ABSTRACT

Graduate School of Global and Regional Studies

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The Difference of Waste Separation Behavior based on Societal Elements

-A case study in Hanoi, Vietnam-

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Introduction

A frequently sought-out solution to municipal solid waste management is the separation of waste at the source. In 2018, Hanoi city generated 3,149,723 tons of solid waste, which equals to 8,629 tons per day. Furthermore, the effects of urbanization and lifestyle changes also lead to drastic changes in the MSW's quantity and quality. With such circumstances, in 2009 the Prime Minister approved the National Strategy of Integrated Solid Waste Management up to 2025, vision towards 2050. This decision emphasized the priority of waste separation as a long-term strategy for waste management in Vietnam.

Source separation demands strictly promulgated regulations and adequate infrastructures that can support the handling of waste from collection, through transportation, to disposal. Household waste is currently not separated at the source and is collected daily then discarded in landfills. Alternative waste management technologies such as waste-to-energy technologies are being introduced in Vietnam, but they require waste separation into correct classification. Source separation heavily depends on the cooperation of the public so understanding the factors that influence people's behavior toward waste separation will play an important role in the future when source separation legislation is adopted.

Hanoi with the transitions in social backgrounds due to urbanization and economic development of the capital city led to a change in people's values. The "village culture", where everyone dwelling in the same neighborhood or "village" knows each other and sees each other like family, is gradually changing as people move into big cities. Their perception of the surrounding environment also shifts when people move to a new place and not yet consider the neighborhood to be their "home". This affects their attitude towards waste management as well. At the same time, the variety of stakeholders in the local authority results in a complex decision-making process, consequently affecting collective action initiatives and local waste management. For that reason, this study of the social impact on waste separation behavior will provide many suggestions

to develop municipal solid waste sorting strategies for not only Hanoi but also other cities in similar situation.

Objectives

In order to productively boost participation in source separation, it is crucial to understand what drives households to take part in waste separation. Especially in the area where extensive changes in demographic and lifestyle are happening, a study to examine the factors, not only in individual aspects but also regarding societal elements, is indispensable. The insufficiency in literature encouraged this study to explore the social impact on waste separation behavior.

For that purpose, the main objective of this research is to examine how the social bond between an individual and the neighborhood impact the behavior for waste separation, especially in the context of developing countries.

The result of this research can provide meaningful implications to not only waste management policies but also city planning policies which should be considered simultaneously for a sustainable impact.

Methodology

This study hypothesized that the behavior model N-O-A and the societal elements Sense of Community and Trust in Authority affect waste separation behavior. Predictor variables are categorized into five factors: Sense of Community (SC – measured by willingness to engage in community activities and to stay long-term), Trust in Authority (TA – measured by relationships with community leaders and confidence in the authority's capability), Need (N – measured by concern for the surrounding environment and cleanliness), Opportunity (O – measured by responses to incentives), and Ability (A – measured by the understanding of waste separation and the practical capability to separate waste).

Data collection was done through online survey. This study adopted a structured questionnaire for the survey. Multiple choice methods and Likert rating scales were used for the questionnaire design. The first part is a set of questions to collect general household information on socio-economic characteristics and living situation including years of residence in the community, types of houses and house ownership situation. The second part are Likert-scale items used to assess the predictor variables of the model. In this section, respondents were requested to grade their level of agreement with the given statements from 1 to 4, with 1 being "strongly disagree" and 4 being "strongly agree". Data was collected through two surveys. The first survey in 2020 collected 778 samples to study the factors influencing waste separation behavior. The second survey in 2022 collected 750 samples to study the impact of age on waste separation behavior.

This study used PLS-SEM run by smartPLS version 3.0 software to explore the causal relationship between the respondents' behavior of waste separation and Need, Opportunity, Ability (the three factors from the existing behavior model), and Sense of Community and Trust in Authority.

Results and Discussion

Sense of Community, Ability, and Opportunity are proved to be significant predictors towards people's waste separation behavior. Among these constructs, Opportunity is the strongest

predictor among newcomers (people who have lived in the neighborhood for 9 years or less) with $f2$ effect size at 0.219. This indicates that reward mechanisms, convenient waste collection locations and frequent pick-up schedules encourage participation in source separation, especially for new residents in the area, who are not as influenced by Sense of Community or Ability.

Another construct that predicts waste separation behavior is Trust in Authority with $f2$ effect size at 0.16 leaning toward stronger relationship. However, it only influences old residents or people who have lived in the neighborhood for 10 years or more, and it is also the strongest predictor among this group.

With P-value at 1%, data analysis result also indicates that Sense of Community affects the waste separation behavior. The sense of community is measured by the respondents' feeling of belonging, the desire to settle and live in the neighborhood for a long time, and the frequency in which the respondents take part in public activities held within the community.

Ability is shown to have an effect on separation behavior at 1% level significant. This result suggests that respondents who have the time and space in the house to sort out their waste, and people who know the difference between organic and recyclable waste are more likely to participate in source separation.

Need from the original model of "Needs-Opportunities-Abilities" Model of Consumer Behavior by Vlek appears to not affect waste separation behavior in this case. This means that the respondents of the study do not think that segregating household waste can improve the cleanliness in the neighborhood, and the current collection of mixed garbage is acceptable, hence no waste separation at the source.

While this is the result from the first case study in 2020, according to the data analysis of the survey that was conducted in 2022 the only factors that have significant correlation with separation behavior in the second case study are Ability and Sense of Community in the group of residents who have been living in the same neighborhood for more than 15 years. This second case study also shows that the behavior pattern is different for the older demographic among newcomers and old residents. This means that both age and living period has an effect on waste separation behavior.

Data analysis also shows major contrast between the two case studies in the response composition of the Likert-scale question. The second survey has much higher rate of strongly agree than somewhat agree, with the highest rate of strongly agree at 66.4% in the second survey. On the other hand, the highest rate of strongly agree in the first survey is 47%. After the period from 2020 to 2022, the average of the responses increased substantially, around 0.3 point. However, the average score of A3. "I have the space to store separated waste in the house" shows the least difference, at 3.17 in the survey in 2020 and 3.23 in the survey in 2022.

Conclusion

The study aimed to explore the social impact on waste separation behavior by examining how the social bond between an individual and the neighborhood impact the behavior for waste separation. This relationship was reflected by the socio-demographic characteristics of the respondents such as age and the living situation. Data analysis has highlighted the behavioral difference between

people who have lived in their current place for less than 10 years (newcomers) and people who have settled down for 10 years or more (old residents). It is found that while Sense of Community, Trust in Authority, Ability and Opportunity make up four predictors of separation behavior for old residents, Trust in Authority does not affect the decision-making regarding waste separation for people who newly move into a neighborhood.

This study result reaffirms the effect on waste separation behavior of internal factors including Ability (the capacity to carry out source separation) and Opportunity (responsiveness to incentives and convenience). Based on these analyses, policy implications have been proposed including a social platform to receive frequent feedback from Hanoi citizens regarding waste management issues, environment education, and reviewing the current waste collection system. Reward mechanisms are also recommended to enhance the willingness to participate in waste separation.

Data analysis also sheds light on the influence of the societal elements Sense of Community with P-value at 1% level on the decision making to participate in waste segregation. Sense of community is measured by the connection with the community leaders and active involvement in communal activity. With the objective of examining how the social bond between an individual and the neighborhood impact the behavior for waste separation, this result confirms the importance of communication and sense of belonging among members of the community. The more a person feel attached to their neighborhood, the more they perceive communal issue such as waste management as a shared responsibility, and actively participate in the initiative. Therefore, community-engagement approach should be incorporated into waste management.

The feeling of belonging in a community is also influence by the time living in the same neighborhood. While the tendency for the elder generation to have a long period of staying in one place is strong, data analysis has also show that the senior demographic's separation behavior differs from that of old residents and newcomers. This indicates that the behavior of waste separation is influenced by both age and living period. In the context of Hanoi where the majority of residential land will become new urban areas in 2030, the living period of people in these areas will be relatively short compares to areas where the relationship between individual and the community is more established. Consequently, the behavior of residents in these different parts of the city will also be diverse.

This study acknowledges that the samples have a higher ratio of people in university and graduate school, possibly because of the tendency of internet use and familiarity with internet survey among people with higher education. Data analyses were carried out with the available samples collected, and we will focus on possible effect of sampling bias in future studies.