SMARTEnvi PROJECT

SMART DECISION TOOLS FOR REDUCING HAZARDS TO OUR ENVIRONMENT AND WATER RESOURCES BY REHABILITATING OPEN DUMPS

NATIONAL REPORT TURKEY

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1. Introduction

Although Solid Waste Management (SWM) deals with all processes starting from occurring of solid waste up to its disposal, Integrated Solid Waste Management (ISWM) is a more comprehensive concept that contains a lot of components, such as public health, economic indicators and aesthetics concerns. The quantity and types of solid waste in Turkey have increased depending on population growth, rapid urbanization and industrialization, and increase in welfare in the last decades. Due to its location, Turkey has been both a bridge between Asia and Europa and the center of ancient civilizations. This geopolitical situation has caused rapid urbanization and increased waste generation.

Municipalities are the main responsible institutions for solid waste management in Turkey. Collection, transportation and transfer, recycling and disposal of municipal solid waste are fields of business activity of municipalities. While collection, transportation and recycling of solid waste are tasks of local municipalities within a metropolitan city boundary, metropolitan municipality implements solid waste removal actions such as landfilling, composting and/or incineration.

European Union (EU) membership process of Turkey has been prolonged for a long time. EU integration regulations related to environmental concerns have been enacted similar to other integration areas. In this context, regulations that include solid waste management were composed according to EU waste directives. The Turkish National Waste Action Plan for 2023 was prepared by the Ministry of Environment, Urbanization and Climate Change in this regard. The medium and long-term goals of this plan include to increase recovery and recycling rate mechanically, biologically and thermally, to decrease usage of the landfill method for removal of municipal solid waste from 89 % at 2014 to 65 % at 2023, to generalize the use of construction and demolition waste management strategies in the whole country, to increase the efficiency of special/hazardous waste recycling rate and to make an investment on supplementary environmental protection plants.

In spite of population growth, rapid urbanization and industrialization, waste generation per capita must be decreased to install waste management strategies. For this purpose, the Department of Zero Waste and Waste Treatment was established within the Ministry of Environment, Urbanization and Climate Change. In addition, charging the waste produced is seen as another option. Furthermore, through transition to “polluter pays principle”, which is

implemented in USA, municipality solid waste management is believed both to decrease solid waste generation rate and to supply income source using waste treatment and disposal.

2. Solid Waste Management in Turkey

The need for proper management of solid waste in Turkey has been a topic that came to the fore after the explosion in the Ümraniye landfill in 1993. In a neighborhood close to the explosion site, many houses collapsed, causing injury and death of many persons. After this disastrous event, the wastes were collected by the municipalities in a controlled manner, recorded in terms of quantity and quality, and disposed by using appropriate disposal methods. While the collection, transportation and disposal of wastes are carried out by the municipalities, their planning and control is carried out by the Ministry of Environment, Urbanization and Climate Change.

In order to protect and develop natural resources and ecosystems, and to create a healthy and livable environment for current and future generations; the Ministry of Environment, Urbanization and Climate Change is responsible for developing strategy and legislation, minimizing waste at source, classifying, collecting, transporting, temporary storage, recycling, disposal, reuse, processing, conversion into energy and final storage, in line with international norms and national priorities, within the framework of the principle of sustainability. National Waste Management and Action Plan (NWMAP), covering the years 2016-2023, has been prepared within the framework of responsibility for determining strategy. The prepared "National Waste Management and Action Plan" covers the current situation of waste management in our country, the issues that need to be improved or developed in the management system, the population and waste projections, the contributions of the stakeholders involved in waste management, the periodic waste management activities planned to be carried out until 2023, the investments in waste management. and financing needs.

The Zero Waste Project, which is the vision project of the ministry, was initiated in order to control our waste within the framework of sustainable development principles and to leave a clean and developed Turkey and a livable world to future generations. As of 2018, the Zero Waste Project will be implemented gradually in public institutions/organizations, airports, ports, marinas, bus stations, train stations, educational institutions, shopping centers, hospitals, recreational facilities and large workplaces, starting from Ankara, and by 2023 it is aimed to spread all over the country.

2.1 Solid Waste Generation in Turkey

As in the world, an increase is observed in the amount of solid waste produced in Turkey and accordingly the change in consumption habits as a result of population growth, and industrialization. It is known that while 23,448 thousand tons of urban solid waste was produced in 1994, the first year of waste counting in our country, 32,209 thousand tons of urban solid waste was produced in 2018 (TURKSTAT, 2021). Figure 2.1 gives the amount of municipal solid waste and waste per capita between 1994 and 2018. Looking at this figure, it is seen that the amount of waste generated per person per day varies between 1.08 and 1.51 kg person/day. In 2018, this value was determined as 1.16 kg person/day. In addition, according to EUROSTAT 2021 data; In terms of the annual amount of municipal waste generated per capita, while the average of EU-28 countries is 502 kg, it is 424 kg in our country (EUROSTAT, 2021).

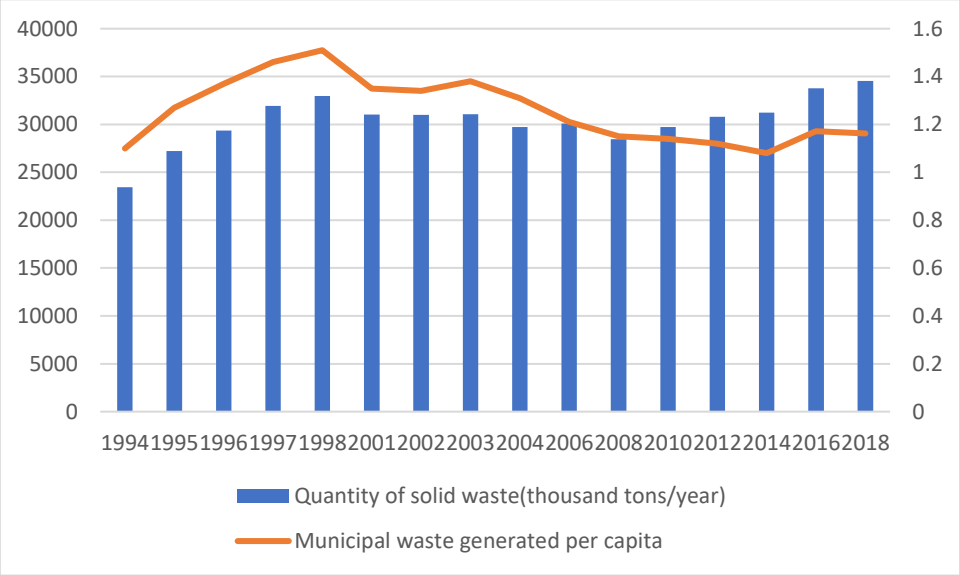

Figure 2.1. The amount of municipal solid waste and waste per capita between 1994 and 2018 (TURKSTAT, 2021)

Waste characterization studies are carried out in certain periods every year for the wastes coming to the landfills in Turkey. Table 2.1 shows the waste characterization information for Turkey between 2003 and 2012. It is seen that the waste type with the largest share consists of food wastes at the level of 30%. This is followed by paper wastes with 20%, other inorganics with 12% and plastics with 9%.

Table 2.1. Types and amounts of solid waste in Turkey

Composition	2003	2004	2006	2008	2010	2012
Food	34.4	33.7	32.4	31.2	30.0	28.7
Paper/cardboard	19.3	19.6	20.1	20.6	21.1	21.6
Textiles	3.2	3.2	3.3	3.3	3.4	3.4
Rubber, leather, bones, straw	2.1	2.1	2.2	2.2	2.3	2.3
Wood	1.6	1.6	1.6	1.6	1.6	1.6
Garden waste	0.8	0.8	0.8	0.8	0.8	0.8
Other organics	2.4	2.4	2.4	2.5	2.5	2.5
Plastics	9.2	9.3	9.5	9.7	9.8	10.0
Construction/demolition	8.8	9.0	9.3	9.5	9.8	10.2
Glass/ceramics	3.3	3.3	3.4	3.4	3.4	3.5
Metals	2.8	2.8	2.8	2.8	2.9	2.9
Other inorganic	12.3	12.3	12.4	12.4	12.4	12.5
Total	100	100	100	100	100	100

2.2. Solid Waste Collection and Transportation

The most important percentage of the cost of the solid waste management system is the collection of waste. The success of an integrated solid waste management system is directly proportional to the success of the collection system. Because reaching the target of the solid waste management system depends on the regular, continuous and timely collection of wastes from their sources.

EU directives and National directives direct to separate accumulation and collection at source in order to expand the recovery, make it efficient and reduce the input of organic matter to the landfills. In this case, the importance of aggregation increases even more.

In our country, the solid waste collection system is almost the same in many cities, especially in metropolitan cities. The collection and transportation of urban solid waste is either done by the municipalities or provided by private companies that the municipalities have agreed upon. Solid waste collection is usually done in 15-tons trucks. The number and times of collection are determined according to the density of the area of garbage collection. In cases where the landfill is far from the city, transfer stations are established.

2.3 Recycling and Recovery

The Zero Waste Project was started to be implemented by the Ministry of Environment, Urbanization and Climate Change in 2018. With this project, it is planned to reduce the amount of waste in Turkey, to collect the recyclable wastes separately at the source and to recycle them at certain rates. Within the scope of this project, public institutions and organizations were determined as the target audience at the first stage. Later, it is planned to be implemented in airports, ports, marinas, bus stations, train stations, educational institutions, shopping centers, hospitals, recreational facilities and large workplaces. According to this project, wastes started to be collected separately according to their color as shown in Figure 2.2. Here, the main types of waste are yellow plastic waste, blue paper waste, green glass waste, gray metal waste, brown organic waste and black non-recyclable waste.

Figure 2.2. Container colors and waste types

The containers shown in Figure 2.3 are used in public institutions for the collection of these wastes. Recycling and disposal of wastes are carried out in most provinces through contracted licensed recycling companies. Municipalities, on the other hand, are obliged to collect or have recyclable wastes collected according to the regulation. In order to carry out these studies, packaging waste management plans are prepared and submitted to the Ministry in order to specify by whom, how, how and when the collection and transportation of packaging wastes will be carried out separately from other wastes at the source.

Figure 2.3. Zero Waste Project waste Containers

In order to continue recycling and recovery activities in Turkey, the Regulation on Control of Packaging Waste is used. According to the polluter pays principle in the Regulation on Packaging Waste Control; the responsibility of covering the collection costs of packaging wastes is given to the enterprises that put their products on the market as packaged, and it is of great importance to register these enterprises. The existence of this principle allows the amount of packaging waste produced and recycled in the country to be recorded. For this purpose, a packaging waste declaration system has been established. Figure 2.4 shows the amount of packaging released to the market and the amount of recycled packaging waste between 2010 and 2018. It is seen that the difference between the amount of packaging put on the market and the amount of packaging recovered in this way has widened in recent years. It is thought that this gap will close in the coming years through the zero-waste project.

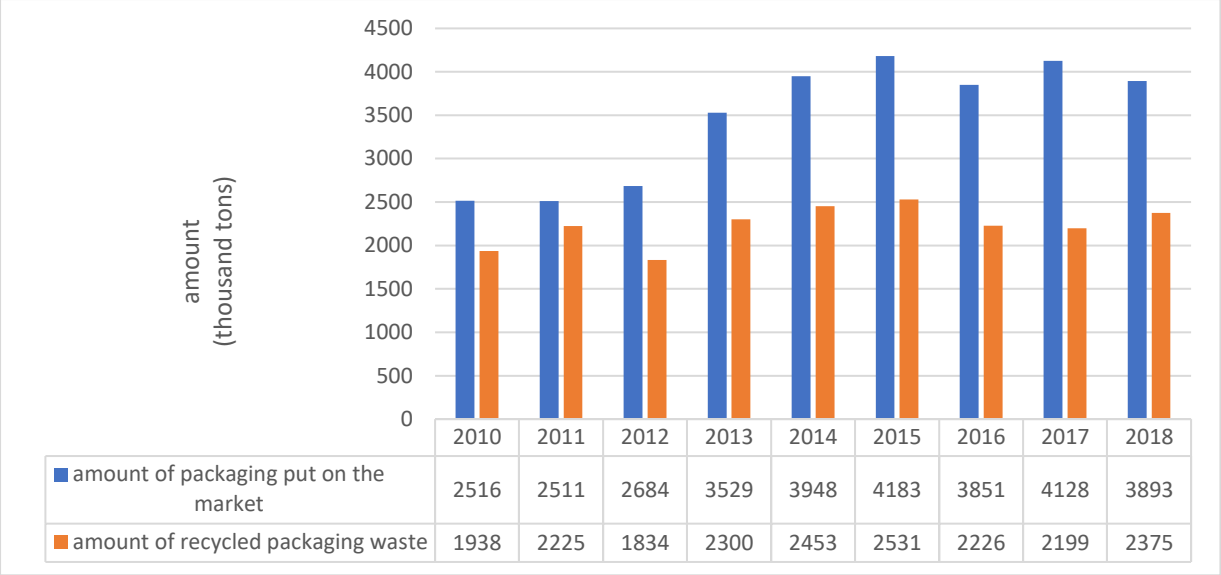

Figure 2.4. Amount of Packaging Released to the Market and Amount of Recycled Packaging Waste by Years According to the Packaging Waste Declaration System (Environmental Indicators)

In Table 2.2, packaging wastes released to the market in 2018 and their recycling rates are given. In this table, it is seen that the most produced and marketed waste is plastic waste. However, when we look at the recycling rates, it is seen that plastic waste with a recycling rate of 63% lags behind paper, cardboard, metal and composite wastes with recycling rates of 93%, 68% and 64%, respectively.

Table 2.2. Packaging wastes produced and put on the market in 2018

Waste code	*Type*	*Produced packaging (ton)*	*Packaging on the market (ton)*	*Recycled (ton)*	*Realized recycling rate (%)*
15.01.02	Plastic	4,099,951	943,567	590,923	63
15.01.04	Metal	179,438	130,981	89,488	68
15.01.05	Composite	102,636	96,773	62,110	64
15.01.01	Paper-cardboard	2,529,403	1,314,154	1,227,249	93
15.01.07	Glass	955,721	860,239	234,699	27
15.01.03	Wooden	1,070,084	547,681	171,048	31
	Total	8,937,232	3,893,396	2,375,518	61

2.4 Solid Waste Disposal Methods

The most common methods used in other countries for waste disposal in our country are landfill, wild storage and recycling/recovery methods. As can be seen in Figure 2.5, waste disposal is generally provided in landfills (TURKSTAT, 2021). This is followed by open wild

storage method and recycling/recovery activities. As of 2017, the recycling rate of municipal waste was 46% on average in EU-28 countries (EEA, 2021). According to the National Waste Management and Action Plan, this value is 13% in Turkey as of 2016 (NWMAP, 2016).

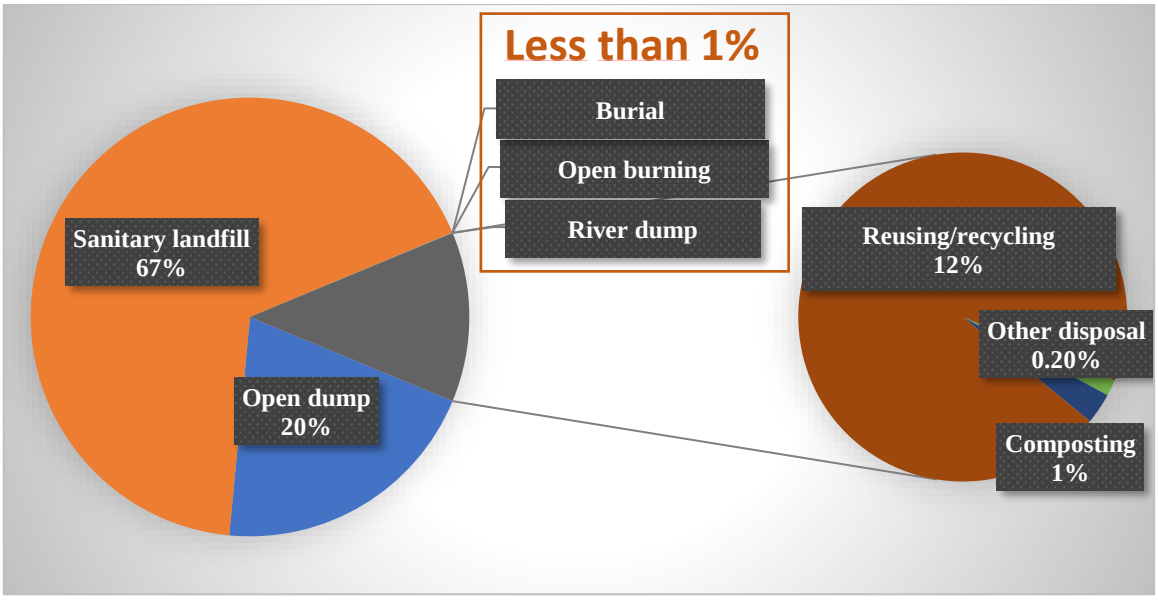

Figure 2.5. Solid waste disposal methods in Turkey, in 2018 (TURKSTAT, 2021)

The amount of waste generated in Turkey between 2004-2018 and the percentages of removal according to disposal methods are given in Table 2.3 (TURKSTAT, 2021). It is seen that there has been a transition from the wild storage method to the regular storage method over the years. It is thought that this method will be completely finished in the coming years with the rehabilitation of wild storage areas.

Table 2.3. Disposal/recovery methods and municipal waste amounts in percent by years (TURKSTAT, 2021),

	2004	2006	2008	2010	2012	2014	2016	2018
Open dump	65,63	59,10	52,04	43,52	37,81	35,47	28,80	20,24
Sanitary landfill	27,99	37,29	44,94	54,39	59,91	63,57	61,23	67,20
Open burning	0,41	0,98	0,98	0,53	0,41	0,01	0,03	0,02
River dump	0,62	0,28	0,20	0,17	0,13	0,06	0,00	0,00
Burial	1,70	0,57	0,41	0,13	0,36	0,02	0,02	0,01
Another disposal	2,25	0,77	0,30	0,48	0,78	0,41	0,13	0,20
Composting	1,40	1,01	1,13	0,77	0,60	0,45	0,46	0,38
Reusing/recycling	-	-	-	-	-	-	9,33	11,95
Total MSW (thousand tons)	25014	25280	24361	25,277	25845	28011	31584	32209

3. Situation and Rehabilitation of Open Dumps in Turkey

Open dumps and unsanitary landfills cause environmental degradation as they are susceptible to open burning and are exposed to scavengers and disease vectors. Open dumping is the oldest and most common way of disposing solid waste and still in use. But normally it is not a solid waste disposal method.

In Turkey, rehabilitation of open dumps consists of slope stability and embankment construction, leachate drainage system, surface water drainage system, gas drainage system and final cover. Before the rehabilitation process, the boundaries of the open dump are determined and the solid wastes that overflow the site are drawn into the area. In order to prevent rainwater from draining down, approximately 3% slope is given to the surface. Leachate drainage system includes, the construction of leachate collection pool, clay layer placement process and geomembrane laying and welding processes. The main function of drainage system is reducing the amount of surface water entering and/or flowing over the dumping site. If significant surface water enters the waste disposal area, the amount of leachate will increase significantly and thus exceed the facilities' collection, holding and treatment capacity. In order to avoid such situations, it is necessary to separate the surface water and prevent it from entering the waste disposal area. The aim of a gas evacuation plant is releasing the gases produced from the landfill layers as soon as possible before they cause environmental effects on the surrounding areas. Typically, a degassing plant for a semi-aerobic landfill system consists of horizontal and vertical/inclined degassing pipes. The final cover is a multi-layered system of various materials used to reduce the amount of rainwater that will enter the landfill when closed. Appropriate final coating systems also minimize surface water in the coating system, resist erosion by wind or current, control landfill gas transmission, and improve aesthetics.

According to Eurostat 2014 data, between 1995 and 2014, while the amount of waste disposed of by landfill decreased, the amount of waste disposed of by material recovery, compost and incineration increased. In Turkey, in 2014, 64% of municipal waste (excluding packaging waste) was disposed of by landfill, 6% by recycling, and the remaining 30% was left in the form of irregular dumping (Figure 3.1).

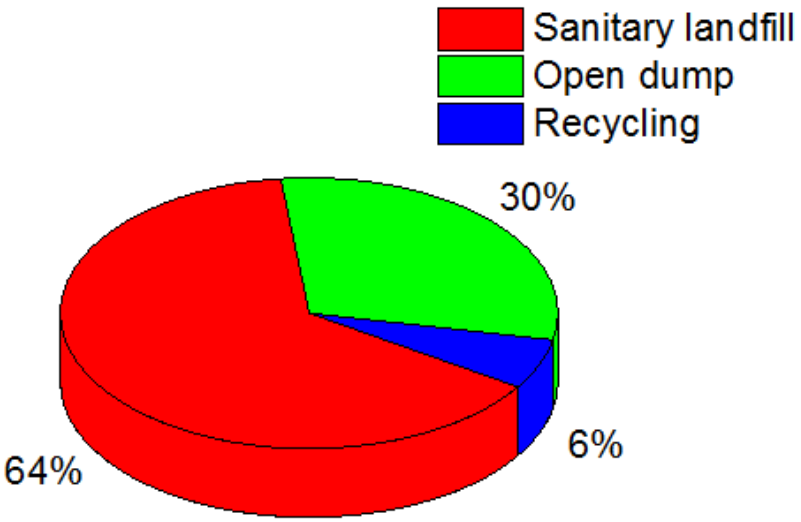

Figure 3.1 Solid waste disposal methods in Turkey

By year of 2014, the number of sanitary landfills was 79, and these facilities served a population of 47.4 million in 1073 municipalities. As of the end of 2015, the number of sanitary landfills increased to 81, and the number of populations served reached 48.9 million people in 1091 municipalities (National waste management and action plan 2023).

In 2016, the number of provinces that established and operates sanitary landfills reached to 59 and the number of sanitary landfill facilities reached to 82. There are over 800 irregular open dump sites in Turkey currently. Some of these fields have been rehabilitated and some still continue to be actively dumping. In addition, in the waste density map, recycling and disposal facility locations related to the management of municipal waste are shown in Figure 3.2 (National waste management and action plan 2023).

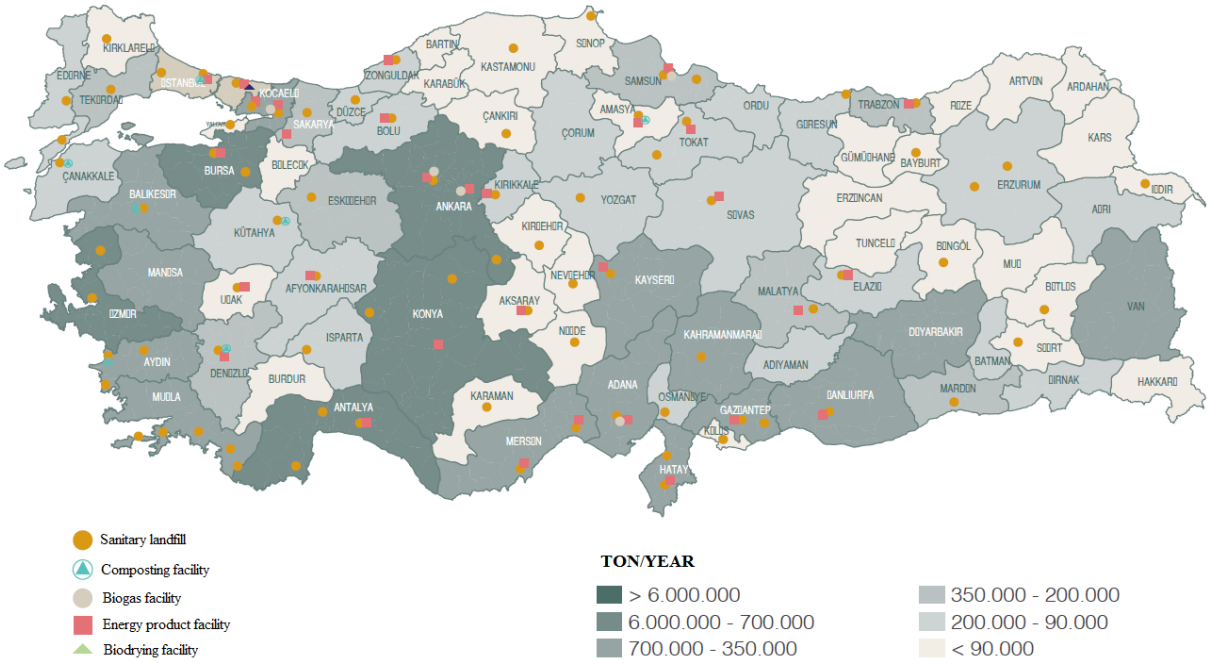

Figure 3.2 Waste Density Map and municipal waste recovery and disposal facilities

The amount of waste generated in Turkey between 2004 and 2018 and the percentages of removal according to disposal methods are given in Table 3.1 (TUIK, 2021). It is seen that there has been a transition from the open dumps to the sanitary landfill method over the years. It is considered that this method will be completely finished in the next years with the rehabilitation of open dumps.

Table 3.1. Disposal/recovery methods and municipal waste amounts in percent by years

Waste disposal and recovery methods	2004		2006		2008		2010		2012		2014		2016		2018	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
Amount of municipal waste collected	**25 014**	**100,0**	**25 280**	**100,0**	**24 361**	**100,0**	**25 277**	**100,0**	**25 845**	**100,0**	**28 011**	**100,0**	**31 584**	**100,0**	**32 209**	**100,0**
Waste delivered to municipality's dumping site	16 416	65,6	14 941	59,1	12 678	52,0	11 001	43,5	9 771	37,8	9 936	35,5	9 095	28,8	6 521	20,2
Waste delivered to controlled landfill sites	7 002	28,0	9 428	37,3	10 947	44,9	13 747	54,4	15 484	59,9	17 807	63,6	19 338	61,2	21 644	67,2
Burning in an open area	102	0,4	247	1,0	239	1,0	134	0,5	105	0,4	4	0,01	10	0,032	6	0,019
Lake and river disposal	155	0,6	70	0,3	48	0,2	44	0,2	33	0,1	16	0,06	0,5	0,002	0,5	0,002
Burial	426	1,7	144	0,6	100	0,4	34	0,1	94	0,4	7	0,02	7	0,021	2	0,006
Other disposal methods	563	2,3	195	0,8	73	0,3	122	0,5	202	0,8	114	0,41	41	0,130	65	0,20
Waste delivered to composting plants	351	1,4	255	1,0	276	1,1	194	0,8	155	0,6	126	0,4	146	0,5	123	0,38
Waste delivered to other recovery facilities	-	-	-	-	-	-	-	-	-	-	-	-	2 946	9,3	3 848	11,9

Costs of solid waste disposal methods in Turkey are given in Table 3.2. As can be seen from this table, although the open dump method (unsanitary landfilling) is a method that should not be chosen, it is preferred because its cost is the cheapest.

Table 3.2. Costs of solid waste disposal methods in Turkey

Disposal Methods	Cost ($/ton)
Unsanitary Landfilling	1–3
Sanitary Landfilling	3–10
Composting	10–40
Incineration	30–80

Figure 3.3 and Figure 3.4 show some open dump rehabilitation examples in Denizli, Turkey. These areas were previously selected as garbage areas without the knowledge of the local government and then continued to be used as a cheap disposal method by the local government. However, today, the harms of open dumping method to the environment and human health have been determined and rehabilitation processes have been applied in these areas. In the rehabilitation process, first the boundaries were determined. Then the wastes were transported to remain within this area. The area has been shaped and compacted. After the impermeability was created with the clay layer, it was covered with soil.

Figure 3.3 Acıpayam open dump site before and after rehabilitation

Figure 3.4 Tavas open dump site before and after rehabilitation

4. Legislations and Directives about Solid Waste Management and Open Dumps

At the Brussels Summit dated 17 December 2004, it was decided to start negotiations with Turkey on 3 October 2005. As a result of this decision and in line with the report and recommendation of the European Commission on October 6, 2004, Turkey has the status of "Participant Country". In the environmental strategy document to be prepared in order to comply with the accession partnership, it was required to set out the short, medium and long-term targets and to implement the environmental acquis in this direction.

In our country, environmental management policies and legislation created by the Environmental Law No. 2872 are developed and implemented on an international scale by harmonizing them with the Turkey's conditions. Different types of waste; consisting of municipal waste, packaging waste, medical waste, hazardous waste, excavation soil, construction and demolition waste, waste batteries and accumulators, waste motor oils, waste industrial oils, vegetable waste oils, end-of-life tires, waste electrical and electronic equipment and end-of-life vehicles are governed by the legislation. All legal regulations, especially the Environmental Law, are implemented by taking into account the waste management hierarchy.

All policies and legislation prepared for waste management have been created by taking into account the European Union (EU) accession period. Waste management policies and legislation created by the Environmental Law numbered 2872 are developed and implemented on an international scale by harmonizing them with country conditions.

In EU, Directive 75/442/EEC constitutes the fundamental legal framework instrument on waste management at Community level. The main provisions of Directive 75/442/EEC as amended are in particular:

– definition of waste, crystallized further by the European Waste Catalogue (EWC) as consolidated by Commission Decision 2000/532/EC as amended, and other waste management terminology,

– the hierarchy of waste management principles: waste prevention, recovery, safe disposal,

– the principle of proximity and self-sufficiency applying to waste for final disposal and the establishment of an integrated network of disposal installations,

– the obligation on the part of Member States to establish waste management plans, which are essential to the realization of this policy,

– permits for establishments and undertakings carrying out disposal and recovery operations,

– inspections by competent authorities, and

– record keeping requirements.

In this context; all applications regarding the management of municipal waste, excavation soil, construction and demolition waste, medical waste, hazardous waste, packaging waste, waste batteries and accumulators, vegetable waste oils, end-of-life tires, waste electrical and electronic equipment, waste oils and end-of-life vehicles are relevant and continue to be relevant on the basis of regulations.

The waste management legislation has been prepared for the environmental and technical needs required by the waste management system in Turkey. The legislation of solid waste management in Turkey is given Table 4.1.

Table 4.1. The legislation about solid waste management in Turkey

Legislation	**Number, Date**
Environmental Law	(2872, 1983)
Metropolitan Municipality Law	(5216, 2004)
Municipal Law	(5393, 2005)
Waste Management Regulation	(2015)
Mining Waste Regulation	(2015)

Waste Electrical and Electronic Equipment Control Regulation	(2012)
Packaging Waste Control Regulation	(2005-2007-2011)
Regulation on Landfilling of Wastes	(2010)
Regulation on Incineration of Wastes	(2010)
Regulation on Control of Medical Wastes	(2017)
Regulation on Control of Excavated Soil, Construction and Demolition Wastes	(2004)
Regulation on Control of Waste Batteries and Accumulators	(2004)

The purpose of the Waste Management Regulation dated 02.04.2015 and numbered 29314 is;

(i) Ensuring the management of wastes from generation to disposal without harming the environment and human health,

(ii) Reducing the use of natural resources and ensuring waste management through ways such as reducing waste generation, reuse, recycling and recovery of wastes,

(iii) It is the determination of general procedures and principles regarding the production and market surveillance of products within the scope of this regulation, which have certain criteria, basic conditions and characteristics in terms of environment and human health.

Regulation on Landfilling of Wastes dated 26.03.2010 and numbered 27533; covers the technical principles regarding the sanitary landfills, the procedures and principles regarding the acceptance of wastes to the landfills and the regular storage of wastes, the measures to be taken, the inspections to be made and the responsibilities to be subject.

With the Regulation on the Control of Packaging Wastes dated 24.08.2011 and numbered 28035; it is aimed to determine the legal, administrative and technical principles for the prevention of packaging waste, the recycling/recovery, disposal, separate collection at the source, transportation and the establishment of relevant standards. According to the regulation, Authorized organizations and those who put them on the market that are not members of the authorized organizations are obliged to recycle 60% of their packaging waste (paper-cardboard, plastic, metal, glass) until 2020.

5. Target Groups

There are many different official and private sectors that work on solid waste management in Turkey. The main official service organizations are Ministry of Environment Urbanization and Climate Change Department of Waste Management, Metropolitan Municipalities, Local Municipalities and Turkish Statistical Institute that supply data about solid waste management. In addition, Chamber of Environmental Engineers, having legal personality, is a non-governmental organization that studies about solid waste management. Different project, structure and consulting companies also work in the field of solid waste management. Moreover, environmental engineering departments of universities educate in this field and implement research activities related to solid waste management.

The Turkish Ministry of Environment Urbanization and Climate Change prepares law and regulations related to solid waste management and regulates rules and legislations according to EU waste directives in the process of coordination with EU. The main responsible organizations specialized in solid waste management are municipalities. Municipalities are directly responsible for collection, transportation, recycling and disposal of solid waste. Besides, municipalities must rehabilitate no-longer-used open dump areas. A lot of environmental engineers affiliate with Chamber of Environmental Engineers and part of them study on solid waste. Finally, environmental engineers who work private sector can serve in solid waste management applications.

Decision-makers, technical personnel and inspectors of ministerial and provincial office:

The Turkish Ministry of Environment Urbanization and Climate Change, Department of Zero Waste takes decisions related to waste management for future in Turkey. The aforementioned ministry has already made a decision about closing and rehabilitation of open dumps' using before landfill instruction. Implementing this Project will be very useful to this organization which gives vital principal decisions. The Project is important in terms of both social awareness and of supply of technical support.

Provincial offices of Ministry of Environment Urbanization and Climate Change deliver periodic inspection involved in environmental problems. Open dumps create a very important environmental problem especially in towns. So, the inspectors working in the provincial government offices, who are generally environmental engineers, should have technical

knowledge about open dumps. Environmental engineers working in the Ministry of Environment Urbanization and Climate Change provincial government offices are directly part of the target group of the Project.

Decision-makers in Municipalities:

As it was mentioned before, municipalities are the main responsible establishments involved in solid waste. Municipalities manage the procedure starting from collection to disposal of solid waste. It is important for decision-makers at municipalities to have knowledge both in terms of environmental health and economy. Open dumps can be ignored in many places due to the fact that they are not used anymore. Whereas, negative effects of these areas to environment are very high as long as they are not rehabilitated. For this reason, decision-makers at municipalities should be informed about harmful effects and rehabilitation of the open dumps. So, one the main target group of the Project is consisting of managers and decision-makers at the municipality.

Technical personnel working at the municipality:

A large number of environmental engineers who are employed in government offices are working in municipalities. They study on treatment of water and wastewater, solid waste management, air pollution control, infrastructure and sewage systems. Departments of Environmental Safety and Control was constituted concerned in solid waste management within the body of the Metropolitan Municipalities in Turkey.

The most important target group in the project may be the aforementioned group. Especially Metropolitan Municipalities are responsible for rehabilitation of open dumps within the municipal adjacent area. All technical personnel (environmental, civil and topographic engineers, technicians etc.) working on solid waste management form the main target group of the Project. It is important that these personnel take technical information about the harmful effect and properties of open dumps and how to rehabilitate them practically through the internet using smart decision systems.

Technical personnel working in private sector:

Some of environmental engineers carry out consulting, project and treatment plant construction businesses in their own private companies. Environmental engineers collaborate with some of

the technical personnel such as civil and topographic engineers etc. to realize this kind of activities. In addition to projects and construction of water and wastewater treatment plants, and landfill and composting plants, the rehabilitation of open dumps is performed by technical staff working in private sector. For this reason, another target group of the project is technical personnel working in private sector.

Non-governmental organizations (CEE, CCE):

Hazardous effect of the open dumps, even if they are closed, should be known and measures should be taken. Raising awareness of the society related to environmental issues is the job of the non-governmental organizations like the Chamber of Environmental Engineers (CEE) and the Chamber of Civil Engineers (CCE). These professional chambers are able to act as a locomotive on their members and on public in terms of open dumps and successful dissemination of the Project depends on them. Moreover, a member of the chamber may be someone who is working on solid waste management at the same time.

Environmental Engineering Department Students:

Rehabilitation of open dumps is an alternative expertise subject for a graduate students attending Environmental Engineering Departments. Open dumps that need to be rehabilitated in Turkey and/or in other undeveloped countries are a new working area for any new-graduated engineer from an Environmental Engineering Department. From this point, Environmental Engineering Department students form another target group of the project.

It is important to make a good introduction and to explain the project outputs to the target groups in face-to-face or online modes in order for the SMARTEnvi project to be successful. Lectures, exams and video presentations determined according to the type of target groups can help to understand the project better.

6. Dissemination

Web site: All data and details about the implemented project are available on the project's website (https://smart-envi.gtu.edu.tr/). Developments related to the project will also be published on this website during the project. The final report and training modules will also be available on this web page when the project is finalized.

Potential project book: It is planned to prepare a book on open dumps during the project process. This book will contain general information on solid waste. The book will focus mainly on the damages, characteristics, rehabilitation methods and techniques of open dumps. In addition, case studies on the rehabilitation of open dumps will also be included in the book.

Journal papers: In order to promote the project, publications will be made in scientific journals and/or symposiums during and after the project. These publications will ensure the effective dissemination of project outputs to scientific circles.

Conferences and visiting: The project will be promoted by sharing the data, documents and training modules related to the project with the relevant non-governmental organizations such as Chamber of Environmental Engineers (CEE), Chamber of Civil Engineers (CCE), and environmental consulting companies. For this aim, some conferences will be carried out at relevant institutions. In addition, various municipalities will be visited in order to promote the project.

7. Conclusion

There have been important developments in solid waste management in the last ten years. Especially, legislations related to waste management have been regulated and additional new regulations have been prepared. Turkey as a candidate country for the European Union, has made its waste legislation compatible with legislations of 27 member states of the Union. Although there are some defects in the implementation of the legislation due to economic reasons, very important steps have been realized regarding to the landfilling of solid waste, the management of packaging wastes, the management of hazardous wastes and the disposal of medical wastes.

The amount and variety of waste is increasing due to population growth, changes in consumption habits and rapid urbanization in Turkey. Fortunately, in recent years, municipalities have rapidly builded landfills and established energy production facilities using the methane gas formed in these areas. Although organic wastes are not to be sent to landfills according to European Union Directives, Turkey cannot do this completely, yet, due to economic reasons. But, the number of composting and incineration plants established in our country is increasing day by day.

As mentioned above, while new landfills have been put into service, many open dumps have been closed. Some of the closed open dumps have been rehabilitated and some of them will be rehabilitated in the future. The ongoing SMARTEnvi Project will raise awareness for the decision makers in the target groups, and will facilitate access to information for the technical staff in terms of the rehabilitation of open dumps.

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