KAHRAMANMARAŞ METROPOLITAN MUNICIPALITY'S APPROACH TO SUSTAINABLE SOLID WASTE MANAGEMENT: AN ANALYSIS BASED ON PLANS, PROJECTS, AND REPORTS[1]

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ABSTRACT | This study aims to analyze the approach of Kahramanmaraş Metropolitan Municipality regarding solid waste management, focusing on its plans, projects, and reports. Utilizing document analysis as a qualitative research method, the study systematically evaluates the municipality's documents related to solid waste management. The findings indicate that Kahramanmaraş Metropolitan Municipality has made significant efforts to address the solid waste issue, particularly following the February 6th earthquakes, which heightened the city's challenges in this area. The municipality's commitment to sustainable waste management is demonstrated through key initiatives, such as the implementation of the "Kürtül Solid Waste Integrated Facility", marking a notable improvement in waste management practices. Furthermore, progress on the "Northern Districts Integrated Solid Waste Facility Project", now nearing completion, reinforces the municipality's ongoing dedication to enhancing solid waste management and sustainability. These initiatives are vital for tackling the environmental challenges faced by the city and promoting a more sustainable future.

Keywords: *Sustainability, solid waste management, Kahramanmaraş Metropolitan Municipality*
JEL Code: *H7, Q53, Q56*

Scope: *Political science and public administration*
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[1] Compliance with the ethical rules of the relevant study has been declared.

KAHRAMANMARAŞ BÜYÜKŞEHİR BELEDİYESİNİN SÜRDÜRÜLEBİLİR KATI ATIK YÖNETİMİNE DAİR YAKLAŞIMI: PLANLAR, PROJELER VE RAPORLAR ÜZERİNDEN BİR ANALİZ

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ÖZ | Bu çalışmada Kahramanmaraş Büyükşehir Belediyesinin plan, proje ve raporlarında katı atık ve yönetimine dair yaklaşımını ortaya koymak amaçlanmaktadır. Nitel araştırma yöntemlerinden doküman analizi yapılmak üzere kurgulanan çalışmada, Kahramanmaraş Büyükşehir Belediyesinin planları, projeleri ve raporları katı atık ve yönetimi çerçevesinde detaylı incelenmiş ve belgelerin sistematik olarak analizi yapılmıştır. Çalışmanın sonucunda Kahramanmaraş Büyükşehir Belediyesinin kentte özellikle de yaşanan 6 Şubat Depremleri neticesinde ciddi düzeyde bir problem haline gelen katı atık sorununu azaltmaya ve bunun yönetiminin sürdürülebilir olmasına yönelik önemli çalışmalar yaptığı görülmüştür. Bu kapsamda uygulamaya koyduğu "Kürtül Katı Atık Entegre Tesisi" önemli bir adım olmaktadır. Yine uygulamaya geçme noktasında son aşamaya gelen "Kuzey İlçeleri Entegre Katı Atık Tesisi Projesi" de katı atık yönetiminin sürdürülebilirliğinde belediyenin çalışmalarının devam ettiğinin göstergesi olmaktadır.

Anahtar Kelimeler: *Sürdürülebilirlik, katı atık yönetimi, Kahramanmaraş Büyükşehir Belediyesi*
JEL Kodları: *H7, Q53, Q56*

Alan: *Siyaset Bilimi ve Kamu Yönetimi*
Türü: *Araştırma*

1. INTRODUCTION

In the historical process, the increasing population worldwide, especially the recent rise in refugee population in Türkiye, along with industrialization and rising living standards brought about by developments worldwide, have changed the balance of production and consumption. Naturally, this has led to increases and variations in the amount and types of waste. All these developments have prompted countries to reconsider their waste infrastructure systems according to current conditions and have compelled them to take steps to reduce and dispose of these wastes.

As a result of the dense population in cities and the effects of the global changes and transformations, solid waste has become a serious problem. Termed as municipal solid waste, mixed household solid waste, recyclable materials (newspapers and magazines, aluminum cans, milk cartons, plastic beverage bottles, metal cans, corrugated cardboard, etc.), hazardous household waste (batteries, light bulbs, paint cans, etc.), commercial and institutional waste (from businesses, schools, and other public buildings), household-like industrial solid waste, garden, market, and bazaar waste (green waste), street, sidewalk, and square sweepings, bulky waste (furniture, appliances, etc.) are increasing in quantity in cities day by day (Öztürk, 2011, p. 44). These wastes not only reflect the culture that produces them but also seriously impact the health of people and their surrounding environment. Globally, people are generating increasing amounts of waste, and the composition of this waste is becoming more complex than ever. This is due to the proliferation of plastic and electronic consumer products and the rapid urbanization of the world. These trends pose a challenge for cities. It is crucial to manage the resulting waste in a socially and environmentally appropriate manner (Vergara & Tchobanoglous, 2012, p. 278). In this context, waste management has become an important unit within the municipalities responsible for urban management, and efforts have been made by municipalities to ensure its sustainability.

In the context of solid waste and its management, various studies are observed in both foreign and Turkish literature. When these studies are generally examined, it is seen that they are either predominantly literature-based or field studies. Additionally, the number of recent studies is limited. This study provides a broad conceptual framework for solid waste and its management, and it is believed that the examination of good practice examples from around the world adds uniqueness to the study. Furthermore, the approaches to solid waste and its management specific to Kahramanmaraş are thought to enhance the study's originality and provide guidance for future research in this field.

Based on this, in the study, sustainability and solid waste management were first discussed conceptually in detail. Additionally, to support this section, the study provides a historical overview of the regulations and policies related to solid waste management in the EU and Türkiye, particularly focusing on metropolitan municipalities. Subsequently, cities prominent in solid waste management worldwide and in Türkiye, and the municipal practices that made these cities successful, were examined. Finally, the current situation of solid waste management in Kahramanmaraş Metropolitan Municipality, which became a metropolitan municipality in 2012, and its approach to this issue were analyzed based on the municipality's relevant documents and the projects it has implemented so far.

2. SUSTAINABLE SOLID WASTE MANAGEMENT: A CONCEPTUAL FRAMEWORK

The Industrial Revolution marked a significant turning point for humanity. With this revolution, large industrial establishments emerged, and subsequently, extensive production was initiated to meet the increasing consumption needs of the growing population. This situation, viewed positively on one hand, is even considered normal to meet the demand for consumption. However, it became evident in the 20th century that the situation was not improving, as observed worldwide. Particularly in the 1970s, significant environmental problems were observed globally. During this period, humanity faced serious environmental degradation, the problem transcended nations and became global, posing a threat to the future of mankind. When we look at the root causes of environmental degradation, excessive production and consumption are seen to be major factors. Among the most significant factors causing environmental degradation today are solid waste. Countries are implementing many practices to solve this problem. Sustainable development also becomes an important solution for countries to minimize this problem.

2.1. Sustainability and Sustainable Development

The earliest studies on sustainability date back to the 18th and 19th centuries. Although the concept has a long intellectual history extending to the “stationary” or “steady-state” economy concept used by economists of those periods, it was in the 20th century, particularly due to serious environmental problems, that the concept of sustainable development emerged. In this century, the concept of sustainability was expanded to include other aspects of environmental issues such as the relationship with the living world (nature) and pollution (Hueting & Reijnders, 1998, p. 19). With industrialization, the acceleration of economic growth has created unsustainable demands on natural

resources, and the increasing technology has also increased the damage to the economy and the environment (López, Anríquez & Gulati, 2007, p. 308). In the 1960s and 1970s, particularly awareness-raising studies were conducted on the environment. Because the problem became global, and environmentalists saw industrialization, excessive population growth, and economic growth as the root causes of environmental problems. Therefore, environmentalists emphasized that natural resources should not be excessively consumed for the sustainability of population growth and industrialization. Additionally, it was stated that serious efforts could cope with the waste materials and pollution resulting from excessive consumption by people (Yeni, 2014, p. 183). Because sustainability suggests that the future of humanity will be possible through the protection of the environment and the prevention of environmental problems (Tosun, 2009, p. 4). From this perspective, sustainability can be defined as the perpetual use of the vital functions (possible uses) of the biophysical environment (Hueting & Reijnders, 1998, p. 19).

The first studies on sustainability emerged based on the principles set forth in the Declaration of the United Nations Conference on the Human Environment held in Sweden in 1972. The concept first appeared in the literature in the report "Limits to Growth 2" published by the Club of Rome in 1972. In summary, this report indicates that the exploitation of limited global resources due to factors such as population growth, industrialization, and excessive production and consumption will further exacerbate environmental pollution. Additionally, the report emphasizes the need to prevent the economy from growing further before environmental disaster progresses, and it suggests that concerted action must be taken worldwide for this purpose (Metlioğlu & Yakın, 2021, p. 1886). In the Brundtland Report (Our Common Future) published in 1987, the concept began to be used globally. In this report, sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". At the 1992 Rio de Janeiro Earth Summit, the use and awareness of the concept increased further with the widespread use of computers and the internet. This summit was attended by 182 world leaders, and the concept gained international dimensions through this event (Özgün & Ayvaz, 2017, p. 112; Yanık & Türker, 2012, p. 292).

Today, the concept of sustainability is frequently used in various fields such as economics, environment, agriculture, construction, architecture, tourism, health, education, and many more. Generally, the concept implies the balanced use of natural resources, reducing waste resulting from consumption, ensuring the recycling of resources, and the continuous protection of the environment, acknowledging the right of future generations to benefit from nature (Koçak &

Balcı, 2010, p. 214). As seen, sustainability encompasses economic development, social development, and environmental protection (Saban et al., 2017).

Sustainable development, on the other hand, emerges as a concept aiming to preserve the economic, social, and environmental well-being of both present and future generations with a balance between economic, social, and environmental sustainability. This concept (Hamilton, 1995, p. 393) is also coded as the benefits that do not diminish in economic, social, and environmental areas, while sustainable development, in essence, aims to ensure that the opportunities for future generations do not decrease compared to the present and that the needs of today are met as fully as possible (Howarth & Norgaard, 2017, p. 193). In fact, the concept (Köşker & Gürer, 2020, p. 90) is used interchangeably with sustainability, but it provides a more comprehensive perspective. There are three main perspectives dominant in sustainable development: basic needs, eco-development, and sustainable utilization (Şen et al., 2018, p. 15). In this regard, while the primary goal of sustainable development is to protect and improve the environment and social equality, it should not ignore the economy, although it is evident that the concept prioritizes environmental and social aspects. It should also be noted that in sustainable development, there is no situation of giving up one for the other among the environment, social development, and the economy (Gowdy & O'Hara, 1997, p. 240), and ensuring the sustainability of each is necessary. The emphasis in the concept of sustainable development is to carry out all kinds of economic and social development activities while protecting and improving the environment and social development (Gedik, 2020, p. 202).

Sustainability and sustainable development, as seen in the aforementioned studies, are used in a similar sense. When we look at the historical emergence and development of sustainable development, it was proposed as a solution to a problem in the world and set goals accordingly (Tutulmaz, 2012, p. 610). It is observed that among these problems in the world and in Türkiye, solid waste and the negative consequences arising from its management are at the forefront.

2.2. Solid Waste Management and Sustainable Solid Waste Management

Recently, the concept of sustainability, which has been frequently used and sought to be implemented, is also being applied in the field of solid waste management today (Akdoğan & Güleç, 2007, p. 43). This is because the increase in waste over time has sparked discussions on how to manage waste effectively. Questions about how to develop an economically feasible, environmentally effective, and socially acceptable urban solid waste management system were on the agenda of countries in the early days (Junquera, Brío & Muniz, 2001, p. 51).

However, the practical aspects of urban waste management (such as collection, treatment, and disposal) and countries' views on source separation, recycling, incineration, and landfilling remained uncertain (Wilson, McDougall & Willmore, 2001, p. 328).

Initially, the idea of removing waste from living areas gained popularity when waste was recognized to cause serious environmental degradation. However, with the increase in waste quantities over time, the need for new disposal areas grew, making this approach unsustainable. Moreover, economically feasible and environmentally acceptable disposal has been a major concern in many industrialized countries. The main challenge faced by policymakers in the waste management sector is how to predict the future quantity and composition of solid waste to design the most appropriate treatment/disposal strategy (Daskalopoulos, Badr & Probert, 1998, p. 155). Additionally, the presence of materials within solid waste that can be reused has led to a fundamental change in thinking. The new approach aims to maximize economic and social benefits from waste while minimizing environmental harm (Bilgili, 2020, p. 89).

From this perspective, solid waste management is defined as the controlled implementation of methods developed to take measures against waste that do not harm human health and the environment (Demirarslan & Başak, 2018, p. 118).

Solid waste management is a discipline consisting of stages such as controlling the quantity of waste, collection, accumulation, transportation, processing, recycling, reuse, and disposal (Beyhan & Gödel, 2021, p. 62), with the preference for the most suitable method in these stages (Menteşe & Kızılçam, 2021, p. 111). Looking at industrialized and developed countries worldwide, it is observed that most of them have adopted a philosophy in urban solid waste management hierarchy that includes waste prevention or minimization in production, material recovery, recycling, incineration, and disposal in controlled and sanitary landfills (Garcıa, Esteban, Marquez & Ramos, 2005, p.781).

In other words, solid waste management encompasses a series of processes, including waste collection, transportation, recycling, and managerial, economic, legal, engineering, and planning aspects, to prevent environmental degradation, improve environmental quality, protect public health, implement sustainable development, and subsequently achieve economic growth (Bilgili, 2020, p. 92). When planning solid waste management, some key issues need to be considered. These include protecting human health and the environment, ensuring the sustainability of natural resources, economic conditions, engineering principles, the aesthetics of the environment/nature, and the daily habits of the

relevant community (Beyhan & Gödel, 2021, p. 62).

With the environmental degradation experienced in the 20th century, solid waste management gained prevalence as a discipline, leading to the idea of ensuring sustainability over time, which gave rise to sustainable solid waste management. Sustainable solid waste management is an approach that preserves natural resources, minimizes environmental damage, and requires participation. In this approach, environmental sustainability is important, as well as economic and social sustainability. Furthermore, sustainable solid waste management has economic, political, administrative, socio-cultural, technical, and institutional dimensions. Additionally, this approach serves various purposes. These are (Tekel, 2007, p. 73):

- Creating sustainable environments in cities and preserving the quality of the environment, Protecting the health and well-being of the urban population,
- Achieving social progress that meets the needs of the urban population (Adams, Phillips & Morris, 2000, p. 221),
- Prudent use of natural resources (Daly, 2017, p. 97),
- Enhancing the value of the city's existing economy and ensuring its productivity,
- Creating new job opportunities and income prospects.
- To achieve the diverse and comprehensive objectives mentioned above in sustainable solid waste management, there are key actors involved. These include (Baud, Grafakos, Hordijk & Post, 2001, p. 4):
- Public sector (national authorities and local government agencies)
- Private sector (large and small registered businesses engaged in collection, transportation, disposal, and recycling activities)
- Small-scale, unrecognized private sector (waste pickers, itinerant buyers, waste material traders, and unregistered small-scale businesses)
- Local governments, communities, and representatives (NGOs).

Sustainable solid waste management is an important part of the idea of sustainable development. Based on sustainable development, sustainable solid waste management has been implemented with the idea of disposing of waste in an environmentally friendly and least harmful way. Thus, the first rule in sustainable solid waste management is the prevention of waste generation and the protection of natural resources, i.e., the environment (Bilgili, 2020, p. 94). This idea has now influenced all countries.

As can be seen, the increasing environmental problems globally, and specifically the solid waste problem, have prompted action worldwide, and international law has evolved over time regarding solid waste management and its sustainability. Particularly in the 1970s, environmental problems paved the

way for environmental regulations to take place in international law. Subsequently, the European Union (EU), aiming to complete its economic integration, began to place more emphasis on the environment during this process. Therefore, it started to consider the environmental impact and assess the environmental costs of any economic activity (Dönmez & Değirmen: 2016, p. 252). In this context, the EU has made significant progress in addressing the solid waste problem and its management.

When looking at the historical development of the EU's environmental policy, waste management appears as the first area of regulation. Especially in the 1970s and 1980s, poorly managed waste led to major environmental disasters, necessitating mandatory measures by policymakers. The development of better waste management policies across the Community began in the first half of the 1970s. The first Waste Framework Directive was adopted in 1975. Similarly, the Council Directive on Toxic and Hazardous Waste came into force in 1978. The Union also established a Waste Management Commission to assist the European Commission in formulating policy in the field of waste management. The shipment of hazardous waste was later regulated in 1984. These three directives, evolving alongside technical and political developments within the Union, form the framework legislation for waste management in the EU (EU Waste Management Legislation, 2024). In subsequent years, environmental regulations on solid waste across the Community increased disposal costs for the industry. This led to the export of hazardous waste to developing countries and Eastern European countries in the late 1980s. In developing countries, disasters and increasing awareness, especially with the support of non-governmental actors like Greenpeace, ensued. Subsequently, many developing countries regarded these practices as “Toxic Colonialism”. In 1989, facing growing opposition to these practices, the international community adopted the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, which prohibits the export or import of hazardous waste to or from non-party countries and requires prior written consent from the recipient country before shipment. In response, the EU established its Waste Management Strategy the same year, introducing higher standards for waste disposal and imposing restrictions on waste transportation (Veral & Yiğitbaşıoğlu, 2018, p. 3).

With the developments in the EU, a process of building a more comprehensive waste policy has been initiated. Subsequently, in the EU, the Waste Framework Directive (2008/98/EC), which includes the waste hierarchy, was established along with the regulations. The Waste Framework Directive includes concepts and definitions related to waste management, such as waste, recycling, and recovery. It also explains when waste ceases to be waste and

becomes a secondary raw material and how waste and by-products are to be distinguished. According to the Directive, waste legislation and policies in EU member states must comply with the waste management hierarchy. This hierarchy prioritizes waste policies in the following order: prevention, preparation for reuse, recycling, recovery, and as the least preferred option, disposal (including landfill and incineration without energy recovery). Additionally, the Directive includes the "polluter pays" principle and the "extended producer responsibility" principle. Regulations have been made regarding hazardous waste and waste oils. Targets for recycling and recovery by 2020 have also been set and work has begun (Uçar, Şemsit & Yüksel, 2018, p. 748).

The development of the EU's waste management policies has been significantly influenced by the Environmental Action Programs (EAPs) prepared since 1973 (Dönmez & Değirmen: 2016, p. 253). In this context, the concept of Thematic Strategies was developed for the first time in the 6th EAP covering the period from 2002 to 2010, and the Thematic Strategy on Waste Prevention and Recycling is one of the seven thematic strategies created in this context. The main elements of the EU's waste management policies are to promote recycling in addition to waste prevention, to use unavoidable waste as a resource, and to minimize the extraction of additional natural resources to ensure resource efficiency and sustainable growth (Veral & Yiğitbaşıoğlu, 2018, p. 4). In the 7th EAP, covering the years 2013 to 2020, it is seen that the importance given to resource use, resource efficiency, and waste increased. In this context, goals such as reducing the amount of waste generated, maximizing reuse and recycling, and restricting landfilling to waste that cannot be recycled or recovered are included in the relevant EAP. In the current 8th EAP, covering the years 2021 to 2030, it is stated that by 2050 at the latest, the EU aims to achieve a priority long-term goal of living well within planetary boundaries, with nothing being wasted, growth being renewable, and climate neutrality being achieved in a prosperous economy. Indirectly, the importance given to waste reuse and the increase in the importance given to waste are noted. Ensuring the full implementation of waste policy targets in all EU member states is also emphasized (İMMİD EU Projects Department, 2024).

The EU's waste management policy is said to have five main objectives. These can be listed as follows (EU Waste Management Legislation, 2024):

- Promotion of environmentally friendly and less waste-intensive technologies and processes, and the production of recyclable products to prevent waste.

- Encouragement of the reuse and recycling of waste, particularly as raw materials.
- Improvement of waste disposal through the establishment of binding environmental standards at the European level (especially in terms of legislation).
- Tightening of provisions related to the transport of hazardous substances.
- Remediation of polluted lands.

As can be seen, detailed studies on solid waste issues and management have been conducted in the EU, with significant goals set for the coming years. The EU, which has formed its environmental policy, has reinforced it with plans and legislation such as the EU Sustainable Development Strategy, Environmental Action Plans, and the EU Waste Framework Directive. In this context, when looking at Türkiye, as a candidate country for the EU, it manages the environment in alignment with EU directives. Additionally, Türkiye has undertaken new legal regulations, capacity-building efforts, plans, projects, reports, and analysis studies in the environmental field, based on the EU framework (Dönmez & Değirmen, 2016, p. 255). It is said that the history of developments regarding solid waste management and sustainability in Türkiye is similar to the EU due to its candidate status. Furthermore, the global environmental issues that occurred worldwide have affected all countries simultaneously, though the responses to these issues have not been the same across all countries.

In Türkiye, the first regulation on environmental matters is found in Article 56 of the 1982 Constitution. This was followed by the Environmental Law No. 2872 enacted in 1983. The legal infrastructure for solid waste management in Türkiye has generally been prepared based on the directives and decisions formulated by the EU. In this context, in 2006, the Ministry of Environment and Forestry developed the EU Integrated Environmental Approximation Strategy for the period 2007-2013. This strategy included information on the technical and institutional infrastructure and the environmental obligations that needed to be fulfilled. Parallel to this Environmental Strategy, the Ministry of Environment also adopted the Waste Management Action Plan (2008-2012). The "Regulation on General Principles of Waste Management" dated July 5, 2008, established the framework legislation for waste management in Turkish law. The Waste Management Regulation incorporated certain provisions of the EU's Waste Framework Directive 2008/98/EC into national law. Furthermore, the Regulation on the Regular Landfilling of Waste, transferred from Directive 1999/31/EC, and other similar regulations derived from EU directives include regulations in this field (Uçar, Şemsit & Yüksel, 2018, p. 752). The latest regulation on solid waste management in Türkiye is the 2015 Waste Management Regulation.

At the national level in Türkiye, various regulations concern solid waste management. The responsibility for removing waste from urban areas or disposing of it in a way that does not harm the environment belongs to many institutions, with the greatest responsibility falling on municipalities that manage urban areas (Solak & Pekküçüksen, 2018, p. 658). Municipalities also have many regulations regarding waste management in their legislation. Municipalities are required to reflect waste management in local policies. This is especially mandatory in the process related to the EU.

In the context of regulations concerning municipalities related to solid waste and its management, Article 7/i of Law No. 5216 on Metropolitan Municipalities states that:

"To ensure the protection of the environment, agricultural plans, and water basins in accordance with the principle of sustainable development; to carry out afforestation; to designate and regulate storage areas for excavation soil, debris, sand, and gravel, as well as for wood and coal sales and storage; to take measures to prevent environmental pollution during their transportation; to prepare and implement the metropolitan solid waste management plan; to provide services related to the recycling, storage, and disposal of solid waste and excavation waste, excluding the collection and transportation of waste from the source to transfer stations; to establish, operate, or contract facilities for this purpose; to provide services related to industrial and medical waste, and to establish, operate, or contract the necessary facilities for this; and to collect, process, and regulate waste from marine vessels" (Law No. 5216, 2004).

According to Article 14/a of Law No. 5393 on Municipalities, "It performs or arranges environmental and environmental health services, cleanliness, and solid waste services." Additionally, according to Article 15/g of the same law, "It is among the municipality's powers and privileges to carry out and arrange all services related to the collection, transportation, separation, recycling, disposal, and storage of solid waste" (Law No. 5393, 2005). There are also many regulations concerning metropolitan municipalities in Türkiye.

When looking at the activities carried out by local governments in Türkiye in the field of solid waste, it is observed that they initially began with the collection and storage of waste. Metropolitan municipalities have started to act based on the principle of separately collecting waste according to its recyclability and environmental impact. Subsequently, uncontrolled waste disposal areas have gradually been replaced by regulated landfill sites. Later, the waste in these landfill areas began to be utilized for energy production. Finally, integrated solid waste management, where all these processes are coordinated in a single center, has started to come to the forefront (Uçar, Şemsit & Yüksel, 2018, p. 755; Yılmaz

& Bozkurt, 2010, p. 18).

In a general assessment, solid waste is no longer considered merely as garbage but as resources that need to be recovered and reused (Bilgili, 2020, p. 94). This can be seen in the waste management policies of the EU and Türkiye. This perspective has also affected cities worldwide. Cities and the actors managing them have implemented plans, projects, and reports to meet changing societal expectations and to create healthy and high-quality living spaces by ensuring sustainable solid waste management.

3. EXAMPLES OF MUNICIPALITIES SETTING AN EXAMPLE FOR SUSTAINABLE SOLID WASTE MANAGEMENT IN THE WORLD AND TÜRKİYE

In today's world, economic, social, and cultural developments have forced cities to change, leading to a qualitative and quantitative differentiation in the services expected by the city and its residents. Municipalities, primarily responsible for cities and urban management, have to adapt their municipal experiences to the conditions of the day in response to these changing expectations. In this context, municipalities focus on fundamental values such as sustainability, accountability, transparency, and participation, and collaborate with various stakeholders responsible for urban management to implement new practices. Sustainable solid waste management has also become an area that cities and subsequently municipalities have been intensively working on in recent years (Dünya Kentlerinden İlham Veren Proje Uygulamaları, 2024; Taş & Durgun, 2022, p. 227).

When we look at the common characteristics of the selected sample countries below, these countries utilize the organic parts of their urban waste for energy production and make their solid waste management sustainable. Instead of simply dumping solid waste into empty land and considering it as a solution, these countries extract economic value from this waste and contribute to the city's economy without harming the environment (Gökpur, Zıba & Dolaz, 2019, p. 350).

3.1. Examples from Around the World

Municipalities have developed various plans and projects to establish, implement, and improve sustainable solid waste management in their respective cities in line with the current conditions. Having facilities and projects in different areas for the disposal of solid waste puts countries ahead in solid waste management. Below are examples of municipalities from around the world and from Türkiye. These selected municipalities have been included in the study

because they are good examples of solid waste and management practices in the world.

The sustainable solid waste management practice of the Groningen Municipality in the Netherlands, known as "Smart and Connected Garbage Bins," has reduced the municipality's carbon footprint by one-fifth. Significant steps have been taken in waste collection in the Netherlands through a collaboration between Vodafone and the entrepreneurial firm Mic-O-Data. The initiative enabled local governments in the Netherlands to reduce their CO_2 emissions by almost one-fifth while improving the services they provide and reducing waste collection costs. In collaboration with Vodafone, waste management company Mic-O-Data has introduced 6,000 connected garbage bins in apartment complexes nationwide to promote recycling. Equipped with a Vodafone M2M SIM that sends daily status signals to waste collectors and alerts them when bins are full or not properly closed, these bins help waste collectors adjust their schedules for emptying full bins or leaving empty ones, thus preventing unnecessary trips. As a direct result, waste collectors now make fewer trips and use less fuel. In some cases, it has been observed that municipalities require fewer garbage trucks. The bins can only be opened using an identification card. The initiative has also facilitated the establishment of a more accountable and transparent system towards the public, allowing local authorities to track who is using the facilities and bill accordingly, while also encouraging the increased use of recycling facilities (IoT Business, 2024).

Brazil (Belo Horizonte) has established the "Integrated Solid Waste Management System." Belo Horizonte, Brazil's third-largest city, realized in the 1990s that it was struggling to manage increasing waste levels, particularly given rapid population growth. It sought to address this issue by improving recycling, creating sustainable waste disposal areas, and partnering with an unusual workforce group (local waste pickers' cooperatives). In 1993, Belo Horizonte introduced the “Integrated Solid Waste Management” (ISWM) model, a selective approach to waste collection and processing. ISWM aims to improve waste collection and management and increase recycling rates. By 2012, 93% of total waste in Belo Horizonte was disposed of in controlled landfill sites or environmentally sensitive waste disposal areas. The vast majority of the population (95%) benefited from the city's household waste collection services. Additionally, through various cooperatives with individual contracts with the city, approximately 600 people were formally employed in the waste management sector. The working conditions of waste pickers have improved significantly, and it has been reported that they earn a profit from the minimum wage of $321 per month (Centre for Public Impact A BCG Foundation, 2024).

In Houston, Texas, USA, the project "Reuse of Construction and Building Materials" has been implemented. According to this project, construction and building materials, including doors, electrical fixtures and equipment, lighting, lumber, metal, plumbing fixtures, plywood, sinks, and showers, account for 38% of the waste stream in the Houston area. The Building Materials Reuse Warehouse, implemented with a grant from the Houston-Galveston Area Council and the Houston Solid Waste Management Department, provides space for excess construction materials that would otherwise be disposed of in local landfills, benefiting the community. The warehouse accepts materials from individuals, supply companies, and contractors and offers these materials for reuse by any nonprofit organization free of charge. The concept behind this project is simple: the more materials they receive, the more space the warehouse has to accept additional materials. Additionally, the warehouse has built a workshop and meeting space and constructed a community center to further promote the concepts of "reuse" and "resource sharing". The Houston Solid Waste Management Department's Building Materials Reuse Warehouse is part of a network of Houston-based community organizations working to keep reusable building materials out of landfills and into the hands of those who can use them. While the Reuse Warehouse focuses on providing materials to nonprofit organizations, many other local organizations make materials available to individuals. As of 2015, the project has diverted 3,000 tons of material from landfills and distributed 90% of it. In addition to helping reduce waste, the project brings the Houston community together and allows businesses and individuals donating materials to clear storage space (C40 Cities, 2024).

In the UK (London), the FoodSave program, implemented by the Mayor of London in 2016, works with small and medium-sized food businesses (SMEs) across the capital to reduce food waste. The program offers free support to help businesses prevent waste and redistribute surplus food to people in need and farm animals. In cases where waste is unavoidable, FoodSave ensures that food is recycled. The project is based on the principles of the London Food Waste Hierarchy. Funding for the project is provided by the Mayor of London, the European Regional Development Fund, and the London Waste and Recycling Board. FoodSave has been largely successful in helping businesses reduce food waste. Since 2013, 97 businesses have supported the program and have made progress toward the following goals together: diverting 964 tons of food waste from landfills annually, preventing 83 tons of food waste annually, and achieving annual cost savings of £366,000. Considering that there are over 800,000 SMEs in London, supporting this group will have a significant impact. However, these businesses are among the most challenging to engage with. Nevertheless,

significant feedback has been received so far, with The Imperial Arms business attributing savings of over three tons of food and £10,000 annually to the program, with plate waste reduced by 54% (Home, 2024).

Milan, Italy, has developed an integrated waste collection plan since 2012, aiming to recycle the highest possible amount of material, including organic waste. Thanks to the food waste collection program for households citywide, Milan ranks very high among European metropolises in terms of separation and collection rates. The city initiated the food waste collection program for households and the transparent bag program for recyclable materials in late 2012, completing its citywide rollout by mid-2014. The city works in coordination with the municipal waste company and citizens and collaborates with building managers to increase awareness of program details. Additionally, the plan allows for efficiency tracking and field optimization measurements. Through the integrated waste collection program, Milan has managed to reduce residual waste from 450,000 tons in 2011 to 316,000 tons in 2015, achieving a recycling rate of 52.7% for municipal solid waste collected in 2015, including 136,000 tons of organic waste (compared to 40,000 tons in 2012). This has enabled the city to meet the EU target of reusing or recycling at least 50% of municipal solid waste by 2020 (C40 Cities, 2024).

3.2. Examples from Türkiye

Istanbul is the province with the highest amount of solid waste in Türkiye. Additionally, it takes a leading role among other provinces in ensuring the recycling and reintroduction of solid waste into sectors. Municipalities in Istanbul have developed various projects to solve the solid waste problem arising from the city being a major metropolis. One of these projects is the "Smart Mobile Waste Transfer Stations Project" implemented by the Istanbul Metropolitan Municipality, aiming to recycle plastic and metal bottles. These stations are placed at metro stops, various educational institutions, and public organizations in Istanbul. The stations are produced and supervised by municipal subsidiaries. Additionally, various statistical and mechanical reactions are measured and recorded through these stations. Apart from this project, the Istanbul Metropolitan Municipality has launched two different game projects called "Waste Sorter" and "Waste Hunter" to instill environmental awareness, waste disposal, and recycling in children. These projects can be downloaded for free on phones and tablets, allowing children to learn about and separate glass, paper, plastic, and metal materials for recycling (İstanbul Metropolitan Municipality, Department of Environmental Protection and Control, 2024).

The "Electricity Generation from Waste and Solid Waste Recycling Facility Project" of Eskisehir Metropolitan Municipality started its operation in

2018. This facility utilizes modern technology products and converts methane gas obtained from the remaining part of the waste after solid waste separation into electricity. Another project, the "Integrated Solid Waste Recycling and Energy Production Facilities Project", which started its operation in 2017, is another project. With this project, Eskisehir Metropolitan Municipality sustainably obtains energy equivalent to the electricity consumption of 95 thousand households from the city's municipal waste. Moreover, this facility has provided employment opportunities for thousands of people. Additionally, the heat generated during this process allows the municipality to grow thousands of plants in the greenhouses located in the facility (Eskişehir Metropolitan Municipality, 2024).

With the implementation of the "Long Nose Solid Waste Disposal Facility and Landfill Project" by Manisa Metropolitan Municipality in 2017, it became possible to significantly reduce serious problems such as continuous explosions in garbage areas and subsequent serious air pollution, as well as the waste problem. Since the implementation of the project until today, around 2.5 million tons of solid waste have been processed and recycled, contributing to the economy. When the project was first implemented, its capacity was 650 tons per day, but with the use of new technologies, its capacity has been renewed to process over 2,000 tons of household waste per day. Additionally, a wastewater treatment plant has been built within this facility. Thanks to these projects, Manisa Metropolitan Municipality is recognized as an environmentally friendly city on the national agenda, making significant progress in waste separation, disposal, and economic contribution (Manisa Metropolitan Municipality, 2024).

Van Metropolitan Municipality implemented the "Integrated Solid Waste Facility Project" in 2018, with a cost of 200 million, significantly addressing the city's waste problem. Additionally, with this facility, electricity is generated from waste, meeting the electricity needs of 35 thousand households. This facility, prepared in accordance with EU standards, also provides income by professionally separating solid waste, contributing to the economy (Van Metropolitan Municipality, 2024).

4. PERCEPTION OF SOLID WASTE MANAGEMENT IN THE PLANS, PROJECTS, AND REPORTS OF KAHRAMANMARAŞ METROPOLITAN MUNICIPALITY

In recent years, solid waste and its management problem, which has become a serious environmental issue in Türkiye, is generally being tackled under the leadership of local governments, especially municipalities. The duty of providing the public with a healthy, clean, and high-quality environment within

the scope of municipalities' direct environmental services has directed municipalities to undertake serious efforts in this area. As mentioned above, there are municipalities in Türkiye that have implemented exemplary projects in solid waste management.

Within the scope of the aim of this study, the approach of Kahramanmaraş Metropolitan Municipality towards solid waste management has been examined through various plans, projects, and reports. However, first, the current position of Kahramanmaraş in terms of solid waste is provided.

Kahramanmaraş is a province whose economy is based on agriculture and animal husbandry. However, like many other provinces in Türkiye, it entered a rapid industrialization process since the 1980s. In this context, many sectors such as textiles, copper processing, cotton processing (ginning), steel kitchenware, construction, feed, packaging, food, paper, and machinery manufacturing, as well as heating and cooling systems, have become leading sectors in the province's industrialization. Looking at the facilities in the province, textile, metal industry, and food facilities stand out (Zıba, Gökpur & Dolaz, 2019, p. 347). When looking at the population of the province (Durgun & Taş, 2022), according to the 2023 population statistics of the Turkish Statistical Institute (TÜİK), it is stated to be 1 million 166 thousand. Additionally, the province is affected by intensive refugee migration, and according to TÜİK's 2023 data, the total number of registered refugees within the province is 90,575, and the proportion of this number to the population of the province is 7.18%. Looking at the data, it can be seen that the population of the province is at a significant level. The growing industry and increasing population in Kahramanmaraş naturally lead to an increase in solid waste over time. As a result, urgent intervention is required in the existing services and management systems of the metropolitan municipality. In this regard, significant steps have been taken across the province regarding solid waste management.

When looking at the organization structure of the metropolitan municipality in terms of solid waste management before examining its relevant documents, it is observed that there is a Waste Management Branch Directorate under the Directorate of Environmental Protection and Control. This information has been shared on the municipality's website, and a telephone number has been provided for citizens' requests and complaints regarding waste. Thus, it is aimed to increase public awareness regarding the recycling of waste into the economy.

In the “Kahramanmaraş Province 2021 Environmental Status Report” prepared for Kahramanmaraş province in 2022, solid wastes were classified, and their average quantities were specified. Below are the solid waste amounts for Kahramanmaraş both in terms of quantity and type (Kahramanmaraş Province

2021 Environmental Status Report, 2024):

- Municipal solid waste: 652.49 tons per day
- Excavation soil, construction, and demolition waste: 452,490 m3 per year
- Packaging waste: 501,656,486 units
- Hazardous waste: 5,652,825 kg
- Waste oils: 272,438 kg
- Waste batteries and accumulators: 21,081 kg
- Vegetable waste oils: 15,569 kg
- End-of-life tires: 9,190 tons per year
- Waste electrical and electronic equipment: 293 tons
- End-of-life scrap vehicles: (not specified)
- Non-hazardous waste: 3,449,644 tons per year
- Medical waste: 1,479,812 tons per year

Due to the earthquakes that occurred on February 6, the amounts of solid waste mentioned above have significantly increased. This situation can be seen in detail in the table below (Doğdu & Alkan, 2023, p. 45):

Table 1: Solid Waste Indicators of Kahramanmaraş Province

	Approximate Mass Waste Amount (tons)	**Hazardous Materials (tons)**	**Soil and Stone Mixture (tons)**	**Bituminous Mixtures and Wood Waste (tons)**	**Mineral Fraction Waste (tons)**	**Reinforced Concrete Waste Amount (tons)**	**Scrap Iron Waste Amount (tons)**
Kahramanmaraş	18.573.962,00	278.609,43	3.120.425,62	4.160.567,49	10.958.637,58	7.429.584,80	179.343,00

Reference: Doğdu & Alkan, 2023, p. 45

Looking at the solid waste quantities in Kahramanmaraş from 2012 to 2022 as presented in the regularly published Kahramanmaraş Environmental Status Reports, it is observed that the solid waste amounts mentioned above have been increasing steadily every year parallel to industrialization and population growth[2]. This situation has led Kahramanmaraş Metropolitan Municipality to take measures to reduce solid waste and to try to solve the waste problem. In this

[2] Additionally, the solid waste amounts mentioned above have significantly increased as a result of the earthquakes that occurred on February 6th.

regard, various facilities have been established, and efforts have been made to address the waste issue. One of these facilities is the "Solid Waste Disposal Facility" (Kahramanmaraş Province 2021 Environmental Status Report, 2024).

The Kürtül Solid Waste Integrated Facility, located in Kürtül, implemented by Kahramanmaraş Metropolitan Municipality, was put into operation in 2013 under the climate change action plan. The facility constitutes a significant step in solving the solid waste problem in the province. Through this facility, 4.8 megawatts of energy is generated from 600 tons of waste collected daily in the city, meeting the electricity needs of 15 thousand households. This step indicates the presence of renewable and sustainable energy applications in the province, as well as the consideration of solid waste issues and management. The daily collected 600 tons of waste are separated for recycling, and the unsorted waste is stored in accordance with environmental health and safety regulations. Following the "National Climate Change Strategy and Action Plan", which is an important document implemented nationwide, the existing solid waste integrated facility in Kahramanmaraş province aims to reduce carbon footprint. With the electricity generated by the Kürtül Solid Waste Integrated Facility, the need for fossil fuels decreases. Additionally, economic savings are achieved since the material used for electricity production is waste. Furthermore, environmental problems are mitigated, and environmentally friendly practices are implemented. (Kahramanmaraş Metropolitan Municipality, 2024a; Governorship of Kahramanmaraş Provincial Directorate of Environment, Urbanisation and Climate Change, 2024). Additionally, this facility has taken significant steps in addressing the increased solid waste problem in the city resulting from the February 6th earthquakes. The substantial amount of waste generated in the city has been sorted at this facility for recycling and continues to be sorted.

Kahramanmaraş Metropolitan Municipality processes the domestic waste collected from seven districts throughout the year by recycling it at Solid Waste Disposal Facilities. Domestic waste collected from the districts of Onikişubat, Dulkadiroğlu, Türkoğlu, Pazarcık, Çağlayancerit, Andırın, and Göksun is recycled and disposed of properly. In contrast, domestic waste collected from the districts of Elbistan, Afşin, Ekinözü, and Nurhak is gathered in uncontrolled disposal sites within their own boundaries. The Environmental Protection and Control Department is the responsible unit for this process. Additionally, collected waste is transported to disposal facilities by municipal vehicles, where it is separated for recycling and then disposed of. The domestic waste from the other four districts—Elbistan, Afşin, Ekinözü, and Nurhak—is collected in uncontrolled disposal areas within their own boundaries (Kahramanmaraş Metropolitan Municipality, 2024b).

Moreover, a project titled “Kahramanmaraş Northern Districts Integrated Solid Waste Facility” is currently in the tender stage with the support of grants and credit funds provided by the EU. Within the scope of the project, actions have been taken in compliance with EU environmental regulations and national regulations to minimize the harmful effects arising from the processing and disposal of solid waste to protect and improve the environment and not to jeopardize public health. Under this project, waste in the districts of Göksun, Elbistan, Nurhak, Ekinözü, and Afşin will first be collected sustainably and then recycled. Additionally, within the project scope, a leachate treatment plant will be established in Afşin, the In-Situ Rehabilitation of Elbistan and Afşin Irregular Landfill Areas will be conducted, and finally, the relocation of Nurhak and Ekinözü Irregular Landfill Areas to Afşin will be carried out. This comprehensive project is expected to significantly reduce the waste problem in the northern districts of Kahramanmaraş Province, especially aiming to reduce the waste problem originating from the Elbistan - Afşin thermal power plants (İLBANK, 2024; Kahramanmaraş Metropolitan Municipality, 2024c).

The Strategic Plan of Kahramanmaraş Metropolitan Municipality covering the years 2020-2024 has been thoroughly examined in terms of solid waste and its management. The plan outlines the municipality's goals to ensure control over solid and liquid waste, provide environmental awareness training related to waste, collaborate with sister cities on waste management, ad plan accordingly in this regard, as well as activate the zero waste project (Kahramanmaraş Metropolitan Municipality, 2024d). Additionally, the most important step in solid waste management within the strategic plan is to expedite the construction of the Elbistan Solid Waste Disposal Facility and complete it by the end of 2024, in line with the goals outlined in the plan. It has been stated that this facility, which is planned to be completed by the end of this year, is essential for Kahramanmaraş, particularly in addressing the waste problem caused by the February 6th earthquake. It is believed that this facility will help reduce the solid waste problem that has increased in the city following the earthquake.

The Activity Report of Kahramanmaraş Metropolitan Municipality for the year 2022 shows that it is consistent with the municipality's Strategic Plan in terms of solid waste and its management. In addition to the Strategic Plan, it is stated that all types of waste should be removed from being considered as garbage and their recycling should be ensured, with efforts being made to reintroduce them into various sectors as raw materials. As a result, it is emphasized that waste will contribute economically to the city (2020-2024 Kahramanmaraş Metropolitan Municipality Strategic Plan, 2024e).

Kahramanmaraş Metropolitan Municipality organizes various trainings,

seminars, and workshops on solid waste, zero waste, and related topics, primarily for students and citizens, as part of its social municipal services. These activities are also announced on their website. The Waste Management Branch Directorate provides information on several critical issues through its activities, including waste prevention, efficient resource use, preventing waste generation, the impact of climate change on the environment and daily life, and water conservation (Kahramanmaraş Metropolitan Municipality, 2024f).

5. CONCLUSION AND EVALUATION

Kahramanmaraş entered a rapid industrialization process in the 1980s, like many other cities in Türkiye, and made significant progress in industries such as textiles. Subsequently, this process accelerated urbanization and led to population growth in the province. Additionally, Kahramanmaraş hosts a significant population of refugees. With all these factors, the expectations for municipal services have changed since Kahramanmaraş became a metropolitan city in 2012. Providing a healthy environment, clean, and quality surroundings have become a priority because these changes in the province have created a serious solid waste management problem. Especially after the earthquakes on February 6 in Kahramanmaraş, the solid waste generated from the debris further exacerbated this problem. In this disaster centered in Kahramanmaraş, approximately 8 thousand buildings throughout the province became unusable, which of course created a serious pile of debris in the city. As a result, it has further increased the existing solid waste problem in the city.

The approach of Kahramanmaraş Metropolitan Municipality to solid waste issues, its management, and sustainability is significant compared to other examples globally. This can be seen in the municipality's relevant plans, reports, and projects. However, when we look at the world cities taken as examples, it is seen that these countries have seriously implemented smart city applications regarding solid waste and management. At this point, it can be said that the work carried out by Kahramanmaraş Metropolitan Municipality is inadequate.

Among the municipality's priority goals in its strategic plan and activity report is the resolution of solid waste issues. It is stated that these goals will be urgently implemented within the processes covered by this plan and report. This is because, as indicated in the Kahramanmaraş Province 2021 Environmental Status Report, there is a serious increase in solid waste quantities every day.

The most important step taken by Kahramanmaraş Metropolitan Municipality to solve the solid waste problem was the implementation of the Kürtül Solid Waste Integrated Facility in 2013. This facility's ability to process 600 tons of urban waste daily, generate electricity, and meet the electricity needs

of 15,000 households is a significant development for the province. Additionally, its ability to perform all these processes without harming the environment, in harmony with the environment, and ultimately contributing to the province's economy is important. Moreover, with this facility, Kahramanmaraş Metropolitan Municipality can be considered among the exemplary provinces in Türkiye. Furthermore, the municipality's Kahramanmaraş Northern Districts Integrated Solid Waste Facility project has reached its final stages and is planned to be implemented. With this facility covering districts like Göksun, Elbistan, Nurhak, Ekinözü, sustainable waste collection and recycling will take place. This project is also an important step to prevent the significant damage caused by the waste generated from the Afşin-Elbistan Thermal Power Plants. Additionally, this new project demonstrates the metropolitan municipality's commitment to a sustainable approach to the solid waste issue. Similarly, these facilities have somewhat mitigated the serious solid waste problem that arose after the earthquake. The debris piles and various types of solid waste have been sorted at these facilities and continue to be sorted for recycling.

Finally, it can be suggested that Kahramanmaraş Metropolitan Municipality should take advantage of the benefits of Smart City applications, one of the modern world's advancements, in addressing the solid waste problem. Likewise, the study is expected to inspire research on this topic and method in different cities.

6. CONFLICT OF INTEREST STATEMENT

There is no conflict of interest between the authors.

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8. AUTHOR CONTRIBUTIONS

YA: Idea, Design, Supervision, Collecting and processing resources, Analysis and interpretation, Literature review, Writer, Critical Review

9. ETHICS COMMITTEE STATEMENT AND INTELLECTUAL PROPERTY COPYRIGHTS

Ethics committee principles were complied with in the study and necessary permissions were obtained in accordance with the principles of intellectual property and copyrights.

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