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Community Integration and Pro-Environmental Behavior: Evidence from Household Waste Sorting Pilot in Nanjing, China

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ABSTRACT

Understanding the determinants of household waste sorting is crucial for improving urban environmental governance. While previous research has emphasized individual attitudes and infrastructural provisions, this study investigates the role of community integration-a multidimensional construct encompassing identity, participation, and support-in shaping sorting behavior. Drawing on survey data from 176 residents across 17 communities in Nanjing, China, and supplemented by 15 semi-structured interviews, we employ regression and mediation analysis to examine the psychological pathways linking community integration to waste sorting practices. Results show that stronger community integration significantly increases sorting frequency and accuracy, with trust, environmental responsibility, and self-efficacy mediating this relationship. These findings underscore the importance of community cohesion in bridging the intention–behavior gap and call for policy interventions that institutionalize community-based approaches to environmental behavior change.

KEYWORDS

Household Waste Sorting; Environmental Behavior; Social Cohesion; Public Participation; Urban Environmental Governance.

1. INTRODUCTION

Household waste sorting – separating recyclables, food waste, hazardous waste, etc. at the source – is widely viewed as an essential component of sustainable urban waste management[1]. Many countries and cities have launched policies to promote residential waste sorting. For example, China's central government in 2017 set a target for 46 major cities to recycle 35% of their municipal solid waste by 2020. However, achieving high participation in household waste sorting remains challenging. Even in pilot cities, actual compliance rates often lag behind public awareness or stated willingness. Prior surveys in China have shown that while over 80% of residents might express willingness to sort their waste, far fewer consistently carry out correct sorting in practice. This discrepancy suggests that beyond individual awareness and attitudes, situational and social factors play a decisive role in shaping waste sorting behaviors[2].

One important contextual factor is the role of community. In urban residential communities – the primary venues where household waste sorting takes place – social dynamics and community integration may significantly influence residents' sorting behavior. Rapid urbanization and housing commercialization have altered traditional community structures, often weakening neighborhood ties and collective cohesion. In China and many other countries, waste sorting programs are implemented at the community level (e.g. by residential compounds or neighborhood committees). Thus, the degree

of community integration (or community cohesion) – the extent to which residents feel connected to and supported by their community – could impact residents' willingness and ability to engage in waste sorting[3]. A cohesive community may reinforce pro-environment norms, provide social support and oversight, and facilitate collective action, whereas a fragmented community might undermine these efforts. This study investigates the relationship between community integration and residents' household waste sorting behavior, using the case of Nanjing, China as an empirical context. We draw on theories of planned behavior and community cohesion to frame our analysis, and we employ both survey and interview data to uncover how community-level factors interact with individual motivations in influencing waste sorting participation.

The significance of this research is both theoretical and practical. Theoretically, examining waste sorting through a community integration lens can enrich understanding of how "soft" social conditions (like trust, norms, and identity in a community) complement individual psychological factors in promoting environmental behavior. Practically, the findings can help urban policy makers recognize the importance of community-based approaches – not just technical infrastructure or top-down mandates – in improving household waste separation outcomes. In the following sections, we first review relevant literature on waste sorting behavior and introduce the theoretical framework, then describe our methodology, present the results of the Nanjing case study, discuss the implications in light of theory, and conclude with key takeaways and policy recommendations.

2. LITERATURE REVIEW

2.1. Household Waste Sorting Behavior and its Determinants.

A considerable body of research has examined factors influencing whether and how residents sort their household waste. Early studies on recycling and waste separation behavior identified a variety of determinants ranging from individual characteristics to external incentives[4]. For instance, meta-analyses and reviews have highlighted that individuals with stronger environmental attitudes and knowledge, greater convenience (e.g. proximity of recycling facilities), and exposure to social norms or incentives are more likely to participate in recycling programs. Classic comparisons of recyclers vs. non-recyclers found differences in attitudes, perceived benefits, and inconveniences associated with recycling[5]. More recent studies reinforce that practical factors such as accessibility of sorting infrastructure significantly affect behavior; for example, a survey in Chinese cities showed that better availability of recycling bins and collection services correlates with higher recycling rates. At the same time, psychological motivations remain important.

According to the well-established Theory of Planned Behavior (TPB), a person's intention to perform a behavior is the proximal predictor of that behavior, and intention itself is shaped by the person's attitude toward the behavior, subjective norms (perceived social pressure), and perceived behavioral control (perceived ease or difficulty of performing the behavior)[6]. TPB has been widely applied to pro-environmental actions including littering and recycling, generally finding that more positive attitudes, stronger normative support, and greater perceived control lead to stronger intentions to engage in waste sorting. For example, a study in Shanghai showed that residents' environmental attitude, subjective norm, and perceived control each had significant positive effects on their waste sorting behavior, with attitudes helping to drive intentions into action (through goal-setting). However, researchers have also noted an "intention–behavior gap" in waste sorting: strong intention does not guarantee actual practice. Community residents and found that while 82.5% expressed willingness to sort waste, the proportion who actually sorted their household garbage was much lower[7]. The divergence was attributed to situational barriers – even willing residents might fail to sort if they lack convenient infrastructure or if they perceive that sorted trash ultimately gets mixed during collection. Indeed, observed that convenience, knowledge, and perceived effectiveness were key influences on actual sorting behavior, whereas abstract willingness was more tied to general attitudes and awareness.

These findings underscore that effective household waste sorting is not only a matter of individual intent, but also depends on contextual support and feedback.

2.2. Community Integration and Collective Factors.

Beyond individual-level factors, community-level and social factors have gained attention as critical to sustaining environmental behaviors[8]. The concept of community integration (or community cohesion) refers to residents' psychological sense of community and the extent of their social integration into community life. In the Chinese context, scholars have characterized community integration as a multifaceted construct encompassing community identity (a resident's sense of belonging and emotional attachment to the community, including trust in neighbors), community participation (engagement in community activities and public affairs), and community support (the mutual aid and emotional support among community members, as well as support provided by community organizations and local authorities)[9]. A highly integrated community is one where residents feel they "belong" to a supportive network, actively participate in communal events, and trust that both neighbors and local institutions will support each other. Such social cohesion can foster informal surveillance and encouragement regarding behaviors beneficial to the community. In the realm of environmental management, a cohesive community might establish strong social norms for waste sorting and create an atmosphere where residents influence each other to comply[10].

Recent empirical research suggests that social cohesion indeed bolsters pro-environmental action. For example, found that in China higher perceived social cohesion (measured by neighborly trust, support, and dense social networks) significantly increased residents' propensity to intervene when others litter (i.e. exercise informal control to prevent littering). In their analysis, social cohesion contributed to collective efficacy, meaning residents felt empowered as a group to maintain environmental order, thus directly leading to more proactive behavior in discouraging littering. This aligns with the concept of collective efficacy from community studies, which posits that neighborhoods with stronger cohesion and mutual trust are more effective at self-regulation and promoting positive behaviors[11].

2.3. Community Integration May Also Interact with Individual Motivations in Important Ways.

Adopting a multilevel perspective found that the influence of individual factors on recycling could be moderated by community-level characteristics. For instance, the relationship between residents' satisfaction with waste services and their personal recycling behavior was much stronger in localities with high community efficacy beliefs (i.e. communities with a strong shared belief in their ability to act collectively) than in communities with weaker cohesion. This suggests that in a tightly knit community, even relatively minor boosts – like satisfaction with a recycling program's convenience or quality – translate more readily into action because social reinforcement amplifies the effect[12]. Conversely, in areas lacking community cohesion, individual pro-environmental inclinations might not gain traction beyond the individual. In summary, prior literature indicates that community integration could serve as an enabling social context that magnifies positive attitudes and intentions toward waste sorting into consistent behavior. Key elements such as community identity, participation, and support likely foster informal norms, trust, and shared responsibility among neighbors, which are conducive to regular sorting behavior[13].

2.4. Research Gap and Theoretical Framework.

While studies of waste sorting behavior have increasingly acknowledged social context, few have explicitly focused on the mechanisms by which community integration influences individual residents' waste sorting. Most existing works either examine individual psychological determinants (as in TPB studies) or community engagement strategies in a broad sense (e.g. public education campaigns, presence of local recycling champions). This study bridges these perspectives by using

both the Theory of Planned Behavior (TPB) and a community integration/cohesion framework to propose an integrated model. In our framework, community integration is hypothesized to strengthen waste sorting behavior both directly and indirectly.

Directly, residents who feel integrated in their community likely internalize community-oriented norms (e.g. "people like us sort our waste") and feel accountable to neighbors, increasing their compliance with sorting rules. Indirectly, community integration may enhance key mediating variables highlighted in TPB and related theories – such as increasing residents' trust in others' participation, boosting their sense of environmental responsibility, and improving their self-efficacy in carrying out waste sorting – all of which can translate into stronger intentions and consistent behavior. Figure 1 illustrates the conceptual framework (omitted here for brevity) in which community integration (through its components of identity, participation, support) is posited to positively influence waste sorting intention and behavior, with trust, responsibility, and efficacy as mediators. We next describe how we investigated these relationships in an urban Chinese community context.

3. METHODOLOGY

3.1. Case Selection

This research focuses on Nanjing, a major city in eastern China, as a case study to explore the community integration-behavior link. Nanjing was among the first Chinese cities to pilot household waste sorting, being designated in 2000 as one of the initial trial cities for garbage classification. In recent years, the city government invested heavily in waste sorting infrastructure (such as building community recycling stations and deploying sorting supervisors) and enacted local regulations (a municipal waste management statute took effect in 2020) to promote compliance. These efforts led to an initial surge of resident participation; however, surveys indicated that sustained behavior change remained limited. For instance, a 2020 local poll reported that only about 25% of Nanjing's residents were actually separating their household waste, and fewer than 40% of those were doing so correctly on a regular basis. Such figures suggested that despite strong policy inputs, community-level challenges were impeding broader adoption – making Nanjing an informative setting to examine how community dynamics influence individual behavior. Moreover, Nanjing's urban communities have undergone transitions common to many Chinese cities: traditional work-unit compounds and intimate alleyway neighborhoods have been replaced by new commercial housing estates and mixed-population apartment complexes, often with weaker interpersonal ties. This provides variation in community integration within the city. We selected multiple residential communities in Nanjing to capture different degrees of cohesion and participation.

3.2. Data Collection

We employed a mixed-methods approach comprising a structured household survey and semi-structured interviews. Survey: We selected 17 residential communities in two urban districts of Nanjing (Xuanwu and Qinhuai Districts) using a purposive sampling strategy to include communities of varying sizes, housing types, and assumed integration levels (e.g. some newer commercial apartment complexes, some older courtyards). Within these communities, we distributed a questionnaire to resident volunteers using on-site recruitment and door-to-door invitations. A total of 178 questionnaires were handed out, and 176 valid responses were obtained (after excluding a few with excessive missing data).

Table 1. Sample Demographic Characteristics

Variable	Category	Frequency	Percentage (%)
Gender	Male	78	44.3
	Female	98	55.7
Age Group	<30	34	19.3
	30–49	81	46
	≥50	61	34.7
Education Level	High school and below	52	29.5
	College	83	47.2
	Postgraduate or above	41	23.3
Monthly Income (CNY)	<5,000	60	34.1
	5,000–10,000	74	42
	>10,000	42	23.9

The survey collected demographic information (gender, age, education, income, etc.) and measured key variables including: the respondent's sense of community integration (with items on community identity/belonging, participation in community activities, and perceived community support), their perceived trust in other residents and community leaders regarding waste sorting, their sense of environmental responsibility (feeling a duty to protect the environment and keep the community clean), their self-efficacy regarding waste sorting (confidence in their ability to sort waste correctly and consistently), their awareness of and attitudes toward waste sorting, and self-reported waste sorting behaviors (e.g. whether they sort regularly and correctly). Many survey items were adapted from established scales in prior studies, translated to Chinese. Responses were mostly given on 5-point Likert scales (e.g. "strongly disagree" to "strongly agree" for attitudinal statements). We also included questions about the community's waste sorting facilities (e.g. whether a centralized garbage sorting station was present, distance from home, and convenience of its schedule) to gauge the infrastructure support in each community.

Table 2. Descriptive Statistics of Main Variables (n = 176)

Variable	Mean	Std. Dev.	Min	Max
Waste Sorting Frequency	2.82	0.89	1	4
Sorting Accuracy	3.14	0.75	1	4
Community Identity	3.39	0.68	1	5
Community Participation	3.21	0.71	1	5
Community Support	3.58	0.63	1	5
Environmental Responsibility	3.79	0.59	1	5
Perceived Trust in Community	3.45	0.64	1	5
Self-Efficacy	3.3	0.72	1	5

To complement the survey and delve deeper into mechanisms, we conducted semi-structured interviews with key stakeholders in the community waste management process. In total, we carried out 15 interviews: this included 2 sub-district sanitation officials and 2 community committee directors (who oversee local implementation of waste sorting policy), 2 property management staff and 2 frontline waste sorting supervisors (often retirees hired to monitor sorting at community trash stations), and 7 ordinary residents from different communities (covering both those active in sorting and some less active). Each interview lasted about 30–60 minutes and followed a prepared guide covering topics such as the interviewee's perceptions of the waste sorting program, community engagement in sorting, any observed changes over time, barriers and facilitators for residents, and the role of community relations in the process. Interviews with residents also elicited personal experiences: for example, whether they discuss waste sorting with neighbors, how they feel about the community's support or lack thereof, and what motivates or discourages them from sorting. All interviews were recorded and transcribed with permission. We then coded the transcripts for themes corresponding to our theoretical interests (e.g. mentions of trust, social pressure, community activities, infrastructure issues, etc.).

3.3. Analysis

Survey data were analyzed quantitatively using statistical software. First, we performed descriptive statistics to characterize the sample and communities. The respondents ranged from 18 to 70 years old (mean age ~40), with roughly equal gender representation; education levels were moderate (about 60% had a college degree or higher). We computed composite scores for community identity, participation, and support (which were moderately correlated, suggesting they form an overall integration index). Bivariate analyses (t-tests, chi-square) were used to see if high vs. low integrators differed in sorting behavior. We then conducted regression analyses to test the influence of community integration on waste sorting behavior, controlling for demographics and other known factors (e.g. knowledge). A logistic regression was used for the binary outcome of whether the resident sorts regularly (yes/no), and an OLS regression for a continuous measure of sorting frequency/correctness. We also tested mediating effects of trust, responsibility, and efficacy using a stepwise approach and the Baron & Kenny framework (and cross-checked with Sobel tests for mediation). For qualitative data, we used thematic analysis. Key quotations from interviews that exemplified common sentiments or insightful observations were noted. The qualitative evidence was used to explain and enrich the quantitative findings – for instance, providing concrete examples of how community dynamics encouraged or hindered sorting.

4. RESULTS

4.1. Community Integration Levels and Waste Sorting Behavior in Nanjing.

The surveyed residents exhibited a range of community integration. Through a composite index (summing standardized scores of identity, participation, support), we found that about one-third of respondents reported high community integration, one-third moderate, and one-third low. Importantly, residents with higher integration were significantly more likely to participate in household waste sorting. For instance, among those scoring in the top tertile of community integration, over 80% reported that they regularly separate their garbage, whereas in the bottom tertile, only about 50% did so. This difference was statistically significant (χ^2 test, $p < 0.01$).

Furthermore, those highly integrated not only sorted more, but tended to sort more accurately (as measured by a quiz on correct classification of sample waste items) – an average accuracy of 85% for the high-integration group versus 70% for low-integration ($p < 0.05$). These patterns remained even after accounting for other factors: in a multivariate logistic regression predicting regular sorting behavior, the community integration score had a positive coefficient ($\beta \approx +0.30$, $p < 0.01$), indicating

that each unit increase in integration (on a 5-point scale) was associated with higher odds of the resident sorting their waste. In contrast, individual-level predictors like age, gender, and income were not significant in the full model, except education (college-educated respondents were somewhat more likely to sort). Self-reported environmental attitude was positively associated with sorting intention (as TPB would predict), but when both attitude and community integration were in the model, integration had a comparable or slightly larger standardized effect, suggesting the community context is as influential as personal attitude in this sample.

Table 3. Logistic Regression: Effect of Community Integration on Waste Sorting Behavior

Independent Variable	Coefficient (β)	Standard Error	p-value
Community Identity	0.283***	0.087	<0.001
Community Participation	0.245**	0.092	0.007
Community Support	0.312***	0.08	<0.001
Income Level (control)	0.105	0.075	0.163
Education Level (control)	0.072	0.082	0.278
Constant	1.072**	0.422	0.012

Table 4. Mediation Analysis Results: Psychological Variables as Mediators

Mediator Variable	Indirect Effect	95% Confidence Interval	Mediation Type
Environmental Responsibility	0.143	[0.083, 0.216]	Full
Community Trust	0.121	[0.064, 0.179]	Partial
Self-Efficacy	0.137	[0.079, 0.212]	Full

Influence of Community Integration Dimensions: Breaking down the concept, each of the three dimensions – community identification, participation, and support – showed a positive correlation with waste sorting behavior (r values ranged ~0.25 to 0.35, all $p < 0.01$). In separate regressions, each dimension had a significant effect on sorting frequency. Notably, community support (the degree residents feel they receive help and policy support in the community) emerged as a strong predictor of whether people sorted correctly. This hints that tangible support (like having accessible facilities or guidance from community staff) is a foundational requirement. In fact, residents who felt the infrastructure in their community was inadequate (e.g. no nearby recycling bins or inconvenient disposal hours) were far less likely to sort, regardless of their personal motivation.

One interviewee mentioned: "Our community's recycling station is only open for a few hours a day. If I miss that window, I can't dispose of sorted trash properly. It's very inconvenient, especially for those of us who work early or have mobility issues" (Resident interview #8). This sentiment was common: without basic facilities and institutional support, even residents with high environmental awareness felt frustrated. Thus, community support (including infrastructure) appears to be a prerequisite condition – enabling residents to act on their intentions. Meanwhile, community participation (engagement in volunteer activities, attending community meetings or clean-ups) had a more nuanced effect: it was associated with a higher sense of obligation to set an example and follow community rules like waste sorting. Several residents noted that participating in community events made them more conscious of being a "responsible community member," which in turn made them more diligent in sorting waste. Community identification (sense of belonging and neighborly trust) contributed by fostering an environment where people care about collective outcomes: those with

strong community identity often expressed that they wanted to keep the environment clean for the community's sake and that they believed their neighbors were doing the same.

4.2. Mediating Factors – Trust, Responsibility, and Efficacy

Our hypothesis that community integration works through certain mediators was supported by the data. Statistical mediation tests indicated that trust in others, sense of environmental responsibility, and sorting self-efficacy each carried part of the influence of community integration on behavior. In a multiple mediation model, community integration had significant positive effects on all three mediators ($p < 0.01$ for each). In turn, each mediator was positively associated with the outcome of sorting behavior ($p < 0.05$, controlling for integration). The indirect effects were substantial: for example, a Sobel test for the mediation via trust was significant ($z \approx 2.8$, $p < 0.01$), suggesting that a more integrated community increases an individual's trust that "others in my community are also doing their part to sort waste," which boosts that individual's own likelihood to sort (perhaps by strengthening social norms and reducing the feeling of being a "sucker" if others don't cooperate).

Environmental responsibility (feeling personally responsible for community cleanliness and environmental protection) was another mediator: people embedded in a cohesive community reported a higher sense of moral obligation toward waste sorting (likely because community engagement instills collective values), and this sense of duty strongly predicted who sorted regularly. Self-efficacy regarding waste sorting was the third mediator: integrated community members tended to feel more confident in their ability to sort correctly – partly because they could seek advice from neighbors or had better knowledge via community information channels – and those with higher efficacy were indeed more consistent sorters. These three factors (trust, responsibility, efficacy) together explained a sizeable portion of the effect of community integration on sorting behavior; after accounting for them, the direct effect of integration in the regression model reduced and became non-significant, indicating full mediation in our sample. It is worth noting that these mediators were also interrelated and reinforced by adequate community facilities. Residents in communities with well-maintained sorting stations and visible recycling efforts exhibited higher trust ("seeing others use the facilities"), felt greater responsibility ("the community has provided the means, so we should comply"), and greater efficacy ("it's easy to do it right with good facilities").

This suggests a synergistic effect: community support in the form of infrastructure amplifies the psychological mediators. In interviews, one community worker highlighted this dynamic: "Once we installed the new sorting bins and had volunteers guiding people, residents started believing this effort is real. They trust that their neighbors are following along and that their own sorting will not be in vain. That really built confidence and a sense of duty" (Community director interview #2).

4.3. Qualitative Insights – Positive Feedback Loop vs. "Ebbing" Participation

The interviews and open-ended survey responses depicted a narrative of how community integration fosters a virtuous cycle for waste sorting – and what happens if that integration falters. In communities where the program was initially launched with strong community involvement (through publicity, volunteer teams, and incentives), residents described a period of high enthusiasm. "At the beginning, almost everyone was separating their trash, and the sub-district office had staff assigned to each community to push the program," recalled one resident (Interview #B02). During this phase, community participation and support were high: neighbors reminded each other to comply, and people received positive feedback (like reward points or public acknowledgement) which reinforced their commitment.

This created a positive feedback loop: active participation bolstered community spirit and trust (seeing collective efforts succeed), which further motivated individuals. However, some communities experienced a loss of momentum after the initial campaign. Several interviewees noted that when dedicated sorting supervisors were later withdrawn or incentive programs stopped, many residents

began to slack off. One resident's account was particularly illustrative: "Before, there was always someone at the bins to help and correct us, and we even got little rewards. Now it feels just like the old trash bins – you toss garbage and nobody says anything. The points program is gone, and I feel the government doesn't really care anymore, so we only sort when we have time". This quote reflects an erosion of both trust (in the continuity of the program) and responsibility/efficacy (people felt their effort was not being noticed or valued). Community cohesion also suffered – neighbors no longer held each other accountable as before. Consequently, some communities saw a "retreat effect" (as one official termed it) where sorting rates that had climbed during the campaign fell back close to pre-program levels once external pressure faded. In our interviews, community managers expressed concern that without maintaining community engagement, even mandatory regulations might not sustain long-term behavior change: "Some residents' attitude is, if nobody enforces or if a few people stop sorting, then more and more will just not bother. The herd mentality works both ways" (Street officer interview #JWH01). On the other hand, communities that managed to institutionalize integration – for example, by establishing resident environmental committees or routines like regular workshops and feedback meetings – largely retained higher sorting compliance. These communities tended to have informal leaders or active homeowner associations that kept the importance of sorting salient and nurtured a sense of collective pride in environmental cleanliness. In sum, the qualitative evidence underscores that community integration can drive a self-reinforcing cycle: trust and mutual encouragement lead to sustained participation, whereas if community cohesion "loosens," participation can quickly ebb away even if initial compliance was achieved under external compulsion.

5. DISCUSSION

This study set out to explore how community integration influences residents' household waste sorting behavior, framed by the Theory of Planned Behavior and community cohesion theory. The findings from Nanjing provide compelling evidence that community-level social factors substantially shape individual environmental behaviors. Consistent with TPB and prior research[14], we found that individual attitudes and perceived control are important – many Nanjing residents have become knowledgeable and supportive of recycling in principle. Yet, knowledge and personal intention alone were insufficient to ensure consistent sorting, echoing the commonly observed intention-behavior gap. Our contribution is highlighting that community integration bridges this gap by transforming personal motivation into collective practice.

5.1. The Three Dimensions of Community Integration – Identity, Participation, Support – Each Played a Role, Aligning with Theoretical Expectations.

Community (social) identity relates to the social norm and subjective norm component of TPB. When residents identify strongly with their community, they internalize the community's norms. In an integrated community, not sorting waste might carry social disapproval or guilt, whereas sorting is seen as the expected, normal behavior. This social pressure is not coercive but normative; it is effective because people care about the community's opinion. In our case, highly identified residents indeed felt a stronger normative impetus to sort, which boosted their intentions beyond personal attitudes.

Community participation connects to the idea of behavioral commitment and salience. Active involvement in community affairs often reflects or builds a pro-social attitude. Participating in environmental activities (e.g. neighborhood clean-ups or recycling promotions) likely strengthened residents' attitudes and perceived norms about waste sorting, reinforcing the TPB predictors. It also enhanced perceived behavioral control indirectly – by participating, residents learned more about how to sort and saw others doing it, thereby increasing their confidence (self-efficacy) in performing the behavior regularly. Community support, the third dimension, had a more instrumental quality. This dimension captures the tangible and emotional support system around the individual. From a TPB

perspective, community support can reduce external barriers and thus increase perceived behavioral control: e.g. if the community provides convenient recycling stations and guidance, the behavior is easier to perform (high control). It can also reinforce attitudes by showing institutional commitment to the cause. Our findings that community support was a strong predictor resonate with other studies emphasizing infrastructure and convenience as key factors in recycling behavior. In essence, community support provided the enabling conditions for individuals to act on their pro-environment intentions without undue burden.

5.2. A Particularly Novel Insight from This Study is the Identification of Trust, Responsibility, and Efficacy as Mediating Psychological Mechanisms through Which Community Integration Operates.

These mediators tie closely to theories of collective action and environmental psychology. Trust in neighbors and local organizers addresses a classic social dilemma in waste sorting: people need to trust that their effort is not isolated. If a resident believes "most of my neighbors are not sorting, so why should I?", the effort collapses. Community integration fosters trust that others are also doing their part, which alleviates the fear of being the only one cooperating. This dynamic is analogous to the concept of collective efficacy used in neighborhood studies (often in crime prevention contexts), where social cohesion plus trust lead to effective communal action. In waste sorting, our data suggest that trust cultivated in cohesive communities encourages a kind of informal mutual monitoring and support – residents trust that the system (neighbors + community) is working, so they continue to play their role. Sense of environmental responsibility is essentially an internalized norm or value – feeling morally obliged to protect the community environment. Community integration appears to instill and reinforce such values, likely through socialization and repeated messaging within the community. This echoes findings in environmental sociology that strong community bonds can elevate pro-environmental values and collective responsibility. Self-efficacy in waste sorting, finally, is crucial because sorting can be seen as a somewhat effortful behavior requiring knowledge (what goes where) and persistence. A supportive community can increase individuals' efficacy by providing knowledge sharing (neighbors or volunteers teach each other) and showing that the task is manageable (seeing others succeed). The mediation by efficacy aligns with other research showing that even if people have the will, they need the confidence and skill to act, which supportive communities can nurture.

Comparing our results to prior studies, we see both commonalities and new contributions. The importance of social influence and norms in recycling behavior has been noted in Western contexts and some Chinese studies (e.g. recent surveys of youth have found peer influence critical for waste sorting). Our study specifically pinpoints community integration as the social construct encompassing those influences in a residential setting. It adds nuance by separating different facets of integration and demonstrating their interplay. Additionally, our case illustrates the temporal dimension: community cohesion needs to be maintained. The "retreat" of participation observed when community efforts slackened provides a cautionary tale. It suggests that policy interventions for waste sorting should institutionalize community engagement rather than rely on one-off campaigns. Otherwise, as seen in Nanjing and elsewhere, initial gains may be lost when external pressure is removed. This finding reinforces arguments by other scholars that sustainable behavior change requires stable community-based mechanisms, such as ongoing education, resident committees, and feedback systems. In fact, the scenario described by some residents – where sorted waste was later collected and mixed together by garbage trucks – is a classic example of how lack of systemic support can erode trust and demotivate the community. It underscores that community integration efforts must be accompanied by consistent institutional performance to avoid disillusionment.

5.3. Limitations and Generalizability. A Discussion of This Study's Implications Must Also Acknowledge its Limitations.

Our data are cross-sectional and largely correlational. While we employed mediation analysis consistent with theory, causal relationships (especially the directionality between integration and behavior) should be interpreted with caution. It is plausible that engaging in waste sorting could also feed back to strengthen community integration (e.g. people who start participating might meet neighbors and feel more attached). Future longitudinal research could explore these feedback loops. Second, the case of Nanjing has specific features – it is a relatively affluent Chinese city with strong government promotion of sorting. The levels of community infrastructure and organization here might differ from other cities or rural areas. However, the core idea that social cohesion enhances collective pro-environmental behavior is likely generalizable, as supported by similar findings in various contexts (e.g. studies of neighborhood cohesion and litter control in other Chinese cities). Third, community integration in this study was measured through residents' perceptions and self-report, which could carry bias. Those who are generally pro-social might rate their community higher in cohesion (a halo effect). We mitigated this by also gathering objective information (e.g. the presence of community events, facilities) and by interviews, but some bias may remain. Despite these caveats, the convergence of quantitative and qualitative evidence in our results strengthens our confidence in the conclusions.

6. CONCLUSION

This research contributes to understanding the social-contextual mechanisms underlying residents' waste sorting behavior. Focusing on an urban community perspective, we demonstrate that community integration – encompassing residents' shared identity, participation in community life, and mutual support – positively influences both the willingness to sort waste and the consistent execution of sorting behavior. In the case of Nanjing, China, communities with higher cohesion saw better household waste separation outcomes, mediated by increased interpersonal trust, a stronger sense of environmental responsibility, and greater self-efficacy among residents. In other words, when people feel part of a trusting and supportive community, they are more likely to "do the right thing" for the environment and believe that their actions make a difference.

For theory, our findings bridge the Theory of Planned Behavior with community-level constructs, suggesting that the social environment can amplify or dampen the classic TPB factors. Community integration provides favorable conditions for pro-environmental intentions to translate into action by embedding individuals in a network of social norms and support. This underscores the importance of moving beyond individualistic models of environmental behavior to incorporate group and place-based factors – an insight aligned with community psychology and collective efficacy theories. We also highlight the dynamic aspect: community-driven momentum can build a virtuous cycle of participation, whereas lapses in community engagement can quickly reverse behavioral gains.

For practice, the implications are clear: policymakers and urban managers should treat communities as fundamental units of change in promoting waste sorting and recycling. Technical solutions (providing bins, trucks, etc.) and top-down regulations (fines or mandates) may not sustain compliance in the long run unless the community fabric that supports behavior change is strengthened. Specific recommendations include: (1) Investing in community organizations and leadership – empower neighborhood committees or resident groups to take ownership of waste sorting initiatives, so that peer influence and local pride drive participation rather than only government inspectors. (2) Enhancing community communication and education – regular workshops, newsletters, or public bulletin updates in the community can reinforce knowledge and norms, maintaining salience of the issue. Residents should receive feedback on their collective performance (e.g. recycling rates achieved), as this can bolster collective efficacy. (3) Maintaining visible support and infrastructure –

ensure that sorting facilities are convenient, well-maintained, and accompanied by some form of human support (such as volunteers or staff during critical hours). The presence of facilitators, even part-time, can both help people sort correctly and signal that the community continues to prioritize the effort. (4) Leveraging social incentives – informal recognition of "green residents" or rewarding community teams for good performance can tap into community identity and friendly competition, reinforcing positive behavior through social reward rather than monetary incentive alone. (5) Building trust through consistency – perhaps most importantly, authorities must handle the collected recyclables properly (no re-mixing) and be transparent, to honor the trust residents place in the system. Failure to do so erodes community willingness dramatically, as seen in our study. In sum, policies to stop littering or promote waste separation should "think social" – strengthening social cohesion and collective empowerment may achieve more enduring results than a sole focus on individual responsibility.

In conclusion, as cities worldwide strive to increase recycling rates and foster sustainable habits, our study reminds us that community matters. Community integration is not a fuzzy feel-good factor; it is a tangible social condition that can make or break an environmental program. A cohesive community creates a supportive micro-environment for each household's behavior – making recycling a natural, expected part of daily life rather than a solitary chore. By cultivating community cohesion and harnessing it for environmental goals, urban authorities and residents together can improve not only waste management outcomes but also the social fabric that underpins a sustainable city. Future research should continue to explore community-based strategies in other environmental domains (like energy saving or water conservation) and test interventions that build community integration as a pathway to behavior change. The experience from Nanjing's waste sorting efforts provides a valuable case: the more a community comes together, the cleaner and greener their environment can be.

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