

Perception of Waste and Waste Transfer Cost

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Abstract

Since its existence, humans have been interacting with their environment to encounter its basic needs. It is obvious that these interactions cause both humans to affect the environment and the environment to affect mankind. And, environment issues are constantly, too, ubiquitous problems. Hence, waste management and waste perception are problems that municipalities should have worked on for a long time. But study has not been carried out on the waste perception and waste transfer problem relations which would base on the term of cost of this issue and previous studies of relation waste perception and waste transfer cost have not directly dealt with this issue.

Hence, it could conceivably be hypothesized that major component of waste collection operational cost can basically be seen fuel cost and personnel cost but one of the main obstacles is waste perception. The argument of this paper relies too heavily on the term of waste perception.

The amount of waste collected and total cost of waste are based on the characteristics of the waste, types of transfer vehicles and the distance between the cities and the transfer stations are other parameters affecting the cost yet waste perception has a most pivotal role in process. Therefore, waste perception could be a major factor, if not the only one.

In this study, in order to determine the effect of solid waste perception on total collection and transportation cost, a realistic survey was conducted and the analysis was carried out.

1. Introduction

With its widespread use among people, waste generate service stands out as the most basic service provided by municipalities. This task, simply

called waste generate by people, involves massive planning, feasibility and costs in the background. Illustrate this fact that waste generate is the collection of waste, taking it to the transfer station, and from the transfer station to the disposal facility in vehicles with larger bodies. Generate and transportation constitute the biggest cost in waste management.

However, waste receptacles are places on the streets in residential district should be collected without delay. The reason for this is to prevent diseases from spreading in cities.

In this connection, the process of time management is so important, the amount of waste generated daily by per person per day should be based on waste perception. This also affects appropriate vehicle sizes and correct transport distances.

A main driving force behind this paper is that waste management is the pyrrhic problem under waste perception and waste transfer cost and logistic cost and its effect. The aim of this study is to explain how effective waste management and high level of waste perception against high cost of waste transfer.

Green energy and the sustainable development are encouraging the recovery of waste. Municipal waste management is less costly in the poorest countries than in emerging or developed countries. [1]

The highest cost item in the integrated solid waste management system is the collection and transportation of waste. The costs can reach up to 80% of total waste management. [2]

Generally, waste collection around the world is done or outsourced by district municipalities (local governments).

The main operating costs are fuel expense, vehicle depreciation and personnel expenses.

Other variables that affect the cost are the amount of waste collected, the physical properties of the waste, the types and capacities of collection vehicles and the distance between the settlement and the transfer center.

In this study, a survey appropriate to the conditions was developed, accepting the perception of solid waste and its impact on transportation costs.

In order for the survey application to be realistic, the survey was created based on waste amount and literature review, and with information received from authorized persons in the private sector and local governments. However, the profits derived from the sale of recycled products rarely cover the expenses required for their conversion. Nevertheless, the absence of waste management causes negative externalities that are even more expensive.

For example, the Global Waste Management Outlook of the United Nations Environment Program (UNEP) 2022 estimates that the global health and environmental costs related to the pollution by waste deposited in the wild or burned in open air, up to 400 million tons of heavy metals, solvents, toxic sludge and other industrial wastes are released annually into the world's waters [3], hypothesized that major component of waste collection operational cost can basically be seen fuel cost and personnel cost but one of the main obstacles is waste perception. The argument of this paper relies too heavily on the term of waste perception.

The parameters and questions were determined after the literature review was done and information's were taken from the authorized persons in municipalities to achieve realistic conditions in the survey.

During this study, the necessary calculations have been made for the survey where the waste transfer cost is admitted on waste perception.

Within the scope of the research, a survey was conducted with 215 students, considering their age, gender and information about waste perception and the specific research questions, as a representative of the research. Few published studies have been conducted to determine the possible effects of these relations. Because, when

asked specifically about "waste": "I separate plastic and paper in waste", it was seen that the perception of waste from the past continues. When waste is mentioned, it seems that an anti-hygienic pile that needs to be disposed of as soon as possible comes to mind.

Shortly, these findings are that waste transfer cost decrease as the students' waste perception increases.

As a result, it has been understood from this study that students' awareness of waste perception is not at a sufficient level, but the majority of those who are aware have insufficient opinions about its impact on the cost of waste transportation. Therefore, it is necessary to quickly explain to the society by underlining that the waste problem is not just about the citizens throwing the waste into the container and the municipality collecting it without any delay. In sociology, he puts the positive into himself and the negative into himself.

The amount of waste collected and total cost of waste are based on the characteristics of the waste, types of transfer vehicles and the distance between the cities and the transfer stations are other parameters affecting the cost yet waste perception has a most pivotal role in process. Therefore, waste perception could be a major factor, if not the only one.

1.1. Literature review

Reviewing the results of the sources concludes that the waste perception that there is no an increasing importance on waste management. Hence It has not been found in literature that there is an increasing importance on the role of waste perception that promotes the idea that important external sources of waste cost, which can be eliminated by completing certain strategies either. Various theories of waste perception how societies that there are many factors that influence waste cost.

In order to provide comparison in the study, the results of the source examination are based on these titles that solid waste modelling for municipalities with real data on municipal waste [4], municipal waste as a common good in public economics and economic value of waste [5], externalities and total cost [6], Cronbach alpha [7] and Cronbach's alpha estimation and hypothesis [8].

After reviewing the previous scientific publications by provided International Institutions and other scholars (journal articles, dissertations, books, studies) and preparatory work, the following

conclusions which questions that there have not been answered by any of the existing studies or research:

- It is necessary to ensure equal access to adequate sanitation and sanitation for all, and end littering in public places and paying particular attention to waste perception and "people in vulnerable situations" in the future due to waste transfer cost.
- It is necessary to ensure universal and equitable access to the problem of safe and accessible waste for cities in the future
- It is necessary to improve waste quality by reducing pollution, minimizing the release of harmful substances, and significantly diminishing waste transfer cost globally.
- Drastically increasing waste perception efficiency across all societies, ensuring a sustainable supply of waste recycling will decrease and significantly reducing the number of cities suffering from waste problem in the future.

1.2. Concrete research questions

In design research, it has been posed research questions to define the scope and the modes of inquiry. Due to the importance of research questions, research provides on the term of waste perception we need to have appropriate survey questions on how to construct research questions. We have filled this gap by using ways of constructing semi structural interview and questions and analyzing the research questions in a survey. Based on analysis, it has been provided guideline and pattern that help students formulate research questions:

- What is the most important impact of waste perception on waste transfer cost in municipalities?
- What kind of keys on age, education, and cultural origins and others affect whether people will develop waste generate? and how can these common traits be used to help diminish the waste transfer cost?
- How do waste transfer cost outcomes compare between low-income people with lack of waste perception living in the cities?
- What are the similarities and differences of the waste perception of in Turkish students and foreign at different classes and different departments at Anadolu University's Faculty of Economics and Administrative Sciences?

Finally, this paper has a new field in variation database and questions but most previous research studies are contained only standard survey questions. Moreover, the project has

unique survey that is more engaging in order to get reports and metrics and it has not been online survey. In addition, no research has been found that surveyed which was based on these questions and previous published studies are limited to local surveys and has been compared different countries residents. Findings are discussed with qualify the previous literature, and directions for future empirical research are pointed out due to waste perception and waste transfer in cost problems.

1.3. Research gaps

There is a substantial large number of current researches on waste management, waste problems, landfills, waste generate. But the gaps in research are remarkable both in terms of subject matter, and size or scope of studies related with the term of waste perception. The term of waste perception should be characterized by case study research, often having the benefit of a regular approach. Along with the gaps in specific subject matter of waste perception, there is a lack of large-scale research that would allow a more complete view of the relations of waste perception and waste transfer problems.

The research gaps are listed below because of the potential value of gap of research literature on waste perception.

Table 1: The research gaps

There are not student's waste perception patterns related to the term of waste.
There is not a systematic study of waste perception: including an assessment of conditions in current waste problems.
There is not proper study related with links between waste perception involved age and gender.
There is not proper study related with attitudes and beliefs of students with regard to waste perception.

Moreover, this study argues waste perception considering transfer costs and waste logistic associated with each attribute. The term of waste perception in this study too considers mainly transfer costs of as well as how and when waste is disposed.

This study argues waste perception considering transfer costs and waste logistic associated with attribute. The term of waste perception in this study too considers mainly transfer costs of as well as how and when waste is disposed.

Considering all the explanations above, with research, I have traced the adequate of approaching the relationship between waste

perception and waste transfer cost, the difficulties of waste management in cities. Since, waste management in cities is an element of environmental regulation and harmonization in the subject of diminishing huge economic cost. It is also a dynamic analysis in terms of waste management problem, waste perception and adaptation in the context of logistic management. Hence, in order to help familiarize participants that survey was conducted in two level.

Cronbach's alpha is to measure of internal consistency because it has been used because we have multiple "Likert questions" in survey that form a scale and to determine if the scale is reliable due to fact that we have concerned with inter-rater reliability. Cronbach's alpha is to demonstrate that survey and scales that we have constructed or adopted for research projects are fit for purpose.

Survey was used the question methods defined in case evaluation of waste perception. The survey is specifically designed to measure waste perception and more.

Consequence, researchers have determined that waste management and waste problems have a relationship with effects. Therefore, these factors have been interlinked. But despite this, not many academic studies have focused on addressing waste perception impact on the linkage between waste transfer cost and waste perception. This is another critical research gap.

1.4. The novelty of research

In this study, the novelty of research is based on the relationship between waste perception and waste transfer cost. Hence, this relation has been discussed as a new part of the explanatory research design. The survey questions have been generated after a thorough investigation of the literature and the waste problems and waste transfer problems identified.

Completed the survey, the descriptive research design has been used for analysis in order to explain the respondents' characteristics of the indicators used. Results have been analyzed using Cronbach's Alpha is used to ensure internally consistent. Moreover, these results will be used for Machine Learning that will have new data that is another the novelty of research.

2. Method

2.1. Study area

This study was conducted at Anadolu University in Eskisehir where has one of the highest students' populations among Turkish universities. The survey was conducted in February and March 2024. The survey had been translated from Turkish to English and to Persian language before it was conducted. This is a demo survey to determine the suitability of the questions has been used was tested out. However, by a group of students as a part of their waste perception, in which it will be collected the following data regarding the data at university in a locality.

Table 2: Descriptive statistics of items related to the scale

Subject Titles		I completely agree	I agree	I am undecided	I disagree	I completely disagree	\bar{x}	ss
Q1. I separate plastic and paper from waste	f	25	24	62	72	33	2,30	1,199
	%	11,6	11,1	28,7	33,3	15,3		
Q2. I collect used batteries	f	78	35	40	35	28	1,54	1,443
	%	36,1	16,2	18,5	16,2	13,0		
Q3. I don't use paper towels	f	93	32	31	20	40	1,45	1,554
	%	43,1	14,8	14,4	9,3	18,5		
Q4. I separate plastic, metal and paper	f	39	22	71	47	37	2,10	1,314
	%	18,1	10,2	32,9	21,8	17,1		
Q5. Do you think recycling waste is important?	f	183	23	5	1	4	0,24	0,694
	%	84,7	10,6	2,3	0,5	1,9		
What do you think is the main reason for people's littering behavior?								
Q7. No waste container	f	54	20	49	39	54	2,09	1,509
	%	25,0	9,3	22,7	18,1	25,0		
Q8. Waste container far away	f	49	18	56	43	50	2,13	1,453
	%	22,7	8,3	25,9	19,9	23,1		
Q9. Waste container is small	f	61	31	47	37	40	1,83	1,472
	%	28,2	14,4	21,8	17,1	18,5		
Q10. Waste container dirty	f	72	40	34	33	37	1,64	1,497
	%	33,3	18,5	15,7	15,3	17,1		
Q11. Waste container is too far away	f	55	30	47	29	55	2,00	1,523
	%	25,5	13,9	21,8	13,4	25,5		
What do you do with plastic bottles?								
Q13. I throw it in the trash at home	f	20	12	37	44	103	2,92	1,306
	%	9,3	5,6	17,1	20,4	47,7		
Q14. I throw it in street containers	f	27	19	57	53	60	2,46	1,318
	%	12,5	8,8	26,4	24,5	27,8		
Q15. I throw it in recycling bins	f	15	17	64	49	71	2,67	1,208
	%	6,9	7,9	29,6	22,7	32,9		
Q16. Waste container for plastics is dirty	f	56	33	50	41	36	1,85	1,426
	%	25,9	15,3	23,1	19,0	16,7		
Q17. I throw plastics into any container	f	35	38	50	43	50	2,16	1,39
	%	16,2	17,6	23,1	19,9	23,1		
Have you heard the following two concepts before?								
Q18. "Circular economy" and "Recycling"	f	9	4	43	61	99	3,10	1,05
	%	4,2	1,9	19,9	28,2	45,8		

Have you heard the following concepts before?

Q19. SO ₂ , NO _x , PM _{2.5} , CH ₄ , fossil CO ₂ and NH ₃ emissions	f	38	30	51	51	46	2,17	1,382
	%	17,6	13,9	23,6	23,6	21,3		
Q20. --Do you think waste should be incinerated for recycling?	f	75	27	66	19	29	1,54	1,391
	%	34,7	12,5	30,6	8,8	13,4		

2.2. Data collection and data analysis [9]

Table 3: Frequency and Percentage of participants demographic variables

	Frequency (f)	Percentages (%)
Gender		
Women	109	50,5
Men	105	48,6
Total	214	99,1
Age		
17	3	1,4
18	9	4,2
19	16	7,4
20	52	24,1
21	42	19,4
22 and over	93	43,1
Total	215	99,5
Department		
Business Management	13	6,0
Economics	35	16,2
Public Finance	160	74,1
Other	7	3,2
Total	215	99,5

Table 3 shows the gender, age and department distribution of the participants. In this dichotomy, 50.5% of the participants are women and 48.6% are men.

3. Results and Discussion [10]

Table 4: Reliability results for the scale (Cronbach's Alpha)

Subjects	Multiple Correlation Coefficient	CR value when subject is deleted
Q3. I don't use paper towels	0,074	0,641
Q5. Do you think recycling waste is important?	0,100	0,633
Q7. No waste container	0,279	0,588
Q8. Waste container far away	0,542	0,565
S9. Waste container is small	0,371	0,583
S10. Waste container dirty	0,362	0,586
S11. Waste container is too far away	0,450	0,579
S13. I throw it in the trash at home	0,334	0,603
S14. I throw it in street containers	0,366	0,605
S16. Waste container for plastics is dirty	0,187	0,630
S17. I throw plastics into any container	0,278	0,592
S18. "Circular economy and "Recycling"	0,040	0,646
S20. Do you think waste should be incinerated for recycling?	0,083	0,630

Table 5: Descriptive statistics regarding distribution normality and participants' waste perception levels, *, $p < 0,05$

	Min	Max	\bar{x}	Standard deviation	Skewness	Kurtosis	the Kolmogorov-Smirnov (KS) test statistic / p-value
Waste perception	0,46	3,38	1,95	0,586	0,028	-0,264	0,057 / 0,090*

Table 6: Testing whether participants' waste attitudes differ according to their gender (T-test), * $p < 0,05$

	\bar{x}	Standard deviation	T-test	p-value
Women	1,80	0,579	-3,998	0,00001*
Men	2,11	0,553		

When Table 4 is examined, the multiple correlation numbers for the items and the Cronbach's Alpha coefficients that will be done when the item is deleted are given.

In this context, Q1 "I separate plastic and paper in the waste." item, Q2 "I collect used batteries." item, Q4 "I separate plastic, metal and paper." article, Q15 "I throw it in recycling bins." Since item and item Q19 "SO₂, Nox, PM_{2.5}, CH₄, fossil CO₂ and NH₃ emissions" reduce Cronbach's Alpha

coefficient, they are not included for mean difference tests.

Accordingly, the current Cronbach's Alpha coefficient was determined as 62.7, and it seems to be at appropriate levels (Cronbach's Alpha value before the items were removed was 52.2).

Table 4 presents descriptive statistics regarding the participants' waste perception levels and the Kolmogorov-Smirnov results applied for the normality test.

Table 7: Testing whether the waste perception of the participants differ according to their age and department (ANOVA)

	\bar{x}	Standard deviation	F	p-value
Age				
19 and under	2,07	0,538	0,684	0,563
20	1,99	0,607		
21	1,93	0,569		
22 and over	1,96	0,586		
Department				
Business Management	1,89	0,739	0,232	0,874
Economics	1,95	0,585		
Public Finance	1,96	0,577		
Other	2,12	0,584		

4. Conclusion

The participants were asked to complete a 20 questions survey about waste perception and the survey significance were analyzed using analysis of variance and Cronbach alpha as appropriate method. The following conclusions can be drawn from this study.

Firstly, a significant number of the students have knowledgeable about the solution to the waste problem, but this knowledge is not sufficient. This result shows that the infrastructure and system work implemented by local governments regarding waste management are not well known by students. In addition, municipal systems cannot be used efficiently enough for this reason.

Secondly, regarding the responsibility and impact of individuals and the administration towards solving the waste problem, most of the students tends to leave the responsibility to the local municipalities and this effects to waste transfer cost. Every student should have known they can influence the level of their own waste cost. Because waste perception is depending on waste pay off. This saves money and protects our environment and decrease waste transfer cost. Students do not awareness of these costs that include waste transfer and this can be conjectured irredeemable perpetual problem.

Therefore, it was concluded that the reliability levels of these data were good. In the subsequent validity analyzes, it was concluded that the method was valid as well. And, students have to be ensured their participation within certain rules from early age associate with waste perception.

Consequently, as the perception of waste increases, the cost of waste collection and the need for a transfer station decreases or the transfer cost disappears. This is a rather significant outcome.

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