the level of daily gain from sachet waste collection.

## 2. Literature Review

### 2.1 Informal Waste Collection as Livelihood and Urban Service

Informal waste workers occupy an important position in urban waste systems because they recover materials that would otherwise remain in mixed waste or enter disposal sites. Nzeadibe and Anyadike (2012) show that informal recycling can contribute to urban livelihoods while remaining insufficiently integrated into formal governance. Adekunle et al. (2023) similarly report that waste picking can provide livelihood opportunities and support material recovery in Ibadan. These findings reinforce the idea that collection is simultaneously an environmental service and an economic activity.

In Kano, the informal recovery system is linked to economic incentives and limited employment alternatives (Nabegu, 2008). The value of collection is therefore influenced not only by environmental awareness but also by access to recyclable material, the price received, the organization of the market and the characteristics of collectors. Where returns are low or uncertain,

participation may be difficult to sustain; where recovered material generates a dependable return, collection can function as a livelihood activity.

## 2.2 Socio economic Determinants of Participation and Returns

Participation in informal recycling can be influenced by expected income, employment alternatives, household responsibilities and individual characteristics. Occupation is important because individuals with fewer alternatives may be more willing to engage in informal collection. Age can influence both the ability to undertake physically demanding collection work and the extent of individual control over livelihood decisions. Household size may influence the need for income but may also affect how limited earnings are distributed across household members. Education may influence access to information, market contacts and opportunities to negotiate within the recycling value chain.

Economic incentives are also central. Gall et al. (2020) emphasize the importance of viable business models and incentives in building a circular plastics economy that includes informal waste pickers. In Nigeria, informal recycling has economic value because recovered materials move through networks linking collectors to intermediaries and recycling businesses (Ezeudu et al., 2024). Consequently, policies that improve market access and the predictability of returns may strengthen participation while simultaneously improving material recovery.

## 3. Methodology

### 3.1 Study Area

The study was conducted in Kano Metropolis, Kano State, Nigeria. The metropolis comprises eight Local Government Areas. The study focused on four Local Government Areas that is Fagge, Dala, Kano Municipal and Ungogo. These local government areas were selected because of their population density and ability to generate more sachet waste.

### 3.2 Research Design and Sampling

A cross sectional survey design was employed. The exact number of sachet waste collectors in the study area was not known and a complete sampling frame was therefore unavailable. The expression  $n = Z^2 p(1-p)/e^2$ , with a 90% confidence level,  $p=0.5$  and a 5% margin of error, gives an indicative sample-size benchmark of approximately 270.6. Four Local Government Areas that is Fagge, Dala, Kano Municipal and Ungogo were purposively selected. Respondents were then reached through the selected collection locations and relevant informal recovery points. Three hundred questionnaires were distributed; 291 responses were received, representing a 97.0% return rate, and 290 complete observations were retained after one non numeric questionnaire entry was excluded. The questionnaire was administered voluntarily to respondents encountered in the selected study locations.

### 3.3 Variables and Model Specification

The first dependent variable, willingness to participate, was coded 1 for willing and 0 for not willing. The binary logistic model was estimated as a function of occupation, gender, household size and age. Robust standard errors was used. The second dependent variable was daily gain from sachet waste collection. The original four gain categories were consolidated into three ordered categories: low gain (less than ₦200 per day), moderate gain (₦201- ₦400 per day) and high gain (₦401 per day and above). The ordered logistic model included gender, household size, age and education. Robust standard errors was used. The ordered logit model estimates associations with the odds of being in a higher gain category, conditional on the proportional odds assumption.

For an ordered outcome Y taking categories 1, 2 and 3, the ordered logit model can be represented as:

$$\log[P(Y \leq j)/P(Y > j)] = \alpha_j - X\beta, \quad j=1,2.$$

The proportional odds formulation assumes that the slope coefficients are constant across the cumulative equations. Odds ratios greater than one indicate higher odds of being in a higher outcome category, while odds ratios below one indicate lower odds, holding other variables constant.

Model significance was assessed using the Wald chi-square statistic and p-values. Results are interpreted at the 1%, 5% and 10% significance levels. The proportional odds assumption for the ordered-logit gain model was assessed using a Wald test and was not rejected (Wald  $\chi^2(6)=5.10$ ;  $p=0.5311$ ).

## 4. Results

### 4.1 Descriptive Profile of Respondents

The sample was predominantly male and young. Out of the 290 complete observations, 280 (96.6%) were male and 10 (3.4%) were female. Nearly half of the respondents (48.3%) were below 15 years, while 24.1% were aged 16-20 years. Most respondents were single (93.1%). With respect to education, 44.8% reported no formal education and 37.9% reported informal/Quranic education. Household sizes of 6-10 persons and 11 persons or more each accounted for 37.9% of respondents. Islamic students constituted the largest occupational group (55.2%). About 70.3% reported daily income below ₦300.

| Characteristic | Category            | Frequency | Percent |
|----------------|---------------------|-----------|---------|
| Gender         | Male                | 280       | 96.6    |
|                | Female              | 10        | 3.4     |
| Age            | Below 15            | 140       | 48.3    |
|                | 16–20               | 70        | 24.1    |
|                | 21–25               | 30        | 10.3    |
|                | 26+                 | 50        | 17.2    |
|                |                     |           |         |
| Marital status | Single              | 270       | 93.1    |
|                | Married             | 20        | 6.9     |
| Education      | Informal/Quranic    | 110       | 37.9    |
|                | Primary             | 40        | 13.8    |
|                | Secondary           | 10        | 3.4     |
|                | No formal education | 130       | 44.8    |
| Household size | 1–3                 | 20        | 6.9     |
|                | 4–5                 | 50        | 17.2    |
|                | 6–10                | 110       | 37.9    |
|                | 11+                 | 110       | 37.9    |
|                |                     |           |         |
| Occupation     | Farming             | 70        | 24.1    |
|                | Islamic student     | 160       | 55.2    |
|                | Formal student      | 30        | 10.3    |
|                | Other               | 30        | 10.3    |
| Daily income   | < ₦300              | 204       | 70.3    |
|                | ₦301–₦500           | 70        | 24.1    |
|                | ₦501–₦1,000         | 8         | 2.8     |
|                | ₦1,001+             | 8         | 2.8     |

**Source:** Field Survey (2026).

#### 4.2 Distribution of Daily Gain

Out of the 290 complete observations, 147 respondents (50.69%) were in the low gain category, 61 (21.03%) were in the moderate gain category and 82 (28.28%) were in the high gain category.

| Gain category | Definition         | Frequency | Percent |
|---------------|--------------------|-----------|---------|
| Low gain      | < ₦200/day         | 147       | 50.69   |
| Moderate gain | ₦201–₦400/day      | 61        | 21.03   |
| High gain     | ₦401/day and above | 82        | 28.28   |
| <b>Total</b>  |                    | 290       | 100.00  |

**Source:** Computed from the 2026 survey data using Stata.

The three gain categories were created from the original four gain categories by combining the original ₦401–₦600 and ₦601–and above categories into the high-gain category.

#### 4.3 Socio-economic Factors Associated with Willingness to Participate

The binary logistic regression is jointly significant based on the Wald test of the explanatory variables (Wald  $\chi^2(10)=48.04$ ;  $p<0.001$ ), with a pseudo- $R^2$  of 0.1362. The model therefore indicates systematic associations between the included socio-economic characteristics and reported willingness to participate within the surveyed sample.

| Variable/category           | Odds ratio | Robust S.E. | 95% CI       | p-value   |
|-----------------------------|------------|-------------|--------------|-----------|
| Occupation: Islamic student | 11.771     | 7.267       | 3.510–39.476 | <0.001*** |
| Occupation: Formal student  | 1.143      | 0.730       | 0.327–3.997  | 0.835     |
| Occupation: Other           | 5.636      | 2.759       | 2.159–14.714 | <0.001*** |
| Female                      | 1.334      | 0.994       | 0.310–5.748  | 0.699     |
| Household size: 4–5         | 0.303      | 0.160       | 0.108–0.853  | 0.024**   |
| Household size: 6–10        | 1.206      | 0.590       | 0.462–3.148  | 0.702     |
| Household size: 11+         | 0.611      | 0.320       | 0.219–1.705  | 0.347     |
| Age: 16–20                  | 4.597      | 2.063       | 1.907–11.080 | 0.001***  |
| Age: 21–25                  | 1.628      | 0.705       | 0.697–3.805  | 0.260     |
| Age: 26+                    | 2.639      | 1.270       | 1.028–6.775  | 0.044**   |

Model statistics:  $N=290$ ; Wald  $\chi^2(10)=48.04$ ;  $p<0.001$ ; pseudo- $R^2=0.1362$ ; log pseudolikelihood= $-159.05154$ . Reference categories: farming occupation, male, household size 1–3 persons and age below 15 years. 95% CIs are reported for odds ratios. \*\*\*  $p<0.01$ , \*\*  $p<0.05$ , \*  $p<0.10$ .

Occupation was strongly associated with willingness to participate. Relative to respondents engaged in farming, Islamic students had about 11.77 times the odds of reporting willingness to participate ( $p<0.001$ ; 95% CI: 3.510–39.476), while respondents in other occupations had about 5.64 times the

odds ( $p < 0.001$ ; 95% CI: 2.159–14.714). Formal students did not differ significantly from the farming reference group (OR=1.143;  $p=0.835$ ; 95% CI: 0.327–3.997).

Gender was not statistically significant (OR=1.334;  $p=0.699$ ; 95% CI: 0.310–5.748). Thus, after controlling for the other variables in the model, the data do not provide evidence of a statistically detectable gender association with willingness to participate. Household size of 4–5 persons was associated with lower odds of willingness relative to households of 1–3 persons (OR=0.303;  $p=0.024$ ; 95% CI: 0.108–0.853). The 6–10 category (OR=1.206;  $p=0.702$ ) and the 11+ category (OR=0.611;  $p=0.347$ ) were not statistically significant.

Age was also associated with willingness. Respondents aged 16–20 had about 4.60 times the odds of willingness compared with those below 15 years ( $p=0.001$ ; 95% CI: 1.907–11.080), while respondents aged 26 years and above had about 2.64 times the odds ( $p=0.044$ ; 95% CI: 1.028–6.775). The 21–25 category was not statistically significant (OR=1.628;  $p=0.260$ ; 95% CI: 0.697–3.805).

#### 4.4 Socio-economic Factors Associated with Level of Gain

The ordered logistic regression for daily gain is jointly significant based on the Wald test of the explanatory variables ( $\chi^2(10)=66.61$ ;  $p < 0.001$ ) and has a pseudo- $R^2$  of 0.0942. Gender and household size categories were not statistically significant in the ordered logit model. Age and, at the 10% level, primary education were associated with the odds of being in a higher gain category. The proportional-odds assumption was not rejected (Wald  $\chi^2(6)=5.10$ ;  $p=0.5311$ ), supporting the use of the ordered logit specification.

| Variable/category    | Odds ratio | Robust S.E. | 95% CI      | p-value  |
|----------------------|------------|-------------|-------------|----------|
| Female               | 0.603      | 0.409       | 0.160–2.277 | 0.456    |
| Household size: 4–5  | 0.485      | 0.279       | 0.157–1.495 | 0.208    |
| Household size: 6–10 | 0.482      | 0.310       | 0.136–1.703 | 0.257    |
| Household size: 11+  | 1.025      | 0.617       | 0.315–3.336 | 0.967    |
| Age: 16–20           | 1.521      | 0.529       | 0.769–3.009 | 0.228    |
| Age: 21–25           | 2.508      | 1.122       | 1.043–6.029 | 0.040**  |
| Age: 26+             | 0.190      | 0.097       | 0.069–0.519 | 0.001*** |
| Education: Primary   | 1.547      | 0.403       | 0.928–2.579 | 0.094*   |
| Education: Secondary | 2.474      | 1.365       | 0.839–7.296 | 0.101    |
| No formal education  | 0.750      | 0.322       | 0.323–1.741 | 0.503    |

Model statistics:  $N=290$ ; joint Wald  $\chi^2(10)=66.61$ ;  $p < 0.001$ ; pseudo- $R^2=0.0942$ ; log pseudolikelihood=−270.42612. Reference categories: male, household size 1–3 persons, age below 15 years and informal/Quranic education. 95% CIs are reported for odds ratios. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ .

Gender was not significantly associated with the level of gain (OR=0.603;  $p=0.456$ ; 95% CI: 0.160–2.277), indicating no statistically detectable gender difference in the odds of being in a higher gain category. Household size was also not statistically significant: the ORs were 0.485 ( $p=0.208$ ) for households of 4–5 persons, 0.482 ( $p=0.257$ ) for 6–10 persons and 1.025 ( $p=0.967$ ) for 11+ persons, relative to households of 1–3 persons.

Age showed differentiated associations with higher gain. Respondents aged 21-25 had about 2.51 times the odds of being in a higher gain category compared with respondents below 15 years ( $p=0.040$ ; 95% CI: 1.043-6.029), while respondents aged 26 years and above had about 0.19 times the odds ( $p=0.001$ ; 95% CI: 0.069-0.519). The 16-20 category was not statistically significant (OR=1.521;  $p=0.228$ ; 95% CI: 0.769–3.009).

Education showed a limited association with gain. Respondents with primary education had about 1.55 times the odds of being in a higher gain category relative to the informal/Quranic education reference group, with the relationship marginally significant at the 10% level ( $p=0.094$ ; 95% CI: 0.928–2.579). Secondary education had an odds ratio of 2.47, but the relationship was not statistically significant at the 10% level ( $p=0.101$ ; 95% CI: 0.839–7.296). No formal education was also not statistically significant (OR=0.750;  $p=0.503$ ; 95% CI: 0.323–1.741).

## 5. Discussion

The findings of this study show that sachet waste collection in Kano Metropolis is both an environmental service and an informal livelihood activity. The participation model reveals that occupational position is strongly associated with willingness. Islamic students and respondents in other occupations had higher odds of reporting willingness than farmers, while formal students did not differ statistically from farmers. This is in line with Nabegu (2008), which links informal plastic recovery to economic motivations and limited alternative employment opportunities. It also supports the broader literature showing that informal recycling can provide livelihood opportunities while filling gaps in formal waste-management systems (Nzeadibe & Anyadike, 2012; Adekunle et al., 2023).

The association between age and willingness is also noteworthy. Respondents aged 16-20 and those aged 26 years and above had higher odds of willingness than respondents below 15 years, while the 21-25 group did not differ statistically from the reference group. This age pattern is consistent with the broader Kano evidence that younger people have participated in informal waste recovery: Muktar (2011) reported that 30% of his 60 scavengers were 15 years or less, while Saleh and Marzuki (2023) documented underage youths among informal waste pushers. These studies provide contextual evidence that younger participation in Kano is not unprecedented, but they should not be used to infer that participation by children is acceptable or safe.

Household size was associated with willingness in the participation model for the 4-5 person category, whose odds were lower than those of respondents from households of 1-3 persons. However, household size was not statistically significant in the ordered logit gain model. This distinction is important because factors associated with willingness to participate need not be the same as factors associated with the level of monetary gain.

Primary education was marginally associated with higher gain at the 10% level, whereas secondary education, despite an odds ratio above one, was not statistically significant at the 10% level. The direction of the estimated association for primary education may be consistent with the possibility

that schooling improves access to information, market contacts or negotiation opportunities within the recycling value chain, but the present cross-sectional data do not directly test these mechanisms.

The findings also have implications for the development of a circular plastics economy. Gall et al. (2020) emphasize that economic incentives and workable business models are important for incorporating informal waste pickers into circular plastics systems. Nathaniel et al. (2012) similarly examined incentive based mechanisms for collecting used sachet bags in Nigeria. In Kano, strengthening the connection between collectors, buying points and recycling firms could improve the predictability of returns. At the same time, occupational safety should be addressed because the environmental value of collection should not be achieved by transferring health and safety costs to informal workers (Dada et al., 2023; Goodman et al., 2020; Solaja et al., 2024).

## 6. Conclusion

This study examined the socio-economic factors associated with willingness to participate in sachet waste collection and the level of gain from the activity in Kano Metropolis. The evidence shows that reported willingness is associated particularly with occupation, household size and age. Islamic students and respondents in other occupations had higher odds of willingness than farmers, while respondents aged 16-20 and those aged 26 years and above also showed higher odds. Gender was not statistically significant. In the gain model, gender and household size were not statistically significant. Age 21-25 was associated with higher odds of being in a higher gain category, whereas age 26 years and above was associated with lower odds. Primary education showed a marginal association at the 10% level, while secondary education was not statistically significant. These findings are associational and should not be interpreted as causal effects.

Overall, sachet waste collection should be understood as a dual purpose activity. It contributes to the recovery of plastic waste and provides an informal source of livelihood. The economic returns are uneven across socio economic groups. Policies that improve access to collection infrastructure, strengthen market linkages and improve the organization and safety of informal collectors may increase the environmental value of recovery while improving livelihood outcomes.

## 7. Policy Recommendations

- i. Designate accessible sachet waste collection and drop off points in high generation areas of Kano Metropolis so that collectors do not depend exclusively on unsafe dumpsites, roadsides or drainage channels.
- ii. Develop predictable buying and incentive arrangements for recovered sachet plastics. Transparent prices and reliable purchasing arrangements can strengthen the economic incentive to collect and sort recyclable material.
- iii. Waste pickers should be encourage to form an organisation/union. The Kano State Refuse Management and Sanitation Board (REMASAB) should oversee the activities of the waste pickers before and after they form their Union.

- iv. The general public should to be educated about waste management because through education, negative perceptions of waste pickers will be reduced and the community will be more inclined to be active participants in sorting their waste.

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