

Importance of Collaborative Work between the Stakeholders of Municipal Solid Waste Management

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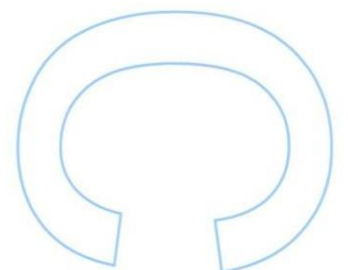
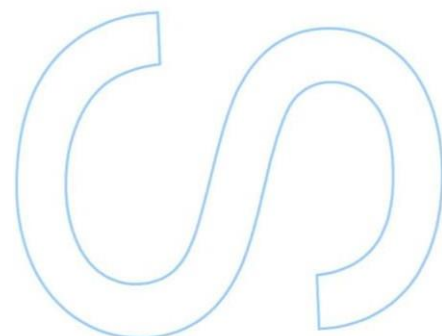
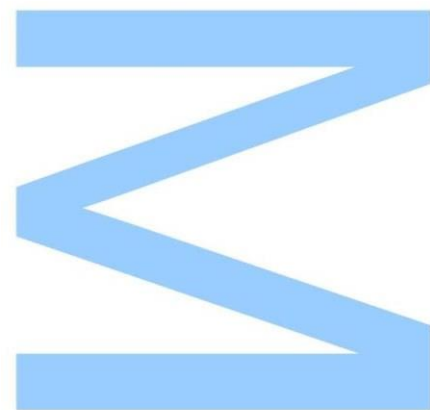
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Özet

Bu tez, genel olarak Kentsel Katı Atık hakkında bilgi veriyor, bu atığın oluşumuna ve yönetimine etki eden faktörleri vurguluyor. Kentsel katı atık yönetiminde başarı yüzdesini nelerin, nasıl artırılabilirliğini tartışıyor. Atığın yönetiminden sorumlu vatandaş, kurum ve kuruluşların koordine ve iş birliği içerisinde çalışmasının önemini savunuyor. Halk, belediyeler ve özel sektörle yapılan anketlerle, sorumlu her paydaşın görüşlerini paylaşmayı, bu paylaşımın kentsel atık yönetiminde çevresel ve ekonomik açıdan sağlayacağı faydayı göstermeyi amaçlıyor. Çankaya (Ankara, Türkiye) ve Lizbon (Lizbon, Portekiz) ilçeleri arasında yapılan karşılaştırmalı analiz sonuçlarını sunarak, benzerlik ve farklılıklara, bunlara sebep olabilecek durumlara dikkat çekiyor.

Anahtar Kelimeler: Kentsel katı atık, işbirlikçi çalışma, paydaş, çevresel ve ekonomik faydalar, yönetim; karşılaştırmalı analiz; Türkiye; Portekiz

Abstract

This dissertation gives information about Municipal Solid Waste (MSW) in general and emphasizes the factors affecting the generation and management of this waste. It discusses what can increase the percentage of success in municipal solid waste management and how it can be increased. It highlights the importance of coordinated and collaborative work between citizens, institutions, and organizations that are responsible for the management of waste. Through surveys conducted with the citizens, municipalities and private sector, it aims to share the views of each stakeholder and to demonstrate the environmental and economic benefits of this sharing in municipal waste management. It presents the results of comparative analysis of the similarities and differences between the districts Çankaya (Ankara, Turkey) and Lisbon (Lisbon, Portugal) and draws attention to situations that may cause them.

Keywords: Municipal solid waste; collaborative work; stakeholder; environmental and economic benefits; management; comparative analysis; Turkey; Portugal

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List of Abbreviations

- APA** – Agência Portuguesa do Ambiente
- BMW** – Biodegradable Municipal Waste
- CBO** – Community Based Organizations
- CBSWM** – Community Based Solid Waste Management
- EPA** – (United States) Environmental Protection Agency
- EPFL** – École Polytechnique Fédérale de Lausanne
- GWMO** – Global Waste Management Outlook
- GTZ** – Deutsche Gesellschaft für Technische Zusammenarbeit
- ILO** – International Labour Organization
- INE** – Instituto Nacional de Estatística
- ISWA** – International Solid Waste Association
- MBT** – Mechanic and Biological Treatment
- MC** – Management by Contract
- MPPP** – Management by Public-Private Partnership
- MSW** – Municipal Solid Waste
- MSWC** – Municipal Solid Waste Composition
- MW** – Municipal Waste
- OAU** – Óleos Alimentares Usados
- OECD** – Organisation for Economic Co-operation and Development
- RGGR** – Regime Geral de Gestão de Resíduos
- RU** – Resíduos Urbanos
- TÜİK** – Türkiye İstatistik Kurumu
- UEO** – Used Edible Oils
- UN** – United Nations
- UNDESA** – United Nations Department of Economic and Social Affairs
- UNEP** – United Nations Environment Programme
- WEEE** – Waste Electrical and Electronic Equipment

Chapter 1: Introduction

One of the most discussed environmental topics in recent years is Municipal Solid Waste (MSW) management. The reason for this much discussion is the problem of waste generation. According to the World Bank's statistics (2019), the world has generated about 2.01 billion tonnes of municipal solid waste in 2016.

Each human action means waste generation. Consequently, the impacts of municipal solid waste are growing so fast and being the primary waste source. Many factors affect this increasing waste generation such as natural conditions, income and development level, social and political considerations. One of the essential points is to implement proper waste management processes considering these factors which vary according to different situations.

Nowadays, more than half of the population lives in urban areas. This causes changes in the balances such as the economy and environment. The growing population leads to increased consumption. Due to increased, unconscious and over-consumption, waste generation is also increasing. This situation is becoming more problematic issue around the world day by day. In addition to population density, other natural conditions such as local climate, waste character, and urban character also affect waste generation. It means that these kinds of factors should be considered to analyze waste generation better and practice proper waste management.

Rapidly developing technology is a serious factor that causes increased consumption. There are many kinds of technological tools in the market, and new versions of these tools gain a place in the market very frequently. Every product means at least both electronic waste and packaging waste. When the consumption caused by developing technology and the growing population are taken together, the result becomes even more important.

The link between developing technology and purchasing power should not be forgotten. As well as purchasing power, capital and labor are essential factors in economic development. Economic development is so important to analyze waste generation. As the rate of economic development and urbanization increases, the amount of solid waste

produced increases. As living standards increase, the amount of waste produced also increases.

When the countries or regions are compared by their income level, municipal solid waste generation shows differences. According to researches (these researches will be shown in the next Chapters), it is showed that high-income countries generate more municipal solid waste per capita than low-income countries. It will be mentioned about this topic more in the next sections.

Social and political considerations are other essential pillars in evaluating municipal solid waste generation and deciding the best management method. Socio-cultural patterns, public habits and so on, are among the main factors affecting the rate of waste generation.

Considering all these factors, municipal waste management becomes so vital topic to protect the environment and public health. Waste management is not always as environmentally and economically as expected. Proper progress and completion of the process are essential not just for the environment and public health, it has importance economically also because waste management is a costly process from beginning to end.

Priority should always be to control and reduce waste to minimize the negative effect of generation. After reduction and separation at source, the next important step is collection. The collection methods are as important as recycling. For a useful, productive, and profitable recycling process, a systematic and regular collection method should be developed. The steps after the environmental and economic collection process vary according to the type of waste. It can be recycling, composting, incineration or landfill. Each step of management is so crucial for environmentally friendly and low-cost management.

All differences that are previously mentioned as factors that have effects on waste generation lead to differences in waste management also. Stated in other words, as a result of waste generation differences, waste management also varies from country to country, region to region. For example, when a comparison is made in terms of income levels of countries, it is possible to see implementation differences between low, middle and high-income countries at every stage of waste management.

Considering all the factors affecting waste production and management, it is so evident that there are differences in resource reduction, collection, recycling and

technologies used, and so on. In low-income countries, the rates of source reduction, collection, and recycling are lower than high-income countries or the technology that is used in high-income countries is high technology on the contrary of low-income countries. Unfortunately, in low-income countries, there is more uncollected waste that is illegally burned or dumped.

Waste pickers are one of the most critical topics in waste management. While there are many waste pickers in the informal labor market, waste pickers have been made legal in some regions. This point has importance and also needs to be discussed in waste management.

Besides all physical steps of waste management, there is another point of great importance: collaborative work. Collection, transportation, treatment or dispose of municipal solid wastes is the duty of local governments. However, this does not mean that only the municipalities are responsible for the whole process. There are many stakeholders who play a role in the management of municipal solid waste, and their activities and cooperation among each other, are the cornerstones of successful waste management. Citizens, government, private sector, and non-governmental organizations should work in coordination to achieve the most environmentally friendly, and economical waste management process.

The issue that should always be emphasized should also be mentioned when the subject is waste management also: Gender equality. "Gender Analysis when applied to the field of waste management, especially in developing nations such as India, Indonesia, the Philippines, and Vietnam, can provide unique insights into the waste sector while also serving as a tool for policymakers and program developers to improve and develop the waste sector." ("The Role of Gender in Waste Management", 2019, p.5). Therefore, gender equality will provide an added value in the field of waste management as in every step and part of life.

An utterly successful waste management process protects human and environmental health, strengthens the economy and increases the standard of living.

This dissertation aims to answer the following research question: “How effective is the coordination and collaboration between stakeholders that in charge of municipal solid waste management?” This way, this scientific research presents a case study about actions that are being carried out in the Lisbon district in Portugal and in the Çankaya district in Turkey. Municipality representatives, citizens and private sector representatives were interviewed by the author to collect necessary data. The questionnaire questions were based on an extensive theoretical review run by the researcher. The interviews were received via e-mail and then transcribed.

1.1 General Goal

This research has as a general goal the study of showing the importance of coordination and collaboration between stakeholders of municipal solid waste management.

1.2 Specific Goals

The specific goals of this dissertation are as follows:

- Making a diagnostic about selective performed programs situation in Portugal and Turkey,
- Performing interviews with people directly involved in selective collection and recycling programs and initiatives,
- Identifying in Portugal and Turkey voluntary actions performed by population involving solid waste management and recycling concerns,
- Identifying by performed interviews and qualitative content analysis aspects, opinions and conflicts among interviewed agents to characterize the municipal solid waste management in Portugal and Turkey,
- Making suggestions, after performed analysis, of initiatives (at public, citizen, private sector levels) for MSW management services increasing at the studied districts.

Chapter 2: Literature Review

2.1 Some Definitions of Municipal Solid Waste

Many organizations define Municipal Solid Waste (MSW) through their focus point. For instance, it is defined by the United Nations (UN, 2018) as:

“Waste generated by households, and waste of a similar nature generated by commercial and business establishments, industrial and agricultural premises, institutions such as schools and hospitals, public spaces such as parks and streets and construction sites. Generally, it is non-hazardous wastes composed of food waste, garden waste, paper and cardboard, wood, textiles, nappies (disposable diapers), rubber and leather, plastics, metal, glass, and refuse such as ash, dirt and dust. Sewage sludge and faecal sludge is also included in the category of municipal solid waste but it excludes wastewater.”

The Organisation for Economic Co-operation and Development (OECD, 2018) defines Municipal Waste as:

“Waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities.”

The definition of Municipal Solid Waste given by the United States Environmental Protection Agency (EPA, 2018) is as follows:

“Municipal solid waste (also called trash or garbage) is defined at the national level as wastes consisting of everyday items such as product packaging, grass clippings, furniture, clothing, bottles and cans, food scraps, newspapers, appliances, consumer electronics, and batteries. These wastes come from homes; institutions such as schools and hospitals; and commercial sources such as

restaurants and small businesses. EPA's definition of municipal solid waste (MSW) does not include municipal wastewater treatment sludges, industrial process wastes, automobile bodies, combustion ash, or construction and demolition debris."

Considering the definitions, some differences stand out. For instance, in contrast to the MSW definition of the UN; OECD and EPA exclude waste generated by construction sites. Furthermore, the description of the UN includes sewage sludge and fecal sludge; the definition of OECD excludes waste from municipal sewage networks and treatment.

In Portugal, "The current General Regime for Waste Management (Regime Geral de Gestão de Resíduos – RGGR) expressed in the Decree Law (Decreto-Lei) N° 73/2011 of 17 June,¹ defines MSW (Resíduos Urbanos – RU) as "waste from households, as well as other waste which, because of its nature or composition, is similar to waste from households". In addition to general household waste, this includes specific waste streams like packaging waste, batteries and accumulators, waste from electric and electronic equipment (WEEE), and used edible oils (UEO) (Óleos alimentares usados – OAU). MSW corresponds to the waste generated by households, as well as small waste producers (daily production lower than 1,100 litres), and big waste producers (daily production equal or higher than 1,100 litres) from commerce, service and industry sectors." (European Commission, 2016, p. 2).

2.2 Municipal Solid Waste Generation

People usually move from rural areas to urban areas for many reasons and it causes growth in the urban population. According to the United Nations Department of Economic and Social Affairs (UNDESA, 2018), the urban population of the world was 751 million in 1950; it increased to 4.2 billion in 2018 and the urban population accounted for 55% of the world's population in 2018.

The following figure shows an increase in the urban population between 1960 and 2018.

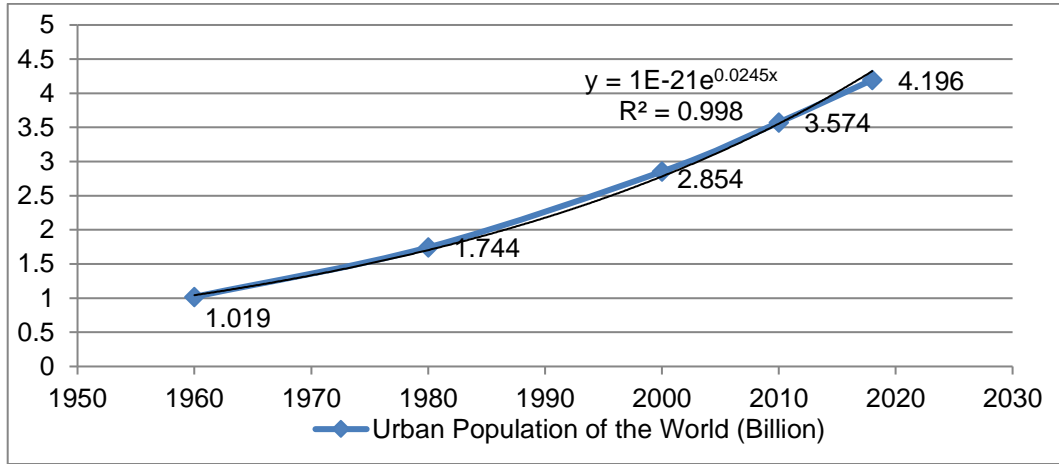


Figure 1- Urban Population of the World between 1960 and 2018 (Source: The World Bank, 2019)

As shown in Figure 1, the urban population presents an exponential trend of increasing, considering data from 1960 to 2018. So, by the correlation gave, it can be foreseen that in 2030, the urban population will increase to over 5.0 billion people.

All countries, regions generate a certain amount of waste. The amount of waste generated per capita varies, and when the population factor is added to the amount of waste generated per capita, the rate of distribution of waste generation differs also.

According to data published by Statista (2018), the average per capita generation of MSW worldwide in 2016, by region (in kilograms per day) was as follows:

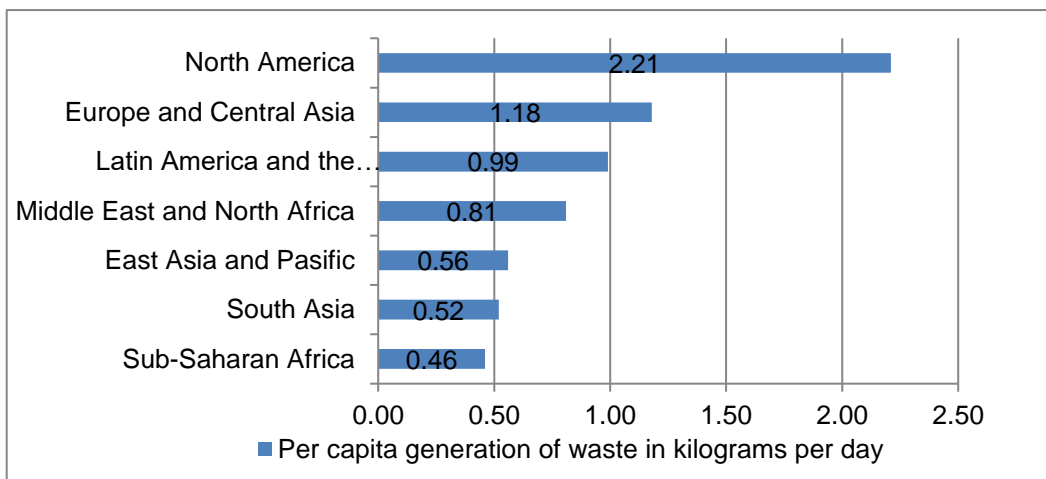


Figure 2- Average per Capita Generation of Municipal Solid Waste Worldwide in 2016 by Region, (Source: Statista, 2018)

As it seems in Figure 3, when the population effect is included in the average per capita generation of municipal solid waste, the rate of distribution of waste generation varies considerably. Under the influence of many factors, the amount of MSW generated per capita in North America is regionally highest, but when population impact is included, it ranks fourth in the ranking. Figure 3 shows the percentage of waste generated after the impact of the population.

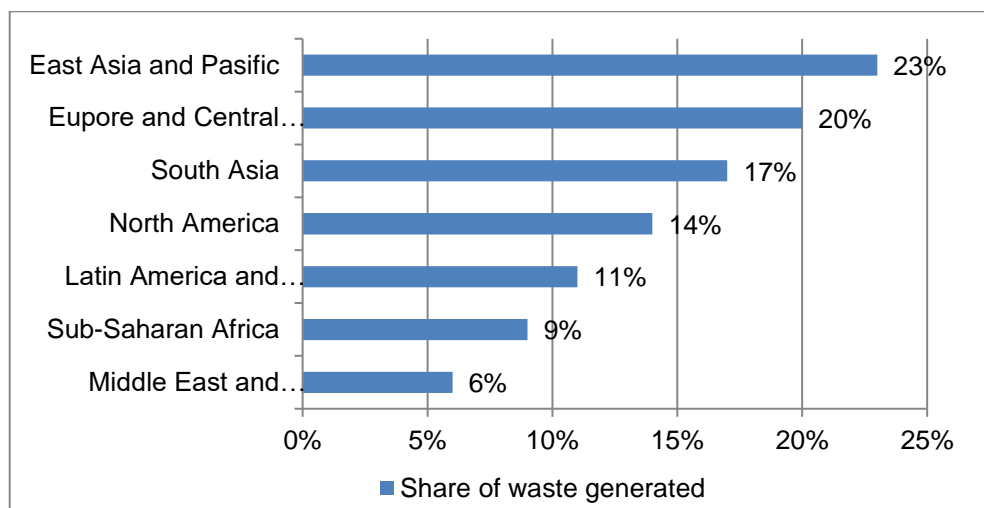


Figure 3- Distribution of Municipal Solid Waste Generation Worldwide in 2016, by Region (Source: Statista, 2018)

As mentioned before, many factors can affect MSW generation; among these, the income level may be highlighted. Income level and living standards are correlated. When living standards increase, consumption increases also, and this situation causes more waste generation. Table 1 shows MSW per capita generation in different income levels.

Table 1- MSW Generation per Capita in Different Income Levels (Source: World Bank, 2012)

Region	Urban Waste Generation Per Capita (kg/capita/day)
Lower-Income Countries	0.60
Lower Middle Income Countries	0.78
Upper Middle Income Countries	1.16
High-Income Countries	2.13
Total	1.19

In the research of Wilson, Rodic, Scheinberg, Velis, and Alabaster (2012), it is also mentioned that per capita waste generation increases with the development level and income level of the country. It is shown that per capita waste generation is highest in high-income level, and then upper-middle, lower-middle and the generation per capita is lowest in low-income countries. For instance, the average municipal solid waste generation rate in Myanmar as an example for lower-middle income countries was $0.45 \text{ kg}\cdot\text{capita}^{-1}\cdot\text{day}^{-1}$ (Dangi, Pretz, Urynowicz, Gerow and Reddy, 2011).

MSW generation per capita values were shown for different countries in Kawai and Tasaki (2015). The value for Ethiopia (low-income economy) is $0.30 \text{ kg}\cdot\text{capita}^{-1}\cdot\text{day}^{-1}$; for Vietnam (lower-middle-income economy) $0.41 \text{ kg}\cdot\text{capita}^{-1}\cdot\text{day}^{-1}$; for Turkey (upper-middle-income economy) $1.12 \text{ kg}\cdot\text{capita}^{-1}\cdot\text{day}^{-1}$ and for Portugal (high-income economy) $1.23 \text{ kg}\cdot\text{capita}^{-1}\cdot\text{day}^{-1}$.

In terms of per capita MSW generation, in 2018, while the European average was 476 kg/capita.year, in Continental Portugal (without Autonomous Regions), waste generation was 505 kg/capita.year (APA, 2019). Eurostat (2019) has pointed out that the MSW per capita generation in Portugal in 2017 was 487 kg, while in Turkey, in the same year, the generation per capita was 425 kg. According to Eurostat data (at the time between 1995 and 2017), the MSW generation in Portugal has increased by about 38.4%. However, in Turkey, the MSW generation has reduced by 3.6%, while the increase rate of MSW generation was 3.4% for EU-28 countries (Eurostat, 2019). It is shown in Table 2 the quantities of MSW generated in different regions of Portugal by year (since 2014), according to APA (2019).

Table 2- Quantities of Urban Waste Generated (10^3 t) (Source: APA, 2019)

Region	2014	2015	2016	2017	2018
Continental Portugal	4474	4523	4640	4745	4945
Autonomous Region of Madeira	110	110	119	124	126
Autonomous Region of the Azores	136	132	132	137	142
Total	4719	4765	4891	5007	5213

It is seen in Table 2 that the amount of MSW generation increases year by year in the different regions of Portugal. In 2018, the increase in the amount of MSW had been associated with the developing economic situation. However, this increase also shows that strategies preventing waste generation do not produce the expected results (APA, 2019).

In Turkey, according to Türkiye İstatistik Kurumu (TÜİK, 2019), between 1994 and 2018, 100% of municipal solid waste was collected. Considering the amount of waste between these years, it is seen that there is a decrease between the year 2003 (26118 10³ t) - 2004 (25014 10³ t) and the year 2006 (25280 10³ t) – 2008 (24361 10³ t). Table 3 reflects how much waste is collected and, so how much waste is generated between 2012 and 2018.

Table 3- Quantities of Municipal Waste Collected (10³ t) (Source: TÜİK, 2019)

Country	2012		2014		2016		2018	
	Amount t	Percentage	Amount t	Percentage	Amount t	Percentage	Amount t	Percentage
Turkey	25845	100%	28011	100%	31584	100%	32209	100%

After the last decline between 2006 and 2008, the amount of waste has increased since 2008. The increase in MSW generation of countries may also be related to inefficient strategies taken by governments to reduce MSW generation.

Senzige, Makinde, Njau, and Nkansah-Gyeke (2014) highlights the other important factor; the impact of socio-economic situation on municipal solid waste generation. According to this study conducted in Dar-es-Salaam in Tanzania, “the per capita waste generation rates obtained are 1.31 kg/capita/day for high followed by the middle and low socioeconomic statuses with 0.94 kg/capita/day and 0.9 kg/capita/day respectively.”

All these are not the only factors that affect waste generation. Natural conditions such as climate, geographical location are also among the main factors affecting the generation. “For instance, in Ghana, the coastal and forest zones generated higher waste than the northern savanna zone.” (Miezah, Obiri-Danso, Kádár, Fei-Baffoe and Mensah, 2015).

The factors that influence municipal solid waste generation should be considered carefully to apply the most efficient and successful waste management.

2.3 An Overview of Municipal Solid Waste Composition

The composition of municipal solid waste varies from region to region. As mentioned by Jain, Urban, Balbach, and Webb (2012), MSW mass is usually composed of Paper, Glass, Ferrous metals, Aluminium, Tin, Copper, Lead, Textiles, Rubber, Plastics, Miscellaneous materials, Food, animal, plant and other waste. An average MSW mass composition was shown globally in the report “What a Waste: A Global Review of Solid Waste Management”, published by The World Bank (2012). Figure 4 shows the presented data:

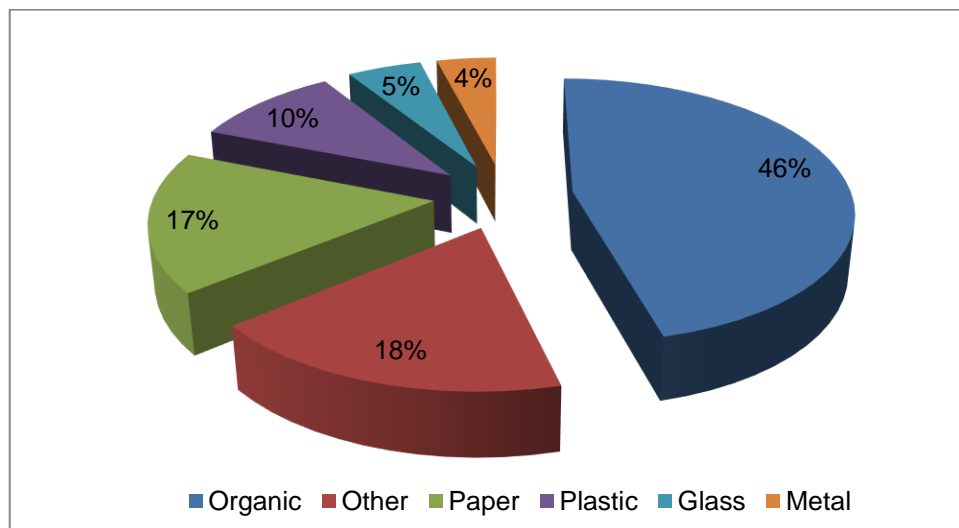


Figure 4- The Average Composition of the MSW Amount Globally (Source: World Bank, 2012)

It is possible to see different classifications in different publications. For example, while “What a Waste: A Global Review of Solid Waste Management” (World Bank, 2012) includes textile in “Other”, on the contrary, in the “Global Waste Management Outlook” (UNEP & ISWA, 2015), “Other” means other inorganic waste and there is a different classification for textile.

“The change of household consumption pattern has changed the waste volume and the waste characteristics or composition.” (Darban Astane & Hajilo, 2017). A good characterization of the waste is so important to choose the best treatment/disposal method.

Waste characterization in Portugal shows that the most significant portions of municipal solid waste are biowaste, plastic, and paper as shown in the next figure:

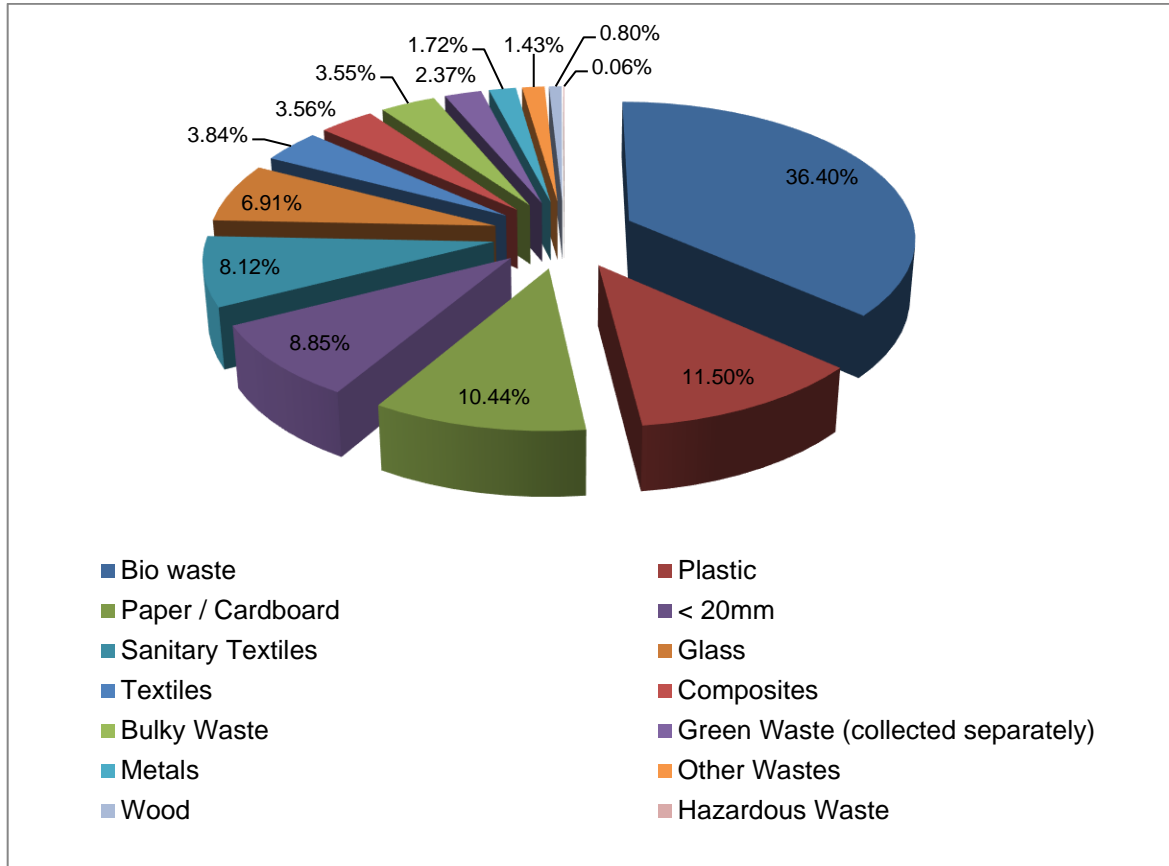


Figure 5- Physical Characterization of Urban Waste Generated in 2018 in Portugal (Source: APA, 2019)

Comparing the average MSW composition generated by Portugal and Turkey, the percentage of organic waste of the Turkish MSW is higher than the Portuguese (Sarptaş & Erdin, 2015 and APA, 2019). The following Table gives the Turkish MSW composition:

Table 4- MSW Composition in Turkey (Source: Sarptaş & Erdin, 2015)

Components	Range (%)
Organics	40-65
Paper/Cardboard	7-18
Plastics	5-14
Metals	1-6
Glass	2-6
Others	7-24

The cluster named "Other" includes the wastes except organics and recyclables, and mainly includes construction, demolition debris, coal, ash, and hazardous waste.

According to Ulusal Atık Yönetimi ve Eylem Planı 2023 (National Waste Management and Action Plan 2023) published by the Turkish Ministry of Environment and Urban Planning, the overall composition of municipal solid waste in Turkey in 2014 is shown in Figure 6.

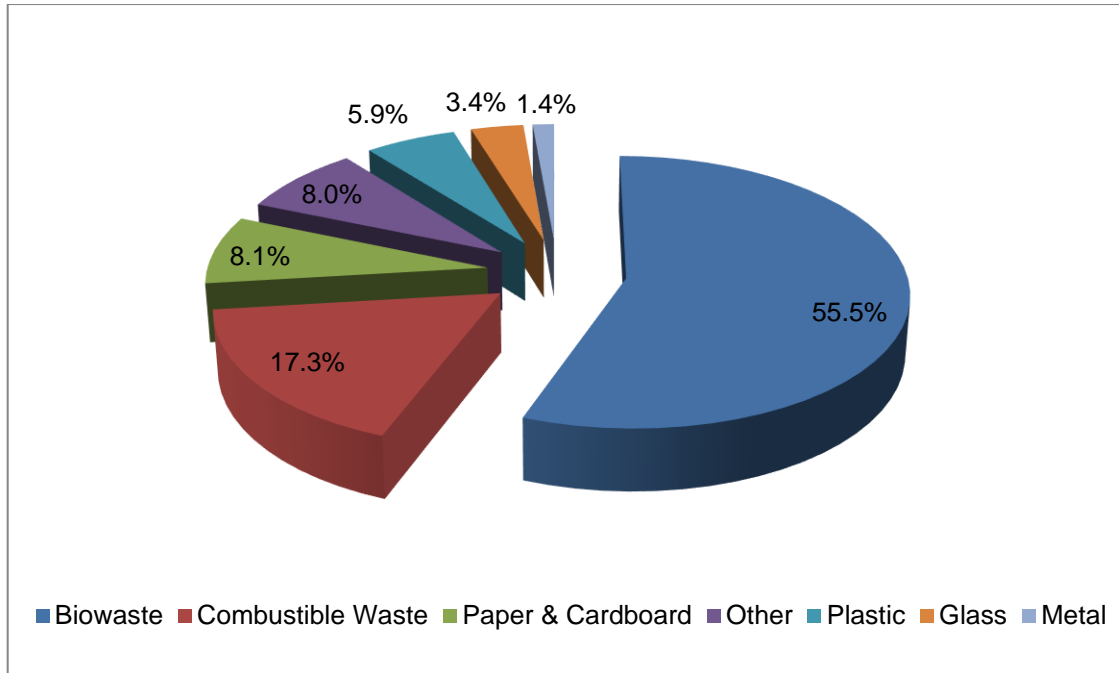


Figure 6- MSW Composition in 2014 in Turkey (Source: Çevre Ve Şehircilik Bakanlığı)

As shown in Figure 6, bio-waste has a very large percentage. According to Sarptaş & Erdin (2015), high organic fractions are because of the high consumption of vegetables and fruits.

Not only waste generation but also waste content may change from place to place and time to time according to different factors such as economy, income level, culture, climate, geographical situation... For instance, paper, and plastic waste proportion is mostly high in high-income countries; the percentage of organic waste in low-income countries is higher.

Variations in MSW composition by income levels are shown in the Global Waste Management Outlook (UNEP & ISWA, 2015) as follows:

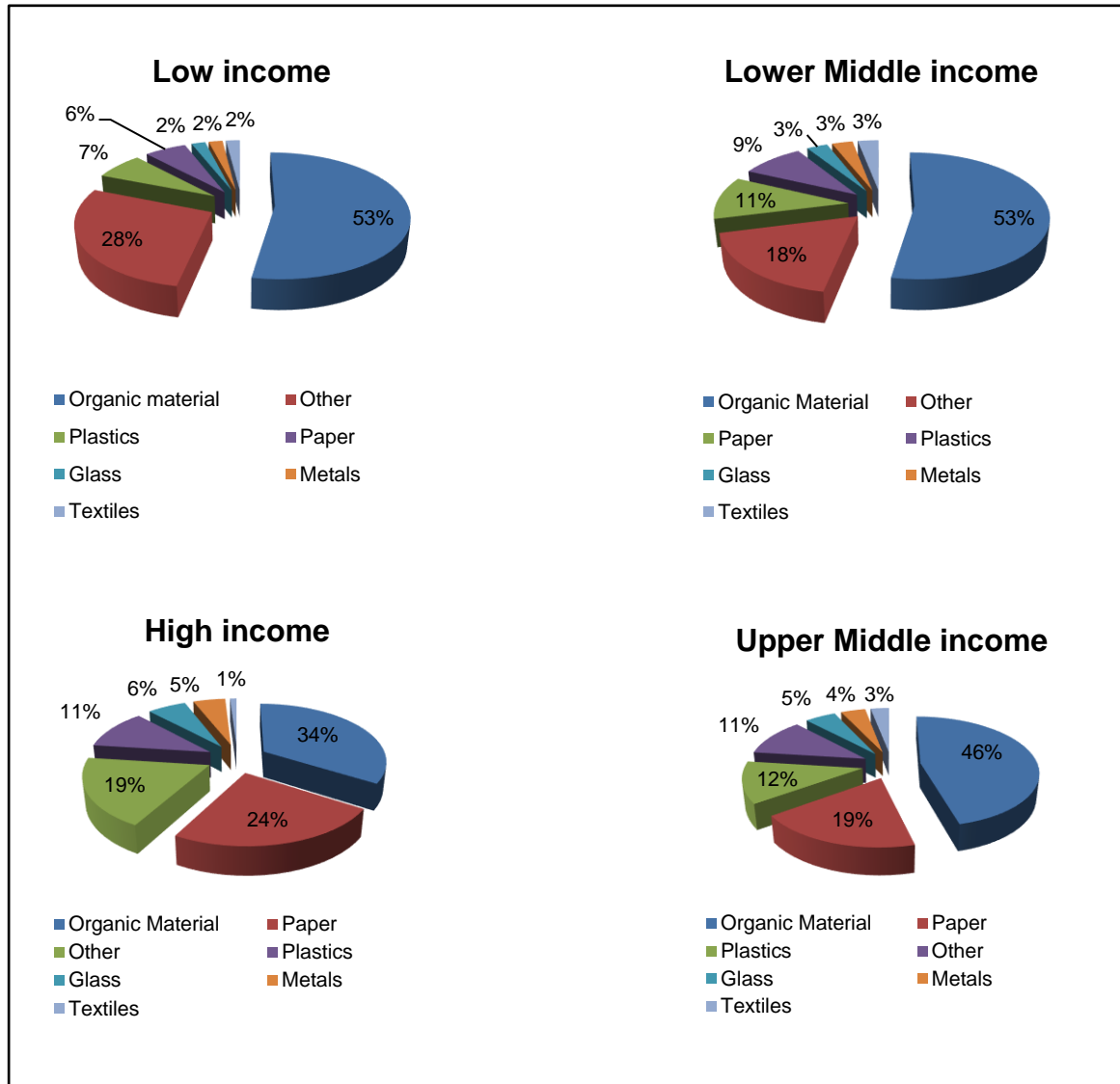


Figure 7- MSW Mass Composition Considering Different Income Level for Countries (Source: UNEP & ISWA, 2015)

The change in waste rates according to seasonal changes and low, medium and high-income levels is stated in another study conducted in Pakistan as follows:

Table 5- Seasonal Generation Rate of Waste Fractions at the Middle, High and Low-income Groups (kg/capita/day) (Source: Zia & Batool & Chauhdry & Munir, 2017)

Waste Components	High Income Group					Middle Income Group					Low Income Group				
	Spring	Summer	Monsoon	Winter	Weighted	Spring	Summer	Monsoon	Winter	Weighted	Spring	Summer	Monsoon	Winter	Weighted
Organic Waste	1.008	0.539	0.328	0.614	0.587	0.339	0.381	0.350	0.452	0.391	0.204	0.202	0.191	0.178	0.193
Paper	0.107	0.034	0.027	0.068	0.054	0.016	0.019	0.023	0.035	0.024	0.014	0.007	0.019	0.028	0.017
Tetra Pack	0.149	0.072	0.033	0.084	0.079	0.032	0.022	0.041	0.057	0.039	0.131	0.020	0.023	0.038	0.027
Plastic	0.018	0.032	0.013	0.024	0.023	0.030	0.021	0.025	0.026	0.025	0.007	0.006	0.010	0.022	0.013
Diapers	0.131	0.026	0.042	0.051	0.052	0.058	0.064	0.060	0.078	0.067	0.062	0.055	0.038	0.112	0.071
Textile	0.015	0.005	0.005	0.029	0.014	0.034	0.007	0.018	0.006	0.012	0.004	0.006	0.012	0.016	0.010
Others	0.02	0.008	0.002	0.010	0.01	0.000	0.012	0.000	0.008	0.007	0.002	0.002	0.005	0.001	0.002
Glass	0.044	0.026	0.016	0.016	0.024	0.028	0.009	0.011	0.032	0.019	0.010	0.008	0.004	0.008	0.007
Metals	0.042	0.019	0.006	0.032	0.023	0.002	0.009	0.015	0.014	0.010	0.000	0.000	0.003	0.001	0.001
Other Non-Combustibles	0.08	0.017	0.003	0.021	0.024	0.020	0.006	0.024	0.026	0.017	0.007	0.003	0.001	0.012	0.006
Total	1.614	0.778	0.475	0.949	0.890	0.559	0.550	0.567	0.734	0.611	0.441	0.309	0.306	0.416	0.347

According to the study carried out by Zia, Batool, Chauhdry, and Munir (2017), municipal wastes can be classified as follows:

Table 6. Details of Waste Components (Source: Zia & Batool & Chauhdry & Munir, 2017)

Organic Waste	Paper	Tetra Pack
Vegetable Food Waste	Other Clean Paper	Tetra Packs
Yard Waste, Flowers	Paper and Cardboard	Juice Carton
Animal Food Waste	Kitchen Towels	(Carton/Plastic/Aluminium)
(Bones)	Dirty Paper (Tissue)	Soft Plastic (Polythene,
News Print	Dirty Cardboard	Gloves, Disposable Plates)
Magazines	Cigarette Butts	Plastic Bottles
Advertisements	Other Clean Cardboard	
Books, Phone Books		
Office Paper		
Plastic	Glass	Textile
Hard Plastics (Plates)	Clear Glass	Textile
Non-Recyclable Plastic	Green Glass	Disposal Sanitary Clothes
Plastic Products (Toys,	Brown Glass	
Hangers, Pens, Empty	Non-Recyclable Glass	
Tubes)		
Metals	Other Non-Combustibles	Diapers
Beverage Cans	Soil	Diapers
Aluminum Foil and	Stones, Concrete	
Container	Ash, Coal	Others
Food Cans	Ceramics	Wood
(Tinplate/Steel)	Batteries	Shoes, Leather
Plastic-Coated Aluminium	Other Non-Combustibles	Rubber
Foil		
Other Metals		

Contrary to what is stated in “What a Waste: A Global Review of Solid Waste Management” (World Bank, 2012) and “Global Waste Management Outlook” (UNEP & ISWA, 2015); the rate of organic waste that is stated in the study performed by Zia, Batool, Chauhdry, Munir (2017) does not decrease as the income level increases.

These studies (World Bank, 2012 and UNEP & ISWA, 2015) have shown that the rate of paper waste is higher in high-income regions, but this study in Islamabad does not reflect the same result. One of the noteworthy points is that the rate of organic waste increased in the summer season and monsoon seasons.

In another study carried out by Ozcan, Yazici Guvenc, Guvenc, and Demir (2016) conducted in Istanbul, in low, middle and high-income regions, waste percentages were recorded in summer and winter months. It was showed municipal solid waste amount is composed by:

- Organics; Food wastes;
- Paper; Newspapers, magazines;
- Cardboard; Cardboard boxes;
- Bulky cardboard;
- Plastics; Plastics except for PET;
- Glass Jars, colorful and colorless glasses;
- Metals; Iron metals, cans, and aluminum materials;
- Bulky metals;
- Electrical equipment; Phones, radios, pc equipment;
- Hazardous wastes; Batteries and accumulators, paint boxes;
- Garden waste; Wood and other garden wastes;
- Other non-combustible; Rubber etc;
- Other combustibles; Combustible materials (diapers, shoes, bags, textile, carpets, etc.);
- Other bulky combustibles; Furniture etc;
- Other bulky non-combustible;
- Other;
- Ash; Ash, stone, rock, etc.

While Table 7 reflects MSW composition percentages in different income level regions in İstanbul in winter; Table 8 shows it in summer. Thus, the effect of seasonal change on waste composition can be observed by these tables comparison.

Table 7- MSW Composition Percentages of the Winter Study According to Income Level (Source: Ozcan, Yazici Guvenc, Guvenc & Demir, 2016)

MSWC	Low Income Region	Middle Income Region	High Income Region
	by Mass on Wet Basis (%)		
Organics	65.41	57.69	61.16
Paper	3.78	7.86	7.41
Cardboard	0.94	1.59	1.35
Bulky Cardboard	2.52	3.67	3.62
Plastics	7.18	11.35	7.16
Glass	3.27	3.74	6.32
Metals	0.44	1.06	0.51
Bulky Metals	-	-	-
Electrical Equipment	-	0.78	0.08
Hazardous Waste	0.72	-	0.08
Garden Waste	0.63	0.14	3.96
Other Non-Combustible	-	0.35	2.78
Other Combustibles	10.45	9.73	5.56
Other Bulky Combustibles	0.06	2.05	-
Other Bulky Non-combustible	-	-	-
Other	-	-	-
Ash	4.60	-	-

Table 8- MSW Composition Percentages of the Summer Study According to Income Level (Source: Ozcan, Yazici Guvenc, Guvenc & Demir, 2016)

MSWC	Low Income Region	Middle Income Region	High Income Region
by Mass on Wet Basis			
Organics	56.47	54.71	46.98
Paper	2.71	3.21	6.35
Cardboard	2.34	2.14	2.70
Bulky Cardboard	5.24	8.21	3.97
Plastics	9.26	7.14	6.90
Glass	4.02	9.68	11.03
Metals	0.94	0.80	1.90
Bulky Metals	-	-	-
Electrical Equipment	3.93	0.04	2.14
Hazardous Waste	-	0.04	0.08
Garden Waste	2.85	2.45	11.23
Other Non-Combustible	1.59	1.16	0.71
Other Combustibles	7.76	9.06	5.99
Other Bulky Combustibles	2.90	1.34	0.00
Other Bulky Non-combustible	-	-	-
Other	-	-	-
Ash	-	-	-

As a result of the study made by Ozcan, Yazici Guvenc, Guvenc, and Demir (2016), the rate of paper waste is lower in the low-income region in summer and in winter than in other regions. The rate of organic waste in summer was highest in the low, medium and high-income regions, respectively. Some notable differences in summer and winter were observed in kitchen waste and glass waste. The reason for these situations is the change in the consumption rate of fruits and consumption habits in summer.

There is a remarkable point in the “Global Waste Management Outlook” (UNEP & ISWA, 2015) publication. This point is the change in different income levels in waste types and quantities in recent years, and important values in the waste management process also such as the calorific value and waste density. For instance, it has been stated that the ash content of waste has decreased in high-income countries in the last 50 years and thus the

calorific value has increased. In addition, in low-income countries, the high proportion of organic waste indicates that waste is wet, dense and has a low calorific value, but reduces the need for compacting during collection.

2.4 Municipal Solid Waste Management: General Aspects

“Municipal solid waste management (MSWM) is associated with the control of waste generation, its storage, collection, transfer and transport, processing and disposal in a manner that is in accordance with the best principles of public health, economics, engineering, conservation, aesthetics, public attitude and other environmental considerations.” (Ramachandra, Bharath, Kulkarni, Sheng Han, 2018).

While waste rates and types vary with many factors, proper management of waste becomes an important topic. Municipal waste is collected by or on behalf of municipalities (OECD, 2015). It is a systematic service and this service should be done in the most environmentally and economic way. In order to achieve this, every step of waste management needs to be progressed with awareness and planning. Reducing waste generation, raising awareness about it and reusing when it is possible, are some of the first steps of waste management. Then, an important point that facilitates the next steps is the separation at source. Basically, the steps can be highlighted as reduction at source, collection & transportation, storage, and treatment/disposal.

In “What a Waste: A Global Review of Solid Waste Management” (World Bank, 2012) publication, municipal waste management hierarchy is listed from most preferred to least preferred option as follows:

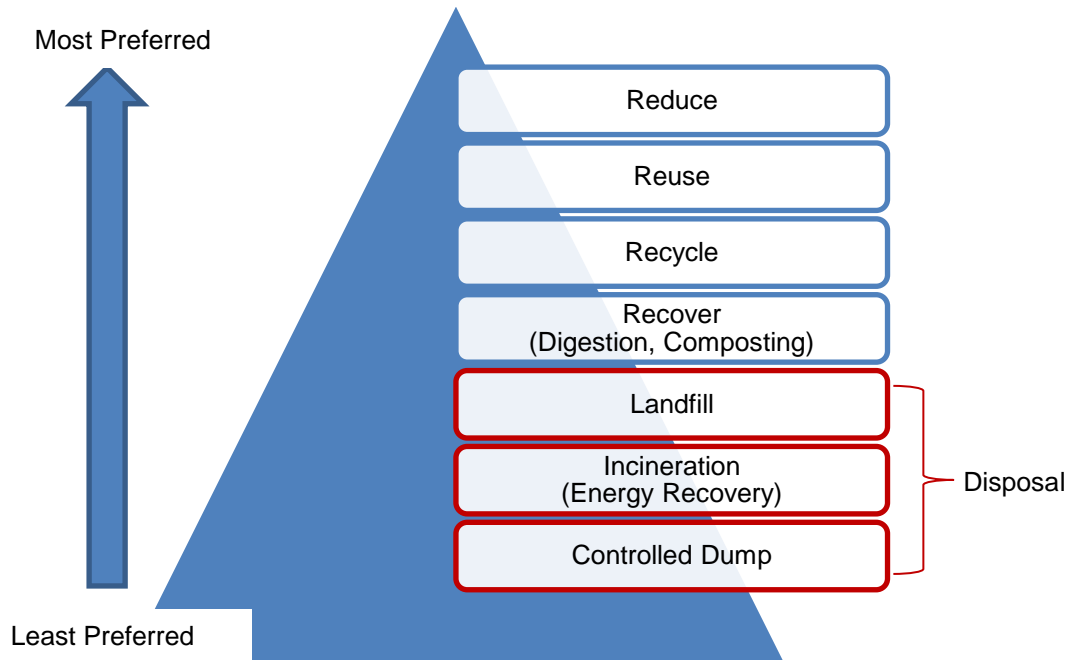


Figure 8- MSW Management Hierarchy, (Source: World Bank, 2012)

In municipal solid waste management, waste treatment methods shown as blue in the figure should be preferred first. Reduce and reuse prevents large amounts of waste generation. After minimizing the waste as much as possible, it is necessary to contribute to the success rate of recycling by separating it at its source. Following this, the separated waste is collected and transported for the treatment/disposal method.

One of the most important steps for municipalities regarding solid waste management is the collection. “The first steps in ensuring sound MSW management are providing a reliable collection service to all citizens and eliminating uncontrolled dumping and open burning. The world’s progress towards this target is the focus of this section.” (UNEP & ISWA, 2015)

Collection is also very important economically. The budget for waste collection also varies according to the income levels of the cities. In high-income cities, the budget allocated to collection is decreasing. Waste collection is not the same in all countries or

regions. For example, in the regions where income level increases, there is more vehicle fleet and the rate of waste collection from settlements is increasing (World Bank, 2012).

“Data compiled for the Global Waste Management Outlook (GWMO) from 125 countries gives the average collection coverage in low-income countries as 36% (the World Bank provides an average of 43%), lower-middle-income countries 64% (World Bank 68%) and upper-middle-income countries 82% (World Bank 85%), with higher-income countries showing collection coverage approaching 100%.” (UNEP & ISWA, 2015, p. 63)

Countries were compared to their level of income by means of management steps in the online course in Coursera, jointly prepared by Eawag is also known as Swiss Federal Institute of Aquatic Science and Technology and École Polytechnique Fédérale de Lausanne-EPFL (2019). According to results, Table 9 shows examples for collection coverage (Waste collection coverage: Percentage of households that receive waste collection service) range of different income level countries.

Table 9- Examples for Collection Coverage Range of Different Income Level Countries (Source: Eawag & EPFL, Coursera Online Course, 2019)

Country Income	Collection Coverage		
	Range	Example	
High-Income	100%	Adelaide, Australia	100%
Upper Middle Income	70-100%	Buenos Aires, Argentina	95%
Lower Middle Income	60-100%	Delhi, India	75%
Low-Income	35-85%	Nairobi, Kenya	52%

With the examples given in Table 9, it is clear that the collection rate decreases in lower-income countries. As mentioned earlier, higher-income countries have a collection that is more systematic collection and more vehicles available for waste collection. This increases the percentage. Of course, factors such as education and awareness level play an important role in the high rate of collection.

There are many procedures for solid waste collection. Figure 9 shows the percentages of different solid waste collection procedures in Portugal. The percentage of collection procedures for 2017 and 2018 are as follows:

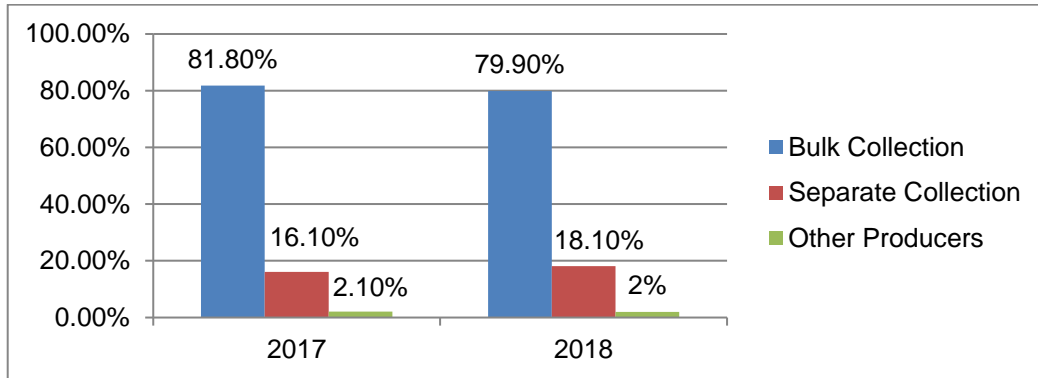


Figure 9- Municipal Waste Collection in Mainland Portugal (Source: APA, 2019)

This figure shows that the most common way of collecting in Portugal is "bulk collection". Afterward, the most common way of collection is the "separate collection" with a much lower percentage.

After the waste collection, management differences are observed in the regions with different income levels in the operations to be applied according to the type of waste. In other words, rates, technologies, etc. vary also in recycling, composting, incineration, landfill or dumping steps.

Globally, about 71% of MSW's are disposed of in landfills (Abdel-Shafy and Mansour, 2018). Eawag and École Polytechnique Fédérale de Lausanne (2019) also compared countries in the online course to their level of income by means of controlled treatment or disposal (Percentage of waste destined for treatment or disposal that is taken to a controlled facility) steps, and recycling rates (Percentage of the waste generated that gets valorized, including recycling and organic waste valorization). The results of the study are shown in Table 10 and Table 11.

Table 10- Examples for Controlled Treatment or Disposal Range of Different Income Level Countries (Source: Eawag & EPFL, Coursera Online Course, 2019)

Controlled Treatment or Disposal			
Country Income	Controlled Treatment or Disposal		
	Range	Example	
High-Income	98-100%	Adelaide, Australia	100%
Upper Middle Income	80-100%	Buenos Aires, Argentina	90%
Lower Middle Income	0-100%	Delhi, India	85%
Low-Income	0-85%	Nairobi, Kenya	0%

Table 10 shows that in higher-income level countries, controlled treatment or disposal rates have been increasing. Technology is one of the most important reasons that make a difference in percentages in income levels. Technology is very necessary for controlled treatment and disposal. This percentage difference occurs because low-income countries do not have the same technology as high-income countries.

Table 11- Examples for Recycling Rate of Different Income Level Countries (Source: Eawag & EPFL, Coursera Online Course, 2019)

Recycling Rate			
Country Income	Recycling Rate		
	Range	Example	
High-Income	10-70%	Adelaide, Australia	55%
Upper Middle Income	1-30%	Buenos Aires, Argentina	5%
Lower Middle Income	5-50%	Delhi, India	35%
Low-Income	5-30%	Nairobi, Kenya	30%

This table shows that lower-income countries can have higher recycling rates. In low-income countries, “although most recycling is through the informal sector and waste picking, recycling rates tend to be high.” (World Bank, 2012). In high-income countries, “recyclable material collection services and high technology sorting and processing facilities

are common and regulated.” (World Bank, 2012). This leads to higher success rates in recycling.

Considering Portugal's rates of preparation for reuse and recycling, it is seen that there has been an increasing rate in recent years. Figure 10 shows the rising values as follows:

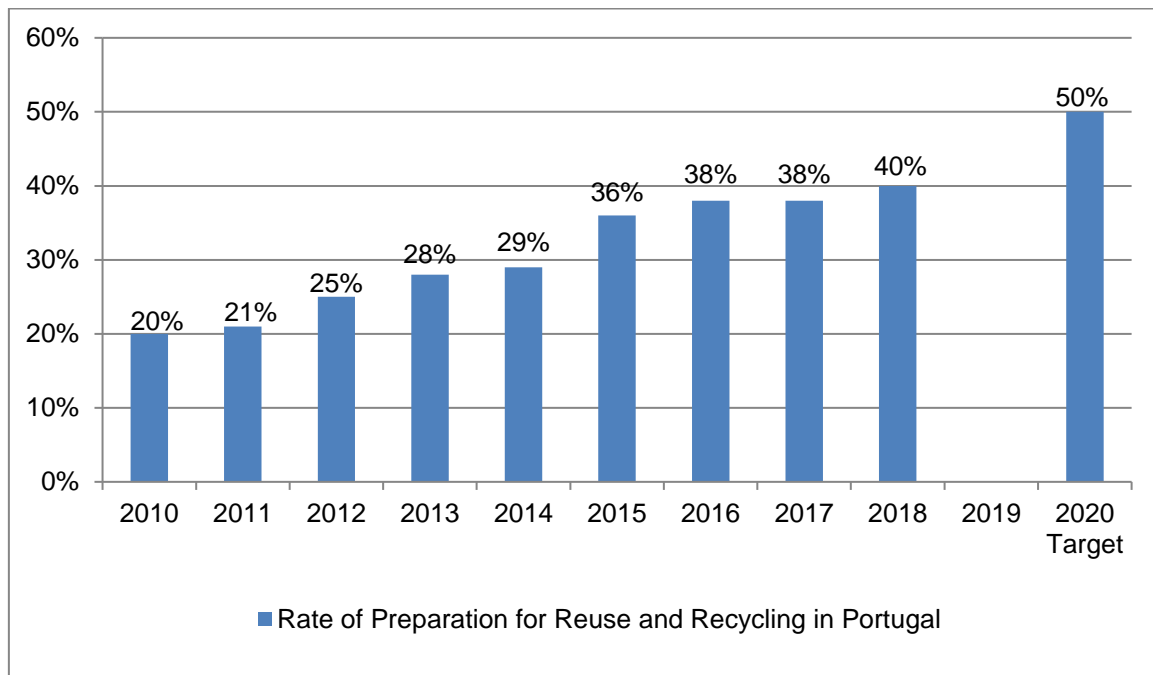


Figure 10- Rate of Preparation for Reuse and Recycling in Portugal (Source: APA, 2019)

In the results presented by APA (2019), it is stated that the ratio is calculated as “The calculation of the rate was based on the guidelines laid down in the Commission’s Decision which establishes the rules and calculation methods for verifying compliance with the objectives set out in Article 11 (2) of the European Parliament and Council Directive 2008/98/EC. The rate thus calculated is intended to assess the quantity of waste entering facilities which prepare for reuse or recycle waste in accordance with the above mentioned Decision, given the potential of recyclable waste.” (APA, 2019)

One of the most important things in municipal solid waste management is the use of biodegradable waste. This is important because they can be used in a much more beneficial way rather than sending to landfill. Here in Figure 11 is shown diversion of biodegradable municipal waste (BMW) from landfill in Portugal in recent years:

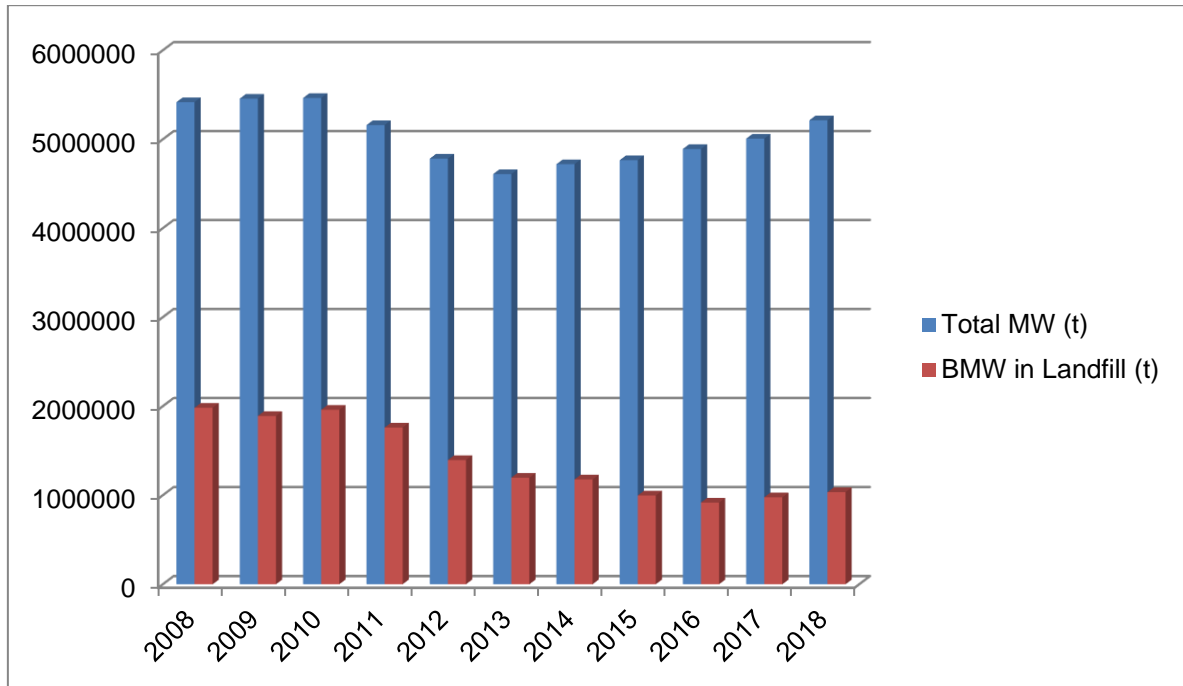


Figure 11- Diversion of Biodegradable Municipal Waste from Landfill in Portugal (Source: APA, 2019)

Figure 11 shows that there is no stable situation in Portugal regarding the management of biodegradable waste. With the increase in the municipal waste rate in recent years, it is seen that the rate of biodegradable waste to Landfill has increased. Given that Landfill is the worst treatment for biodegradable waste, Portugal seems to need to make an improvement.

Considering the different procedures of waste treatment and disposal in Portugal, the percentages of 2018 as follows:

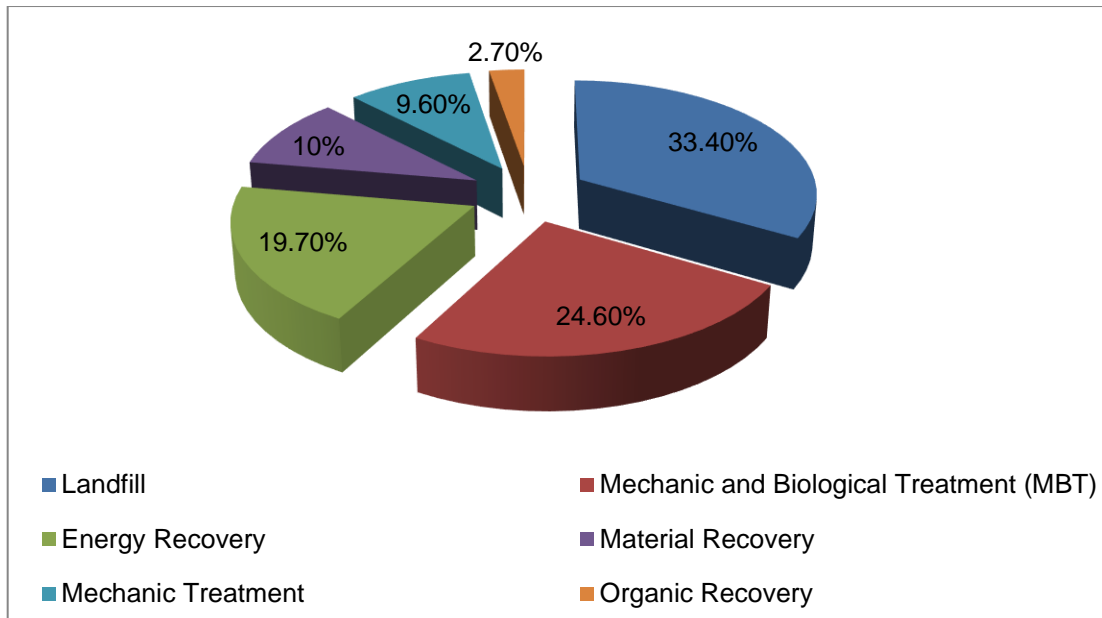


Figure 12- Municipal Waste per Management Operation in Mainland Portugal in 2018 (Source: APA, 2019)

It is seen that landfill and MBT constitute more than half of Portugal's treatment and disposal methods in 2018. The figure below shows the changes in MW per management operation in mainland Portugal between 2010 and 2018.

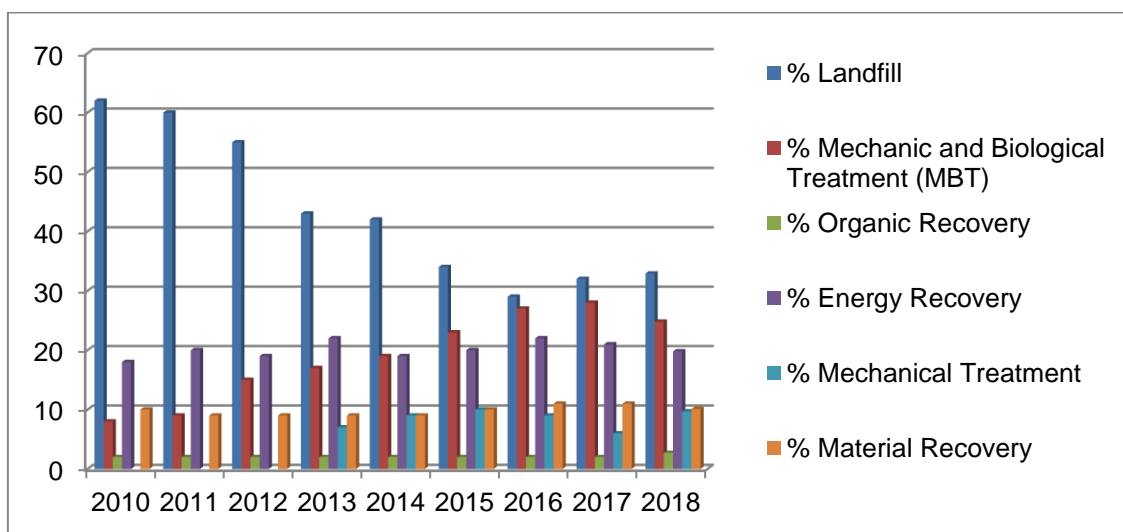


Figure 13- Evolution of MW per Management Operation in Mainland Portugal (Source: APA, 2019)

Although there has been a significant decline in the landfill rate compared to 2010, it is still the highest rate of management. Contrary to this decrease in landfill, there is a remarkable increase in MBT compared to 2010. In 2010, landfill and energy recovery played a major role in management. In 2018, the largest percentages were landfill and MBT.

“For the year 2018, it appears that the total fraction of landfilled waste, directly and indirectly, with the latter being considered as waste and discarded from treatment processes, it was found that about 58% of managed wastes were sent to the landfill. Comparing the total sent to landfill with the total produced in mainland Portugal shows that about 58% goes to the landfill. Significantly higher than 33% as a direct destination, which again indicates that the percentage of rejects from treatments that is not valued is significant.” (APA, 2018)

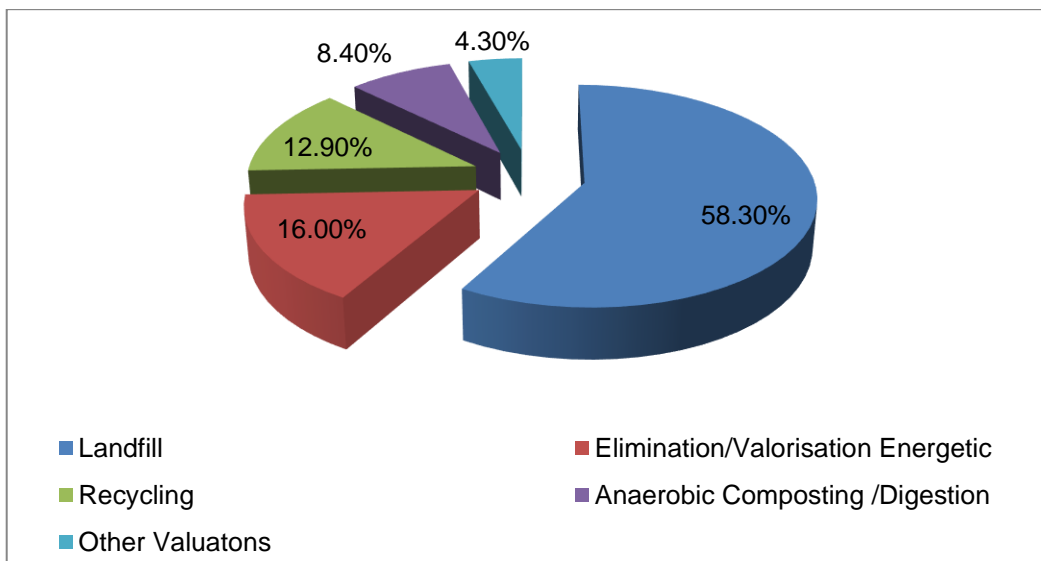


Figure 14- Final Destination of Urban Waste in mainland Portugal, (Source: APA, 2019)

Considering the situation in Turkey, distribution of disposal/recovery methods of municipal waste in 2016 according to Yılmaz & Abdulvahitoğlu (2019) is presented as follows:

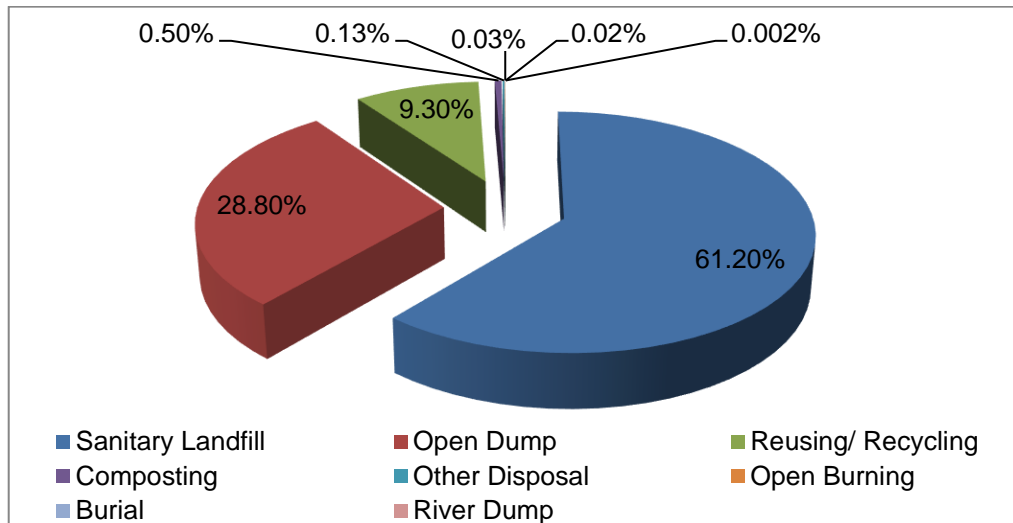


Figure 15- Distribution of Disposal / Recovery Methods of Municipal Waste In 2016 (Source: Yılmaz & Abdulvahtoğlu, 2019)

Figure 15 shows that the "landfill" destination method has the highest percentage in Turkey in disposal/recovery methods. Table 12 presents the percentages in 2016 and 2018 with a more detailed classification (TÜİK, 2019).

Table 12- Percentages of Waste Disposal and Recovery Methods in Turkey between 2016 and 2018 (Source: TÜİK, 2019)

Waste disposal and recovery methods	2016		2018	
	Amount (10 ³ t)	%	Amount (10 ³ t)	%
Waste delivered to municipality's dumping site	9095	28.8	6521	20.2
Waste delivered to controlled landfill sites	19338	61.2	21644	67.2
Burning in an open area	10	0.032	6	0.019
Lake and river disposal	0.5	0.002	0.5	0.002
Burial	7	0.021	2	0.006
Other disposal methods (Data refers to disposals by burning in an open area, dumping into river/onto land and burying.)	41	0.130	65	0.20
Waste delivered to composting plants	146	0.5	123	0.38
Waste delivered to other recovery facilities (Data refers to wastes such as glass, metal, paper, plastic, etc. that are collected separately by municipalities and sent to recovery facilities and other wastes sent to biogas and composting facilities.)	2946	9.3	3848	11.9

According to the data of TÜİK (2019), there is a significant alteration in the “dumping site” destination percentage between 2016 and 2018. Other notable changes are the increase in the percentage of waste sent to "recovery facilities" and "landfill sites".

After the figures that are shared, it is seen that among the disposal/recovery methods, “landfill” destination has the highest ratio in both Turkey and Portugal.

Between 2010 and 2013, the percentage change was seen in the landfill per capita for Turkey -6% and for Portugal -29%. (OECD, 2015).

When municipal solid waste management is considered across the world, it is necessary to mention a critical point, the informal sector. This sector plays an important role

in waste management in low-income countries. In this case, the integration of the informal sector becomes a more important topic for better waste management.

“The International Labour Organisation (ILO) defines informal sector waste workers as individuals or small and micro-enterprises that intervene in waste management without being registered and without being formally charged with providing waste management services.” (Proparco’s Magazine, 2012).

“In most developing countries, the informal recycling sector is structured like a pyramid. At the bottom of the waste trade pyramid are the waste pickers who engage in the free collection of waste from municipal garbage bins, streets and dumps. Above them are the itinerant scrap buyers who purchase small quantities of waste (plastic, paper, glass, metals, etc.) from households. In several countries, households also sell their recyclable waste to itinerant buyers in street shops. Between the waste collectors and the reprocessors are various levels of traders, including retailers, stockists and wholesalers, many of whom are not registered as businesses.” (Proparco’s Magazine, 2012)

The involvement of the informal sector in waste management also has a major economic impact. In one study, striking examples are as follows:

Table 13- Waste Recovery Rate in Seven Cities (Source: Proparco’s Magazine, 2012)

	Belo Horizonte (Brazil)	Canete (Peru)	Delhi (India)	Dhaka (Bangladesh)	Managua (Nicaragua)	Moshi (Tanzania)	Quezon City (Philippines)
Tons per year recovered all sectors	145,134	1,412	841,070	210,240	78,840	11,169	287,972
Percent recovered by formal sector	0.1%	1%	7%	0%	3%	0%	8%
Percent recovered by informal sector	6.9%	11%	27%	18%	15%	18%	31%

It is seen that the informal sector plays a major role in the 7 cities shown in Table 13 as an example and waste recovery is almost only provided by the informal sector. In the given examples, the role of the formal sector in waste management is scarcely any.

The informal sector is changing many things not only in terms of waste recovery rates but also in economic terms. Cost savings of waste pickers for municipal waste collection and disposal by the city is shown as follows:

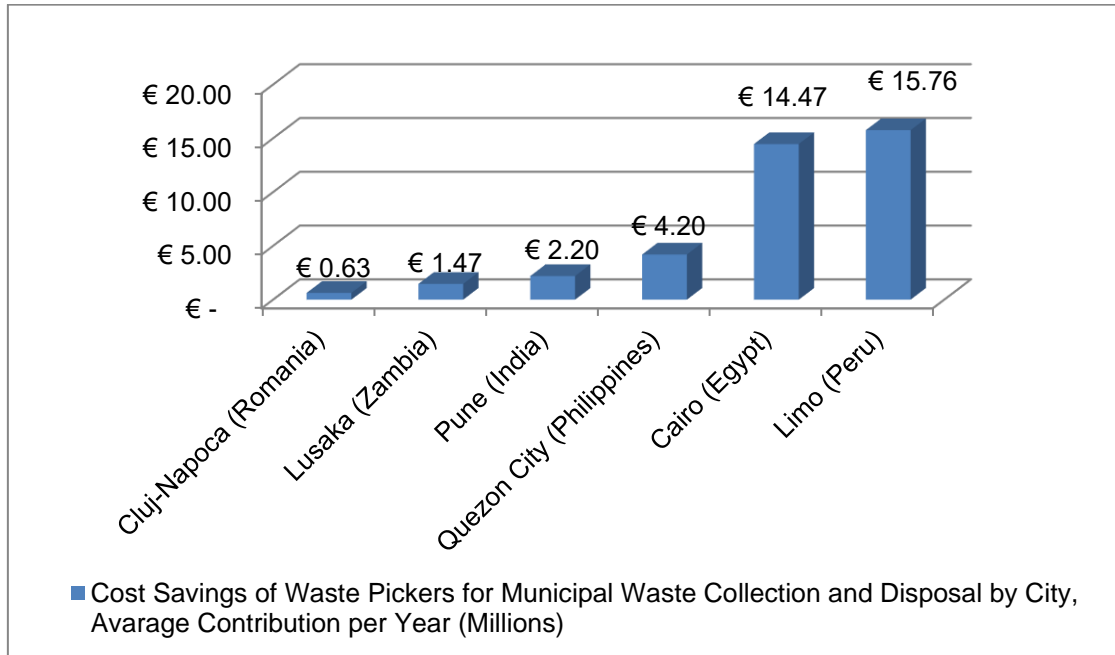


Figure 16- Cost Savings of Waste Pickers for Municipal Waste Collection and Disposal by City, Average Contribution per Year (Millions) (Source: Proparco's Magazine, 2012)

It has already been emphasized in this dissertation that proper and successful waste management is also very important for the economy. Figure 16 proves this discourse. This figure also shows how important it is to include the informal sector in waste management.

Informal sector integration is important for solid waste management because this integration provides many social, environmental and economic advantages. (Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, 2010).

Çankaya Municipality implemented a pilot project in Bahçelievler, Ankara, Turkey. (Çankaya Municipality, 2016). Within the scope of this project, the waste pickers working in the region have been contracted with the company that the municipality is working with, under the Packaging Waste Control Regulation. The employees collecting packaging waste became Turkey's first insured waste pickers. Waste pickers were trained before being included in the pilot zone study.

In addition to waste pickers, there are many other actors in waste management such as citizens, private sector, public sector, non-governmental organizations and so on. It is very important that these actors work collaboratively because this is a must for a successful waste management process.

In this case, first of all, community-based waste management is so essential. Citizens should be aware of the importance of community-based solid waste management (CBSWM) for their health and environment. In order to create this awareness, local authorities must do their part. Because with the conscious participation of citizens in waste management, many things will change positively. For example, according to Forsyth (2005), “collaboration with local citizens may reduce the costs of technology transfer by them to participate in the shaping of technologies implemented, or in identifying local needs.”

A study (Sinthumule & Mkumbuzi, 2019) which was conducted in Zimbabwe tried to implement CBSWM in local area in Bulawayo. The result of the study showed that CBSWM did not reduce inappropriate waste disposal behavior in local communities. It was seen that local people did not understand the benefits of CBSWM and there is a great need to increase citizens’ awareness. In addition, another important conclusion was that local authorities should provide the required municipal solid waste infrastructure such as waste containers to allow citizens to separate waste at source. Evidently, no environmental improvement could be achieved in the study area. This study also showed the importance of balance and collaborative work for waste management.

Different interesting projects can be undertaken to involve the public in the waste management process. For example, in five cities in Morocco, as part of the World Bank’s Development Policy Loans for Solid Waste Management, citizen report cards were introduced to gain public feedback on waste services. Because of low access to local technology, face to face communication was used to receive the feedback of citizens about service quality and willingness to sort and recycle household waste and so on. After receiving feedback, results were discussed with residents, private operators, and the municipality. According to the conversations, parties were trying to improve waste management and the outcomes influence the contract of the private waste operator (Kaza, Yao, Markgraf, 2016). The best thing in the project is the marked change in the improvement of waste management.

In Alipour, Rahmati, Akbarbeyki (2015), it was mentioned that one of the hardest tasks of urban managers is way of motivating people to accept the role of citizens. One of the reasons municipalities have difficulty in providing adequate waste services to citizens is the inadequate service coverage and operational inadequacies of services, including unskilled labor (McAllister, 2015).

The other important connection is the one between the public and private sectors. Public-Private partnerships mean corporation between public and private actors. "Under a PPP related to MSWM, the public authority should play a major role as a regulator that sets the environmental goals, while private sector brings financial resources, technical capability, and entrepreneurship to provide the public service." (Arbulú & Lozano & Rey-Maqueira, 2016).

In a study on municipal waste management in São Bernardo do Campo, Brazil, two models were applied. One of these models was "Management by Contract (MC) (Law 8.666 / 93)" while the other was "Management by Public-Private Partnership (MPPP) (Law 11.079 / 04)". For the two models, the cost-benefit relationship, environmental improvements and economic issues were discussed. As a result of the study, MPPP generated about 52% less residue for final disposal in sanitary embankments, with a consequent decrease in air, soil and water pollution; there was also a decrease in the use of natural resources and an increase in the amount of material obtained through selective collection and it showed that the improved efficiency resulting from investments in the MPPP, will lead to a reduction in costs (Madinah, 2016).

"Non-governmental organizations (NGOs) operate between the private and governmental realms. NGOs may help increase the capacity of people or community groups to play an active role in local solid waste management." (Schübeler & Wehrle & Christen, 1996).

In the study conducted in Khulna, Bangladesh on the impact of NGOs and CBOs (Community-Based Organizations) on waste management, it was seen that this participation has improved the overall MSW management system, especially waste collection process from sources and able to motivate the residents to store the waste properly and to keep clean the premises. (Ahsan & Alamgir & Imteaz & Nik Daud & Islam, 2012).

While discussing the necessity of collaborative work, the importance of sharing and balance among stakeholders, the role of women in waste management should be mentioned. “The effectiveness of waste disposal initiatives can be improved through the incorporation of an understanding of gender differences and inequalities. Waste disposal projects can also provide support to women (especially if they are responsible for waste disposal) and ease their overall work burden through improved family health. Waste disposal initiatives can also contribute to gender equality through offering opportunities for women’s increased employment. Gender differences and inequalities can affect various aspects of waste disposal.” (Woronluk & Schalkwyk, 1998).

Successful waste management will be inevitable when every detail that will contribute to municipal solid waste management is considered and implemented.

Chapter 3: Methodology

3.1 Studied Districts: Municipality of Lisbon, Lisbon & Çankaya Municipality, Ankara

In this dissertation, two districts have been examined and compared to their municipal solid waste management procedures and politics. The first studied district was Lisbon, located inside the Lisbon metropolitan area in Portugal; the second one was Çankaya district, situated into Ankara metropolitan area in Turkey.

3.1.1 Municipality of Lisbon, Lisbon, Portugal

Lisbon metropolitan area is the capital of Portugal. The city is shown in Map 1 as follows:



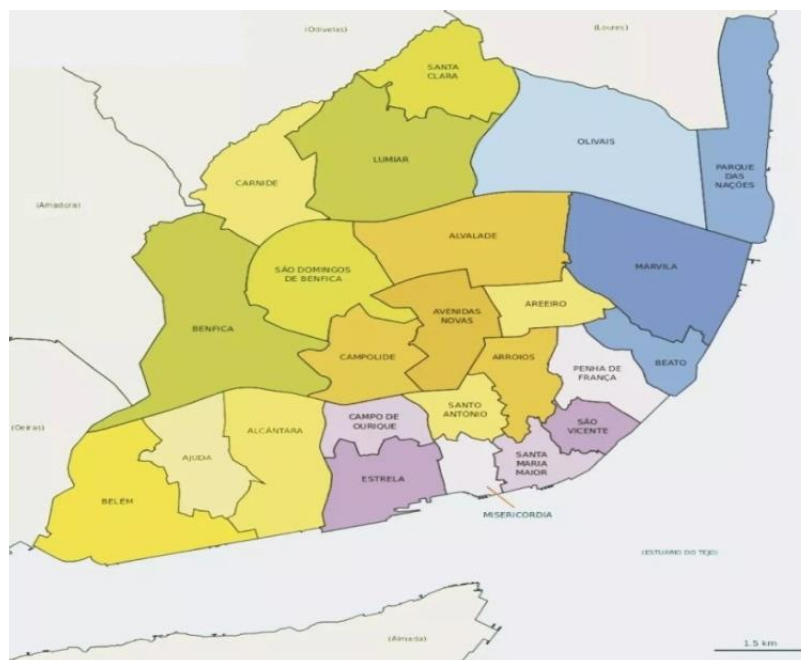
Map 1- Lisbon Metropolitan Area (Source: Wikipedia, 2019)

Within the area indicated by the red area on the map, ie within the Lisbon metropolitan area, there are 18 municipalities (Instituto Nacional de Estatística Statistics Portugal – INE, 2019). These municipalities are as follows:

- Almada
- Amadora
- Barreiro
- Cascais
- Lisboa
- Loures
- Mafra
- Moita
- Alcochete
- Setúbal
- Sintra
- Montijo
- Odivelas
- Oeiras
- Palmela
- Seixal
- Vila Franca de Xira
- Sesimbra

The population of the Lisbon metropolitan area was 2,846,332 in 2018, while Lisbon's 507,220. The municipality of Lisbon has the largest population of municipalities within the metropolitan area of Lisbon. According to 2018 data, area (km²) of territorial units by geographic localization of the Lisbon metropolitan area was 3,015.24 km² and it was 100.05 km² for Lisbon (INE, 2019).

There are different neighborhoods within Lisbon. Map 2 shows these neighborhoods.



Map 2- Neighbourhoods of Lisbon Municipality (Source: Atlas Lisboa, 2019)

As shown in Map 2, there are 24 neighbourhoods in Lisbon:

- Santa Clara
- Carnide
- Lumiar
- Olivais
- Parque das Nações
- Benfica
- Sao Domingos de Benfica
- Alvalade
- Marvila
- Campolide
- Avenidas Novas
- Areeiro
- Beato
- Belem
- Ajuda
- Alcantara
- Campo de Ourique
- Estrela
- Santo Antonio
- Misericordia
- Arroios
- Santa Maria Maior
- Sao Vicente
- Penha de França

This means that the Municipality of Lisbon is responsible for serving these 24 neighborhoods and one of these services is environmental service. Municipal solid waste management is the main environmental service.

The process of waste management starts with collection. There are 1050 workers in the Urban Waste Department and 219 municipal collection trucks, 184,000 municipal bins in Municipality of Lisbon. First of all, the municipality collects waste with the following systems (Lisboa Câmara Municipal, 2018):

- Big public bins,
- Door – to – door collection,
- Collection by request,
- Reception centers.

The municipality has 134 collection routes/day and 85 door – to – door collection routes/day. 850 tonnes of municipal solid waste are collected in a day with all collection systems (Lisboa Câmara Municipal, 2018). Figure 17 shows the distribution of collection systems.

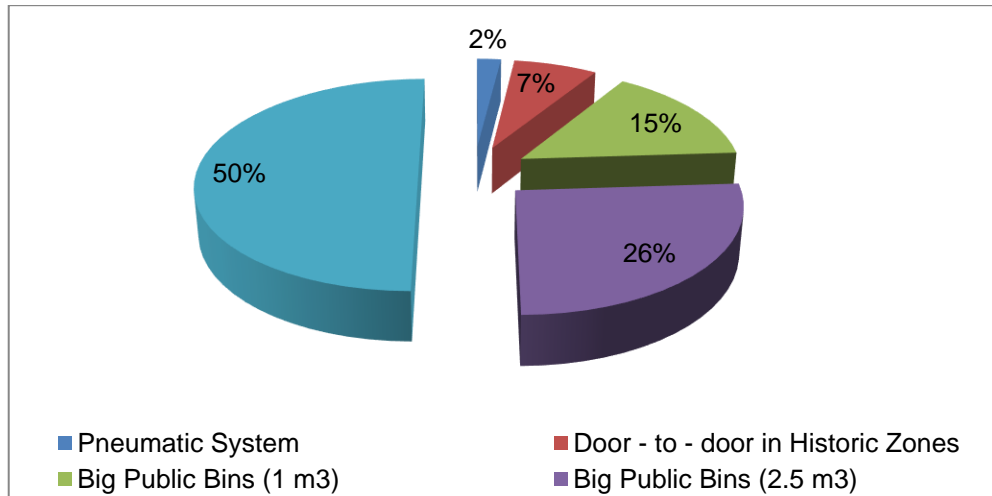


Figure 17- Distribution Percentage of Collection Systems of Household Waste (Source: Lisboa Câmara Municipal, 2018)

The graph shows that the most commonly used collection method in Lisbon is the “Pneumatic System”.

Besides mixed waste, glass, paper, packages, biodegradable waste, inert ashes, residual waste, there is a collection but on-demand for bulky waste, furniture, green waste, and construction and demolition waste, waste electrical and electronic equipment (WEEE). Municipality of Lisbon has reception centers for cardboard, cooking oils and WEEE.

Following the waste collection process, Lisbon Municipality transports the waste to Valorsul’s facilities for the following treatment systems.

Table 14- Treatment Systems of MSW of Lisbon Municipality (Source: Lisboa Câmara Municipal, 2018)

Waste Stream	Treatment System
Mixed Waste	Mass burning with energy recovery
Glass, Paper, Packages	Manual and mechanical sorting process (sorting plant), Recycling
Biodegradable Waste	Anaerobic digestion plant with energy production, Organic compost
Inert Ashes, Residual Waste, Others	Sanitary Landfill with biogas recovery

Valorsul is the company that is responsible for the waste treatment and recovery of 19 municipalities in Portugal (Lisboa Câmara Municipal, 2018).

Figure 18 shows the percentages of MSW treatment systems in Lisbon.

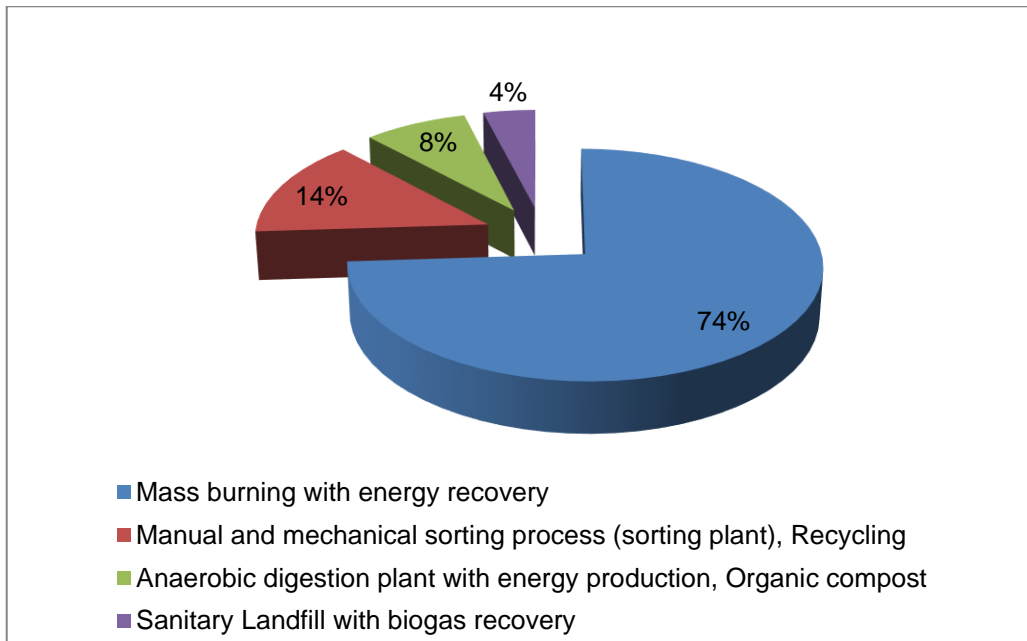


Figure 18- Percentages of Treatment Systems (Source: Lisboa Câmara Municipal, 2018)

It is seen that mass burning with energy recovery is the most widely used method in MSW treatment systems in Lisbon.

3.1.1.1 Questions for Representatives of Municipality and Private Sector and, Citizens

As mentioned in previous sections, collaborative work between the private sector, public sector, citizens, etc. is so important. In this case, to have successful collaborative work, each stakeholder that has a role in municipal solid waste management should know their opinions and ideas of each other, to improve more and more. In line with this idea, the opinions on municipal solid waste management, of the citizens living within the borders of the Lisbon Municipality, Lisbon (District) Municipality and Valorsul (private sector) were taken by asking some general questions with specific objectives. The questions are based on the "Literature Review" section.

The questions that have been asked to the citizens (live inside Lisbon) and representatives of Lisbon Municipality and Valorsul and their specific objectives are shown in Table 15, Table 16 and Table 17:

Table 15- Questions and Specific Objectives of It for the Citizens Living within the Borders of Lisbon Municipality (Source: Research data)

Question	Objective
What do you think about MSW management inside the Lisbon Municipality borders?	To identify the general opinion of the citizens about MSW management
What are pluses and minuses?	To identify the evaluation of MSW management from citizen's view
What could be better?	To identify the ideas of citizens for better MSW management
How do you manage your waste?	To identify the awareness stage of the citizens and showing their effort to support MSW management
As a person living within the borders of Lisbon Municipality, can you rate the municipal solid waste management within these borders from 1 (lowest) to 10 (highest)?	To identify the satisfaction level of the citizens about MSW management

Table 16- Questions and Specific Objectives of It for Representative of Lisbon Municipality (Source: Research data)

Question	Objective
How MSW management works inside Lisbon Municipality borders?	To identify the steps of MSW management inside Lisbon Municipality borders, understanding the collaboration with the other stakeholders of MSW management.
What are the pluses and minuses in MSW management? What are the difficulties?	To identify the difficulties in MSW management from the view of Lisbon Municipality and understanding their evaluation
What could be better?	To identify the plans and the targets of the municipality for better MSW management

Table 17- Questions and Specific Objectives of It for Representative of Valorsul (Source: Research data)

Question	Objective
How MSW management works in Valorsul?	To identify the steps of MSW management in Valorsul, understanding the collaboration with the other stakeholders of MSW management.
What are the pluses and minuses in MSW management? What are the difficulties?	To identify the difficulties in MSW management from the view of Valorsul and understanding their evaluation
What could be better?	To identify the plans and the targets of the company for better MSW management

3.1.2 Çankaya Municipality, Ankara, Turkey

Ankara metropolitan area is the capital of Turkey. The city is shown in red in Map 3 as follows:



Map 3- Ankara Metropolitan Area (Source: Wikimedia Commons, 2014)

There are 25 municipalities within the Ankara metropolitan area (Ankara Büyükşehir Belediyesi, 2019). These municipalities are as follows:

- Akyurt
- Altındağ
- Ayaş
- Bala
- Beypazarı
- Çamlıdere
- Çankaya
- Çubuk
- Elmadağ
- Etimesgut
- Evren
- Gölbaşı

- Güdül
- Haymana
- Kalecik
- Kahramankazan
- Keçiören
- Kızılcahamam
- Mamak
- Nallıhan
- Polatlı
- Pursaklar
- Sincan
- Şereflikoçhisar
- Yenimahalle

The population of the Ankara metropolitan area was 5,346,518 in 2016 (Ankara Kalkınma Ajansı, 2017), and Çankaya's was 921,999 in 2017 (Çankaya Belediyesi, 2017). The municipality of Çankaya has the largest population of municipalities within the metropolitan area of Ankara (Çankaya Municipality). According to 2014 data, area (km²) of territorial units by geographic localization of the Ankara metropolitan area was 25,632 km² and it was 483 km² for Çankaya (Harita Genel Müdürlüğü, 2014).

Map 4 shows the borders of the Çankaya district.



Map 4- Map of Çankaya Municipality (Source: Google Maps, 2019)

Inside the borders that are shown in Map 4, there are 123 neighborhoods within Çankaya Municipality (Çankaya Municipality). Therefore Çankaya Municipality is responsible for MSW management of all these 123 neighborhoods.

According to the information shared by Çankaya Municipality in September 2019, 25% of the waste generated in the households is packaging waste inside the Çankaya

Municipality borders. Of this, 30% consists of plastic, 40% paper-cardboard, 10% metal, 10% glass, 10% other waste (composite-textile-wood).

Collection of household waste and transfer to storage areas, where are decided by the Ankara Metropolitan Municipality are carried out by the Directorate of Cleaning Affairs of Çankaya Municipality.

Domestic wastes are treated after being divided into three main groups according to their characterization. Recyclable wastes such as paper, plastic, glass, and metal are transferred to the relevant recycling facilities. Biodegradable organic wastes are directed to the fermentation system to generate energy.

After packaging wastes are classified, they are sent to recycling facilities for recycling. Waste batteries are stored in impermeable storage areas in Istanbul. Wastes electrical and electronic equipment are sent to recycling facilities and recycled after the processes passed in recycling facilities. Vegetable waste oils are used in biodiesel production.

3.1.2.1 Questions for Representatives of Municipality and Private Sector and, Citizens

Based on the same idea that highlights the importance of collaborative work between the private sector, the public sector, citizens and so on, the opinions on municipal solid waste management, of the citizens living within the borders of the Çankaya Municipality and, representatives of Çankaya Municipality and Alkın Kağıtçılık (private sector) also were taken. The questions are based on the "Literature Review" section. Table 18, Table 19 and Table 20 show the questions and specific objectives of it that are asked to the representatives of Çankaya Municipality and Alkın Kağıtçılık and the citizens live inside Çankaya.

Table 18- Questions and Specific Objectives of It for the Citizens Living within the Borders of Çankaya Municipality (Source: Research data)

Question	Objective
What do you think about MSW management inside the Çankaya Municipality borders?	To identify the general opinion of the citizens about MSW management
What are pluses and minuses?	To identify the evaluation of MSW management from citizen's view
What could be better?	To identify the ideas of citizens for better MSW management
How do you manage your waste?	To identify the awareness stage of the citizens and showing their effort to support MSW management
As a person living within the borders of the Çankaya Municipality, can you rate the municipal solid waste management within these borders from 1 (lowest) to 10 (highest)?	To identify the satisfaction level of the citizens about MSW management

Table 19- Questions and Specific Objectives of It for Representative of Çankaya Municipality (Source: Research data)

Question	Objective
How MSW management works inside Çankaya Municipality borders?	To identify the steps of MSW management inside Çankaya Municipality borders, understanding the collaboration with the other stakeholders of MSW management.
What are the pluses and minuses in MSW management? What are the difficulties?	To identify the difficulties in MSW management from the view of Çankaya Municipality and understanding their evaluation
What could be better?	To identify the plans and the targets of the municipality for better MSW management

Table 20- Questions and Specific Objectives of It for Representative of Alkın Kağıtçılık (Source: Research data)

Question	Objective
How MSW management works in Alkın Kağıtçılık?	To identify the steps of MSW management in Alkın Kağıtçılık, understanding the collaboration with the other stakeholders of MSW management.
What are the pluses and minuses in MSW management? What are the difficulties?	To identify the difficulties in MSW management from the view of Alkın Kağıtçılık and understanding their evaluation
What could be better?	To identify the plans and the targets of the company for better MSW management

3.2 Data Collection Procedures

The representatives of the municipalities and private sector and, citizens were interviewed by some general questions (as mentioned) via e-mail.

Table 21 and Table 22 present the profile of the respondents as a citizen as follows:

Table 21- Characteristics of the Interviewed Residents inside Çankaya Municipality Borders (Source: Research data)

Citizen	Gender & Age	Professionalism
1	Female, 38	Chef Cook
2	Female, 68	Chemical Engineer
3	Male, 49	Architect
4	Male, 38	Health Technician
5	Female, 45	Company (Urban Transformation) Partner
6	Female, 64	Retired Teacher
7	Female, 60	Retired Manager
8	Female, 50	Educator
9	Female, 45	Officer
10	Female, 41	Academician
11	Male, 40	Consultant
12	Female, 60	Academic Member
13	Female, 29	Architect
14	Female, 51	Consultant
15	Female, 43	Architect
16	Female, 30	(Tourism Sector)
17	Female, -	School Manager
18	Female, 38	Officer
19	Male, 44	Officer
20	Female, 62	Officer-Manager

Table 22- Characteristics of the Interviewed Residents inside Lisbon Municipality Borders (Source: Research data)

Citizen	Gender & Age	Professionalism
1	Male, 23	Computer Programmer
2	Male, 24	IT
3	Male, 25	Software Tester
4	Female, 21	Student
5	Male, 30	Project Manager
6	Female, 24	Intern
7	Female, 34	Quality Controller
8	Female, 32	Business Analyst
9	Male, 29	Test Automation Developer
10	Non-binary, 29	Brand Ambassador
11	Male, 54	Sales Support

3.3 Method of Analysis

In this thesis, Microsoft Power BI and Excel were used to analyze the collected information and data. The Word Cloud was created through Power BI and The Radar Chart through Excel. Then the figures obtained with these tools were interpreted.

Chapter 4: Results and Discussions

4.1 Lisbon, Lisbon Metropolitan Area, Portugal

The opinions (according to the survey) of the citizens and the representatives of the municipality and private sector in the Lisbon district are shared in Table 23, Table 24 and Table 25.

Table 23- General Idea of the Citizens Living within the Borders of Lisbon Municipality (Source: Research data)

Question	Objective	General Opinion
What do you think about MSW management inside the Lisbon Municipality borders?	To identify the general opinion of the citizens about MSW management	The MSW management is not so good inside the Lisbon Municipality borders.
What are pluses and minuses?	To identify the evaluation of MSW management from citizen's view	<p>Plus:</p> <p>There are improvements in management.</p> <p>Minuses:</p> <p>Bad time planning to collect waste. Low amount of recycling bins. Lack of awareness.</p>
What could be better?	To identify the ideas of citizens for better MSW management	<p>There should be better time planning to collect waste.</p> <p>More recycling bins should be provided.</p> <p>Awareness should be raised.</p>
How do you manage your waste?	To identify the awareness stage of the citizens and showing their effort to support MSW management	The majority separate the waste at source as much as possible.
As a person living within the borders of Lisbon Municipality, can you rate the municipal solid waste management within these borders from 1 (lowest) to 10 (highest)?	To identify the satisfaction level of the citizens about MSW management	(Explained Below)

Answers that are given by citizens of Lisbon district show that the majority find the MSW management in Lisbon not so good or enough and it is also said that management depends on different places.

There is a good point that citizens are aware of the improvement in management.

On the other hand, citizens are complaining about seeing a recycling bin filled and even overflowed. Therefore, they really would like to see better time planning for collection.

One of the most highlighted topics by citizens is the amount of recycling bins. It is thought that the amount of recycling bins is really not enough. Citizens are required to have a sufficient number of recycling bins and regular checks. Some citizens think that the current recycling bin controls are sufficient, while others want to see controls increased.

Awareness is the strongly mentioned topic in the answers. Citizens think that there is a lack of awareness and, information and would like to have more knowledge about management steps. They believe awareness should be increased.

Citizens of Lisbon district separate their waste as much as possible and it is mentioned that there is an effort to reduce also.

the cloud as "noise". Some other deficiencies that citizens draw attention to are "incentive" and "information". These are reflected in the cloud too.

The last question that posed to citizens was “As a person living within the borders of Lisbon Municipality, can you rate the municipal solid waste management within these borders from 1 (lowest) to 10 (highest)?” Figure 20 reflects the replies of citizens:

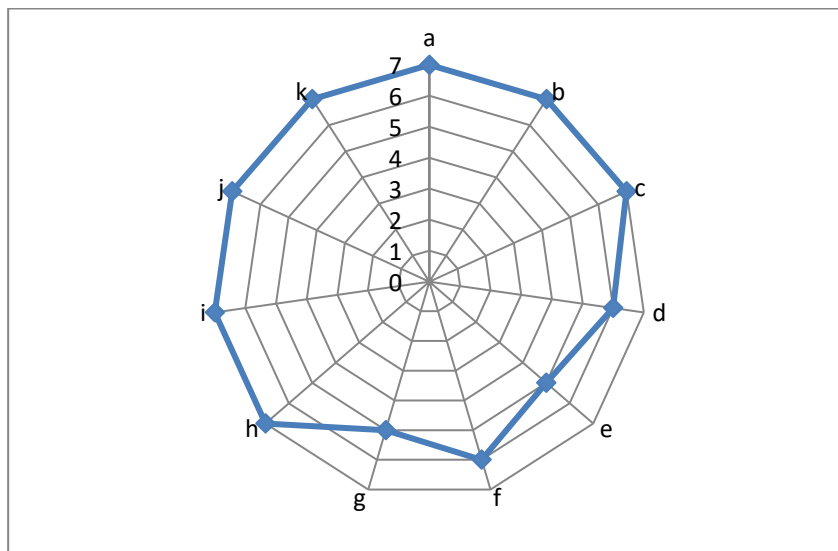


Figure 20- Evaluation of MSW Management by Citizens inside Lisbon Municipality Borders (Source: Research data)

Figure 20 shows that citizens living within the boundaries of the Lisbon district municipality find municipal solid waste management to be above average, but still think there are points that need improvement. Votes ranged between five and seven, with the majority voting as seven.

Table 24- The View of Lisbon Municipality (Source: Research data)

Question	Objective	General Opinion of the Answers
How MSW management works inside Lisbon Municipality borders?	To identify the steps of MSW management inside Lisbon Municipality borders, understanding the collaboration with the other stakeholders of MSW management.	It works relatively well in terms of quality service and recycling targets with improvements.
What are the pluses and minuses in MSW management? What are the difficulties?	To identify the difficulties in MSW management from the municipality's view and understanding their evaluation	<p>Pluses:</p> <p>Already succeed projects. New projects with new targets.</p> <p>Minuses/Difficulties:</p> <p>Public participation. Understanding the importance of new challenges and rules.</p>
What could be better?	To identify the plans and the targets of the municipality for better MSW management	The implementation of incentives related to waste separation.

Considering the answers of the Municipality of Lisbon, it is seen that;

The municipality thinks that works relatively well in terms of quality service and recycling targets. However, they are working harder to improve management. They especially work on increasing the waste collection vehicle fleet, number of staff, enforcement actions, and penalties, the incentives, education, implementation of a system “pay as you throw”, collection of organic waste in households, circular economy with awareness campaigns, and promoting actions such as “repair cafes” where people can repair, trade, buy and sell used products.

They believe that they have a good percentage of the waste collection but they are starting a new waste collection with higher targets. They are planning to widen it more and expecting that recycling rates will be increased a lot.

From the Municipality's point of view, the great difficulties and risks are related to population participation and understanding of the importance of new challenges and rules.

The topics that could be better are the implementation of incentives related to waste separation, included a system “pay as you throw” and other benefits to promote recycling.

Table 25- The View of Valorsul (Source: Research data)

Question	Objective	General Opinion of the Answers
How MSW management works in Valorsul?	To identify the steps of MSW management in Valorsul, understanding the collaboration with the other stakeholders of MSW management.	A collaborative work is being carried out with Lisbon Municipality on the treatment and disposal of the waste. Valorsul promotes selective collection.
What are the pluses and minuses in MSW management? What are the difficulties?	To identify the difficulties in MSW management from the view of Valorsul and understanding their evaluation	<p>Pluses: Wastes are treated in a wide range and waste management is contributed. Achieving the targets.</p> <p>Minuses/Difficulties: Accomplishing environmental targets. Uncertainty in electricity price that is produced by the company and sold to the national grid.</p>
What could be better?	To identify the plans and the targets of the company for better MSW management	<p>Collection system of recyclable materials. Having the Pay-As-You-Throw model. The technique of recovering recyclable waste. Reduction of the amount of organic waste sent to Landfill.</p>

Valorsul explains its collaborative work with the Municipality of Lisbon on the treatment and disposal of the waste. In addition, Valorsul promotes selective collection.

The company is responsible for a large-scale waste treatment process. This is a plus to support waste management; on the other hand, they may have difficulty in achieving environmental targets. Although this is a challenge, they say they achieved it last year and they will do it again.

One of the company's waste treatment methods is energy production from waste. They are generating energy in the form of electricity and sell for the national grid. The company considers uncertainty in this electricity price as negativity. They think that the expected change in the price of electricity will affect the gate fee (the charge applied to a given amount of waste in a waste treatment plant). Because they believe they should balance their incomes.

The issues that the company thinks could be better are as follows:

- Collection system of recyclable materials,
- Having the Pay-As-You-Throw model,
- The technique of recovering recyclable waste,
- Reduction of the amount of organic waste sent to Landfill. They mentioned that for this purpose, incineration can be a good solution.

4.2. Çankaya, Ankara, Turkey

According to the same survey, Table 26, Table 27 and Table 28 show the opinions of the citizens and the representatives of the municipality and private sector in the Çankaya district.

Table 26- General Idea of the Citizens Living within the Borders of Çankaya Municipality (Source: Research data)

Question	Objective	General Opinion
<p>What do you think about MSW management inside the Çankaya Municipality borders?</p>	<p>To identify the general opinion of the citizens about MSW management</p>	<p>The MSW management is insufficient inside the Çankaya Municipality borders.</p> <p>There are more minuses than pluses.</p> <p>Plus:</p> <p>MSW management inside Çankaya borders is above the standards.</p> <p>Minuses:</p> <p>Bad time planning to collect waste.</p>
<p>What are pluses and minuses?</p>	<p>To identify the evaluation of MSW management from citizen's view</p>	<p>Low amount of recycling bins, collection centers.</p> <p>Collecting method.</p> <p>People are not encouraged.</p> <p>Building managers and janitors etc. are not included in the MSW management.</p> <p>Lack of informative works and education, raising awareness campaigns.</p>
<p>What could be better?</p>	<p>To identify the ideas of citizens for better MSW management</p>	<p>There should be better time planning to collect waste.</p>

		<p>More recycling bins should be provided.</p> <p>There should be a better collection system/method. Citizens should not think the waste that they separated into different bags/bins, is collected in a one and the same bin. Citizens should be encouraged about MSW management.</p> <p>Citizens, especially building managers and janitors should be included in the waste management process.</p> <p>There should be information and training campaigns, and social projects to increase public awareness.</p> <p>There may be a penalty, especially on waste sorting when it is necessary to provide better management.</p>
<p>How do you manage your waste?</p>	<p>To identify the awareness stage of the citizens and showing their effort to support MSW management</p>	<p>The majority separate the waste at source and believe the importance of sorting at source.</p>
<p>As a person living within the borders of the Çankaya Municipality, can you rate the municipal solid waste management within these borders from 1 (lowest) to 10 (highest)?</p>	<p>To identify the satisfaction level of the citizens about MSW management</p>	<p>(Explained Below)</p>

When the answers are interpreted in general, it is seen that the following opinions are given:

Municipal solid waste management within the borders of the Çankaya Municipality is generally evaluated insufficient by the citizens.

Although the environmental awareness of the citizens living within the borders of the Çankaya Municipality is high, and MSW management is above the standards, awareness can be raised by the municipality and informative training can be provided. Although there are already some works, it is reported that it does not reach the citizen. It is underlined that education is very important. It is requested to carry out studies to improve the environmental awareness of children and to give lessons in schools.

It is thought that citizens should be included in municipal solid waste management. It is expected that at least building managers and janitors will be informed and contribute to coordinated and systematic management. Some answers show that informal paper waste collectors are working in coordination and are asked to include this team in the sector for municipal solid waste management.

One of the most highlighted points is the lack of recycling bins. Citizens demand this number to be increased. There are even opinions stating that recycling bins should be placed in every apartment. After placing the recycling bins, their checks are expected to be done regularly.

There are answers, mention that the municipality can collect and transfer the municipal solid waste separately from the source by means of different colored bags to be distributed. On the other hand, there is an idea that says instead of garbage bags, there may be different alternatives. There are also opinions reflect the idea that fines will increase the success rate of waste management.

According to the result of the survey, citizens living within the boundaries of the Çankaya Municipality, generally separate waste at source. In fact, there are citizens trying to reduce consumption, using 2nd hand, composting at home. However, some citizens have a perception that "I separate my waste, but it is mixed in the waste collection vehicle and my separation doesn't work."

to see “separation”, “sorting”, “collecting” and some waste types in the cloud. Citizen wants to check the waste bins more often. Therefore, "time" is also seen.

There was another question posed to the citizens. Eleven out of twenty citizens of Çankaya answered the last question "As a person living within the borders of Çankaya Municipality, can you rate the municipal solid waste management within these borders from 1 (lowest) to 10 (highest)?" Figure 22 shows the results below:

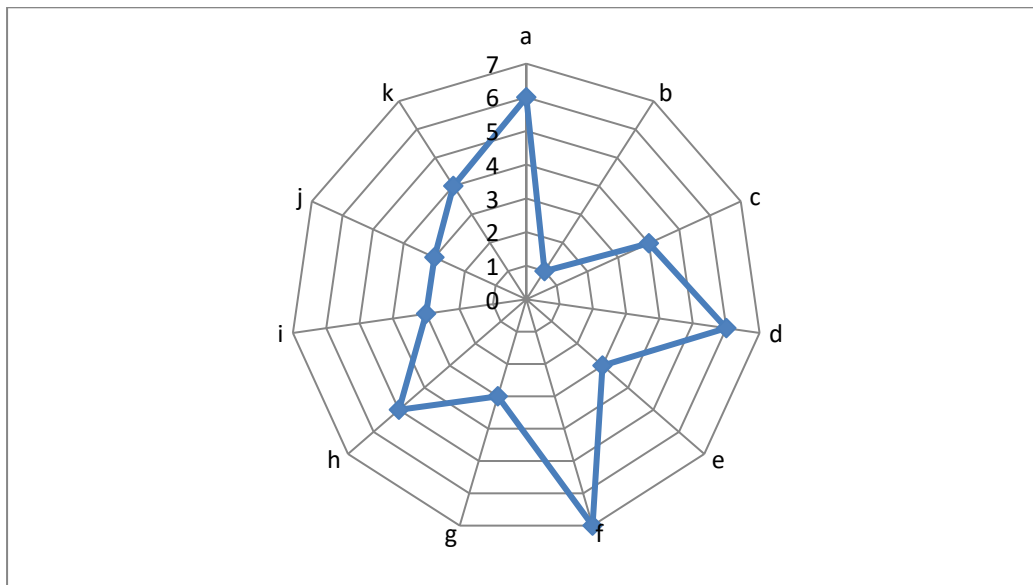


Figure 22- Evaluation of MSW Management by Citizens inside Çankaya Municipality Borders (Source: Research data)

As can be seen from the above figure, waste management within the borders of the Çankaya Municipality does not satisfy the citizen. Votes ranged between one and seven, with the majority voting as three.

Table 27- The View of Çankaya Municipality (Source: Research data)

Question	Objective	General Opinion of the Answers
<p>How MSW management works inside Çankaya Municipality borders?</p>	<p>To identify the steps of MSW management inside Çankaya Municipality borders, understanding the collaboration with the other stakeholders of MSW management.</p>	<p>The wastes are categorized in different classes and collected separately at the source. Later on, according to waste type, treatment/disposal methods are applied. In these processes, the municipality is in cooperation with the private sector.</p>
<p>What are the pluses and minuses in MSW management? What are the difficulties?</p>	<p>To identify the difficulties in MSW management from the municipality's view and understanding their evaluation</p>	<p>Plus: Improvement works are continuing.</p> <p>Minuses: Some regulatory issues (such as frequent changes in regulations, non-enforcement of penalties), street collectors, lack of awareness are some of the minuses from the view of the Çankaya Municipality.</p> <p>Due to a lack of resources, the collection efficiency of packaging waste is not at the desired level.</p>
<p>What could be better?</p>	<p>To identify the plans and the targets of the municipality for better MSW management</p>	<p>Separate collection of recyclable waste at the source would be better.</p> <p>The efficiency of the collected packaging wastes will increase and the amount of domestic waste collected in the households will be reduced.</p>

Citizens have an important role in municipal solid waste management. One of the other essential stakeholders are the municipalities.

Çankaya Municipality summarized waste management as follows; wastes are classified into different groups and collected separately at source. Afterward, the wastes are sent to the authorized facilities and the treatment or disposal process is applied.

The municipality stated that there are some regulatory problems, such as frequent changes in regulations and no penalties. In addition, problems such as street collectors and lack of awareness are highlighted. They made an assessment that the level of collection of packaging wastes is not at their desired level due to lack of resources and reported that the improvement works are continuing.

The municipality believes that the separate collection of recyclable waste at the source would be better.

The results of the survey show that there are the same situations that are considered negative by both the municipality and the citizen such as lack of awareness and no penalty. Both sides are aware of the street collectors and insufficiency of separate collection.

Table 28- The View of Alkın Kağıtçılık (Source: Research data)

Question	Objective	General Opinion of the Answers
How MSW management works in Alkın Kağıtçılık?	To identify the steps of MSW management in Alkın Kağıtçılık, understanding the collaboration with the other stakeholders of MSW management.	<p>A joint work is being carried out with Çankaya Municipality on separate collection of packaging waste at source.</p> <p>Brochures are distributed to the households to inform them, and wastes are collected with indoor and outdoor waste bins.</p> <p>In this context, waste is collected from workplaces, houses, public institutions and organizations, schools, shopping malls, large shopping malls, markets. In short, waste is collected from everywhere that separates waste correctly.</p>
What are the pluses and minuses in MSW management? What are the difficulties?	To identify the difficulties in MSW management from the view of Alkın Kağıtçılık and understanding their evaluation	<p>Plus:</p> <p>Pros provide more motivation to run this business.</p> <p>When the desired awareness for recycling is provided, a clean future, a sustainable environment is formed, a generation that is sensitive to human and respectful to nature raise.</p> <p>In addition, serious gains are provided to the economy of the country and unemployment is prevented with the contribution to employment.</p> <p>Minuses:</p> <p>The fact that the public does not have enough information on this subject is one of the biggest cons. The mixing of household waste into packaging wastes destroys the characteristics of the entire waste in the</p>

waste bin, and if this waste is not noticed, the characterization of almost all wastes in the vehicle can be disrupted and it is not possible to use it for recycling.

What could be better?

To identify the plans and the targets of the company for better MSW management

The amount of waste that accumulates less (houses, offices, etc.) is a waste of time. For this reason, it will be more efficient if large recycling bins can be left to each neighborhood (there are examples abroad) and it can be ensured that the public, offices, institutions, etc. can leave their waste to these points. Costs will also decrease considerably.

Alkın Kağıtçılık explains its collaborative work with the Municipality of Çankaya as "Separate collection of packaging waste at source". In addition to collecting wastes, they also emphasize that informational activities are carried out.

The company thinks the lack of sufficient information on the public as the biggest minus. They state that this lack of information reduces the success rate of recycling. When the desired awareness for recycling is provided, they feel that a clean future, a sustainable environment is formed, a generation that is sensitive to human and respectful to nature raise and, they contribute to the national economy and employment.

The Company considers waste collection to be a waste of time where very little waste is collected. They believe that in order to save both time and cost, waste bins should be placed in each neighborhood and the people, workplaces, etc. should drop their waste to these points.

4.3 Comparison of the Situation between Lisbon and Çankaya Based on Collected Opinions

This section will make a comparison of the analysis of current situations, after evaluating the responses of citizens, responsible municipalities in Lisbon and Çankaya and private sectors separately. First of all, when started with the views of the citizens, it shows that:

Citizens living in both districts think that solid waste management is generally insufficient. Strongly highlighted common points from both citizens are:

- The number of recycling bins are not enough,
- The need for better time planning for waste collection,
- The need for awareness to be increased.

Both citizens in Lisbon and Çankaya mention that they separate their waste at source as much as possible and try to do more than this such as reduction at source.

Differently from Lisbon citizens, the citizens that live in Çankaya,

- Explained the situation more and gave examples for the current situation and ideas for the things that can make the management better,
- Mentioned about street collectors,
- Stated that fines can increase the success rate of waste management,
- Highlighted that citizens should be included in municipal solid waste management. It is expected that at least building managers and janitors will be informed and contribute to coordinated and systematic management.

Secondly, considering the answers of municipalities, both municipalities think the same on improvement. In addition to current works, they continue to improve. Both mentioned “fines” and they would like to apply or increase penalties. They believe that the things that promote recycling can be better. Both sides emphasize a lack of awareness somehow.

Differently from Çankaya Municipality, Municipality of Lisbon gave more information about their works and plans. They mention about “pay-as-you-throw” model that is wanted to be implemented more. Some topics that are just stated by Çankaya Municipality are street collectors and regulatory issues.

According to the new country classifications by income level: 2019-2020 (World Bank, 2019), Turkey is in upper-middle-income economies; Portugal is in high-income economies classification. In Çankaya, the mention of street collectors by both the citizens and the municipality, and pointing out this issue, supported the "Literature Review" and showed the effect of income level on municipal solid waste management.

Finally, when the private sector is considered, it is seen that the scope of inclusion of the two firms in waste management is different. While the scope of the company working in cooperation with the municipality of Lisbon is very wide in waste treatment, the company working with Çankaya Municipality is cooperating with the municipality only on packaging waste. While the company in Çankaya speaks more of the public awareness and the positive impact this awareness will have on the success rate of recycling, the firm in Lisbon says that changes in systems, techniques, and methods can be improved and this will have a positive impact on the percentage of success in recycling.

Chapter 5: Conclusions

The aim of this dissertation was to give an explanation to the question: “How effective is the coordination and collaboration between stakeholders of municipal solid waste management?”

Accordingly, and based on the view that MSW management is not the responsibility of a person or an organization, the importance of collaborative work was focused and a case study about actions that are being carried out in the Lisbon district in Portugal and the Çankaya district in Turkey were presented. Municipality and private sector representatives and citizens were interviewed by the author to collect necessary data.

The answers were analyzed. Concerns, recommendations, and expectations of citizens and, current works, plans, and targets of municipalities and the private sector were presented.

Considering the responses of the stakeholders living or working in the districts of Lisbon, it is seen that the common opinion of the stakeholders is that waste management does not go bad but there are points that need to be improved and there is an effort for development. It is seen that the company, which cooperates with the municipality of Lisbon, is more focused on its technical projects. In addition, it is seen that the municipality is focused on both legal and technical issues and citizens' integration to waste management. Likewise, citizens also wanted to be informed about waste management.

The responses of the stakeholders within the boundaries of the Çankaya Municipality showed that municipal solid waste management is not sufficient and there are points that need to be improved. While the answers of the citizens show that they are conscious and want to be more, they want to be involved in waste management; municipal and private sector responses point to the public's unconsciousness and difficult integration in waste management. In addition to the “awareness” topic, the lack of resources and regulatory problems of the municipality are noteworthy.

The most striking point in both district municipalities is the emphasis on awareness, information and awareness issues by different stakeholders, but no stakeholder assumes the reason for this lack. It was deduced that there is a lack of cooperation, sharing, and communication among the stakeholders. This has been seen to have a significant negative impact on the success rate of municipal solid waste management, especially in Çankaya, and it has come to the conclusion that the importance of inter-stakeholder collaborative

work is significant. If cooperative work increases, the success rate in municipal solid waste management will increase.

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