

Sustainable Solid Waste Management in Danang, Vietnam: the 3R Approach Focusing on Community Participation

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1. Introduction

Solid waste management (SWM) is an integral component of the social-ecological system. For establishing a sustainable society, it is vital to improve SWM systems [1]. Integrated solid waste management is a comprehensive system involving various activities and processes to manage solid waste that is adaptable to each community. Reduce, reuse, and recycle (3R) are the central activities of ISWM implementation [2].

Through examining Danang City's current SWM system, this study delves into the demand and available resources for implementing the 3R initiative in a specific region. In addition, this research aims to deepen our understanding about public opinions and attitude towards the current SWM system and the 3R program. The results will contribute to informing Danang's local authorities and policy makers in designing educational programs and making changes in policies and technologies. These improvements will also assist in attaining the objectives of sustainable development regarding SWM, as well as inform other sustainability goals and efforts going forward, part of a much-needed integrated approach.

2. Materials and Methods

2.1 Research area selection

Danang City was chosen for doing this research and it is the third biggest city in Vietnam with a population of 887,070 people (Vietnam General Office for Population Family Planning 2009). Ward number 3 belonging to Cam Le district was selected to conduct surveys because it is considered an ideal model of modern urban areas of the city and a new method of waste collection has been tested at this area.

2.2 Secondary data collection

The data regarding waste generation, collection, transportation, disposal, and fees were collected

to ascertain the problems occurring at every stage of the SWM system. This kind of data can be found at Danang Urban Environment Company (URENCO)

2.3 Primary data collection-Residential survey

For the objective of interpreting public awareness towards the city SWM and the 3R program, a survey was conducted from June to August 2012. Thirty one questions related to solid waste management along with five personal questions are included in the questionnaire. Face-to-face interviews were conducted with 30 households in ward 3, Cam Le District. The qualitative data analysis computer program called Anthropac ver. 4.98 (Analytic Technology Company, Lexington, KY) was used to analyze open-ended questions. Also, SPSS ver. 20 (IBM Corporation, New York) program was used to support for analyzing the multiple choices and yes/no questions.

3. Results and Discussion

3.1 Current status of solid waste management in Danang City

3.1.1 Solid waste generation and composition

Solid waste in Danang city is generated from various sources including households, commercial centers, offices, schools, institutions, hospitals, airports, parks, construction activities, and industrial activities. In Danang, the waste generation rate is about 0.65 kg/person/day (Chi and Long, 2011).

Regarding SW composition, the waste stream in Danang is comprised of more than 70% organic material such as food and leaves, 12% plastic bags, and 18% comes from other categories. The huge percentage of food waste accrues because households favor cooking their own meals at home and people prefer unprocessed food, and this results in a lot of cuttings [3].

3.1.2 Solid waste collection activities

In order to collect waste from households living on medium and large streets about 6000 of 240 or 660-liter curbside containers were placed in specific points along the streets. One hundred and twenty tricycles are used to carry these containers to transfer stations. To collect waste from households living on small roads and far away from curbside containers, the tricycles are also equipped with door-to-door waste collection containers. Additionally, 68 compressed waste trucks and waste container trucks—with capacities of 3, 5, 7, 10 or 16 tons—are used to transfer SW from the curbside containers to the landfill.

3.1.3 Solid waste ultimate disposal by landfill

Solid waste generated from Danang is carried to and treated at the new Khanh Son landfill. The site, which is 15 km from the center of Danang, has operated since 2007. The landfill has an area of 48.3 ha in which 15 ha is used for the municipal SW. The price for treating one ton of SW is about one dollar. The municipal SW area is divided into five parts. By July 2012, the total amount of SW that was buried at the landfill was about 1.2 million tons.

3.2 Survey results

3.2.1 Social characteristics of respondents

Gender, age, and occupation were demographic characteristics explored in this study. Most respondents (63.3%) were female while 36.7% were male. The mean age of respondents was 44.4 years. Respondents have different kinds of jobs. People who are employed in offices account for the highest percentage (16.7%), the next is civil servants (13.3%) and retired (13.3%).

3.2.2 Public opinions and attitudes toward SWM system

The results indicated that most respondents were unsatisfied with particular elements of the SWM system. Most respondents want the city to improve curbside containers, collection activities, waste fees, and street sweeping. Additionally, landfills are also a concern of the community due to their pollution. The Danang landfill which has the area of 48.3 ha was expected to operate for 50 years, but due to a significant increase in the

amount of SW in recent years, there may be not enough room for burying SW in the near future. By July 2012, the total amount of SW that was buried at the landfill was about 1.2 million tons. The majority of participants thought that 3R is a good program and revealed their willingness to participate. The existing large fraction of compostable materials in the solid waste stream (76%) and the willingness of 53% of respondents to compost at home are advantageous for implementing 3R. The results also showed that 60% of respondents favor implementing the “pay as you throw” program which considerable contribute to the success of 3R.

4. Conclusion

This research results provide stakeholders with essential information in designing educational programs and making improvements in SWM policies and technologies. These improvements assist Danang City to develop more sustainably. In this 3R program, educational programs should be central, elaborately designed in order to encourage the public to reduce SW by making compost at home, reusing many products before disposal, and buying “sustainable products.”

Reference

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