The importance of regional and local policies on municipal solid waste management in Europe - exemplified by six regions in Italy, Poland and Spain

Prepared by:
Christian Fischer, Emmanuel Gentil, Lukasz Koziel, Bryn Lindblad, Andrea Rispo, Marta Jofra Sora, Ignasi Puig Ventosa, Matteo Ferraris, Francesco Nicolli, Susanna Paleari and Roberto Zoboli
European Topic Centre on Sustainable Consumption and Production

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EEA project manager
Almut Reichel
Author affiliation

Christian Fischer, Copenhagen Resource Institute, http://www.cri.dk/

Context

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Disclaimer

This ETC/SCP working paper has been subject to European Environment Agency (EEA) member country review.

Please note that the contents of the working paper do not necessarily reflect the views of the EEA.
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This report presents the outcomes of analyses of six regional studies of municipal solid waste management in Campania and Lombardy in Italy, the Lodz region and Warmińsko-Mazurskie in Poland and Castilla-La Mancha in Spain. The study is undertaken by the European Topic Centre on Sustainable Consumption and Production (ETC/SCP) for and in collaboration with the European Environment Agency (EEA). The authors of the report are Christian Fischer, Emmanuel Gentil, Łukasz Koziel, Bryn Lindblad and Andrea Rispo from Copenhagen Resource Institute; Marta Jofra Sora and Ignasi Puig Ventosa from Environment and Management (ENT), Barcelona; Matteo Ferraris, Francesco Nicolli, Susanna Paleari and Roberto Zoboli from Institute for Economic Research on Firms and Growth (CERIS) and Almut Reichel from the EEA. Mia Farré Jensen and David McKinnon, Copenhagen Resource Institute, were responsible for the proofreading of this report.

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Executive summary

Improving municipal waste management is an important task at all governance levels – EU, national, regional and municipal – because waste is a resource if managed well, but an environmental burden and threat if managed improperly.

The EU has a comprehensive regulatory framework addressing waste and municipal waste (MSW). Several overarching EU strategies and policies on different aspects of waste have been developed over the last two to three decades. On national, regional and local levels, municipal waste management is often intensely debated.

This report explores the role of regional and local authorities in achieving good performance in MSW management. It seeks to assess the extent to which regional and local governments are merely implementing EU and national legislation, and to what extent they themselves act as drivers towards better MSW management. The report also seeks to uncover the key tools used in this process, and extract key lessons from regions that have a well-functioning waste management system.

Six regions have been selected for assessment for the period 2000 to 2013: The Italian regions Campania and Lombardy, the Polish regions Lodz and Warminsko-Mazurskie and the Spanish regions Castilla-La Mancha and Catalonia.

Key findings

All six regions have decreased the share of MSW that ends in landfill in the last ten years, although there is a large difference between the regions. During the last ten years the share decreased more than the EU-average for all six regions except Castilla-La Mancha. The decrease is especially large in Catalonia and Lombardy.

The EU Landfill Directive requires a reduction of the landfilled amount of biodegradable MSW of 75 %, 50 % and 35 % of the amount generated in 1995. In Italy and Spain the reduction targets have to be achieved by 2006, 2009 and 2016, respectively. Poland has a four year derogation period and the target years are 2010, 2013 and 2020. These targets apply to the national level.

Comprehensive initiatives have been taken in all six regions to fulfil the targets. However, the chosen strategies are different. Catalonia and Lombardy have focussed both on material recycling (glass, metal, paper & cardboard, plastics etc.) and bio-waste recycling, as well as moderate use of mechanical biological treatment (MBT). Lombardy has increased incineration to a high level, whereas Catalonia has a moderate use of this technology. Both regions developed their strategies 10 to 15 years ago. Castilla-La Mancha, the Lodz region and Warminsko-Mazurskie have all focused very much on MBT, no incineration and so far only limited separate collection of waste for material and bio-waste recycling. Campania has been in a ‘waste crisis’ during the analysed period and the European Commission initiated an infringement procedure against Italy in 2007 because of lack of implementation of certain policies in the region. At the beginning of the period Campania had focus only on MBT, where the output of this process was either landfilled or stored in bales due to a deficit of treatment capacity. Later in the period there was more focus on separate collection of waste including bio-waste but also on incineration.

Lombardy has already fulfilled the Landfill Directive’s 35 % target for 2016 and Catalonia has almost achieved the 2016 target. Lodz and Warminsko-Mazurskie have large difficulty with fulfilling the 75 % and 50 % targets for 2010 and 2013 respectively in time, but a planned significant future use of MBT indicates that the 35 % reduction target can be achieved by 2020. Castilla-La Mancha has fulfilled the 75 % target for 2006 and almost the 50 % target for 2009. Whether the 35 % reduction target can be achieved by 2016 without some separate collection of bio-waste depends on the generated amount of biodegradable MSW compared with the amount generated in 1995, and how
efficient the applied mechanical biological treatment technology is in reducing the biodegradable content.

The 2008 Waste Framework Directive includes an obligation for Member States to recycle 50% of materials such as at least paper, metal, plastic and glass from households and similar waste by 2020. There is no EU obligation that this target should be met at regional level. However, Italian, Polish and Spanish national legislation have all introduced targets and obligations for their own regions, and sometimes also for the municipalities, to achieve recycling levels similar to the EU target. Although the different strategies used by the six regions seem to ensure compliance with EU Landfill Directive targets, they also have strong and divergent consequences for the regions’ prospects of achieving a high level of recycling of MSW.

Because Catalonia and Lombardy have introduced separate collection of different recyclables and bio-waste, these two regions are expected to achieve 50% recycling of MSW by 2020. Campania is still struggling with the risk of waste crisis in Naples, but thanks to a change in strategy in recent years, with more focus on separate collection of especially bio-waste, it seems that the region has a fair chance of achieving 50% recycling by 2020, although this will require an annual increase rate of 1.7 percentage points from 2010 to 2020.

Castilla-La Mancha, Lodz and Warminsko-Mazurskie all need an annual increase rate of recycling of over 3.5 percentage points in order to achieve 50% recycling by 2020. This is a very high increase rate, higher than that of Catalonia and Lombardy in the period from 2001 to 2010. It will require not only that material recycling is increased, but also that significantly more recycling of bio-waste is initiated. All three regions have invested substantially in MBT treatment, but this technology only extracts about 3% to 7% of input as dry recyclables. In MBT the organic fraction of mixed waste is stabilised, but it is seldom of sufficient quality to be used as fertilizer or soil improver, and it is therefore usually landfilled or used for re-cultivation of landfills. The conclusion is that MBT can contribute to or ensure the achievement of the targets in the Landfill Directive, but it cannot secure sufficient recycling to achieve 50% recycling. This level of recycling requires separate collection for material and bio-waste recycling.

The regional data used for this report is obtained by using Eurostat’s regional MSW database and national as well as regional statistical reports. It has to be underlined that countries might have used different methods to calculate, for example, recycled amounts, which might influence the comparability in some cases. In order to secure the highest comparability of the data, the different graphs in the report include explaining notes, when special characteristics for the applied data are important to highlight.

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1 Countries could meet the Waste Framework Directive’s recycling target without bio-waste recycling if they choose calculation methods where only paper, glass, plastic and metals are included.
Some of the **most important factors behind the successes** in Catalonia and Lombardy are:

- Active and early use of waste management planning, including precise percentage targets for separate collection and how the waste is to be managed;
- Definition of sub-regions or inter-municipal waste associations (ATOs and Zonas) responsible for providing sufficient treatment capacity in the form of mechanical sorting, composting, MBT, incineration and landfilling;
- Good co-operation between the public authorities and private investors including clear agreements, especially about financial obligations, between the public authorities and the producer responsibility organisations;
- Guarantee that the appointed and constructed treatment facilities receive sufficient waste to make the investments economically viable;
- Active use of landfill taxes to provide incentives for diverting waste away from landfill and, in Catalonia, also an incineration tax in order to divert waste away from incineration plants toward recycling;
- Use of the revenues from the landfill and incineration taxes to support municipalities and other stakeholders in investing in better collection schemes and treatment facilities;
- Focus on the quality of the separately collected waste materials and bio-wastes in order to ensure that these recyclables can be sold.

Many of these factors had, to a large extent, been developed by the two regions before the introduction of legally binding recycling targets in EU or national legislation. The two regions have in that sense been frontrunners within their countries.

The other regions developed their strategies to implement national waste laws, which again is often in response to EU legislation such as the Landfill Directive or the recycling targets in the Waste Framework Directive. In that context, it is interesting that Campania, Lodz and Warminsko-Mazurskie have all defined precise targets for separate collection of different waste types and a landfill tax of around EUR 25 per ton.

The analysis of the six regions confirms the importance of regional and even local policies for better waste management: reducing municipal waste landfilling rates; increasing recycling rates; implementing behavior-change incentives; and managing the costs of municipal waste management.

Regional waste policies do not just implement EU and national legislation; they can be frontrunners for better MSW management at both national and European level.
1 Introduction and objectives

1.1 Background

Improving waste management is a high priority within the EU. The reason for this is twofold. On one hand, poor waste management can be a risk to the environment and to health, due to poorly controlled emissions from waste that can pollute air, soil and water, including the marine environment. On the other hand, waste, if managed appropriately, can provide valuable material and energy resources that are beneficial to both society and the environment.

Waste has historically been a very strongly regulated area within the EU. The first Waste Framework Directive was passed in 1975, and since then, regulation has evolved considerably to minimise the risks to environment and to human health and, more recently, to stimulate the recovery of materials and energy from waste. This regulatory framework also advocates waste prevention. The most important specific targets in the EU legislation addressing MSW are explained in Box 1.1.

Unfortunately, the implementation and enforcement of the different regulatory instruments have not always been satisfactory. In 2011, the European Commission, DG Environment, asked the European Environment Agency (EEA) to provide improved knowledge on the implementation of environmental policies in EU Member States. Waste was one of two selected policy areas where pilot projects were initiated. In agreement with DG Environment, the pilot project on implementation of waste policies focuses on municipal solid waste (MSW). The project runs from 2012 to 2014.

In 2012, the European Topic Centre on Sustainable Consumption and Production (ETC/SCP) assisted the EEA in conducting ex-post analyses of MSW management in 32 countries and preparing a synthesis report on the findings. The synthesis report and 32 individual country papers were published by the EEA in March 2013.

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2 ‘Managing municipal solid waste - a review of achievement in 32 European countries’ (EEA, 2013)
Box 1.1  EU targets on municipal waste

1) The EU Landfill Directive requires that EU Member States must reduce the amount of biodegradable municipal waste landfilled relative to the quantity generated in 1995 (EU, 1999). Countries must reduce landfilling of biodegradable municipal waste to 75% of the amount generated in 1995 by 2006, declining to 50% by 2009 and 35% by 2016 (EU, 1999). Twelve countries have been given a four year derogation, meaning that they must meet the targets by 2010, 2013 and 2020, and another four countries have individual derogations.

2) In 2008 the Waste Framework Directive introduced a new 50% recycling target for waste from households to be fulfilled by 2020. In 2011 it was decided by a Commission Decision that countries can choose between four different calculation methods to report compliance with this target (EU, 2011):

   1. Recycling rate of paper, metal, plastic and glass waste from households,
   2. Recycling rate of paper, metal, plastic, glass household waste and other single types of household waste or of similar waste from other origins,
   3. Recycling rate of household waste,
   4. Recycling rate of total MSW

According to the EU legislation, it is the responsibility of the Member States to ensure compliance with the EU waste legislation including meeting quantified targets. The EU legislation contains no direct obligations or demands towards regional and local authorities regarding the compliance with quantified targets. Each Member State defines the competent authority for each of the obligations. However, Article 28 (1) in the EU Waste Framework Directive (EU, 2008) indicates indirectly that the establishment of waste management plans can be done by regional and local authorities.

One of the important conclusions from the previous analysis of national municipal waste management is:

   “In most of the countries where regional recycling data were available, there was substantial variation between different regions, indicating that regional and local policies have a significant influence on municipal waste recycling rates. While EU targets and national targets are the overall drivers of better municipal waste management, regional and local implementation is crucial for achieving positive results. It also suggests that regions with high recycling rates could serve as good practice examples and become knowledge sharing platforms for other regions nationally and across Europe” (EEA, 2013).

The variation of recycling rates in the different regions within 14 countries is shown in Map 1.1. In ten of the 14 countries, there is a difference in recycling rates of more than 15 percentage points between regions with the highest and lowest rates.
1.2 The selected regions

This report aims to shed light on the differences between regional waste policies by using selected examples, and to identify lessons that can be learnt for better MSW management across Europe.

In the light of the above, the EEA asked the ETC/SCP to commence with regional studies of MSW performance and management in 2013. In agreement with DG Environment, the EEA selected Italy, Poland and Spain for further study. It has been decided to assess two regions in each country. In Italy, the northern region Lombardy and the southern region Campania have been selected. In Poland, the Lodz region and the northern region Warminsko-Mazurskie have been selected and in Spain, the autonomous regions of Catalonia in the North East of the country and Castilla-La Mancha in central Spain were investigated. The six regions are shown in Map 1.2.

The criteria for selecting these regions were informed by the desire to include:

- regions that perform well,
- regions that have made progress despite generally low MSW performance,
- regions that have made a specific effort in the management of biodegradable municipal waste.

The management of MSW in each of the six regions is described in detail and assessed in six regional ETC/SCP working papers (ETC/SCP, 2014; ETC/SCP, 2014a; ETC/SCP, 2014b; ETC/SCP, 2014c; ETC/SCP, 2014d and ETC/SCP, 2014e).
1.3 Objectives for the regional studies
The three selected countries are all among the larger EU countries. In all three countries, the regional authorities have significant power regarding the implementation of EU waste legislation and national laws.

As mentioned above, EU and national targets for management of MSW are normally the overall drivers of better municipal waste management. Because MSW management is primarily linked to waste from households, responsibility for implementing policies to meet the overall targets and obligations for MSW management usually falls on regional and/or local authorities, although producer responsibility schemes also play a role.

Consequently, implementation at the regional and local levels is crucial for achieving positive results in the management of MSW. In some circumstances, the regional and local authorities can actually be front-runners of better MSW management. These front-runners can provide real case evidence that can be used to develop more progressive waste policy at the national level.

The overall objectives of the study are to:

- Assess the role of the regional and local authorities in achieving good performance in MSW management, and the role of interactions between the national/federal, regional and local levels;
- Identify the drivers that enable certain regions to perform well, and the barriers that slow the progress of other regions towards better performance;
- Identify lessons learnt from the examples of better implementation.

1.4 Short presentation of the six regions

The two Polish regions

Lodz
The Lodz region is situated in the central part of Poland. The Lodz region covers an area of 18 218 km² and in 2012 it had 2.52 million inhabitants. The regional capital, Lodz, is the third-largest city in Poland, with 715 000 inhabitants in 2012. The main reasons for selecting the Lodz region are:

- The region has a lot of industry and one very large city, Lodz;
• The recycling level of MSW was very low in 2005, but it has increased to 8% in 2011;

• The amount of MSW sent to mechanical biological treatment and composting has increased within five years from 1% to 20%.

**Warminsko-Mazurskie**

Warminsko-Mazurskie is situated in the northern part of Poland and is bordered by Russia (Kaliningrad) to the north. The region covers 24,200 km² and is the fourth largest of the Polish regions, but also one of the least populated. In 2012 it had about 1.45 million inhabitants. The capital of the region is Olsztyn, with 175,000 inhabitants in 2012. The main reasons for selecting the Warminsko-Mazurskie region are:

• Warminsko-Mazurskie has few larger cities (> 50,000 inhabitants) and many people live in rural areas;

• Although the total recycling level of MSW is still quite low, the region has increased its material recycling considerably during the last six years to a level of 14% of the total generated MSW, and seems to have ambitious plans for the management of biodegradable waste;

• There is a long and strong tradition for inter-municipal waste management associations.

**The two Italian regions**

**Campania**

Campania is a region in southern Italy with an area of 13,590 km². The population is around 5.7 million inhabitants. The biggest municipality is Naples, the regional capital with a population of 960,000.

Campania has recently been mentioned in the media as an example of bad waste management, in particular during the ‘waste crisis’ in Naples. An infringement procedure was initiated by the European Commission in 2007 against Italy regarding the lack of implementation of certain waste policies in Campania. In June 2013 the Commission decided to refer Italy back to the European Court of Justice for its long-running failure to manage waste adequately in the Campania region, more than three years after a previous ruling (EU, 2013).

The main reasons for selecting Campania are:

• Campania has been successful in reducing the share of MSW going to landfill; from 100% in 2000 to 50% in 2011, and has made significant progress in separate collection in just a few years;

• The strategy of the regional government is strongly aimed at recycling instead of incineration, in spite of the still low levels of separate collection in many parts of the region;

• Campania illustrates the difficulties in handling decentralised waste management in a complex socio-economic situation;

• There is a great variety of performance in waste management among different provinces within the Campania region.
Lombardy

Lombardy is a region of northern Italy with an area of 23,863 km² and a population of 9.7 million inhabitants. The largest city is Milano with a population of 1,240,000. The economic structure is based on a significant role of manufacturing.

The main reasons for selecting Lombardy are:

- Lombardy radically changed its strategy on MSW management within just one decade. This change was stimulated by the crisis of landfill capacity in the early 1990s that started a process of investments in incineration coupled with significant developments of separate collection and material recycling;
- Lombardy has had utilised good regional planning to implement national legislation, and has engaged the regional public utility companies working in waste collection and management;
- There is high diversity among provinces and municipalities. In this regard the region can offer an example of specific local limitations and problems in a framework of average success in moving towards better MSW management.

The two Spanish regions

Catalonia

Catalonia is a region in north-eastern Spain with an area of 32,114 km² and a population of 7.6 million inhabitants in 2012. Its capital Barcelona has an estimated population of 1.6 million (2013).

The main reasons for selecting the Catalan region are:

- Catalonia benefits from a strong economy (one of the highest GDP per capita in Spain), which has enabled investments in waste management infrastructure;
- The region is one of the most densely populated in Europe, which causes large challenges regarding the generation, collection and management of municipal solid waste;
- Catalonia has made significant progress between 2001 and 2013, due mainly to an early adoption of the European legislation and a strong political will; and
- The region has achieved high level of source separation of dry recyclables and organic waste (kitchen and garden waste).

Castilla-La Mancha

Castilla-La Mancha is situated in the central part of Spain with an area of 79,463 km² and a population of 2.1 million inhabitants in 2012. Its capital is Toledo with a population of 84,000.

The main reasons for selecting the region of Castilla-La Mancha are:

- Castilla-La Mancha has a relatively low recycling rate and a relatively high landfill rate, but good progress has been observed in the development of recycling;
- Waste management has been rationalised into eight autonomous and self-sufficient sub-regions, in order to optimise the waste management infrastructure and to reduce costs;
- An ambitious and comprehensive waste management plan was published (2009-2019); and
- Most of the municipal waste sent to landfill has received some level of mechanical biological pre-treatment, effectively reducing the biodegradable content of the waste.
1.5 The institutional framework for regional MSW management

The institutional framework for regional MSW management differs among large EU countries like Italy, Poland and Spain, but the regions in these countries do have a substantial responsibility for waste planning and waste management in common.

Table 1-1 gives a general overview of the institutional framework for MSW management in the three countries. The table shows some strong similarities but also some important differences:

- Only Poland and Spain have a national waste management plan, but in all three countries the regional authorities have responsibility for developing regional waste management plans. The regional plans transpose the national plans or national waste laws to the regional level. In Spain, local authorities may also develop local waste management plans, according to the national and regional plans;
- The regional authorities in all three countries are responsible for issuing permits to waste facilities, and in Poland and Spain they also carry out inspections of the waste facilities, whereas in Italy this task lies with the provinces;
- The regional authorities in Poland play a strong role in capacity planning, and may determine to which waste facilities MSW should be delivered, whereas this power is allocated to provinces/ATOs (inter-municipal associations) in Italy and inter-municipal associations in Spain;
- The actual investments in waste facilities for sorting of recyclables, mechanical biological treatment plants, composting plants, incineration plants and landfills are undertaken by inter-municipal associations but also by private investors or public private partnerships. Traditional recycling plants are normally owned by private investors;
- In order to fulfill the EU Landfill Directive’s targets for reduction of landfilled biodegradable municipal waste, Italy introduced in 2006 binding targets for landfilling of biodegradable municipal waste by 2008, 2011 and 2016. The targets are defined as kg per capita and they have to be fulfilled on provincial or inter-municipal level (ATO). Poland and Spain both follow the definition of the targets as they are defined in the EU Landfill Directive, i.e. as percentage reduction of biodegradable MSW landfilled compared to the amount generated in 1995. In Poland these reduction levels have to be fulfilled on municipal level (Poland May, 2012). In Spain the reductions have to be fulfilled at national and regional level (Spain, 2001).
- In order to achieve the EU target of 50 % recycling of MSW by 2020, Poland has introduced an obligation for all municipalities to increase collection and recycling of glass, metals, paper & cardboard and plastic waste (Poland, 2012). The target level increases successively every year from 2012 to 2020. In 2006, Italy introduced an obligation for the provinces/ATOs to increase separate collection of MSW from a minimum level of 35 % by 2006 to 65 % by 2012, and this has increased the recycling level. The Spanish national waste plan sets targets of a binding character for the regions of 50 % recycling of MSW by 2020 (Spain, 2011).
- The choice of collection system, the collection of MSW and the choice of collectors are first of all the responsibility of the municipalities and the inter-municipal waste associations (ATOs in Italy, MPOs in Poland and inter-municipal associations in Spain).

It has to be underlined that the Polish institutional framework changed drastically in 2012, and Table 1-1 refers to the new framework. The new system had to be implemented by mid-2013 at the latest. Before then, the overall tools for implementing waste management planning were very weak. Households could choose their own collector and the collectors (not the regional authority or the
municipalities) decided where to deliver the collected waste. With new responsibilities for municipalities regarding collection of MSW and introduction of a new system (RIPOK) in 2012 – where the collected MSW must be delivered to specific plants nominated by the regional authority – the waste management planning system now has some very strong steering tools.
Table 1-1 Overview of the institutional framework of municipal waste management in Italy, Poland and Spain, 2013

<table>
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<tr>
<th>National level</th>
<th>Regions</th>
<th>Providers</th>
<th>Municipalities</th>
<th>Intermunicipal waste management associations</th>
<th>Private stakeholders</th>
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- Waste laws
- Waste management plan
- Binding quotas for maximum landfilling of MSW or BMW
- Binding quotas for recycling or separate collection of MSW
- Capacity planning
- Select facilities where waste is to be delivered
- Undertake investments in waste management facilities
- Select areas for waste facilities
- Permit to waste facilities
- Choice of separate collection system
- Choice of collectors (by tender)
- Municipal owned collectors (without tender)
- Collection of waste
- Building and operation of treatment facilities
- Supervision of waste facilities' emissions
- Supervision of waste collectors and waste receiving facilities
- Supervision of municipalities' implementation of waste laws
- Landfill tax
- Incineration tax

Source: ETC/SCP, 2014; ETC/SCP, 2014a; ETC/SCP, 2014b; ETC/SCP, 2014c; ETC/SCP, 2014d and ETC/SCP, 2014e. *Poviats do not play a significant role in the MSW system. They issue some permits such as: Waste transport permits, landfills with the capacity of waste receiving less than 10 tonnes per day and recovery of non-hazardous waste, for example composting plants.
2 Municipal waste generation and management in the six regions

This chapter gives an overview of the generation and treatment of MSW in the six regions. It also includes an assessment of the prospects for the regions to achieve 50 % recycling by 2020 in order to contribute to the 50 % recycling target that EU Member States have to fulfil according to the 2008 Waste Framework Directive.

The quantitative development of MSW management in the six regions has been assessed for the period 2000 to 2011, where possible. For some regions and for some parameters it is only possible to show the development at the end of the period.

2.1 Generation of MSW

MSW generation per capita is quite different across the six regions, cf. Figure 2.1. In 2010 and 2011 Catalonia generated the most MSW per capita at about 550 kg, almost twice the generation in Warminsko-Mazurskie (about 300 kg). The Spanish regions Catalonia and Castilla-La Mancha generated around 25 to 50 kg above the EU-average of 500 kg per capita. Before the economic crisis, Catalonia’s level was almost 100 kg over the EU-average, but has decreased during the past five years and is now approaching the EU-average. MSW generation in the Italian regions of Lombardy and Campania was around the EU-average, whereas in the Polish regions Lodz and Warminsko-Mazurskie it was almost 200 kg per capita lower than the EU-average.

What is the background for such differences in MSW generation per capita between the regions? Two main factors are important: 1) There is a link between economic development (GDP) and the level of waste generation, although it is not a linear relationship over time and 2) The definition of MSW itself is not unambiguous, and this will affect what is included in the reported waste generation.

Figure 2.2 partly confirms a link between GDP and waste generation. It can be argued that the wealthier a region is, the more MSW is generated per capita. Figure 2.2 shows that Catalonia and Lombardy, being the two wealthiest regions included in this study also have the largest MSW
generation per capita. The less wealthy regions like Campania, Lodz, and Warminsko-Mazurskie have a lower generation of waste per capita.

However, the relationship between GDP and waste generation is not simple or unambiguous. Catalonia’s GDP per capita is 50% larger than that of Castilla-la Mancha (Eurostat, 2011) and it also has a larger MSW generation per capita but only about 10% higher. The same pattern is seen for Lombardy and Campania, where the Lombardian GDP per capita is almost twice that of Campania (Eurostat, 2011), but MSW generation per capita is only slightly higher. Finally, the Lodz region has a 25% higher GDP per capita than Warminsko-Mazurskie, and the MSW generation was in fact also about 25% larger before the crisis. In the two Polish regions GDP per capita has continued to increase after the economic crisis started, but the difference in MSW generation has decreased to about 6%.

This development confirms that there is not a simple linear link between GDP and MSW generation in these regions.

Figure 2.2  Relationship between GDP and MSW generation per capita, 2001 to 2010

![Relationship between GDP and MSW generation per capita, 2001 to 2010](image)

Source: Campania, 2013; Castilla-La Mancha, 2013; Catalonia, 2013; Eurostat, 2011; Eurostat, 2013a; GUS Poland, 2005-2011; GUS Poland 2006-2012 and Lombardy, 2013. For Castilla-La Mancha only the period 2004 to 2010 is included. For the Lodz and Warminsko-Mazurskie regions only data for 2005 to 2010 is included.

The low GDP per capita in Campania can also be explained by a large shadow economy because of the presence of “Camorra” and to the fiscal evasions.
The second main factor behind differences in MSW generation per capita is that the definition of MSW itself is not unambiguous, and therefore the reported MSW generation level per capita will, by nature, differ between countries, between regions and between municipalities. BOX 2.1 details the different elements of Eurostat’s definition of MSW. These give rise to uncertainty about what has been included in regional and national reporting, and increase the difficulty in documenting a simple relation between economic activity and MSW generation per capita.

### Box 2.1 MSW definitions and reasons for differences in reported levels of generated MSW

<table>
<thead>
<tr>
<th>Definition</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Eurostat definition of MSW is:</strong></td>
<td>Municipal waste is mainly produced by households, though similar wastes from sources such as commerce, offices and public institutions are included. The amount of municipal waste generated consists of waste collected by or on the behalf of municipal authorities and disposed of through the waste management system’ (Eurostat, 2013).</td>
</tr>
<tr>
<td><strong>The definition both includes a collection element, a waste type element and a source element.</strong></td>
<td>The term is therefore not unambiguous.</td>
</tr>
<tr>
<td><strong>A collection element:</strong></td>
<td>The amount of municipal waste generated consists of waste collected by or on behalf of municipal authorities and disposed through the waste management system.</td>
</tr>
<tr>
<td><strong>A waste type element:</strong></td>
<td>Municipal waste is mainly waste types which are typically produced by households.</td>
</tr>
<tr>
<td><strong>A source element:</strong></td>
<td>Municipal waste is mainly produced by households, though similar wastes from sources such as commerce, offices and public institutions are included.</td>
</tr>
</tbody>
</table>

The definition of MSW implies that if a municipality offers a large variety of waste management schemes, the reported generated amount will normally be larger than the amount in a municipality with only few services. If a municipality besides collection of mixed MSW also offers separate collection of different types wastes like paper, glass, plastic, metal, WEEE, garden, food and bulky waste, it will report a larger waste amount than a municipality only offering collection of mixed MSW and separate collection of glass, paper and packaging waste. If a municipality with many services also offers these to commerce, offices and public institutions, the reported generated amount will be even larger.

In addition to GDP and differences in collection services, the amount of generated waste is also linked to socio-economic parameters such as, for example, number of households per 1000 inhabitants, the population’s age structure and the number of babies using disposable diapers. It has not been possible to include the influence of these factors in the study.

Apart from the general trend that wealthier people generate more waste (due to increased consumption levels, e.g. by buying new furniture and electrical equipment more frequently), richer regions can also often afford more advanced waste collection services, resulting in a higher collection rate (and registration) of actually generated MSW. Poorer regions can have less effective collection schemes, resulting in less of the generated waste being registered by the formal waste management system – this waste is often managed by the informal waste sector.

### 2.2 General overview of MSW management

Figure 2.3 gives an overview of MSW treatment in the six regions covering the years 2001, 2005, 2008 and 2010/2011, together with the EU average in the same years for comparison. A large diversity exists between the regions, but an overriding characteristic is that waste has increasingly been diverted away from landfills (lilac) and in direction of more recycling, mainly material recycling (blue). In three regions, bio-waste recycling has increased substantially, and in some regions the share of incineration has also grown (red). For four of the regions a significant amount of information about
the final waste treatment compared with the generated amount is missing in the period 2001 to 2011, although the information gap has improved over time. In Campania, the waste categorised as “Information gap” is primarily waste that has been stored in bales and awaiting a final treatment. It has, however, decreased over the period.

**Figure 2.3  Management of municipal waste in % of generated amounts in 2001, 2005, 2008 and 2010/2011**

![Figure 2.3](image)


Notes: For Castilla-La Mancha and Warminsko-Mazurskie there is no data available for 2001. Separately collected for material recycling in % of generated amount includes, for the Polish regions, material output for recycling from segregation of mixed recyclables MSW. *For Campania mainly storing of waste in bales.

In the following sections the development of each of the different management options for MSW is assessed in more detail.

### 2.3  **Landfilling of MSW**

Landfilling of MSW has decreased in all regions in the last 10 years, as shown in Figure 2.4. All regions apart from Lombardy landfilled a larger share of their MSW that the European average throughout the period, but the share did decrease more than the EU-average. This is especially the case for Catalonia and Lombardy. The Lodz and Warminsko-Mazurskie regions have, in more recent years, also decreased their landfilling rate.

The data for Campania is affected in the period 2001-2008 by the storage of waste, due to a deficit of treatment capacity. If storing of waste is regarded as landfilling, there was only a slight decrease of landfilling in Campania (red colour) before 2008. From 2008 to 2010, a large reduction of landfilling was achieved in Campania.
Figure 2.4  Municipal waste landfilling rates, 2000-2011

Source: Campania, 2013; Castilla-La Mancha, 2013; Castilla-La Mancha, 2013a; Catalonia, 2013; Catalonia, 2013a; Eurostat, 2011; GUS Poland, 2005-2011; and Lombardy, 2013

Notes: The landfilling rate is calculated as a percentage of municipal waste landfilled per municipal waste generated.

2.3.1 Landfilling of biodegradable waste

The EU’s Landfill Directive (EU, 1999) requires that all EU Member States reduce the amount of biodegradable waste landfilled. The Directive includes a combination of long-term and intermediate targets for reducing the amount of biodegradable municipal waste landfilled relative to the quantity generated in 1995.

The Landfill Directive requires a reduction of the amount of biodegradable waste landfilled. The exact target is determined with reference to the amount of biodegradable waste generated in 1995, so that:

- In 2006, the quantity of biodegradable waste landfilled must not exceed 75% of the amount generated in 1995;
- Must not exceed 50% by 2009;
- Must not exceed 35% by 2016.

The EU targets are to be fulfilled on national level and not on regional level. Twelve countries, among them Poland, have been given a four-year derogation period, meaning that the two Polish regions Lodz and Warminsko-Mazurskie must achieve the targets by 2010, 2013 and 2020, respectively.

Instead of transposing the percentage-based targets set out in the EU Landfill Directive, in 2003 Italy adopted the following targets based on the quantity of biodegradable waste landfilled per capita. These must be reached on provincial level or inter-municipal level (ETC/SCP, Lombardy, 2014):

- Before 27 March 2008: landfill of biodegradable municipal waste must be reduced to below 173 kg per inhabitant per year;
- before 27 March 2011: landfill of biodegradable municipal waste must be reduced to below 115 kg per inhabitant per year;
• before 27 March 2018: landfill of biodegradable municipal waste must be reduced to below 81 kg per inhabitant per year.

Figure 2.5 indicates the reduction of biodegradable municipal waste landfilled in the six regions as a percentage of the generated amount in 1995. Figure 2.5 thus shows to which extent the regions are contributing to fulfilling the EU targets. It has to be underlined that some of the figures are calculated based on our own assumptions because no precise information has been available. The assumptions are explained in the notes.

**Figure 2.5  Biodegradable municipal waste landfilled in % of generated amount in 1995**

![Figure 2.5 Biodegradable municipal waste landfilled in % of generated amount in 1995](image)

**Sources:** APAT, 2007; Castilla-La Mancha, 2013b; ETC/SCP, 2014; ETC/SCP, 2014a; ETC/SCP, 2014b; ETC/SCP, 2014d; Lodz, 2012; Warminsko-Mazurskie, 2012

**Notes:** The Polish figures are taken from the two regions’ waste management plans. The Italian figures for 2005 and 2006 and the Lombardian figure for 2009 are based on kg per capita of landfilled biodegradable waste (BMW) according to official information. The generated amount of BMW for Lombardy in 1995 is calculated based on the amount of MSW in 2000 and assuming 62% is biodegradable. The Campanian figures for 2009 and 2010 are calculated based on the assumption that 62% of the landfilled amount of MSW is biodegradable. The calculated generated amount of BMW in Campania for 1995 is based on the 2001 MSW figure for the region. The Catalan figures are calculated based on the assumption that 59% of the MSW sent directly to landfill is biodegradable and that the output from MBT sent to landfill is 29% biodegradable waste (PROGREMIC, 2014). The figures for Castilla-La Mancha are calculated based on the assumption that 63.7% of the waste sent directly to landfill is biodegradable. Furthermore, it is assumed that 29% of the MBT output sent to landfill is biodegradable (same as in Catalonia).

Figure 2.5 shows very large differences between the regions in the level of biodegradable municipal waste landfilled, but also in the development within the regions (all numbers related to the amount of biodegradable municipal waste generated in 1995):

- Catalunya and Lombardy have both reduced the level of biodegradable waste going to landfill quite significantly: Catalunya from about 70% in 2001 to around 40% in 2011. In Lombardy from 23% in 2005 to 9% in 2009. Lombardy has already met the EU-target for 2016 and the Italian target of 81 kg per capita of biodegradable MSW landfilled. Catalunya has fulfilled the EU-targets for 2006 and 2009 and the target for 2016 was almost fulfilled in 2011.
- Castilla-La Mancha has also reduced its share significantly from about 80% in 2006 to 73% in 2007 and to 51% in 2011. The region has therefore almost achieved the EU-targets for 2006 and 2009.
- For Campania there was a large increase from about 25% in 2005 to 64% in 2006 according to the official data, which could be due to the stored waste bales being included in the 2006
figure, but not in the 2005 figure. In 2009 and 2010 the amount of biodegradable municipal waste landfilled was around 50% of that generated in 1995.

- In the Polish region of Lodz the absolute amount of landfilled biodegradable waste has increased to 80% more than the amount generated in 1995. In Warminsko-Mazurskie, the absolute amount of landfilled biodegradable MSW has remained at about 75% related to the generated amount in 1995 throughout the period. According to the official data, the amount of biodegradable MSW generated in Warminsko-Mazurskie has in fact increased by 50 percentage points from 1995 to 2010.

For both Polish regions, the reported levels of biodegradable MSW landfilled does not seem consistent with the fact that landfilling of total MSW has decreased by about 15 percentage points from 2005 to 2011. In addition, the reported figures suggest that 80% more biodegradable waste was landfilled in 2010 than was generated in 1995. This indicates that the amount of biodegradable generated MSW in 1995 is heavily underestimated in the regions’ Waste Management Plans.

2.4 Recycling of MSW

The diversion of waste away from landfills implies that more waste is either recycled or incinerated. Figure 2.6 and Figure 2.7 show the development of separately collected waste for material recycling and for bio-waste recycling. This is used as a proxy for the actual amounts of recycling taking place.

Here, the amount ‘recycled’ is assumed to be equal to the amount actually delivered to different types of recycling facilities, whereas the waste ‘separately collected for recycling’ often is sent through a sorting process, where rejects occur. The rejected waste is not sent for recycling. However, data on rejects do not exist.

The separately collected waste for material recycling does not include bio-waste nor recycling of materials recovered through MBT. However, for the two Polish regions, material output to recycling from sorting of separately collected mixed dry recyclable MSW and recyclable fractions sorted out of mixed MSW are included.

2.4.1 Material recycling

Figure 2.6 shows that three regions (Campania, Castilla-La Mancha, Lodz and Warminsko-Mazurskie) had a lower level of material recycling throughout the whole period from 2000 to 2011 than the EU-average (25% in 2011). All regions except Castilla-La Mancha have increased their rate of material recycling over the period (especially Campania), but three of the regions still only materially recycle 8-14% of generated MSW. Throughout the period, Lombardy had higher recycling rates than the EU-average whereas Catalonia’s recycling rate fluctuated around the EU average.
Figure 2.6 Material recycling rates, 2000-2011

![Material recycling rates, 2000-2011](image)

Source: Campania, 2013; Castilla-La Mancha, 2013; Castilla-La Mancha, 2013a; Catalonia, 2013; Catalonia, 2013a; Eurostat, 2011; GUS Poland, 2005-2011; and Lombardy, 2013

Notes: The material recycling rate is calculated as the percentage of total municipal waste generated that is separately collected for material recycling. The separately collected amounts of glass, metals, paper & cardboard, plastics, wood, WEEE, vegetable oils and bulky waste are regarded as a proxy for the material recycled amounts, and is assumed to be an overestimation of the actual recycling rate. For the two Polish regions material output to recycling from segregation of separately collected mixed dry recyclable MSW and recyclable fractions sorted out of collected mixed MSW are included. The 2010 figure for Lodz seems to be unreliable.

### 2.4.2 Bio-waste recycling

Figure 2.7 shows that the bio-waste recycling rate in Lombardy is consistently above the EU-average. This difference has even increased since 2007, and the Lombardian rate was 19% in 2011. The bio-waste recycling rate in Catalonia increased at a rate of one percentage point per year and by 2011 was almost the same as the EU-average of 14%.

Campania had an extremely high increase: from 6% bio-waste recycling to 15% in the years from 2008 to 2010. However, almost all of the separately collected bio-waste is treated out-side Campania due to lacking capacity of aerobic and anaerobic digestion and composting plants (Adelaide Pollinaro, 2013). According to the regional waste management plan for Campania (Campania, 2012) the capacity in the region is 120 000 tonnes per year and the needed capacity is 440 000 tonnes. Castilla-La Mancha, Lodz and Warminsko-Mazurskie all have recycling rates of bio-waste lower than 4%.
Figure 2.7  Bio-waste recycling rates, 2000-2011

Source: Campania, 2013; Castilla-La Mancha, 2013; Castilla-La Mancha, 2013a; Catalonia, 2013; Catalonia, 2013a; Eurostat, 2011; GUS Poland, 2005-2011; and Lombardy, 2013

Notes: The bio-waste recycling rate is calculated as the percentage of the total municipal waste generated that is separately collected as bio-waste. The amounts of separately collected waste of food, garden or bio-waste are included and are regarded as a proxy for the amount bio-waste that is recycled and is assumed to be an overestimation of the actual recycling rate. Mixed municipal waste sent to mechanical-biological treatment (MBT) is not regarded as recycling, but the part of the organic output from MBT in Castilla-La Mancha used for agricultural purposes is included. In Catalonia such organic output from MBT has not been allowed to be used for agricultural purposes and is therefore not accounted for as recycling. Moreover, in Spain, national legislation introduced in 2011 does not allow to label the product resulting from MBT as compost, but as bio-stabilised material. This means that MBT output cannot be used for agricultural purposes. Since this law was only put in place in 2011, it implies that the bio-stabilisate from MBT may have been considered as compost up to 2011. This is the case for the Castilla-La Mancha data used for Figure 2.7 and for this report (Spain, 2011 and Catalonia, 2014).

2.4.3  Total recycling

The total recycling rate – material recycling plus bio-waste recycling – in the six regions is shown in Figure 2.8.

Lombardy has recycled more of its generated municipal waste than the EU-average in the entire period, increasing from 32 % in 2000 to 47 % in 2011. Catalonia has also increased its total recycling rate – from below the EU average of 25 % in 2001 to slightly above the EU average of 38 % in 2011 (from 19 % to 41 % respectively).

The other four regions have also increased their total recycling rates. Campania has experienced an extremely large increase in overall recycling from 2007 to 2010. Box 2 gives an overview of some of the changes that have happened in this period in Campania. Castilla-La Mancha, Lodz and Warminsko-Mazurskie have also increased their total recycling level, but still below 15 % of generated MSW is recycled. For these three regions, it seems that the increase of total recycling measured in percentage points has not increased more than the EU-average, although these regions had a low starting point and therefore better possibilities to harvest some low hanging fruits.
Figure 2.8  Total recycling rates, 2000-2011

Source: Campania, 2013; Castilla-La Mancha, 2013; Castilla-La Mancha, 2013a; Catalonia, 2013; Catalonia, 2013a; Eurostat, 2011; GUS Poland, 2005-2011; and Lombardy, 2013

Notes: The total recycling rate is calculated as the percentage of municipal waste generated that is separately collected. The separately collected amounts of wastes of glass, metals, paper & cardboard, plastics, wood, WEEE, vegetables oils, bulky waste and bio-waste are regarded as a proxy for the material recycled amounts, which are assumed to be an overestimation of the actual recycling rate. For the two Polish regions material output to recycling from segregation of mixed recyclable MSW are also included. The 2010 figure for Lodz seems to be unreliable.

Box 2.2 MSW management in Campania - Main developments

MSW management in Campania has been strongly influenced by the state of ‘Waste Emergency’ declared in 1994 because of landfill saturation. After an acute phase of waste management crisis in the mid-2000s, exceptional measures were decided in 2008, including the designation of waste sites as areas of ‘strategic interest’ under military control. The opening of new landfills was authorised against the wishes of the local population.

In order to improve the monitoring of the entire MSW management chain, the SIGER was created (Sistema Informativo per la Gestione dell’Emergenza Rifiuti – Information System for the Management of ‘Waste Emergency’). It is a system of validation and certification of data for each municipality of Campania.

The end of the emergency was declared in December 2009 when the powers and competences passed from the Commissioner nominated by the central government to the regional government. After the exceptional measures and especially after the end of the Commissioner's phase, Campania experienced great progress in MSW management:

• Campania had a rapid increase in its total recycling share from 14 % in 2007 to about 33 % in 2010.

• Organic recycling in particular increased from about 4 % to 15 % in the same years, which represents an almost fourfold increase.

• Material recycling doubled from 9 % in 2007 to 18 % in 2010.

• Incineration increased from zero to 19 % after the opening of the Acerra incinerator in 2009.

(Source: ETC/SCP, 2014)

However, Campania, and especially Naples, is still struggling with illegal waste disposal. The piles of garbage which marked the crisis in previous years have largely disappeared from the streets of central Naples but illegal disposal of especially industrial waste continues in outlying areas and in the nearby countryside (Reuters, 2013 and Spiegel, 2014).
2.5 **Incineration of MSW**

The diversion of municipal waste away from landfill has in some regions partly also been achieved by an increase in incineration. Figure 2.9 shows some large differences between the six regions regarding the extent to which incineration is applied as a treatment option. Three of the six regions studied here use waste incineration. It has to be underlined that the figures cover amounts incinerated in dedicated incineration plants and cement kilns, and include outputs from mechanical biological treatment plants received at these plants.

Lombardy has increased its incineration rate from 25% in 2000 to 45% in 2011. In fact the increase mainly took place from 2000 to 2007, when the incineration rate increased by more than three percentage points annually. Catalonia also has a reasonably high incineration rate, but it has decreased from 20% in 2000 to 16% in 2011. Campania had a large increase from 0% in 2008 to 9% in 2009 and 19% in 2010. This development is due to the creation of the first regional incineration plant in Naples in 2008 (ETC/SCP, 2014).

![Figure 2.9 Municipal waste incineration rates, 2000-2011](image)

Source: Campania, 2013; Castilla-La Mancha, 2013; Castilla-La Mancha, 2013a; Catalonia, 2013; Catalonia, 2013a; Eurostat, 2011; GUS Poland, 2005-2011; and Lombardy, 2013

2.6 **Mechanical biological treatment of MSW**

Instead of sending waste directly to dedicated incineration plants, many regions have introduced mechanical biological treatment for the treatment of mixed MSW. This process usually only recovers around 3 to 7% of the input as dry recyclables for recycling (Matthias Kühle-Weidemeier et al, 2007; Krzysztof Jatczak, 2013). The treatment results in water and degradation losses, which, although differing from region to region, are often around 30% of the weight of the incoming waste. Normally up to 30% of the incoming waste can be used as fuel (refuse derived fuel, RDF). This RDF can either be used in cement kilns, if the chlorine content of the waste is low, or it can be sent to dedicated incineration plants. The organic fraction of mixed waste is usually biologically treated and thus stabilised. It seldom has a sufficient quality to be used as fertilizer, and it is therefore landfilled or used for re-cultivation of landfills. However, in Castilla-La Mancha the stabilised organic fraction of mixed waste is used on farmed land.
Inputs of waste to MBT plants are therefore not to be regarded as recycled in the countries’ statistical reporting to Eurostat. Instead the outputs of MBT are allocated to incineration, landfilling and recycling. The sum of these outputs will not be 100% of the input, due to water and carbon loss during the process.

**Figure 2.10** Rates of mixed municipal waste treated in MBT plants in % of generated amount, 2000-2011

Source: Campania, 2013; Castilla-La Mancha, 2013; Castilla-La Mancha, 2013a; Catalonia, 2013; Catalonia, 2013a; Eurostat, 2011; GUS Poland, 2005-2011; and Lombardy, 2013

Notes: The Campanian data for 2003 to 2007 - showing a high rate of MBT - have to be seen in context of the very low amounts of waste collected for recycling and incineration, and instead in the extensive use of pre-treatment of waste, where the output was stored as bales waiting for final treatment such as incineration and potentially also landfilling. This situation resulted in a large decrease of landfilling in the region from 2003 to 2007 (shown in Figure 2.4, if the stored bales are not regarded as landfilling). Warminsko-Mazurskie is shown without any MBT. However, in 2012 and 2013 two plants were inaugurated with a total capacity of 170 000 tonnes, corresponding to almost 40% of the total amount of MSW generated in the region. The Lodz data represents amounts of mixed municipal waste treated with biological and mechanical-biological methods for 2010 and 2011, and biological only for 2005-2009.

Figure 2.10 shows that both Campania and Castilla-La Mancha are relying very much on MBT. The Campanian data for 2003 to 2007 shows an extremely high level of MBT, which has to be seen in context with the very low amounts of waste collected for recycling and incineration, as well as the large decrease of landfilling in the region from 2003 to 2007 (shown in Figure 2.4, assuming that the stored bales are not regarded as landfilling). The stored bales in Campania are the output from shredding and pre-treatment of mixed MSW in so called ‘tritovagliatura facilities’ and it can be used as low quality refuse derived fuel (RDF) (ETC/SCP, 2014). Around an estimated 7 million of tonnes...
of bales, accumulated during the 2000s, are still stored across 18 sites. At the beginning of 2014 the program of incineration of bales at the plant of Acerra actually started (ETC/SCP, 2014).

The fluctuation in Castilla-La Mancha from 2009 to 2011 is due to technical problems with the MBT plants (Castilla-La Mancha, 2013b). Catalonia and Lodz have increased their level of MBT and both regions sent around 20 % of their MSW to MBT in 2011. Lombardy has sent a decreasing MSW amount to MBT in the period from 2004 to 2011, but about 10 % of generated waste still goes to MBT.

Warminsko-Mazurskie is shown without any MBT. However, in 2012 and 2013 two plants were inaugurated with a total capacity of 170 000 tonnes, corresponding to almost 40 % of the total amount of MSW generated in the region. In total, over 500 000 tonnes will be available by 2014, which is more than the total generation of MSW. The Lodz region is expected to have a MBT capacity of over 1 million tonnes by 2015, which is also more than the total amount of generated MSW.

This shows that all regions except Lombardy send a substantial part of their waste to MBT. In that context it is important to recognise that only a very small part of the input to a MBT plant is sorted out for recycling. MBT is thus predominantly a pre-treatment before incineration or landfill.

2.7 Information gap about treatment of MSW

Some regions cannot provide information about the management of all generated MSW. Reasons for this include that part of the waste is not collected and therefore disposed of by the households, or because the MSW is sent out of the region for treatment, which can make it more difficult for the authorities to obtain information about the final destination and treatment. Another reason can be that the waste is pre-treated by sorting or by MBT and then mixed with waste from other sources. This makes it difficult to follow the waste in the further treatment process, and to know what type of final treatment the waste receives.

Campania has been, for many years in the past, a hub of illegal disposal of hazardous and industrial waste coming from other regions and managed by criminal organisations, as also confirmed by recent new discoveries of old illegal dumping sites. The illegal management of industrial and hazardous waste is however outside the scope of this report.
Figure 2.11 Information gap between generated and treated amounts. Stated in % of generated MSW


Figure 2.11 shows that whereas Catalonia and Lombardy know how all of the MSW generated in their respective regions is treated, the other four regions have a high percentage of ‘Information gap’ during the whole period. In Campania the high percentage of ‘Information gap’ in the beginning of the period and the large decrease from 2008 to 2010 is related to the large amount stored temporarily due to insufficient treatment capacity.

The share of waste for which there is no available information about the final treatment, is also decreasing in the two Polish regions, although the level is still high. For the Polish regions there is a large gap between the generated amounts and the collected amounts of MSW, whereas there is complete information about the final treatment of the collected amounts. The large gap between the generated amounts and the collected amounts is more due to the fact that much of the bio waste is home composted or used as a fuel in households and less to the fact that large areas have no collection of waste, at least not collection of mixed MSW (Warminsko Mazurskie, November 2013). About 81 % of the MSW generated in Warminsko Mazurskie in 2010 was collected although 95.8 % of the households in the region were covered by collection of mixed MSW (ETC/SCP, 2014e). In general Poland has a very large difference between information on generation of MSW and treatment of MSW (GUS, 2011).

Figure 2.11 also illustrates that better data quality for regional MSW is needed. There are large uncertainties on how much MSW is in fact recycled and landfilled, although it seems that the information on incineration is more reliable. The uncertainty also reflects that when MSW is pre-treated, there is a major risk that information about the final treatment is lost. This is especially the case in regions with large amounts of mixed MSW sent to MBT.
2.8 Prospects for reaching 50 % recycling by 2020

The 2008 Waste Framework Directive (EU, 2008) includes a 50 % recycling target for waste from households, to be fulfilled by 2020. In 2011 the European Commission decided that countries can choose between four different calculation methods to report compliance with this target. These four methods are explained in section 1.1.

The Waste Framework Directive’s targets apply only at national level; the Directive does not require each region to meet the targets separately. Nonetheless, this report includes an assessment of the regions’ contribution to achieving the target. This is done by looking at the recycling rate of MSW, corresponding to calculation method 4 in the Commission Decision from 2011. Many EU Member States have already introduced obligations towards their regions and municipalities in order to be able to achieve the 50 % recycling target. Such initiatives must also be seen in relation to the obligation in the Waste Framework Directive’s Article 11 that by 2015 all Member States need to have introduced separate collection of glass, metal, paper and plastic waste from households.

In January 2012 Poland introduced a new law, according to which the municipalities have to achieve 50 % recycling by 2020 of glass, metal, paper and plastic waste from households and similar wastes from other sources. For each year, a target level for recycling is set: 16 % by 2015, 18 % by 2016, 20 % by 2017, 30 % by 2018, 40 % by 2019 and 50 % by 2020. This a very ambitious increasing rate from 2017 to 2020. Poland has chosen to use calculation method 2 according to the above mentioned Commission Decision, i.e. to monitor the target as recycling of glass, metal, paper and cardboard and plastic waste from households and similar waste from other sources.

Already in 2006 Italy introduced a legal obligation for all provinces and ATOs that 35 % of the MSW had to be separately collected by 2006, 45 % by 2008 and 65 % by 2011 (ETC/SCP, Lombardy, 2014). Italy will either choose calculation method 2 or 4, according to the Institute for Environmental Protection and Research, (ISPRA, 2013).

Spain has introduced legal obligations for their regions to achieve 50 % recycling of total MSW by 2020 (Spain, 2011) choosing method 4 (Spanish Ministry of Environment, 2013).

Figure 2.12 shows that Catalonia and Lombardy had a large annual increase of their recycling rates of two to three percentage points annually in the period 2001 to 2010. These two regions have therefore a good chance to reach 50 % recycling of MSW by 2020 if they continue with their efforts.

Campania had an increase of its recycling rate by one percentage point annually in the period from 2001 to 2005. In the period from 2006 to 2010 the region increased the recycling annually at a rate of over five percentage points. This officially reported increase is extremely high compared to experiences in other countries and regions, and it is based on an increase of recycling of bio-waste mainly treated outside the region. However, an increase rate of five percentage points is also planned to be achieved in Poland, cf. the above mentioned targets for Poland. Although Campania had a very high increase between 2006 and 2010, the region still needs to achieve a further annual increase of about 1.7 percentage points from 2010 to 2020 in order to reach 50 %.
2.9 Treatment costs and taxes

The cost of different treatment options can be a crucial factor influencing progress toward a certain target. Diverting waste away from landfill will be very difficult if landfilling is much cheaper than composting, for example.

Figure 2.13 shows the average gate fees for some of the different treatments in the six regions. The fees stated include taxes where present in the regions. The fees are stated as an average, but the deviations are also indicated where possible. The figure illustrates that the gate fees for landfilling in Catalonia, Campania and Lodz are lower than for MBT, incineration, composting and anaerobic digestion. The gate fee for landfilling in Lombardy is similar to that for MBT and incineration, but is lower than for source separated bio-waste treatment.
Figure 2.13 documents the importance of using landfill taxes as an instrument to divert waste away from landfills. It shows that the incineration tax in Catalonia gives some incentive to divert waste away from incineration to recycling, but the incineration gate fee is still lower than the gate fee for source separated bio-waste.

**Figure 2.13 Gate fees for landfilling, incineration, mechanical biological treatment and composting in EUR per ton**

Source: Campania, 2012; ETC/SCP, 2014a; ETC/SCP, 2014b; ETC/SCP, 2014c; ETC/SCP, 2014e and Lombardy, 2013a

Note: The landfill tax is zero for Castilla-La Mancha and only Catalonia has an incineration tax. All other empty data points are because no information is available, or the treatment does not exist in the region.

Figure 2.13 shows that the landfill tax for mixed MSW is highest in Poland (EUR 26 /ton) and Campania (EUR 25 /ton). Poland has a national tax (called fee in Poland) on landfilling of waste. The tax varies depending on type of waste and was increased substantially in 2008. Italy also has a national landfill tax, but the national regulation only defines the highest level (EUR 26 /ton) and the lowest level (EUR 5.2 /ton) of the tax. Each region defines the actual tax level. Until 2012 Campania had a low landfill tax level, but now has one of the highest landfill taxes in Italy. Until 2009 the landfill tax in Lombardy was EUR 15.50 /ton, but this has decreased to EUR 10.5 /ton. Spain has no national landfill tax but regions may apply one. Castilla-La Mancha does not have a tax, but Catalonia introduced one in 2004. In Catalonia the tax increased from EUR 10 /ton to between EUR 12.4 and EUR 21.6 /ton, depending on whether municipalities have introduced separate collection schemes for bio-waste (and have access to MBT technology) or not. Catalonia introduced a similar tax on incineration in 2009, set at EUR 5.7 /ton or EUR 16.5 /ton based on the same principle. In all six regions the landfill taxes are at the lower end of the range of landfill taxes in European countries.

### 2.10 Households’ payment for waste management service

Economic incentives for households to sort waste at source can be an important factor in the overall success in increasing recycling of MSW. Economic incentives can have a great influence on people’s behaviour. In instances where households pay a fee unrelated to the amount of mixed waste produced, and not dependent on participation in separate collection schemes, there is no financial incentive for households to sort their waste. Similarly, a waste management fee that is part of a wider utility bill (for example consumption of water), or is included in the property tax, also gives no incentives for better sorting.
It is difficult to obtain an overview about how much a household pays for waste management services in the six regions. The fees vary a lot between municipalities within each region, and some regions have benefited from EU support for waste management infrastructure, via structural funds, which hides the true costs of waste management.

Figure 2.14 shows that households in the two Italian regions pay the highest fees, but with large variations especially in Campania. The fee is on average about EUR 380 in Campania and EUR 200 in Lombardy. In Catalonia and Castilla-La Mancha, the average payment is about EUR 80 and EUR 90 per household respectively, again, with large differences between municipalities. In the Lodz region, the payment is - as a simple average - about EUR 75 per household for a mixed MSW bin alone, but lower (EUR 32) for households that have both a bin for separately collected waste and a bin for mixed MSW. In the city of Lodz itself, the fee is about EUR 140 per household with only a mixed MSW bin and about EUR 130 per household with separately collected + mixed MSW bins. In Warminsko-Mazurskie the average is about EUR 45 for mixed MSW and EUR 30 for schemes where the households also have bins for separately collected waste.

![Figure 2.14 Households payment for waste management service. EUR per household](image)

Source: Castilla-La Mancha, 2013c; ETC/SCP, 2014; ETC/SCP, 2014b; ETC/SCP, 2014c; ETC/SCP, 2014d and ETC/SCP, 2014e

In general, it seems there is a large potential in all six regions for increasing the use of economic incentives to encourage better source separation. However, it has only been possible to find information about source separation incentives applied via differentiated fees for households in the Polish regions.
3 Strategies and key success factors

3.1 Differences and similarities in the development

The development of MSW management in the six regions from 2000 to 2011 presented in chapter 2 indicates some important differences and similarities:

- The two Polish regions Lodz and Warminsko-Mazurskie experienced almost the same development trends and have applied similar strategies. In 2005, only 2% of MSW was recycled, about 70% landfilled, with an information gap of almost 30% of the waste generated. During the period, material recycling has increased to about 14% in Warminsko-Mazurskie and 8% in the Lodz region, although at a slow speed. Bio-waste recycling has not really been introduced, but there has been a reduction of MSW landfilled to about 50% in Lodz and 60% in Warminsko-Mazurskie. Still, there is an information gap on the final treatment of about 25% of the generated waste. A large and steep increase of pre-treatment in form of MBT is now taking place in the two regions, although this is not yet reflected in the published statistics for Warminsko-Mazurskie. In the Lodz region MBT has increased from 3% in 2009 to 17% in 2011, which can partially explain the missing information about the final treatment of waste in this region, as water and degradation losses occur during the MBT process.

- The two Spanish regions Castilla-La Mancha and Catalonia experienced very different developments in waste management. At the beginning of the period, both regions were dominated by landfilling although in Castilla-La Mancha almost 90% of generated MSW was landfilled, and ‘only’ about 65% in Catalonia. Catalonia, however, has succeeded in increasing both material recycling and bio-waste recycling to a total recycling rate of 41% of MSW, keeping incineration constant and decreasing landfilling to 40%. MBT has increased from 0% to 21%. In Castilla-La Mancha, the strategy has been very much focused on MBT only. In 2011, 65% of MSW was sent to MBT. Unfortunately, MBT does not result in significant levels of recycling. Since there are no incineration plants in Castilla-La Mancha, 70% of the MSW was still landfilled in 2011 and total recycling stagnated at 12%.

- The two Italian regions had a very different starting point and have also implemented different strategies, although these strategies seem to be more similar at the end of the period. In 2000 Campania landfilled almost 100% of generated MSW, whereas in Lombardy recycling, incineration and landfilling accounted for about one third each. Campania has been strongly influenced by the state of ‘waste emergency’, declared in 1994 due to landfill saturation, which ended in December 2009. In Campania, MBT, combined with storing of waste bales, dominated until 2009. Since then, material recycling and especially bio-waste recycling have increased substantially: the reported total recycling increased to 33% in 2010 of which, however, almost all bio-waste recycling took place outside the region. Simultaneously, incineration has been introduced covering around 20% of generated MSW, whereas landfilling is now reduced to 48%. During the period Lombardy has increased both material recycling and bio-waste recycling year-on-year to a total level of 46%, and a similar percentage of generated MSW is incinerated: only 7% of generated MSW ends in landfill.

Table 3-1 gives a simple overview of the focus of the MSW management strategies in the six regions. Three of the regions (Castilla-La Mancha, Lodz and Warminsko-Mazurskie) seem to rely heavily on MBT treatment, and to such an extent that it may prove difficult to achieve 50% recycling of MSW. This is particularly true given that bio-waste recycling has, until now, only been a very limited feature of their MSW strategies. The other three regions (Campania, Catalonia and Lombardy) have a more flexible strategy with focus both on material recycling, bio-waste recycling, MBT and incineration although Campania until 2008 relied heavily on MBT.
Table 3-1 A simple overview of different MSW strategies in the period from 2000 to 2012

<table>
<thead>
<tr>
<th></th>
<th>Bio-waste and material recycling + heavily depending on incineration (&gt; 40%)</th>
<th>Bio-waste and material recycling + moderate incineration (max 25%) and moderate MBT (max 25%)</th>
<th>Material recycling + moderate to high MBT (25% - 50%)</th>
<th>Heavily depending on MBT (&gt; 50%)</th>
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<tr>
<td>Castilla-La Mancha</td>
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<tr>
<td>Catalonia</td>
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<td>Campania</td>
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<td>√ (since 2009)</td>
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<td>√ (before 2009)</td>
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<td>Lombardy</td>
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<td>Lodz</td>
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<td>√ (from 2012)</td>
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<tr>
<td>Warminsko-Mazurskie</td>
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<td>√ (From 2012)</td>
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3.2 Important factors for achieving success

The following factors seem to have been important for achieving more recycling and better MSW management in general.

3.2.1 Precise and binding targets help all actors

Precise minimum targets are important for both the public authorities and private stakeholders and create certainty for investors. In 2006 Italy introduced binding targets for the percentage of separately collected waste, with the target increasing each year until 2012 where it was set to 65%. While this implies that such targets in Italy are driven at the national rather than regional level, Lombardy had, already in the 1990s, developed increasing treatment capacity and separate collection. In other words Lombardy was already quite advanced in MSW management when the federal government introduced precise requirements for separate collection. The binding federal targets for separate collection do, on the other hand, seem to have a positive influence on the development of MSW management in Campania.

Precise targets, formulated in terms of percentages of generated MSW, are a strong driver, but they can be difficult to administrate in the absence of historically reliable data. The EU targets for reduction of landfill of biodegradable MSW are linked to the amount generated in 1995, for which only very few Member States have reliable data. Italy did not have good data for 1995 and therefore decided to define the targets as maximum amounts of biodegradable municipal waste allowed to be landfilled in kg per capita. This seems to be a better and more practical solution where historical data is missing.
In 1993 Catalonia introduced the obligation that municipalities with more than 5,000 inhabitants must separately collect bio-waste. The regional waste management plans for 2001-2006 and 2007-2012 included recycling targets, although they are not legally binding. In 2004 the introduction of the landfill tax created an economic incentive for all municipalities to set up separate collection schemes. In 2009 an incineration tax was applied in Catalonia. The Catalan Waste Management Fund redistributes money from the landfill and incineration taxes to the municipalities that have introduced separate collection, creating a positive incentive.

However, experts in Catalonia and Lombardy have noted that increasing the rate of separate collection is, in itself, not sufficient: there has to be more focus on the quality of the separately collected MSW (ETC/SCP, 2014b; ETC/SCP, 2014d). The economic value of the recyclables can be too low compared to the costs of the collection. For example, low-quality plastic recyclables cannot be used for production of plastic, and low-quality compost cannot be used as fertilizer or soil improver and might only be suited for recultivation of landfills. In general, door-to-door separate collection seems to provide the best quality of recyclables. Even if the collection costs are higher, the treatment costs are lower as it results in fewer rejects that must be disposed of and higher revenues from the recyclables (ETC/SCP, 2014b; ENT, 2014).

Poland has introduced minimum recycling targets for glass, metal, paper & cardboard and plastic waste. The targets are mandatory for the municipalities. They were introduced in 2012 and have to be finally fulfilled by 2020. The impact of these targets has yet to be seen.

### 3.2.2 Producer responsibility

In all three countries, extended producer responsibility (EPR) has been introduced for packaging waste, and producer responsibility is also in place for WEEE and batteries as a consequence of EU Directives.

The development of schemes for packaging waste seems to have been especially important for the increase of recycling of MSW. In Italy the development of packaging waste compliance schemes (CONAI) has been a very important source of financial sustainability for separate collection developments undertaken by municipalities. In Spain, the EPR organisations (Ecoembes) make agreements with the regional government directly regarding their financial obligation to cover the costs of the collection and treatment of such as packaging waste. In Poland EPR schemes for packaging waste are also operating, but the way the producer responsibility schemes work in Poland means, according to some stakeholders, that there is a risk that the cost of the collection of the recyclables is covered (at least partially) by the citizens (ETC/SCP, 2014; ETC/SCP, 2014a; ETC/SCP, 2014b; ETC/SCP, 2014c; ETC/SCP, 2014d and ETC/SCP, 2014e).

All together the producer responsibility schemes imply that a backbone has been established for improving MSW management.

### 3.2.3 Administrative units that are too small deter infrastructure investments

Treatment plants for recycling, composting and digestion, sorting, mechanical-biological treatment, incineration and proper landfilling of MSW are expensive to build and operate. Therefore, a single municipality is often too small a unit to secure infrastructure investments and management of the plants. Municipal waste treatment needs a certain volume or scale in order to be undertaken by reliable private or public actors that can secure sufficient quality in the treatment, meet environmental standards and operate economically efficiently. Therefore, it is not surprising that all six regions have created subregions or inter-municipal waste companies for MSW management (ATOs in Italy, AGES and Zonas in Spain, MPOs in Poland). Collection of MSW, on the other hand, can often be more easily organized by individual municipalities or groups of small municipalities.
In Italy and Spain, sub-regional or inter-municipal waste companies have been allocated certain duties regarding the waste treatment, while responsibility for capacity planning lies at the regional (Spain) and provincial (Italy) level. The investments in the waste management facilities can be undertaken by inter-municipal waste companies, by private investors, or as a private public co-operation. In Poland, the regions are responsible for capacity planning and nomination of the waste receiving facilities (RIPOK system), but it is often inter-municipal associations (MPOs) or private public partnerships that invest in and manage facilities.

### 3.2.4 Good planning needs to be supplemented with effective implementation tools

In order to secure private, public or public private partnership (PPP) investments in MSW management facilities, it is crucial that public authorities can control to which waste facilities collected waste should be delivered and for which kind of treatment, instead of leaving this decision to the collectors (often private companies).

As stated above, the construction of sorting plants, MBT-plants, anaerobic-digestion plants (bio-gas), incineration plants and landfills requires large investments. Potential investors need certainty that sufficient waste will be available to operate the plant at or near capacity for the next minimum five to ten years. Plants that do not receive sufficient waste will not be profitable and, in case of publicly owned plants, deficits will have to be covered by the taxpayers.

In the two Italian and two Spanish regions, the responsible authorities can decide to which plant and which type of treatment the collected waste shall be delivered. However, in dense populated areas in Catalonia, where there are several local facilities available, the municipalities have the last word at the time of transporting waste into one or another facility. However, in Poland such a system has only been introduced in 2012 (and implemented by July 2013). Until 2012, the households had to select a waste collector, which then decided where to deliver the waste: the regional authority and the municipalities had no say in the destination of the collected waste.

This system proved to be too liberalised and atomized, and no investor – private or public – would risk the large investments required to construct new waste management facilities with so much uncertainty surrounding the delivery of sufficient waste for a payback period.

The new arrangement removed this uncertainty. Municipalities now have the responsibility for organising the collection of MSW based on tenders. The regional authorities have the responsibility to provide sufficient treatment capacity regarding mechanical biological treatment, sorting of mixed dry recyclables, composting plants, hazardous waste treatment, transfer stations and landfilling (RIPOK). The new RIPOK system nominates certain facilities to be the primary receivers of MSW and others are nominated to be supporting facilities.

The new Polish overall framework conditions have provided new steering tools that makes it much easier to achieve the benefits of a strong inter-municipal co-operation on waste management. In other words, although good waste management planning is a pre-condition for good MSW management, good planning is not itself sufficient if the authorities lack tools to implement the plan.

Of course, the final recycling after sorting of waste glass, metals, paper & cardboard and plastic also requires investments. These recyclables, however, follow market prices and trade routes and their recycling is usually fully organized by private actors.

### 3.2.5 Use of landfill taxes can promote alternatives

Five of the six regions apply a landfill tax. Italy introduced a national landfill tax in 1999, defining only the lowest (EUR 5.2 /ton) and highest tax level (EUR 25.8 /ton). The regions set the tax level and decide how to use the revenues. In Italy, 90 % of the revenue goes to the regions and 10 % to the provinces. The tax has an environmental dimension, as regions shall spend 20 % of the revenue on...
improving the waste management system, financing regional environmental protection agencies or protecting natural areas (Fischer, 2012). In 1999 Lombardy had a tax of EUR 13 per ton, which was increased to EUR 15.5 in 2003. In 2009 Lombardy decreased the tax to EUR 10.5 per ton. Campania has gone in the opposite direction, starting with a very low tax of EUR 5.2 per ton in 1999. This was kept until 2012, where the tax increased to 25 EUR per ton.

Poland has a national landfill tax (called a ‘fee’ in Poland) that was introduced in 1998. The tax increased significantly in 2008 and it is now about EUR 26 per ton for mixed MSW but lower for pre-sorted or pre-treated waste. 50 % of the revenues go to municipal government funds, 10 % to county government, 26 % to provincial ecological funds and 14 % to National Ecological Funds. Local governments can only use revenues for environmental objectives. The revenues can be used as grants to investments in waste management facilities (Fischer, 2012).

As mentioned in section 2.9, Spain does not have a national waste tax, but Catalonia has a landfill tax, introduced in 2004. The original rate of the tax was EUR 10 per ton of municipal waste. However, for municipal waste coming from municipalities that had not initiated separate collection schemes for bio-waste, the tax rate was set at EUR 20 per ton from 2010. In 2012 the landfill tax rates were increased to EUR 12.4 per ton and EUR 21.6 per ton respectively.

Catalonia also has an incineration tax, introduced in 2009. In 2013 the tax level was EUR 5.7 or EUR 16.5 per ton depending on whether the waste comes from municipalities with separate collection schemes for bio-waste or not (ETC/SCP, 2014b). The revenue generated by the landfill and incineration taxes has ranged from EUR 32.2 million in 2004, peaking at EUR 33 million in 2006 and consistently declining until 2011 to reach EUR 22 million, despite an increase of the landfill tax per ton of waste. From 2009 to 2011, the loss of revenue from the landfill tax was partly compensated by the revenue generated from the incineration tax. This constant decrease of tax revenue from the landfill and incineration taxes clearly demonstrates that the fiscal instrument has been effective in reducing the quantity of waste disposed to final treatment, which is beneficial from a waste policy view (ETC/SCP, 2014b).

In Catalonia, around 90 % of the revenue of the tax is returned to local authorities (tax rebate) according to their waste management performance, based on a number of criteria. The main goal is to favour bio-waste treatment and separate collection of bio-waste, along with other aspects of better waste management. A correction factor is applied to give a higher tax return to rural and semi-urban areas that have a higher cost per tonne for waste collection. An additional correction factor gives a higher tax return for the municipalities that have a lower contamination level of the source separated bio-waste (Puig Ventosa et al., 2012). This is important, as it gives a stronger incentive for municipalities to improve the quality of the source separated bio-waste, in order to produce better compost quality, which can be used safely in agriculture or horticulture (ETC/SCP, 2014b).

It seems that in all five regions the landfill tax has provided effective incentives for the diversion of waste away from landfills. The level of the tax is also important: it seems that a level above EUR 20 ton is more likely to result in positive impact. Finally, the effect of the landfill tax is amplified if the tax revenues are returned fully or partly to local authorities for investments in waste management, or as grants to private and public investments in better waste facilities, rather than contributing to overall public expenses, such as schools, hospitals, roads etc.
4 Discussion and conclusions

4.1 Diversion of MSW and biodegradable MSW away from landfills

As shown in Figure 2.4, all regions apart from Castilla-La Mancha have reduced the share of MSW going to landfill over the last ten years. Lombardy has already achieved a very low landfill rate of 7%. It seems that Catalonia and Campania are on a path to continue decreasing landfilling. The two Polish regions will reduce landfilling because more and more waste is sent to MBT. Castilla-La Mancha can also be expected to reduce its landfilling rate thanks to full use of MBT technology in the future.

In case of no change in composition of waste to landfill, a reduction of MSW landfilled also implies a reduction of biodegradable MSW landfilled. Catalonia and Campania anticipate a reduction in the landfilling of biodegradable waste as more and more waste is separately collected as bio-waste and paper & cardboard waste, and as more waste is incinerated. For Campania it is assumed that the huge increase in separate collection of bio-waste from 2008 to 2010 - treated outside the region, which is unusual for composting – reflects that the bio-waste is being recycled and not sent to landfill.

As shown in Figure 2.5 the generation of biodegradable MSW seems to have increased in the Lodz region since 1995. One explanation for the reported increase in landfilling of biodegradable MSW could also be that the generation of biodegradable MSW in 1995 was underestimated or miscalculated. Under all circumstances, it creates problems for the region regarding achieving the Landfill Directive’s reduction targets. However, the introduction of new MBT plants with a capacity to treat all generated MSW already by 2015, as well as the introduction of separate collection of paper & cardboard, can secure a significant reduction of biodegradable MSW landfilled. There also appears to be an underestimation of the generated amount of biodegradable MSW in 1995 in the region of Warminsko-Mazurskie, but not as significant as for Lodz. With the MBT capacity introduced in the Warminsko-Mazurskie region in 2012 and 2013, and the introduction of separate collection of paper and cardboard as well as bio-waste, it seems that the requirements according to the EU Landfill Directive can be met.

In Castilla-La Mancha the authorities expect that all waste not separately collected will be pre-treated by MBT in the future. At the moment, only 60% of the mixed waste is pre-treated due to technical problems at some of the MBT plants. Because of the economic crisis the region does not expect to introduce separate collection of bio-waste in the coming years, which could make it difficult to fulfill the Landfill Directive’s targets for the reduction of biodegradable MSW landfilled. The Directive’s 75% and the 50% targets (as a percentage of the biodegradable MSW generated in 1995) seem to have been fulfilled. Meeting the 35% target by 2016 in the absence of separate collection of bio-waste, however, depends largely on the amount of bio-waste generated and the efficiency of the MBT technology in reducing the biodegradable content of the mixed waste.
4.2 50 % recycling of MSW

In Castilla-La Mancha, the Lodz region and Warminsko-Mazurskie there is a considerable risk that the recycling of MSW will remain below the 50 % target. The main reason is the high amount of mixed MSW sent to MBT. MBT is known to recover only a very small proportion of materials for recycling, normally a maximum of three to seven percent. The biodegradable part of the waste sorted during the MBT process is not normally of sufficient quality to be used as fertilizer or soil improver, as it tends to contain too high a concentration of heavy metals and organic pollutants. Therefore, this part can usually only be used for applications such as re-cultivation of landfills or, if of particularly bad quality, landfilled itself. Therefore MBT will not secure 50 % recycling.

Separate collection of glass, metals, paper & cardboard, plastic and bio-waste, and sorting of mixed dry recyclables separately collected (of glass, metals, paper & cardboard and plastics) has to be increased significantly to achieve the 50 % recycling of MSW target by 2020. It will also require an increased treatment capacity, especially for bio-waste, which is not as 'tradable' as dry recyclables. (However, in terms of compliance with the 50 % recycling target of the Waste Framework Directive, bio-waste recycling is not important if a country chooses method 1 to report compliance.)

If 50 % recycling – measured in relation to total generated MSW - is to be achieved, it will, as a rule of thumb, require at least 30 % - 35 % material recycling, and at least 15 % - 20 % bio-waste recycling, depending on waste composition. Lombardy and Catalonia seem to have very good possibilities for achieving this by 2020. Campania has a reasonable potential, but it will require an annual increase of 1.7 percentage points of the recycling rate until 2020.

Castilla-La Mancha, Lodz and Warminsko-Mazurskie will all require a yearly increase in recycling of between 3.5 - 4.0 percentage points, which is an extraordinary increase. Lodz and Warminsko-Mazurskie have plans to reach 50 % recycling for glass, paper & cardboard, metals and plastics, which is the method Poland will apply for achieving the 50 % target by 2020. This target, however, also seems very ambitious as it will require a yearly increase of recycling of these four fractions by 3.8 and 3.9 percentage points respectively.

Castilla-La Mancha has no plans for introducing separate collection of bio-waste because it is considered too expensive for the region at the moment due to its economic situation, and material recycling in the region is largely limited to packaging waste (ETC/SCP, 2014b). With this strategy, it seems more than doubtful that the region can achieve 50 % recycling by 2020.

Recyclables such as glass, paper, metal and plastics are often traded across borders, but bio-waste and compost are usually not, because the bio-waste or compost is not valuable enough to justify the transportation costs. More separate collection of bio-waste therefore has to be followed up by

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5 Moreover, in Spain, national legislation introduced in 2011 does not allow to label the product resulting from MBT as compost, but as bio-stabilised material. This means that MBT output cannot be used for agricultural purposes. Since this law was only put in place in 2011, it implies that the bio-stabilisate from MBT may have been considered as compost up to 2011. This is the case for the Castilla-La Mancha data used for this report.
investments in local or regional digestion and/or composting plants, and by creating a market for the compost locally.

**4.3 Separate collection of MSW in multi-storey buildings**

The introduction of separate door-to-door collection of different waste streams is rather straightforward in residential areas dominated by single houses, semi-detached houses and similar types of houses. It is more challenging to encourage and organize MSW separate collection for people living in multi-storey buildings, and the result is often a lower quantity and quality of the separately collected MSW. Four of the six regions include quite large cities such as Barcelona, Lodz, Milan and Naples, where many people live in multi-storey buildings. Street garbage bins or street containers (bring systems) are often the backbone in the collection system in such areas, as opposed to door-to-door collection. These bring systems often struggle to encourage the inhabitants to separate their waste instead of putting all the waste in the mixed waste bin. The consequence of this is a reduced amount of separately collected waste. Furthermore, the separately collected wastes from street containers normally contain a larger percentage of impurities. The final recycled amount of MSW will therefore be smaller compared with the amount of door-to-door collection, and the revenues for the recyclables will be lower, due to their poorer quality.

Therefore, exchange of ideas and experiences between the regions and municipalities in Europe on how to solve these problems could be of great value: for example, experiences of successfully implementing separate collection bins in high rise buildings; either within each flat or in the residential staircase area or at the residential floor area. Even if the optimal collection system often depends on local conditions in the large cities, reliable documented solutions to this problem will help many regions.

**4.4 Expensive not to invest in sufficient waste management treatment capacity**

Some information about the fees paid by households for collection and treatment of MSW has been uncovered, but the information is not very detailed. Households in Campania pay the largest fee (EUR 380 per household per year). This is twice the cost in Lombardy (EUR 200), and three to four times higher than the fees in Catalonia (EUR 80), Castilla-La Mancha (EUR 90) and Lodz (EUR 75). Lowest is the average fee in Warminsko-Mazurskie, where it is about EUR 45.

This seems to indicate that the ‘Waste emergency’ in Campania and especially the waste management crisis of Naples have been very expensive for the inhabitants. When no sufficient waste treatment capacity is available and much of the collected waste has to be treated outside the region, the bill becomes very high in the long run.

**4.4.1 Lack of incentives for households to separate waste**

Another important aspect of household waste management fees is that they generally do not seem to provide sufficient economic incentive to make households sort their waste. ‘Pay as you throw’ systems, based on how much mixed MSW citizens dispose of, are rare.

In four regions, households pay the same fees for a single mixed MSW bin as they do for having a bin for separately collected waste and a bin for mixed waste. In Lodz and Warminsko-Mazurskie it has been possible to identify some differences between these two bin systems, but it seems that the differences in the fees are not sufficiently high to encourage better sorting.

**4.4.2 Reliance on external subsidies**

Some of the selected regions, for example, Castilla- La Mancha and Campania, have relied on external (EU) subsidies to support the closure of illegal dumpsites and develop new waste management infrastructure. Campania will receive EUR 135 million in EU contributions from the
2006-2013 budget (European Parliament, 2011). The Lodz region and the Warminsko-Mazurskie regions have also received EU subsidies to build several treatment facilities. The investments in treatment facilities help create treatment capacity in the regions and in that way initiate a take-off of better waste management.

However, by receiving EU funds, the true cost of waste management is not always reflected in the charges to the households and commercial activities. One of the biggest challenges faced by the region of Castilla-La Mancha, for example, is to more adequately recover the full cost of waste collection and treatment from households.

4.5 Structured dialogue between stakeholders on MSW management

In some regions, for example in Lodz and Castilla-La Mancha, different stakeholders underlined the importance of a structured dialogue and formal exchange of points of views and experiences between the different stakeholders (municipalities, regional authorities, national authorities, private and/or public operators, NGOs, citizens) in order to develop coherent and optimised waste management planning and implementation.

Although some dialogue already takes place, it was argued by a number of stakeholders at the regional, municipal and plant operator level, that they would welcome a higher degree of formal interaction between the different levels of authorities including the national level in order to learn and improve best practice. They would also like to be involved in strategic discussions concerning the best means of reaching regulatory compliance. These comments suggest that there is room for improvement with regards to co-operation between the different authority levels and different stakeholders.

4.6 Lessons learnt

Almost all six regions have succeeded in improving their management of MSW within a relatively short time period. A very strong driver has been the fulfilling of EU requirements, especially the landfill diversion targets for biodegradable MSW according to the EU Landfill Directive, the recycling targets for packaging waste as required by the EU Packaging and Packaging Waste Directive (glass, metals, paper & cardboard and plastic), but also the new requirement of 50\% recycling by 2020 set in the 2008 EU Waste Framework Directive.

Had these EU requirements not been introduced and transposed into national regulation, it is doubtful if the improvement in MSW management in Campania, Castilla-La Mancha, Lodz and Warminsko-Mazurskie would have been so strong.

Having said that, it also has to be underlined that the two wealthiest regions studied, Catalonia and Lombardy, initiated their own strategies, plans and implementation of better MSW management in the 1990’s, preceding the development of EU requirements and their transposition into Spanish and Italian legislation. These two regions show that the regional level can serve as a crucial driver and factor in improving MSW management. Both regions have succeeded in changing their strategies away from landfill towards material recycling, bio-waste recycling and incineration with energy recovery within a decade. The achievement of quite a high level of bio-waste recycling in the two regions (13\% - 18\%) is particularly interesting, given there are no obligations in the EU regulation to recycle bio-waste, only a demand of how much bio-degradable MSW is allowed to be landfilled.

Some of the factors behind the achieved results in Catalonia and Lombardy are:

- Active and early use of waste management planning, including precise percentage targets for separate collection and how the waste is to be managed;
• Definition of sub-regions or inter-municipal waste associations (ATOs and Zonas) responsible for providing sufficient treatment capacity in the form of mechanical sorting, composting, MBT, incineration and landfilling;

• Good co-operation between the public authorities and private investors;

• Guarantee that the appointed and constructed treatment facilities receive sufficient waste to justify the investments. However, the economic crisis has presented some problems, especially in Catalonia, because the generation of MSW has declined;

• Active use of landfill taxes to provide incentives for diverting waste away from landfill and, in Catalonia, also an incineration tax in order to divert waste away from incineration plants toward recycling;

• Use of the revenues from the landfill and incineration taxes to support municipalities and other stakeholders in investing in better collection schemes and treatment facilities;

• Focus on the quality of the separately collected waste materials and bio-wastes in order to ensure that these recyclables can be sold.

Campania seems to have partly initiated a process similar to those in Catalonia and Lombardy. However, in Campania the process is very much driven by national laws, and the fact that the region has been in an emergency situation with waste management under central administration until the end of 2009. The region itself has now taken over and some positive results have been achieved. The officially reported data covering Campania leaves some uncertainty about the actual level of recycling, because much of the bio-waste is treated outside the region. Furthermore, there are still problems with waste collection in Naples.

The two Polish regions and Castilla-La Mancha started their initiatives on better MSW management after the pertinent EU Directives and targets had been transposed into Polish and Spanish legislation. The initiatives were not initiated by the regions themselves. It seems that better regional MSW management in these regions, so far, has been very much depending on the framework created by the national authorities.

This is also exemplified by the importance of the substantial increase in the Polish landfill tax in 2008, which has provided a stronger incentive to divert waste away from landfills. The two regions in Poland also demonstrate that if legal framework conditions do not adequately support regional and municipal authorities, it makes it very difficult to improve MSW management. The tools available to regional and municipal authorities in Poland to implement waste management planning were very weak until 2012. Before 2012, households could choose their own collector and the collectors decided where to deliver the collected. The introduction of the new system (RIPOK) in 2012, – where the collected MSW waste has to be delivered to specific plants nominated by the regional authority – has created a much stronger set of waste planning tools.

The high MBT capacities in Lodz, Warminsko-Mazurskie and Castilla-La Mancha, created partly with financial support from the EU, represent something of a challenge. While high MBT capacities clearly support the diversion of biodegradable MSW from landfill, MBT itself will not secure the needed jump towards a recycling society.

The analysis of the six regions confirms the importance of regional and even local policies for better waste management: reducing municipal waste landfilling rates; increasing recycling rates; implementing behavior-change incentives; and managing the costs of municipal waste management.

Regional waste policy does not just implement EU and national legislation; it can be the frontrunner for better MSW management at both national and European level.
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