

Residential Garbage Management from University Students Perception Though Case Study in South Korea

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Abstract – Strategies for municipal solid waste (MSW) management constitute a prominent part of environmental planning and urban planning. This paper views the waste management on the example of Seoul with a high-dense and complex environment of an Asian city. From the literature review for Korea and other countries, the MSW management methods are viewed for ubiquitous infrastructure of new cities and for existing urban areas in terms of their sustainable maintenance. This paper is focused on MSW management for pedestrian pathways adjusted to streets, public spaces at bus stops, and public spaces at the university campus. Then the paper presents the results of an initial pilot survey about a garbage management from the university student's perceptions conducted in 2015. In the initial pilot survey the students from Korea University, Yonsei University (Seoul), Catholic university (Buckcheon) and Hannam University (Daejeon) were questioned. The paper seeks to analyze student's perceptions of environmental issues and raise the interest on environmental sustainability. The study maybe further extended in terms of application of new technologies for the enhancement of existing MSW approaches.

Keywords – Municipal Solid Waste (MSW), Waste Management in Residential Urban Areas, Public Spaces, MSW Disposal and Recycling Patterns, Seoul.

I. INTRODUCTION

With the perspectives and world trends for saving resources [1], the effective management of resources acquires an important value for the cities. With that the effective waste collection, waste recycling and disposal make a part of city municipal services ensuring the sustainable city maintenance.

In Seoul, one of the Asian global cities, the waste management is evaluated by Seoul Institute to be 300 kg for business places, public and residential places, and 5 ton for construction works for construction entities in a day [2]. Since 1995 Seoul government introduced volume-based waste fee system, which reduced waste quantity for residential households and increased waste recycling [3].

The municipal solid waste (MSW) management seems to be organized differently for new developments (such as new 'smart cities') and existing urban areas of a city. For newly planned developments, MSW infrastructure is planned as a part of ubiquitous infrastructure, for example in Songdo smart city [4]. While in the existing urban districts in Seoul, due to high residential density, growth of commercial facilities, and pedestrian transit in public spaces, the enhancement of existing methods becomes an important problem. For these areas the social awareness for effective MSW management methods is essential.

Thus, for different urban conditions MSW management has to be a prominent part of inclusive environmental urban planning and urban regeneration.

This paper aims to view the waste management on the example of Seoul and to present the results of a pilot social study among university students in terms of waste management. This study intends to raise the interest on environmental sustainability among students for their daily life MSW recycling and disposal patterns.

This paper is focusing on students' waste recycling patterns and perception of MSW in the following places:



- ① Pedestrian pathways along the streets in residential and commercial areas;



- ② Public spaces:
At the Public Bus Stops



- ③ Public space:
At the University Campus

With more details, the next section presents the study flow and methods utilized in the current study.

II. STUDY FLOW AND METHODS

The study flow is shown at Fig. 1. Firstly, the theoretical background section will view the urban planning and urban regeneration methods for MSW management. Secondly, case studies in Seoul consider three types of public spaces on particular examples and explain the results of a pilot survey. Lastly, conclusion and discussion section will talk over possible suggestions and implications of the study.

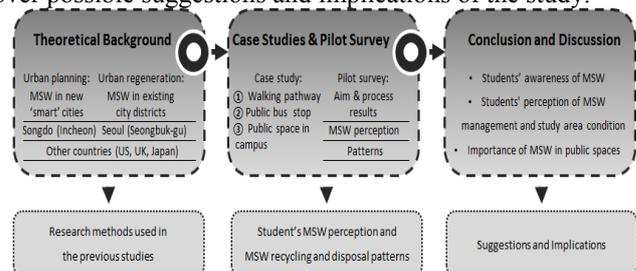
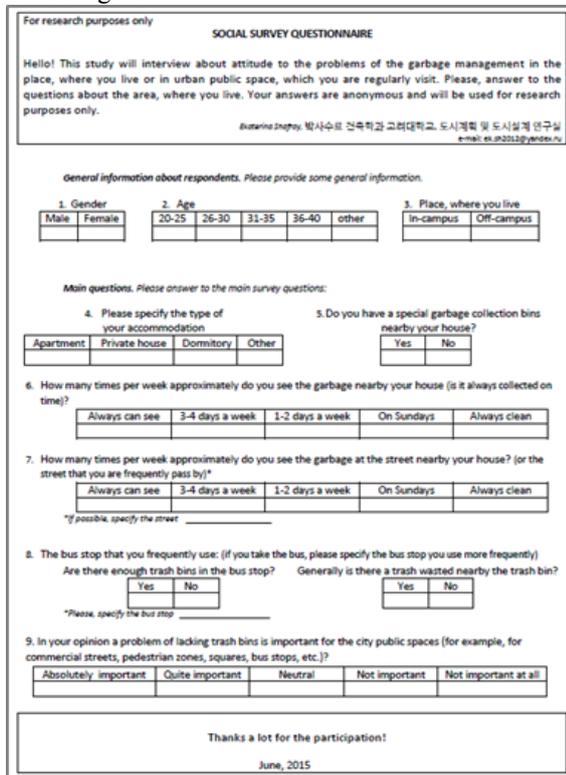


Fig. 1. The Study Flow
Source: Authors (2017)

As research methods this study is using literature reviews, case study for the selected places in Seoul, and pilot social survey among university students.

Initial Pilot Survey Description

The students from Korea University, Yonsei University (Seoul), Catholic university (Buckcheon) and Hannam University (Daejeon) were asked to share their opinion about residential waste management using a written questionnaire. The form for the questionnaire for a pilot social survey is shown at Fig. 2.



SOCIAL SURVEY QUESTIONNAIRE

Hello! This study will interview about attitude to the problems of the garbage management in the place, where you live or in urban public space, which you are regularly visit. Please, answer to the questions about the area, where you live. Your answers are anonymous and will be used for research purposes only.

For research purposes only

1. Gender: Male, Female
2. Age: 20-25, 26-30, 31-35, 36-40, other
3. Place, where you live: In-campus, Off-campus

4. Please specify the type of your accommodation: Apartment, Private house, Dormitory, Other
5. Do you have a special garbage collection bins nearby your house? Yes, No

6. How many times per week approximately do you see the garbage nearby your house (is it always collected on time)?
Always can see, 3-4 days a week, 1-2 days a week, On Sundays, Always clean

7. How many times per week approximately do you see the garbage at the street nearby your house? (or the street that you are frequently pass by)?
Always can see, 3-4 days a week, 1-2 days a week, On Sundays, Always clean

8. The bus stop that you frequently use: (if you take the bus, please specify the bus stop you use more frequently)
Are there enough trash bins in the bus stop? Generally is there a trash waited nearby the trash bin?
Yes, No

9. In your opinion a problem of lacking trash bins is important for the city public spaces (for example, for commercial streets, pedestrian zones, squares, bus stops, etc.)?
Absolutely important, Quite important, Neutral, Not important, Not important at all

Thanks a lot for the participation!
June, 2015

Fig.2. Questionnaire Form for a Pilot Survey
Source: Authors (2017)

The overall number of students participated in a pilot survey is 46 respondents. The pilot survey was conducted by author in June, 2015.

The next section presents the literature review and theoretical background for this paper.

III. THEORETICAL BACKGROUND

This section summarizes the previous literature in terms of urban planning and urban regeneration approaches for MSW management in Seoul, South Korea, and in other developed countries (such as US, European countries, and Japan).

The literature review is shown at Table 1. Among Asian countries, Japan and South Korea as high-income countries pay more attention to incorporate new 3R (Reduce, Reuse and Recycle) technologies [11] and minimize landfilling areas. South Korea is currently implementing Volume-based Garbage Collection Fee (VGCF) system, Per Bag Trash Collection Fee System, and Separate Waste Collection policies [6] (see at Fig.3).

Table 1. Literature Review (MSW Management)

Position	Authors, Year	Purpose of Study/ Utilized Methods
Urban Planning		
MSW Management as a Part of Ubiquitous Infrastructure For New Cities: Songdo Smart City (South Korea)		
1	Shwayri. (2013) [4]	“Ubiquitous Eco-City” with global and local trends
2	Yigitcanlar & Lee (2014) [5]	Examines ubiquitous technologies, infrastructures, services, and management systems
Global ‘eco-cities’ comparison and their key characteristics		
3	Joss (2011) [6]	Comparison of world 79 ‘eco-cities,’ including three major projects in South Korea (GwangGyo, Incheon, Songdo)
Other countries/ Comparison		
4	Zygiaris (2013) [7]	Analyzes characteristics of green, interconnected, instrumented, open, integrated, intelligent, and innovating layers to create Smart City Reference Model (e.g. Barcelona, Edinburgh, and Amsterdam)
5	Lee, et.al. (2014) [8]	Conceptual framework to conduct comparative case studies from different perspectives (Seoul and San Francisco)
Urban Regeneration		
Maintenance and Update of Infrastructure for Existing Urban Districts: Seoul (South Korea)		
6	Lee & Paik (2011) [3]	Social questionnaire used to outline the impact of factors on recycling and waste management behaviors including NEP (New Environmental Paradigm)
7	Kim & Kim (2010) [9]	The analysis of Life Cycle Assessment (LCA) for waste disposal for food waste and its relation to global warming and resource recovery
Other countries/ Comparison		
8	Husaini, et.al. (2007). [10]	Case study European household waste management schemes, possibilities and barriers for implementation in UK
9	Shekdar (2009) [11]	Assessment the expectations of Solid waste management (SWM) systems (including 3R (Reduce, Reuse and Recycle) technologies) in Asian countries (Japan, South Korea, India, Indonesia, etc.)
10	Laquian (2011) [12]	Waste emission and SWM as a component of mega-cities infrastructure management

Source: Authors (2017)

For new developments, such as Songdo International Business District and smart cities, the ENVAC (Automated Waste Collection System) is developed as a part of ubiquitous infrastructure [1], [2]. The ENVAC trash collection system in Songdo is shown at Fig.4.



Fig.3. District Supply Trash Bag (white- general waste; yellow- food waste). Source: K. Kim (2015)



Fig.4. ENVAC Trash Collection System in Songdo Smart City
 Source: Authors photography (2015)

For urban planning of new developments like ‘smart cities’ or ‘eco-cities,’ Joss (2011) [6] emphasized the importance of concepts of low-carbon and low-waste. These cities include Destiny Florida in the USA, Tangshan Caofeidian in China, GwangGyo in South Korea and Masdar in the United Arab Emirates, and others.

Overall, the approaches for urban planning and urban regeneration for MSW management recently are being affected by environmental protection notions and environment pollution warnings. For instance, [9] analyzed the relation of food waste to aglobal warming and resource recovery. However, in a particular case, for the young generation, such as university students, it needs to be a constant process of increasing awareness of environmental issues though the waste recycling and disposal patterns in daily life.

Despite a well-established system of per bag trash collection fee system for residential households in Seoul, the waste disposal problem remains in public spaces in a city. The problem of animproper waste disposal is very relevant to pedestrian pathways along the streets, public spaces at bus stops, public spaces nearby or at the university campus, because these places have a heavy pedestrian transit and often lack of trash bins.

Therefore, this study is focusing on waste disposal and recycling patterns as wellas on perception of those issues

among university students, and also provides a case study of particular public spaces. The next section will introduce the selected case studies and present the results of a pilot social survey.

IV. CASE STUDY AND PILOT SOCIAL SURVEY AMONG UNIVERSITY STUDENTS

A. Case Study Places (Seoul)

The public places for a case study were selected in Seoul in Seongbuk-gu district nearby Anam subway station. This area has a pedestrian transit flow and it is a crowded student area nearby Korea University campus(see Table. 2).

Table 2. Selected Case Study Places on Waste Disposal

Type	Location	Waste Disposal Characteristics
	① Seoul, Seongbuk-gu district, Inchon-ro	Garbage prepared for collection by the district service. Situation/ Problem: • Aesthetically does not look good; • Students often leave waste and coffee cups above garbage
	② Seoul, Seongbuk-gu district, Anam bus stop	Garbage prepared for collection by the district service. Situation/ Problem: • Not enough public trash bins to contain all the trash • Often small trash items are left over or nearby trash bins
	③ Seoul, Seongbuk-gu, Nearby Korea University campus	Trash bins at the campus public space Situation/ Problem: • It seems that the quantity of trash bins is lacking; • Overall the campus area is well managed by service staff



Source: Authors (2017), Naver maps (2017)

Overall, through visual observations, case studies show that frequently in public spaces small trash items (such as coffee cups, bottles, etc.) are left on the garbage bags or nearby trash bins, as often there is not enough trash bins for waste recycling or disposal. However, these areas are cleaned up by district service very fast. Besides, many small businesses owners or staff manage the pedestrian pathway or space nearby their store and pick up the improperly disposed garbage.

However, it is a frequent case that students improperly dispose small trash items nearby trash bins or garbage bags. Therefore, the next subsection tries to reveal waste recycling and disposal patterns for students and also to characterize their perception on the environment protection issues.

B. Pilot Social Survey Description and General Information about Respondents

The pilot survey was conducted by author in June, 2015 with university students. The overall number of students participated in a pilot survey is 46 respondents. The students participated in a pilot survey are from Korea University, Yonsei University (Seoul), Catholic university (Buckcheon), and Hannam University (Daejeon).

Number of male respondents is 23 persons, female respondents – 23 persons. The respondent's age is shown at Table 3. At most, the respondent's age is 20-25 years (78.3% from total number of respondents).

Table 3. Respondent's Age

Total	20-25	26-30	31-35	36-40	Other
46 respondents	36	3	4	1	2
100%	78.3%	6.5%	8.7%	2.2%	4.3%

Source: Authors (2017)

The questionnaire form is simple (shown previously on Fig. 2), anonymous, and a short time required to fill it out. The pilot survey results are shown at the next subsection.

C. Pilot Social Survey Results

The pilot survey contains few questions in order to outline student's opinion on MSW recycling and disposal in several places. Firstly, it asked about the respondent's place of accommodation and situation with trash disposal around their place of accommodation. Secondly, it asked about respondent's opinion of public space at the street condition. Particularly, how many times per week respondent see garbage disposed at the street. Thirdly, the questionnaire asked the respondent's opinion on bus stop

condition in terms of waste disposal and availability of trash bin. And, finally, it asked to evaluate the importance of trash bin availability/ or lack of trash bin in public spaces. Then the results on these questions are shown on below.

The first questions on types of accommodation (see Table 4 and Table 5) show that majority of students live off-campus (82.6%) in apartment buildings (54.3%), private house (17.4%) or dormitory (15.2%).

Table 4. Respondent's Accommodation

Total	In-campus	Off-campus
46 respondents	8	38
100%	17.4%	82.6%

Source: Authors (2017)

Table 5. Type of Accommodation

Total	Apartment	Private house	Dormitory	Other
46 respondents	25	8	7	6
100%	54.3%	17.4%	15.2%	13.1%

Source: Authors (2017)

The next question on availability of garbage collection bins nearby the place of residents (see Table 6) shows that mostly respondents are satisfied with the number of garbage bins at their place of residence (69.6%).

Table 6. Availability of Special Garbage Collection Bins nearby a Place of Residence

Total	Yes	No
46 respondents	32	14
100%	69.6%	30.4%

Source: Authors (2017)

The next question is also about the waste disposal near the place of residence (see Table 7). It shows a large spread of answers from 'always can see' (28.3%) to 'always clean' (15.2%). This result can be explained by different aesthetic quality of space and location of waste collection spots (outdoor/ inside; organized/ unorganized).

Table 7. How Many Times per Week Approximately do You See the Garbage Disposed nearby Your House (Is it Always Collected on Time)?

Total	Always can see	3-4 days per week	1-2 days per week	On Sunday	Always clean
46 respondents	13	9	13	4	7
100%	28.3%	19.6%	28.3%	8.7%	15.2%

Source: Authors (2017)

Secondly, the questions on waste disposal situation at the public spaces show the following. As for the waste disposal at the street, similar to the previous question, there is a spread of answers (see Table 8). Specifically, 'always can see' was chosen by 28.3% of respondents, while 'always

clean’ was selected by 17.4% of respondents. Generally, the answers vary on this question.

Table 8. How Many Times per Week Approximately do You See the Garbage at the Street nearby Your House?

Total	Always can see	3-4 days per week	1-2 days per week	On Sunday	Always clean
46 respondents	13	12	11	2	8
100%	28.3%	26.1%	23.9%	4.3%	17.4%

Source: Authors (2017)

Thirdly, a ‘waste disposal at the public space at bus stop’ contained two questions: trash bin availability at the bus stop and cases of improper waste disposal nearby the trash bin (presented at Table 9 and Table 10). The questionnaire also asked to specify the name of the bus stop, if respondent wants to. The Anam bus stop (at Korea University), Hannam university bus stop, and Catholic University (Bukcheon) were indicated. Generally, responses pointed out the lack of the trash bins at the bus stops (60.9%).

Table 9. Are there Enough Trash Bins in the Bus Stop?

Total	Yes	No
46 respondents	18	28
100%	39.1%	60.9%

Source: Authors (2017)

Table 10. Generally is There a Trash Wasted Nearby the Trash Bin?

Total	Yes	No
46 respondents	29	17
100%	63.0%	37.0%

Source: Authors (2017)

And, lastly, the other question (see Table 11) asked to evaluate the importance of trash bin availability or lack of trash bin in public spaces. The results found that 86.9% of respondent’s replies were positive, indicating ‘absolutely important’ and ‘quite important’ answers.

Table 11. Importance of a Problem of Lacking Trash Bins for the City Public Spaces (e.g. for commercial streets, pedestrian zones, public squares, bus stops, etc.)?

Total	Absolutely important	Quite important	Neutral	Not important	Not important at all
46 respondents	25	15	6	0	0
100%	54.3%	32.6%	13.1%	0.0%	0.0%

Source: Authors (2017)

Generally, the responses indicate the importance of availability of trash bins at the public places. With that, South Korea, similar to Japan, has very few trash bins in public places. People are supposed to dispose their garbage at home.

The waste recycling and disposal facilities at the places of residence seems to be better organized than in public spaces, such as pedestrian pathways at streets or public spaces at the bus stops. In the places of heavy pedestrian flow, at the areas popular among the students or around universities, the improperly disposed small trash items could be seen placed over the garbage bags or around trash bin. This problem needs to be solved for enhancing the aesthetic and environmental quality of urban environment and for the public safety.

Recently waste management became a relevant issue for many municipalities. Seoul also carried out “Zero Waste, Seoul 2030 Plan” for the efficient recycling rate and social programs. All solutions for waste recycling and disposal at public spaces need to satisfy many criteria, such as public safety, convenience to use, and to be aesthetic and environment-friendly.

V. CONCLUSION AND DISCUSSION

The recycling, saving and management of resources has a significant value for many cities. In Seoul, the waste recycling and disposal facilities at the places of residence are well-developed. However, the efficient waste collection and removal at public spaces of the city seems to remain an important issue.

The pilot social survey conducted with several university students in South Korea has found a different vision of students for waste disposal in public places and places of residence, and the importance of trash bin availability.

Although the respondent sampling for a pilot study is quite small, the general study aim is to raise awareness among students on environmental issues. A survey on this topic maybe further continued with a larger sampling size.

In summary, considering the observed problem for an improper waste disposal in public spaces that is seen through visual observations in several case studies, the following suggestions could be applied:

- 1) **Information Level:** There is a need for information campaigns explaining about the ways of maintenance of public spaces and keeping a clean space. Considering a small quantity of trash bins in public spaces and existing practice of waste disposal, it suggests to refrain from improper waste disposal (even for small items) and recycle/ dispose them at home.
- 2) **Local Urban Regeneration Level:** The trash bins located in the public spaces have to be safe. Along with the practice of making the trash bins from transparent materials, other safety measure can be applied as well. It helps to control the disposed trash in terms of its safety for environment and for people. Therefore, a need for a small fee for the trash disposal into such bins can be discussed.

3) **Public Safety Level:** The installation of CCTV cameras in public places and places with large pedestrian flow can increase the public safety and reduce the cases of improper waste disposal.

Further, MSW management needs a detailed study with consideration of new technologies and experience. The study maybe further extended in terms of application of new technologies for the enhancement of existing MSW approaches.

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