

WORKING PAPER

*The Spanish Waste Sector:
Waste Collection, Transport and Treatment*

Dolores DIZY MENÉNDEZ & Olga RUIZ CAÑETE

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*The Spanish Waste Sector:
Waste Collection, Transport and Treatment*

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1. INTRODUCTION

Residues are one of the most important environmental problems in developed societies and, in particular, in the more industrialised countries¹. Within the waste sector it constitutes an important urban activity by reason of ITS economic and health impact. In addition, treatment and recycling of waste have peculiarities of a physical nature, being systems and collection that substantially affect the quality of the environment.

In the case of Spain analysis is difficult because the information available on the waste sector is scattered and not uniform, with important differences in the methodology for estimating, calculation and processing data². A wide variety of statistical sources have been used to carry out this work: official data from Eurostat, Spanish National Institute of Statistics (INE) and various Ministries. Other information was obtained from companies that provide these services and different local government survey agencies. Interviews were also held with public and private experts in the Spanish waste sector.

There are five phases in integral waste management: deposit, collection, transportation, treatment and disposal. In this article we will focus only on the first three, while treatment and disposal will be developed in subsequent works. However, the object here is the analysis of waste generated by households, business and institutions³.

We first describe the legislative framework of household waste in Spain and its production and situation in relation to other European countries. Seeing the scale of the municipal and regional outsourcing of waste services and the management modalities, the collection models, the origin and destination of collected waste and the distribution of the market are examined. The costs and financing of Spanish waste services are also estimated. Finally, the quality and satisfaction with the service provided are evaluated.

¹ According to the *Survey of Home and Environment* (Spanish National Institute of Statistics 2008) 76.9% of the Spanish population of 16 years and over are very concerned about the environment and 27.9% have detected one or another problem.

² For example, in 2007 comparison of information on waste generation yields the following variability: Eurostat 588.0 kg/inhabitant/year, Spanish National Institute of Statistics 550.5 kg./inhabitant/year, and Ministry of Environment 521.0 kg./inhabitants./year.

³ Mining, quarrying, construction, manufacturing and other industrial waste are not included in the analysis.

2. LEGAL FRAMEWORK

According to Spanish legislation (Law 10/1998 on Residues), “household waste” means residues generated in homes, shops, offices and services or any other entity that cannot be described as dangerous. Waste from street cleaning, municipal parks and gardens, recreation areas and beaches, dead domestic animals, furniture, fittings and abandoned vehicles and materials from minor works and home repairs likewise falls to be classified as “household waste”.

The collection, treatment, transport and removal of solid urban waste are considered as public services of general interest, provision of which is obligatory in all municipalities and, in the case of councils of more than 5 000 inhabitants, selective waste collection is also required by law.

The Spanish waste regulation is large and is adjusted frequently in order to bring it into line with European legislation. The most relevant regulation concerns for waste management and treatment are:

1. European legislation:

- Directive 2008/98/EC is the current European waste framework, with the obligation of incorporation by December 2010. It requires a recycling rate of at least 50% by 2020 for paper, metal, plastics and glass in household waste.

This Directive makes a clear distinction between residue and non-residue and between recovery and disposal. It is based on the principles of energy efficiency, eco-efficiency, reduction of the greenhouse gases effect and, as main innovation, analysis of environmental impact throughout the product lifecycle. It establishes an urban waste management cycle based on five points: prevention, preparation for reuse, recycling (collection), recovery and disposal. In addition, it provides for the imposition of sanctions as a means of controlling illegal discharge.

- Directive 2006/12/EC, effective in Spain, introduces the need to regulate the residues with economic rigour and the development of specific waste prevention plans. Current European waste policy leaves in place the traditional distinction between hazardous waste and non-hazardous waste to establish a common legislative regulation for all type of waste.

2. Spanish legislation:

- The Local Regime Law (*Ley 7/1985, de Bases de Régimen Local*) assigns the competence in waste treatment to municipalities.
- The Residues Law (*Ley 10/1998, de Residuos*) is the legal framework on the production and management of the two types of waste (domestic and hazardous waste)⁴ and establishes the obligation to adopt national waste plans. These plans are elaborated by the integration of the respective regional plans and should be reviewed from time to time, but in any case at least every four years.

Two main objectives are set out in the Residues Law:

- a) To prevent the production of waste; to establish the legal framework for its production and management; to promote reduction, reuse, recycling and other forms of valorisation of waste.
 - b) To regulate contaminated land to protect the environment and human health.
- The Second Integrated National Residues Plan (PNIR) 2008-2015⁵ was approved on 26 December 2008 by the Council of Ministers with a 23 million euro budget and three main priorities, called *the three Rsr*: first, to reduce, second, to re-use and, third, to recycle. It sets out the guidelines and the main measures to be implemented, which are developed in thirteen specific plans for each type of waste (domestic, hazardous, used tyres, sludges, old batteries, ...).

The PNIR is based on the principles of self-sufficiency and proximity and has the follows basic objectives:

- a) To promote correct management of the residues through the creation of new infrastructures and improvement of existing infrastructures in order to guarantee efficient waste management.

⁴ The Residues Law applies to any type of waste with the exception of radioactive waste, emissions, discharges of liquid effluents, discharges from land to sea, and discharges from ships and aircraft to the sea.

⁵ The first National Plan for Residues (I PNIR) covered the years 2000-2006.

- b) To reduce waste production through changes in management, giving priority to the options that less affect climate change.
 - c) To impel correct treatment of waste so also eliminate illegal landfills and to consolidate I+D+i programmes applied to waste management.
 - d) To increase the responsibility of the involved agents: public authorities and services, companies, consumers and users.
- Other regulatory rules are: the Packaging Law (*Ley 11/1997, de Envases*); the Incineration Act (*RD 653/2003, sobre Incineración de Residuos*); Elimination of Waste by the Llandfill Act (*RD 1481/2001, sobre Eliminación de Residuos mediante Vertedero*).
 - In recent years the Autonomous Communities have also developed and approved strategic waste plans based on their own policies and competences. Certain municipalities have also established programmes and objectives for the improvement of waste management, mostly concerning household waste.

Analysis of the Spanish legislation reveals that all the different levels of administrations (national, regional and local) have competences in the waste sector:

- a) National level: the Environment Ministry (MARM) elaborates the national plans and attends to the authorization and inspection of waste to/from EU countries.
- b) Regional level: the Autonomous Communities elaborates the strategic plans for waste. They also attend to the authorization, inspection and sanction of waste production and management activities.
- c) Local level: the municipal authorities manage the urban waste (domestic, industry and commerce, offices and services).

The municipal competences span most of the phases: collection, treatment and final disposal of waste. Municipal legislation more specifically regulates the following activities:

- a) Classification of waste
- b) Management of solid urban (household) waste.

- c) Medical/biological waste
- d) Industrial waste
- e) Special waste
- f) Other waste
- g) Selective waste collection
- h) Fixed installations (depots, workshops...)

In the case of Spain the municipalities, large or small, have a high-priority paper in the waste sector. The councils are responsible for the majority of waste process phases -refuse collection, treatment and disposal, and each decides how to provide and to finance the services with total independence.

3. WASTE PRODUCTION

One of the most difficult aspects of the environmental policy of the European Union is urban waste. Environmental Action programmes have failed to prise apart production of waste from economic growth, and the current values are still far removed from the target values.

In 2007 the total collected municipal waste⁶ was 258.5 million tonnes in the European Union 27 (186.8 million tonnes in the European Union 15); or an average of 9.7 million tonnes. Germany (46.4 million tonnes), United Kingdom (34.8), France (34.4), Italy (32.5) and Spain (26.2) reported the highest amounts, with very high values compared with the European average.

The production of municipal waste in Europe over the past 13 years displays a clear trend towards stabilisation⁷ with a slight increase of 4.8% between 1995 and 2007. The increase of household waste has been more substantial in Spain, with a growth rate of 7.1%, well above the European and OECD averages.

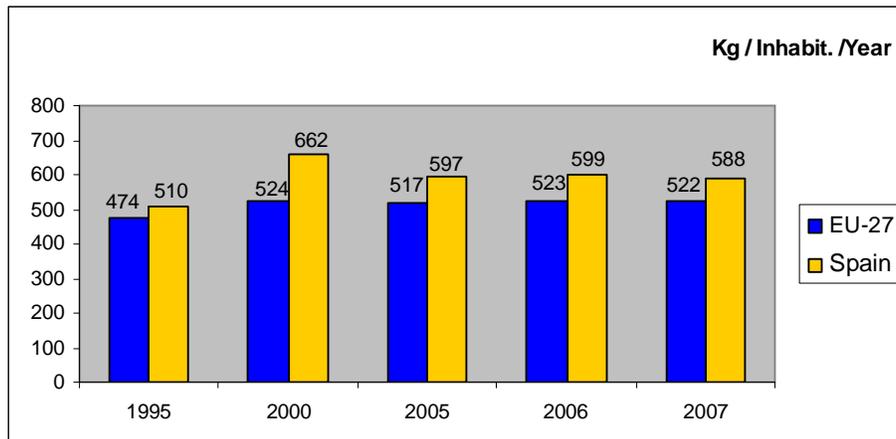
Between 1995 and 2007 waste production was 591 kg per person per year as the Spanish average and 512 kg as the European average (Figure 1). The Spanish evolution can be explained by many and various reasons:

⁶ Household waste accounts for around 7.3% of all waste generated in EU-27; this share was higher (9.3%) in the old Member States. Spain follows the European average: 15% of the total amount was allocated to domestic activities.

⁷ Recent household waste developments in the European Union shows three periods: growth between 1995 and 2002, reduction 2002 to 2005 and a slight upturn in recent years.

population growth, increase of the migrant population, and being the preferred tourist destination in Europe.

Figure 1. Municipal waste production trends

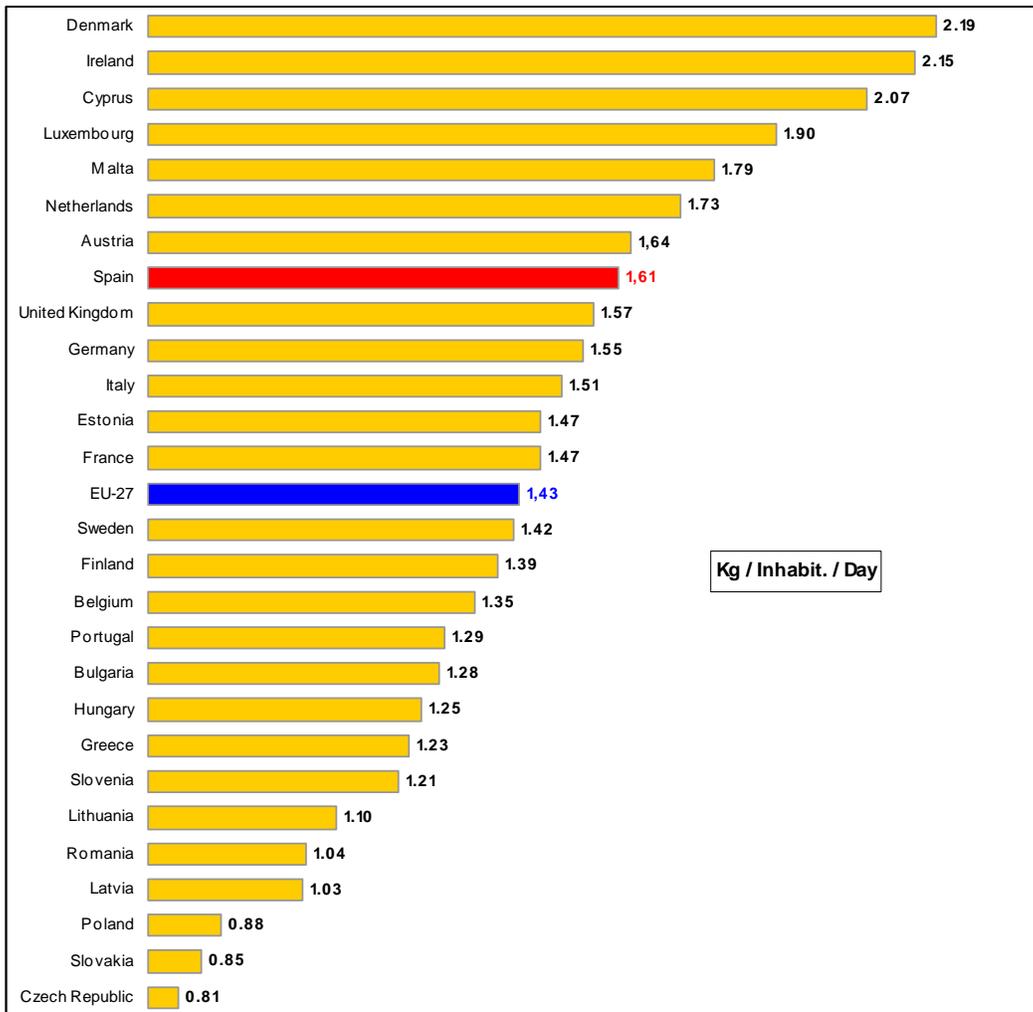


Source: Eurostat (2009).

In 2007 the average amount of waste produced per person in the European Union was 522 kg. However, this quantity is fairly scattered across the Member States. Denmark (801 kg per inhabitant), Ireland (788) and Cyprus (754) had the highest *per-capita* production of municipal waste in Europe; the lowest values are reported by the Czech Republic (294), Slovakia (309) and Poland. In Spain the waste generated was 588 kg per inhabitant, almost 4% above the European average.

Figure 2 shows the waste produced in the European context. Production of municipal waste in Spain is evidently greater than in Europe: 1.6 kg per inhabitant per day as the national average, as against 1.4 kg for Europe.

Figure 2. Waste production in Europe in 2007

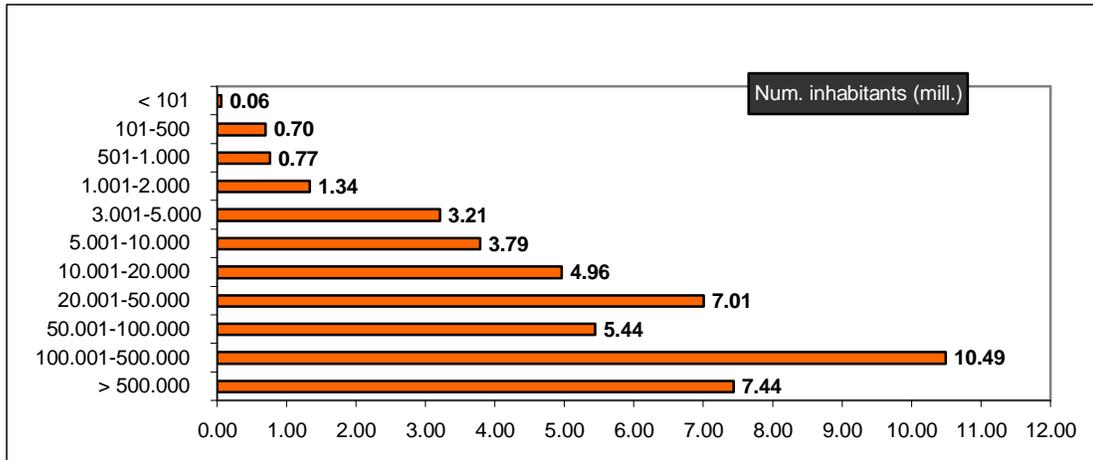


Source: Eurostat (2009).

It is important to know the distribution of population and municipalities in order to understand the problems due to waste generation in Spain.

In Figure 3 municipalities are classified according to the number of inhabitants. Only 0.8% of Spanish municipalities have more than 100 000 inhabitants, whereas 60% have less than 1 000 inhabitants. This concentration of population in smaller administrative units gives waste collection a more rural character. This is long-distance collection with small collection volumes, thus requiring the introduction of waste transfer centres and subsequent long-distance transport to treatment and disposal plants.

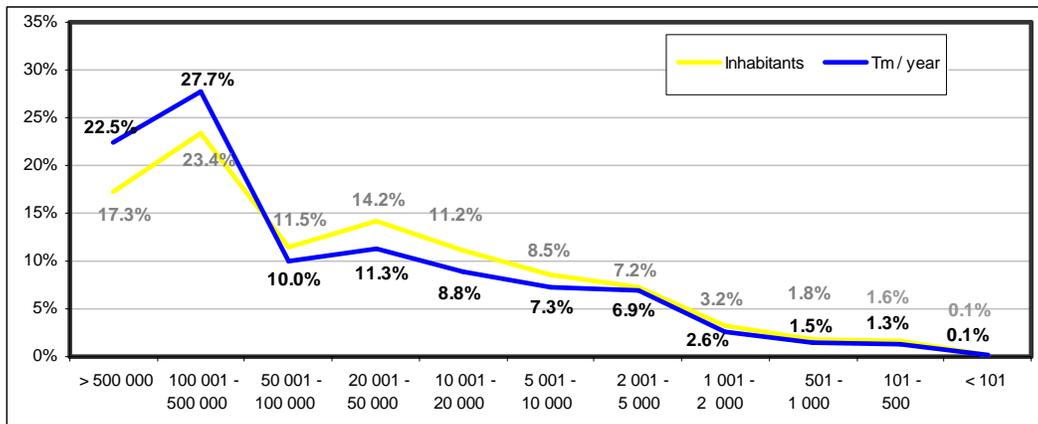
Figure 3. Distribution of Spanish population in 2007



Source: INE (2008).

Spanish population distribution is evidently very uneven because of the great concentration in large cities. The quantity of waste follows a similar distribution but presents a greater concentration (Figure 4). So, towns and cities with more than 100 000 inhabitants represent 41% of the population and produce 50% of the waste, whereas municipalities with less than 1 000 inhabitants represent 4% of the population while producing 3% of the waste.

Figure 4. Spanish inhabitants and household waste

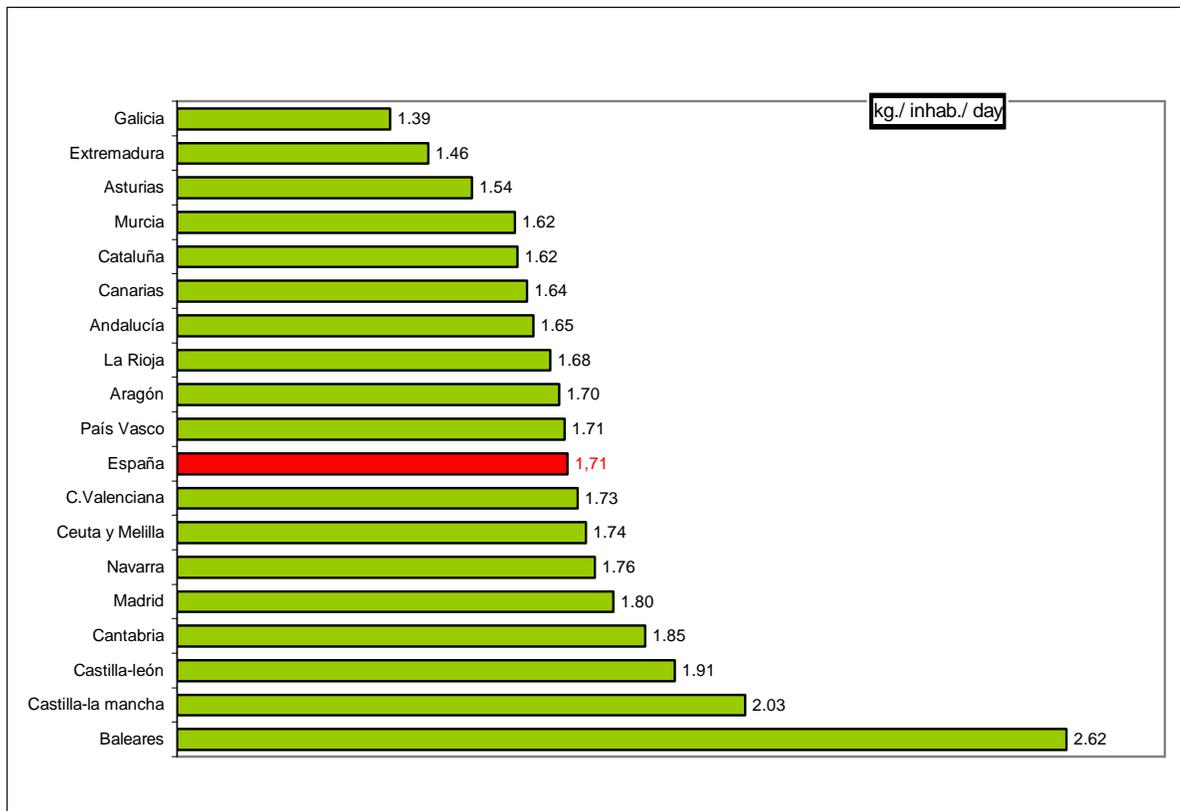


Source: Own estimate.

Furthermore, household waste distribution differs between Spanish regions from 2.2 kg per inhabitant per day in Canarias to 0.8 kg per inhabitant per

day in Galicia (Figure 5). The national average production waste is 1.71 kg per inhabitant per year.

Figure 5. Household waste production in Spanish regions in 2007



Source: INE 2009.

The highest household waste production rates were reported in the Baleares, a region that it is an important holiday destination, so tourists produce waste although they are not considered as being inhabitants. The values for Ceuta and Melilla are also high because of the immigrant population and for the same reasons.

4. FORMS OF MANAGEMENT

In Spain all waste from homes, shops, offices and services activities deposited in the street for collection and transport for disposal or treatment plants is owned by the City Council. In addition, regardless of the form of waste management, the ownership of the services is always of the council;

the equipments can or not revert to the council at the end of the concession depending on the specifications of the contract.

In Spain household **waste collection** is organised under different administrative arrangements⁸:

A. Direct management by the home municipality (public service) or own public entities (subcontracted or licence service):

- Public company with municipal and/or regional capital. This modality cater to a minority of the population; services are provided jointly to several municipalities of small inhabitants (rural area), as is the case of Cogersa (Asturias) or Gespesa (Extremadura). In some exceptional cases, there are municipalities with a larger populations that perform waste collection services direct through a municipal enterprise without competitive bidding, such as Emaya in Palma de Mallorca (401 270 inhabitants) and Lipasam in Sevilla (703 206 inhabitants).
- Direct municipal service. This form of management is applied in smaller municipalities, apart for certain exceptions such as Valladolid (317 864 inhabitants), Badajoz (148 324 inhabitants), Huesca (52 059 inhabitants) or Teruel (35 396 inhabitants).

B. Indirect management by private agents under an international public contract (public bidding) system:

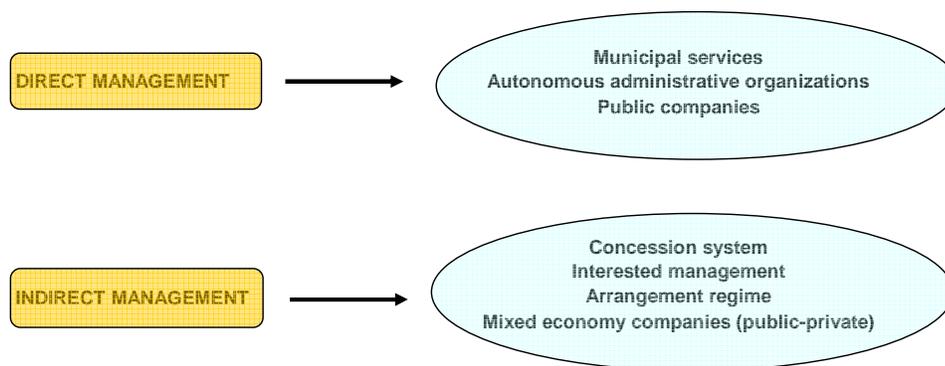
- Private companies with administrative concessions running for between 8 and 10 years. This system is applied to most of the population and in practically all the major Spanish cities, such as Madrid, Barcelona, Valencia and Zaragoza, each with more than 500 000 inhabitants.
- Mixed-capital (public-private) companies with administrative concessions usually running for 8 to 10 years. Such is the case of Limasa in Malaga (568 305 inhabitants), a mixed company whose shareholding is formed by municipal capital (49%) and several private companies (FCC 26%, Urbaser 17.5%, Sando 5% and Unicaja 2.5%).

⁸ The Regulatory Law of Local Administrations (Ley 7/1985, Reguladora de las Haciendas Locales).

Each municipality decides the form of management modality of its waste services. The Spanish councils have ample room for manoeuvre when deciding rules and procedures and characteristics. Under the law, municipalities may be grouped in order to optimize the management of services.

Figure 6 shows the various legal modalities established in Spanish legislation.

Figure 6. Forms of management in the provision of waste services



It is important to emphasise that the role of the municipalities changes depending on the type of management chosen. In indirect management the public sector is responsible only for the regulatory aspects; in direct management, however, it is responsible for the regulatory aspects and for service management.

In the case of indirect management, the plenary session council has to approve the administrative and technical rules of the tender, such as routes, technical innovations, frequency and quality of service, financial resources (fees, taxes or public prices), obligations stipulated in contracts and surveys of the development of the service.... The bidders must design their services (according to municipality requirements), to evaluate the service costs and to define how to reassess the annual cost of the services during the contract in a sealed bid. However, these aspects are not regulated when the service is offered through direct management.

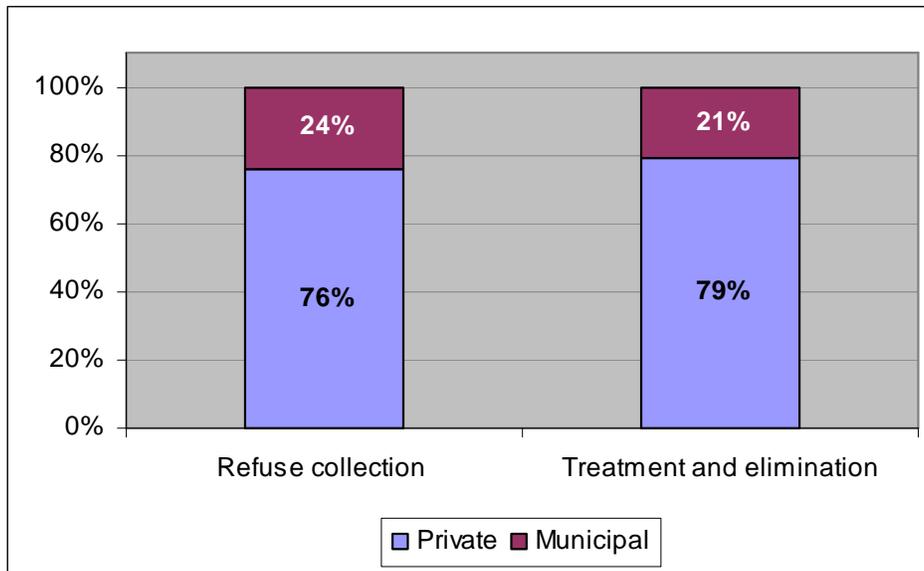
The tenders are for periods of 8 to 10 years, the municipality fixing the service features in the specifications an annual operating fee. Providers must (i) design the services, (ii) price the costs and (iii) give an economic

offer for the whole licence period. In addition, the initial investment (machinery and fixed installations) is assumed by the contractor, being the sole person in economic control of end-to-end operation for the term of the concession. Consequently, the provider effects payments, defrays the labour costs, participates in collective bargaining, implements the services, negotiates the financial aspects,...The contractor also invoices the services to the municipality and develops technological improvements.

The production costs offered will be checked only by increase of the population, of the services and of the labour costs. The energy costs will be reviewed according to the official price indexes.

In Spain the temporary evolution of waste management shows a trend towards decrease of direct management in favour of indirect forms of management. In 2008, 76% of the waste collection services and 79% of the treatment and disposal services were provided by indirect management by private companies in the form of temporary licences under international public tender.

Figure 7. Household waste management market
(% population)



Source: Own estimate.

In Spain there are two forms for the **transport and treatment** of household waste:

- A. Direct management through companies property of the Autonomous Communities which capital is totally public: Cogersa (Asturias), Remesa (Melilla) and Cogermu (Murcia) o Gespesa (Extremadura). There are also mixed companies the majority capital of which is public; for example, Sogama in Galicia with 51% participation by the Autonomous Community and 49% by a private electrical company (Fenosa).
- B. Public bidding by mixed or private companies active in the treatment of waste in any of its forms: incineration, biological treatment plants, controlled landfills etc. Such, for example, is the case for the autonomous communities of Cataluña and Madrid; in the city of Málaga the company Limasa comprises holdings by the council (49%) and four private companies -FCC (26%), Urbaser (17.5%), Sando (5%) and Unicaja (2.5%)-.

In the case of waste treatment and disposal services, investments are made by the contractors during the outsourcing period, but the councils will remain the owners of the installations at the end of the day. Tenders are for the long term (10-30 years), longer than for waste deposit and collection services.

The preference for indirect management is due to various reasons: (i) it limits the indebtedness of the municipalities, (ii) it increases competition, (iii) it requires a meticulous wording of the contract, and (iv) it demands a precise delimitation of the liabilities of the operator. At the same time it reinforces the capacity of control of management and transparency in the decision-making process. Spain is now one of the European countries with more private contracting in public waste services.

The main barriers to entry in the waste sector are the necessary level of experience and the high investments required for implementation of the services. To turn synergies to best account tenderers will operate either individually or in joint ventures, or again through entities of public-private capital.

In Spain there is a very competitive market in waste sector. The requirements imposed in the tenders have positive spin-off for costs, quality and technological developments of household waste services.

5. HOUSEHOLD WASTE COLLECTION MODELS

There are four identifiable household waste collection models:

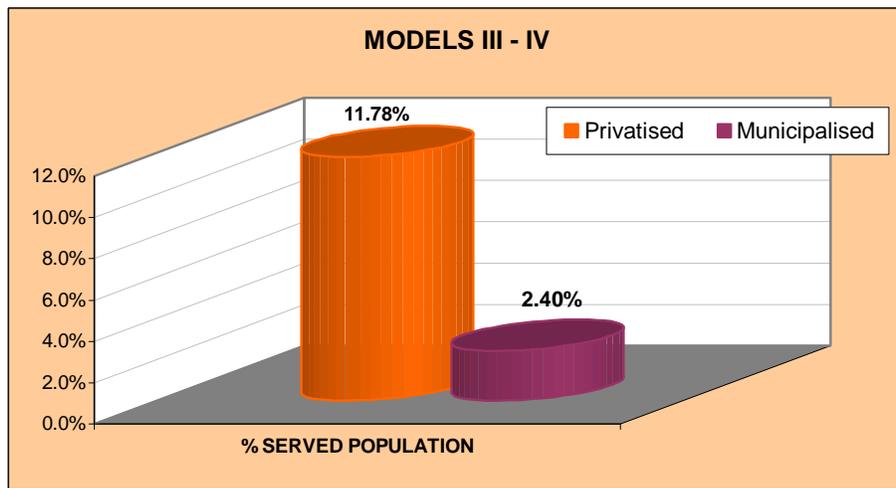
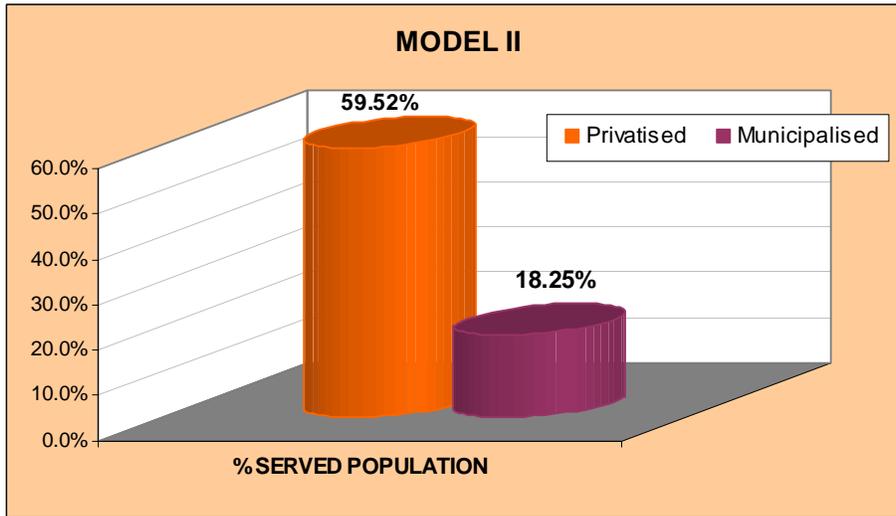
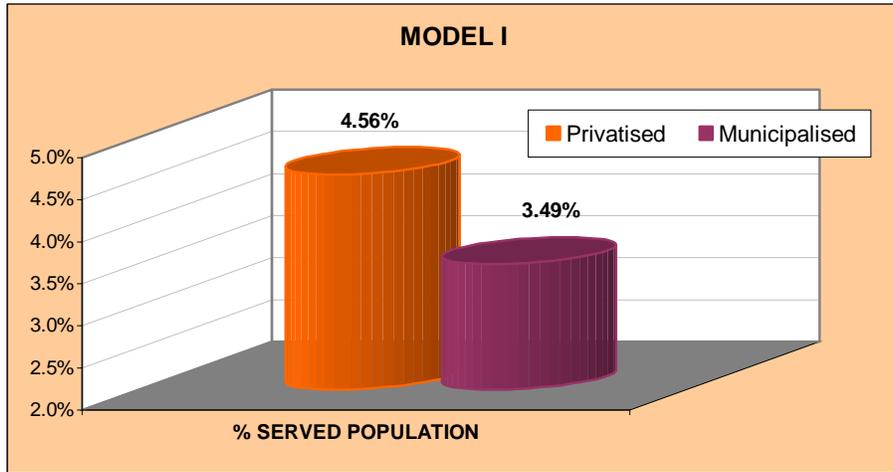
- Model I: traditional waste collection without preselection.
- Model II: selectively packaged waste collection ("*yellow bag*") plus collection of unsorted household waste.
- Model III: selective collection of the organic fraction plus collection of unsorted household waste.
- Model IV: selective packaging and collection of the organic fraction plus collection and unsorted household waste.

Whatever the chosen model, the streets of all Spanish municipalities have large-capacity containers (2 to 5 cubic metres) to receive paper, cardboard and glass.

Models I and II are mutually exclusive and, therefore, can never coexist in the same municipality. Model III may be complemented with selective collection of packaging, in which case packaging, organic waste and unsorted household waste are collected separately (Model IV). The development of the latter Models (III and IV) is the result of the implementation of treatment systems based on the use of organic products for biomethane.

Figure 8 shows the relative importance of each model of waste collection as measured by the percentage of the client population.

Figure 8. Household waste collection models



Source: Own estimate.

6. DOMESTIC WASTE PRODUCTION: COMPOSITION AND TREATMENT

Collection and transport of household waste in Spain is subject to at-source sorting. The different products are separated by citizens in various forms:

- Collection by housing buildings (“*door-to-door*”). In this case, the household waste is placed in standardised dustbins of different volumes: the smallest has a capacity of 120-230 litres, the largest 2 400 - 3 200 litres.
- Collection in large-capacity containers located in streets or in isolated zones called *civic amenities sites* (CAS). This compilation is made with containers of 3 000 to 4 000 litres.

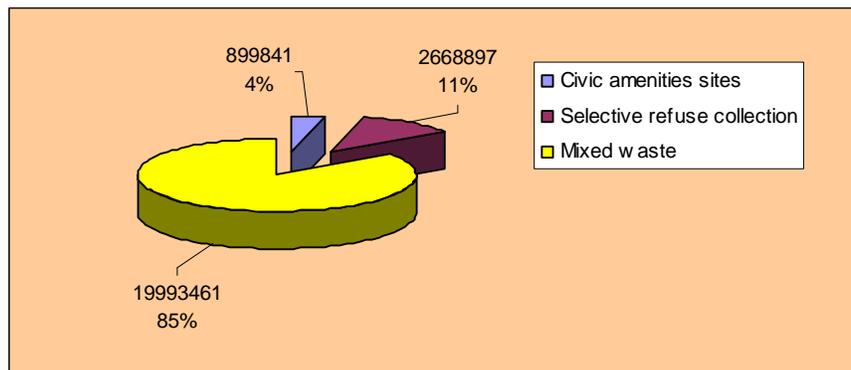
Household waste collection in Spain by waste collection form was as follows in 2007:

| Waste collection modality | Tonnes | % |
|---------------------------|------------|---------|
| Sorted waste collection | 2 668 897 | 11.33% |
| Unsorted waste | 19 993 461 | 84.85% |
| Civic amenity site waste | 899 841 | 3.80% |
| Total | 23 562 199 | 100.00% |

Source: MARM (2008).

As can be seen in Figure 9, the culture of recycling in Spain is below the European average. 84.8% of household waste is collected in the unsorted container placed in homes (mixed waste), while only 15.1% of household waste comes from one or another selective process, through selective refuse collection (11.3%) or waste in civic amenities sites (3.9%). Selective waste collection with waste sorting requirements have however been initiated in the big cities in recent years.

Figure 9. Household waste production (tonnes year 2007)



Source: MARM (2008).

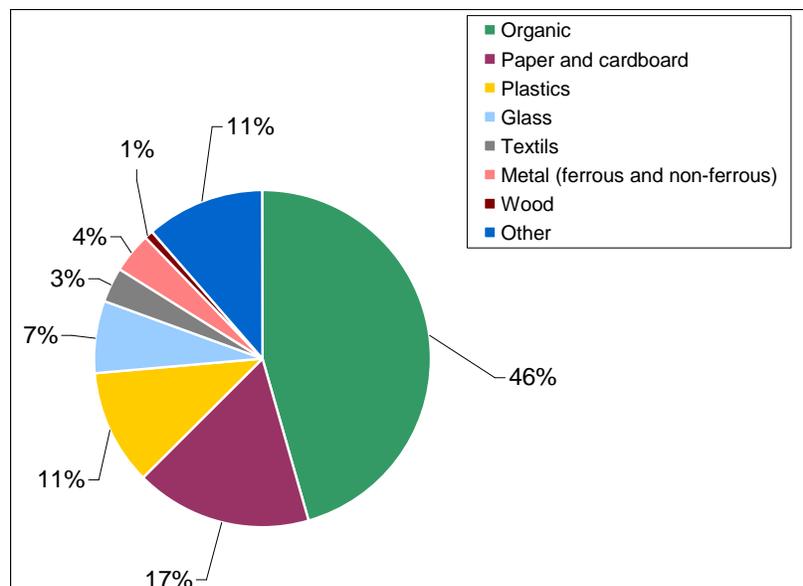
Figure 10 shows the composition and treatment of household waste. That is to say, the **origin and the destination** of the 23 millions tonnes of urban waste produced in Spain in the year 2007.

The Spanish household waste originates from seven main products:

- Organic material (46%). Representing almost half of the waste generated by households and its volume is higher in rural areas while the municipality has a lower economic level. The scale of organic waste is greater than the average for the European countries. This explains why in Spain there are large numbers of installations that process organic waste to produce compost and electricity in bio-methane plants.
- Paper and cardboard (17%). This fraction is collected for subsequent recycling with high-volume special communal containers. In recent years the number of containers installed in the streets has increased and the citizen contribution realised in the civic amenities sites. In spite of the effort of recycling so far, the collection of paper and cardboard remain lower than the European average.
- Plastic waste (11%). In some cities is collected separately for recycling.
- Glass (7%). This component represents a contribution of 35 kg per inhabitant per year. There is a national entity (ANFEVI) that coordinates the recycling of this product.

- Ferrous and non-ferrous materials (4%). Among them tinplate stands out as the iron compound that, once recycled, is employed in food production for cans and in industry for containers for paint and oils.
- Textiles (3%) and wood (less than 1%).
- Other waste is mainly composed of cellulose and gums. Their fraction is smaller, but some are highly pollutant, and in most cases they are considered dangerous for health.

Figure 10. Spanish household waste composition



Source: INE (2009).

The amount of municipal waste treated in 2007 according to type of installation is as follows⁹:

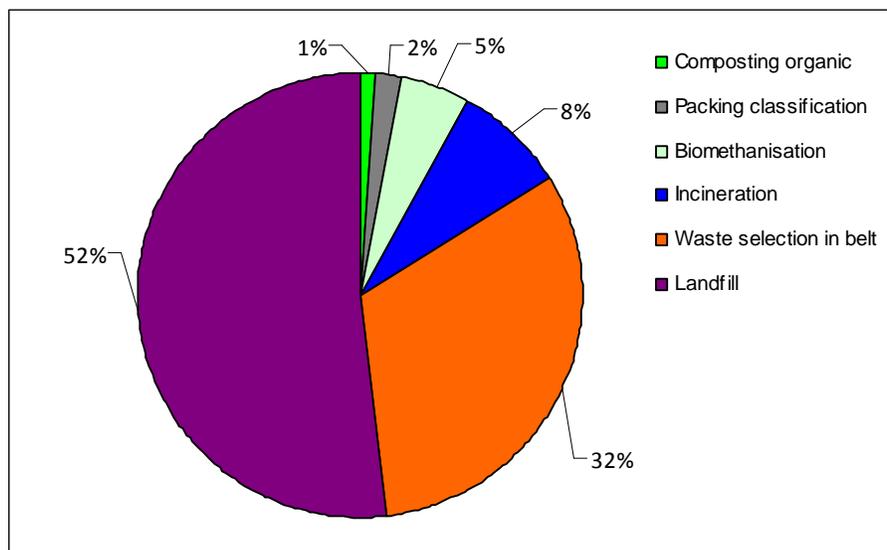
⁹ Treated waste is always higher than collected waste because waste in landfills and incineration installations include rejects from classification of packaging and biological treatment plants.

| Type of installation | N° installations | Treated waste (tonnes) | Tonnes per plant | % |
|-------------------------|------------------|------------------------|------------------|---------|
| Packing classification | 88 | 559 271 | 6 355 | 2.54% |
| Composting organic | 20 | 161 781 | 8 089 | 0.74% |
| Waste selection in belt | 61 | 7 249 622 | 118 846 | 32.96% |
| Biomethanisation | 12 | 1 041 453 | 86 788 | 4.74% |
| Incineration | 10 | 1 911 649 | 191 165 | 8.69% |
| Landfill | 162 | 11 609 567 | 68 331 | 50.33% |
| Total | 353 | 21 993 343 | 62 304 | 100.00% |

Source: MARM (2009).

With respect to treatment of domestic waste, half is sent to landfill and a third goes to waste selection in belt. Only 8% is incinerated and 5% is sent to a biomethane plant (Figure 11).

Figure 11. Household waste treatment



Source: MARM (2009).

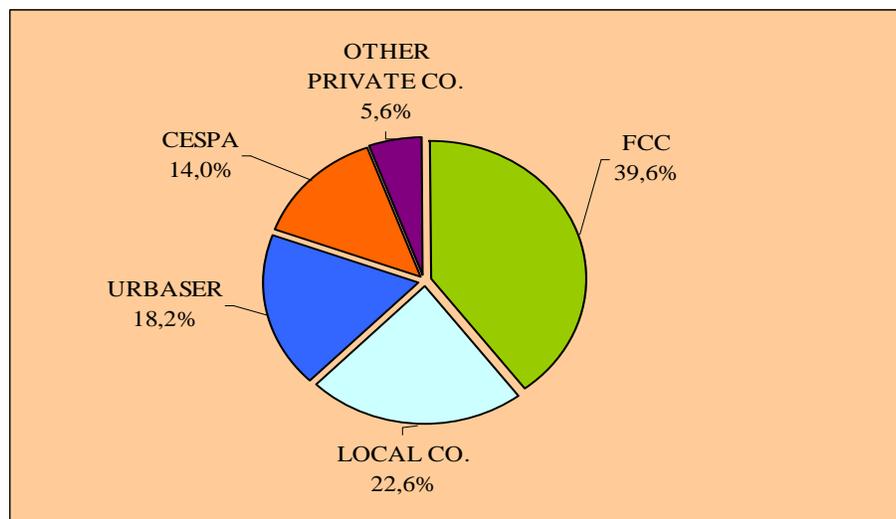
There are three integrated-management packaging systems in Spain: ECOEMBES for all packaging materials, ECOVIDRIO for glasses only and SIGRE for medical products. These systems are non-profit entities financed by contributions received from partner companies according to the number and type of generated waste. Its revenues are destined to cover waste collection, transport and classification costs.

7. DEGREE OF COMPETITION

The market share as measured by the percentage of population served shows the degree of competition introduced (Figure 12). In Spain 76% of the waste collection market is provided by private companies and 24% is under municipal management.

Nearly 72% of the private waste collection market is distributed between three private companies: FCC 39.6%, Urbaser (ACS group) 18.2% and Cespa (Ferrovial group) 14.0%. A further 22.6% of the private market belongs to local companies and 5.6% is in the hands of private companies with small market shares (less than 1% each) such as Sav, Agbar, Sacyr, Acciona, ...

Figure 12. Refuse collection private market share in 2008
(as percentage of served population)

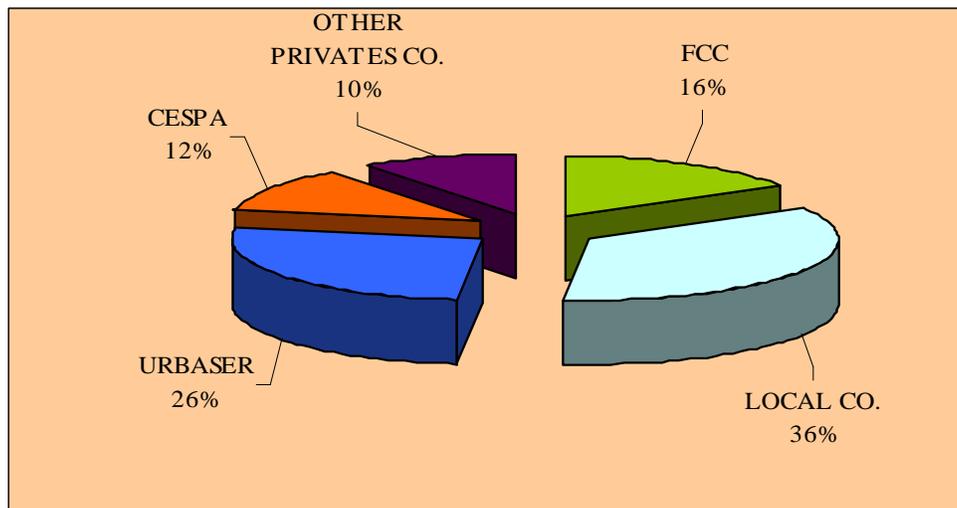


Source: Own estimate.

The Spanish situation contrasts with the rest of Europe. The International Solid Waste Association (ISWA) conducted a survey in 2007 in nineteen European representative cities such as Berne, Gothenburg, Sunderland, Oviedo, Prague, ... The results indicate that (i) in almost 65% of the cases waste collection was directly managed by the municipalities, (ii) 20% of the cases were managed by private companies and (iii) the other cases were managed by mixed companies.

In Spain, 79% of the waste treatment and disposal market is covered by private companies and 21% is under municipal management. Half of the private waste treatment market is split between three companies (Figure 13): Urbaser (ACS group) 26.1%, FCC 16.3% and Cespa (Ferrovial group) 12.2%. Another 35.3% of the private market belongs to local companies and 10% is in the hands of private companies with small market shares such as Sacyr (4.5%) or Acciona (2.4%).

Figure 13. Treatment and elimination private market share in 2008
(as percentage of served population)



Source: Own estimate.

However, in Spain waste collection services are often associated with street cleaning in the same contract. This is of great interest because it can bring significant cost savings for the municipality due to the fact that it allows optimisation of the number of employees, vehicles, fixed installations, ...

8. FINANCING AND COST OF WASTE SERVICES

Each municipality decides how to **finance** its waste services. A minority of councils decided to finance them through the municipal budget while others include the cost of household waste in the water charges.

However, most councils have established a specific collection waste tax, but its amount is not linked to the quantity of household waste:

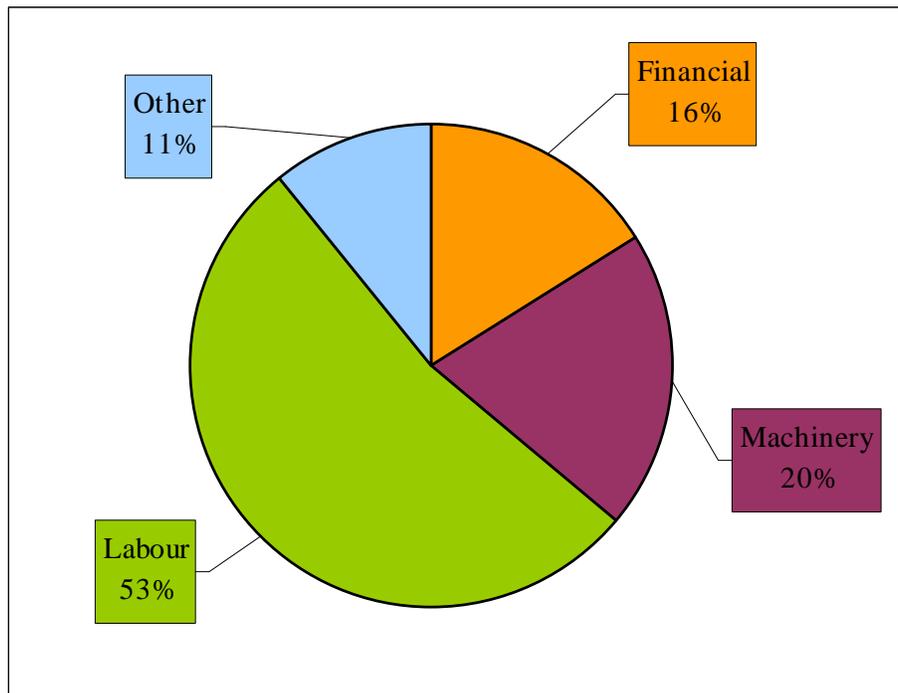
- In 46% of capital municipalities the rate consists of a fixed household tax.
- In 54% of capital municipalities the tax is a percentage (fixed or variable) of the administrative property value.

Furthermore, the amount of the waste tax is very different between municipalities and within the same municipality depending on the street. The national average could be estimated at 60 euros per year per household.

The **cost of waste collection and transport services** is initially determined by the density of the waste. Most of the cost will be a consequence of the incidence of the performance in the collection. That is to say, the cost depends on the forms of waste collection, on the conditions and routes of the services, on the employed labour and on the distance to the elimination or transfer centre.

It may therefore be of interest to know the cost structure of a contract for household waste collection, the estimated distribution of which is shown in Figure 14.

Figure 14. Estimated cost of waste collection services



Source: Own estimate.

Most of the cost of household waste collection is labour cost, between 45% and 55% of the total cost; it is followed in size by maintenance machinery costs (20%) and financial cost (15% investments and amortisations).

For instance, in a city of 200 000 inhabitants the sum of labour costs, machinery costs and financial costs is approximately 270-350 euros per inhabitant per year for a complete contract; this means, with new equipment and new fixed installations for a 10-year contract. This would amount to about 60-70 euros per tonne of household waste collected and transported.

9. QUALITY AND SATISFACTION WITH THE SERVICE

In relation to the **quality of the waste collection service** provided, it is important to note that in Spain collection frequencies are very high and they are run in different shifts, mostly morning and evening. Almost 90% of the municipal services are available six days a week; in the capital province and large municipalities collection is daily for 363 days of the year (Madrid, Barcelona, Valencia, ...). This gives an idea of the high quality of service provided.

Furthermore, most of the waste collection services are nocturnal: 42% of municipalities perform the service in night shifts and 58% run next-day and night shifts. The common forms of collection are: night collection in the city centre for reasons of traffic and morning shifts in suburban areas.

In Spain, there are no statistics at national or regional level to measure the level of citizens' satisfaction with the waste collection service. At local level in more than 75% of the municipalities no studies have been conducted on the citizen's perception of waste management. The minority of Spanish municipalities organise specific internal surveys on the quality of public services in general while others infer the level of satisfaction through the requests, suggestions and complaints submitted.

Of those municipalities with indicators, the degree of satisfaction with waste refuse collection is as follows: "good or very good" with conventional collection (truck) and selective collection; "acceptable" with pneumatic collection. On the other hand, consumers greatly appreciated the existence of medium-capacity containers for the collection of paper and glass in the street. However, more demanded a higher frequency of

collection and more cleaning and preservation. Many citizens simply do not know where to find the civic amenities sites in their municipalities.

From information obtained in different municipalities, consumers' organisations and waste service providers, it is possible to conclude that the level of satisfaction with the waste collection services is high in relation to the quality of service offered, for both frequency of collection (six days a week in both urban and rural zones) and schedule (principally in the early hours of the night in urban zones and during the day in rural zones).

The citizens also valued very positively the reduction of noise and the increasing use of non-polluting collection vehicles (natural gas and electric trucks). These improvements are possible for the existence of a highly competitive market imposed by the system of international bidding mainly used, which has repercussions for the costs and in technological development.

10. SUMMARY AND CONCLUSIONS

In Spain the waste collection, treatment, transport and elimination of solid urban waste are considered public services of general interest, the provision of which is obligatory in all municipalities and, in the case of boroughs of more than 5 000 inhabitants, selective waste refuse collection is also required by law.

Spanish population distribution is very unequal because of the great concentration in large cities. Cities with more than 100 000 inhabitants thus represent 50% of the population and produce 70% of the waste, while municipalities with less than 1 000 inhabitants represent 5% of the population and produce 3% of the waste.

In sum:

- Municipalities play an important role in the supply of waste services: each municipality decides the form of management and the financial instruments.
- Local public services experienced significant changes during the 1990s. The municipalities increased the number of activities open to competition and reduced direct management in favour of indirect management. Spain is now characterised as a country of maximum subcontracting of waste services to private or to mixed companies.

- The evolution of waste management in time reflects a trend to the reduction of direct management in favour of indirect forms of managements. 76% of waste services and 79% of treatment and disposal services are managed indirectly by private companies in the form of temporary concession under international public tender.
- The municipalities lay down the administrative and technical rules. Providers must design the services according to the requirements of the municipality, set their costs and establish the formula of annual review of the cost of the services during the term of the contract.
- There are four models of waste collection: Model I: mixed collection without selection of waste (8% of served population); Model II: selective packaging collection and unsorted household waste (78% of served population); Model III: selective organic fraction collection and unsorted household waste and Model IV: selective packaging and organic fraction and unsorted household waste (14% of served population).

Whatever the chosen model, there are large-capacity communal containers on the streets of all Spanish municipalities for the collection of paper, cardboard and glass.

- 84.8% of household waste is collected directly on the streets from non-selective dustbins (mixed waste), while only 15.1% comes from one or another selective process (11.3% from selective refuse collection and 3.9% from the civic amenities sites).
- The treatment of the collected waste depends on its composition. In 2007 the origin of waste produced in Spain was: 44% organic material, 17% paper and cardboard, 11% plastics, 7% glass, 4% metal (ferrous and non-ferrous), 3% textiles, 1% wood and 11% other (mainly cellulose and gums).
- With respect to the treatment of household waste, half goes to landfill (51%) and one third is sent to composting plants. Only 8% is incinerated and 5% is sent to a biomethane plant.
- The private waste collection and treatment markets are divided between three highly specialised private companies with high technology and international dimensions. In waste collection the private market share is: FCC (40% of private market), Urbaser (18%) and Cespa (14%). In treatment and elimination the private market share is: Urbaser (26%), FCC (16%) and Cespa (12%).
- Each municipality decides how to finance its waste services: a minority of councils decided to finance them through the municipal budget or a surcharge in the water charges. However, the majority of councils have established a specific waste tax, but its amount is not linked to the

quantity of household waste; there is sometimes a fixed fee for households (46% of capital municipalities); for others the percentage (fixed/variable) is based on an administrative property value (54% of capital municipalities).

- The waste collection service quality is high: 90% of the municipal services are available six days a week and, in the provincial capitals and large municipalities, waste collection is daily. In addition, the majority of urban services are performed in night shifts.
- In general, the degree of satisfaction is high in relation to the traditional waste collection (via truck) and selective waste collection (containers in the street). The pneumatic waste collection is rated lower by the citizens due to the unpleasant smell and congestion of the containers.

The main strengths are (i) the modernisation and technological innovation involved in indirect management and (ii) the degree of competition obtained. It is based, for the most part, on qualitative environmental aspects (noise pollution and emissions of gases). The increase in the waste recycled and the improvement of infrastructures are other positive aspects, though still insufficient. The introduction of preventive plans in certain sectors and for certain types of waste is also a positive aspect to consider.

Finally, the aspects requiring improvement include those designed to reduce the quantity of waste sent to landfills, raising the percentages of recycling, increasing the number of industrial installations for treatment of waste, and improving the technology associated with waste treatment. It is further necessary to improve the social perception of the treatment and recycling of waste, as well as the availability and quality of the statistics, especially, those referring to waste production and management.

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