

# THE MUNICIPAL WASTE MANAGEMENT SECTOR IN EUROPE: SHIFTING BOUNDARIES BETWEEN PUBLIC SERVICE AND THE MARKET

by

Barbara ANTONIOLI and Antonio MASSARUTTO\*

*University of Udine, Italy*

**ABSTRACT:** *This paper provides a comparative assessment of the organization of urban waste management in selected European countries and discusses the regulatory implications of the ongoing evolution. Using an institutional economic approach, focused on governance of transactions along the value chain, we argue that: i) there is evidence of an increasing shift towards operator-based integrated systems; ii) the emphasis put on material and energy recovery opens the market far beyond the traditional legal monopolies established for managing urban services. These results pose new challenges for economic regulation and make it more complicate to trace the boundary between the public service and the market domain. Spaces for competition in the market have become much larger, but the role of public regulation and planning are nonetheless more far-reaching than in the past.*

**JEL classification:** L33, K23, L43

## **El sector municipal de la gestión de los residuos sólidos en Europa: desplazamiento de la frontera entre servicio público y mercado**

*El artículo propone una evaluación comparativa de la organización de la gestión de los residuos sólidos urbanos en una serie de países europeos y examina las implicaciones de la evolución experimentada sobre la correspondiente regulación. Basándose en un enfoque económico institucional, centrado en la gestión de las transacciones según la cadena de valor, los autores tienen en cuenta: i) un deslizamiento creciente hacia sistemas integrados organizados alrededor de los operadores; ii) el creciente interés por el reciclaje y el aprovechamiento energético que abre el mercado más allá de los monopolios tradicionales legales creados para administrar los servicios de residuos urbanos. Estos resultados comportan nuevos desafíos para la regulación económica y marcan el trazado de la frontera entre el servicio público y el ámbito comercial más complejo. En el mercado han crecido de forma importante los espacios de competencia, pero el papel de la regulación pública y de la planificación se extienden, sin embargo, tanto más que en el pasado.*

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\* E-mail: antonio.massarutto@uniud.it.

## **Der Sektor der kommunalen Abfallwirtschaft in Europa: Verschiebung der Grenzen zwischen öffentlichen Dienstleistungen und dem Markt**

*Dieser Artikel liefert eine vergleichende Bewertung der Organisation der städtischen Abfallwirtschaft in ausgewählten europäischen Ländern und diskutiert die regulatorischen Implikationen der laufenden Evolution. Unter Verwendung eines institutionenökonomischen Ansatzes und mit dem Fokus auf die Steuerung der Transaktionen (governance of transactions) entlang der Wertschöpfungskette argumentieren wir, dass i) es Evidenz gibt hinsichtlich einer zunehmenden Verschiebung zu integrierten Betreiberbasierten Systemen; ii) die Konzentration auf Material- und Energierückgewinnung den Markt weit hinaus über die traditionell rechtlichen Monopole öffnet, die für das Management städtischer Dienstleistungen eingerichtet wurden. Diese Ergebnisse stellen neue Herausforderungen für die Regulierung dar und machen es noch schwieriger, die Grenzen zwischen den öffentlichen Dienstleistungen und der Domäne des Marktes zu verfolgen. Der Spielraum für Wettbewerb im Markt wurde viel größer, dennoch ist die Rolle der öffentlichen Regulierung und Planung weitreichender als in der Vergangenheit.*

## **Le secteur municipal de gestion des déchets en Europe: déplacement des frontières entre service public et marché**

*L'article propose une évaluation comparative de l'organisation de la gestion des déchets urbains dans une sélection de pays européens et il examine les implications de l'évolution en cours sur la régulation. Se basant sur une approche économique institutionnelle, centrée sur la gouvernance des transactions selon la chaîne de valeur, les auteurs font état i) d'un glissement grandissant vers des systèmes intégrés organisés autour des opérateurs; ii) d'un intérêt accru pour le recyclage et la récupération d'énergie qui ouvre le marché bien au delà des monopoles traditionnels légaux mis en place pour gérer les services urbains de déchets. Ces résultats entraînent de nouveaux défis pour la régulation économique et rend le tracé de la frontière entre le service public et le domaine commercial plus complexe. Des espaces de concurrence dans le marché se sont fortement accrus mais le rôle de la régulation publique et de la planification s'étendent cependant davantage que par le passé.*

### **1 Introduction**

During the last 30 years, the focus of municipal waste management (MWM) services has been shifted from its original aim – removing garbage from urban areas – to the more far-reaching objective of governing materials flows through the economy and fostering resource efficiency, in order to divert as much waste as possible from landfill (Massarutto 2007a). This transformation has been driven by the need to face a quantity of waste that since 1980 has increased 65% in absolute and 40% in per capita terms (OECD 2008), and by the difficulty in expanding the supply of traditional disposal methods.

This change has determined a radical metamorphosis of the economic characteristics of the waste management industry, posing rather new challenges to the public

sector. On the one hand, the scope of public regulation is clearly much larger today than in the past. On the other hand, the public sector is also stably involved in the supply side. The interest of the private sector has also been rapidly growing (Buclet and Godard 2000). MWM has clearly become a member of the family of what the EU jargon labels 'services of general economic interest'.

The aim of this paper is to enlighten the consequences of this policy change on the industrial organization of MWM and the related implications for competition and economic regulation.

Our study is based on the empirical evidence provided by a study conducted by Ciriec, under whose impulse five national case studies have been analyzed with a dedicated detailed survey: Italy, France, Austria, Belgium, Spain (Massarutto 2010, Djemaci 2009, Klein and Loser 2009, Collignon and Gathon 2009, Dizy and Ruiz 2010). A more basic inquiry, based on literature and interviews with experts conducted from distance has been conducted on five further countries (Portugal, Germany, Sweden, Netherlands and UK).<sup>1</sup>

The present paper offers a synthesis of the main results emerged from the comparative analysis of national case studies, with the aim of understanding the common trends behind national specific features.

We adopt an institutional economic perspective, focused on the governance regime that characterizes transactions along the value chain of the MWM industry. Following Brousseau and Glachant (2008), we stress the importance of micro-institutions ensuring the governance of transactions, and deduce from these implications for economic regulation and public policy.

Three phases can be identified in the value chain of MWM (Massarutto 2007b). The first one regards *collection services*, whose counterparts are waste producers and service operators. The second is the market for the *handling and disposal of waste*, whose counterparts are operators of collection services and owners of treatment facilities and disposal sites. The third is *recovery/recycling*, whose counterparts are waste producers, treatment operators and final users of waste-derived materials, with the decisive intermediation offered by the organizations sponsored by industry in compliance of national and EU strategy aimed at shifting responsibilities over recycling targets on manufacturers and retailers (hereafter referred to as 'compliance schemes', CS). Our study moves from the hypothesis that contractual arrangements between these phases (size and scope of legal monopoly; patterns of coordination and vertical integration, etc) are the decisive aspect to be examined.

We first present a background of the industry, outlining the institutional framework and the main structural dimensions, trying to enlighten the progresses made towards the achievement of environmental policy targets set out by the EU (par. 2).

We discuss then more in detail the implications of the institutional regime for the public service (par. 3). Waste management is framed by a 'dual' regime: a public service regime, characterized by legal monopoly and public service obligations (municipal waste)

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1 For a more complete list of references for national case studies see Antonioli and Massarutto (2011).

and the market regime, characterized by the possibility left to waste producers to choose the preferred supplier of waste handling services on the market (commercial waste). A key point emerging from our analysis is the increasing integration that is occurring between both segments, once almost fully separated, and now characterized by intense transactions and flows in both directions.

The next step (par. 4) concerns an analysis of the industry structure that emerges from this fundamental transformation. We will outline the main trends characterizing it: concentration, vertical integration, increased role of private sector (either represented by genuinely private operators or by the corporatization of public enterprises), and will discuss the implications for economic regulation.

We will argue that, although moving from different starting points and different institutional settings, there is a common trajectory towards vertical integration (among phases) and horizontal integration (among management of waste flows that arise from different sources, e.g. municipal and business waste).

We suggest that this is motivated by the emerging economies of integration between collection, treatment and disposal, on the one side; and from the shift of an increasing quantity of waste from the (regulated) disposal market to the (more competitive, although yet regulated) market for recycling and recovery of materials and energy.

This is causing a real shift in the economic nature of the industry, calling for innovative regulatory arrangements, and posing new challenges (but also creating new opportunities) for public sector operators as well.

## 2 Background

### 2.1 The evolution of MWM regimes

The institutional regime that frames EU waste management arises from the parallel development of different policy areas, with different aims and priorities, and also different timing (Buclet and Godard 2000, Buclet 2002, Massarutto 2007a).

As a result, the governance system of MWM typically involves three different institutional levels, having sometimes conflicting targets:

- national level, framed by the EU, mainly focused on material balance and economic, technical and environmental regulation;
- regional level, focused on planning of disposal capacity, enforcement of the self-sufficiency principle, authorization of facilities and overview of MWM practices;
- local level, focused on the organization of MWM services, in the frame of general rules concerning management and finance of local services, competition laws etc.

The early municipal garbage collection services were created basically on the key value of *public health*. In the pre-industrial world, waste was dealt with in a simple and unregulated manner, typically with the return of organic matter to nearby rural areas, intense recycling of whatever valuable by an army of rag-pickers, and finally dumping or open-air burning of the residual in an uncontrolled way. This model still applies to many developing economies.

Urbanization and amelioration of living standards determined MW to become a nuisance and a threat to public health. Municipalities assumed responsibility for organizing collection with the goal of removing garbage from the streets and preventing nuisance, first on a voluntary base, later on with a statutory obligation of doing so. Until waste flows remained reasonably small and mainly organic, disposal was hardly a problem. Nearby areas could provide convenient sites in the exhausted quarries that supplied construction materials to the growing cities; recycling was a marginal activity, carried out by small and often informal premises, exploiting the small economic value of scrap materials, some of which (such as paper and metals) used to have a lively secondary market, though affecting only a minor fraction of the MW flow (Ascari et al. 1992).

The second phase introduces the key value of *pollution control*. Dir. 75/442 started putting focus on the environmental consequences of waste dumping and technical standards started to be imposed on disposal facilities. Regulations were mostly concerned with the setting of technical and emission standards for disposal facilities and on the need to establish public overview over waste management practices, putting a ban over uncontrolled dumping. Progressive harmonization was intended to prevent arbitrage favoured by asymmetric rules (Buclet 2002).

This strategy has been progressively improved. Its key element concerns the responsibility to take care of waste destination. This is put on the waste producer, i.e. the person in whose hands a certain material has acquired the legal status of waste, which depends on the willingness or the obligation to get rid of it. Legal destinations are listed authorized treatment techniques, respecting minimum environmental quality standards.

Until materials remain under the domain of waste policy, each transfer requires that the receiver is an operator that is authorized to handle that particular waste material, identified by a code. Shipments of waste are allowed only in certain cases and with demanding duties of care that depend on the concerned materials, grouped in different 'lists' (so called green, amber and red list) according to the duties of care imposed.

Waste arising from productive activities was left under the responsibility of producers, with the duty of finding appropriate authorized solutions and providing evidence of this through a complex monitoring system aimed at keeping track of operations concerning treatment or shipment of waste to third parties. A complex reporting system has been introduced with this purpose.

For MW, the responsibility is placed instead on the municipality, having the corresponding duty to organize collection services and to regulate access. After collection, the municipality becomes therefore the 'owner' of MW and has the duty to provide for its correct handling. A self-sufficiency principle is imposed for treatment and disposal (yet not for recovery: as we'll see, the unclear boundary between these activities allows the rule to be interpreted in a flexible and often 'creative' way).

Dir 75/442 provided for individuating authorities at a convenient level, responsible for 'waste management plans' aimed at ensuring that adequate capacity was in place so as to address all the waste flow generated.

Prevention and recycling until the 90s were privileged in abstract, though no explicit targets were given. The quantity of waste to be disposed of was hence considered as an exogenous constraint.

This end-of-pipe approach is reversed from the '90s. The EU strategy, nowadays framed by Dir. 2008/98 is based on 3 key principles:

- the *ladder principle* (choices should prioritize waste reduction, then reuse, recycling, energy or down-grade recovery, and finally the treatment of residual waste, in order to ensure it is disposed of in a safe way), with quantitative targets to be achieved for materials recycling and other forms of recovery
- the *self-sufficiency principle* (waste should be handled as close as possible to its origin)
- the *polluter-pays principle* (the cost generated by waste, including negative externalities, should be charged to the one who is responsible for its generation).

A cornerstone of this policy has been the concept of extended producer responsibility (EPR). This can be intended as a strategy designed to promote the integration of environmental costs associated with goods throughout their life cycles into the market price of the products, by attributing related responsibility to manufacturers (OECD 2007).

Despite evidence of potential economical benefits from recycling, mainly due to the parallel explosion of traditional disposal costs, the system showed a clear inertia. Until it remained driven by the private interest of recyclers recycling encountered a bottleneck; this can be interpreted as a consequence of high transactions costs, that prevent the exploitation of an otherwise profitable alternative to traditional disposal (OECD 2007).

The source of transactions costs lies in the higher geographical scale needed in order to market waste-derived materials, but also the limited interest of waste management operators (once the cost of disposal can be passed-through on service fees) and the difficulty in matching the requirements on the demand side (stability, reliability, predictability of waste destinations) and those on the supply side (economic convenience, quality of materials according to industrial processes, avoidance of sunk costs for adapting them, etc.)

Through EPR, industry – and more generally actors in the upstream value chain of products that will someday become waste to be disposed of – are requested to assume responsibility over the destiny of the materials contained in the marketed products. This responsibility may be only economic (bearing the cost of treatment and assuming the risk of covering damage), but more often involves the guarantee of achieving quantitative targets related to prevention and recycling. Since the concerned cost is internalized in the value chain, it finally results in the market price of products, and can be understood as an alternative channel through which waste management is paid for.

In practice, this strategy led to the creation of dedicated entities ('compliance schemes', CS) funded by industry and responsible for achieving recovery targets. CS connect the waste management world with industry, by providing more stable market conditions for separated collected materials and promoting market initiative for developing reuse capacity, either in the more traditional and established sectors (such as paper and glass) or in the more complex ones, such as in the case of plastics, that require longer value chains, more sophisticated division of labour and more creative and innovative solutions for the re-use.

This mechanism was initially introduced for certain waste flows (e.g. batteries, mineral oils, pharmaceuticals), but has been extended to many others, among which the one that is more relevant for MWM is for sure that of packaging waste, representing alone 1/3 of the total.

## 2.2 Achievements

The implementation is proceeding at a varying speed.

Waste prevention is still lagging behind. Waste quantities in EU-15 have continued to increase until 2002; since then, a diminution takes place in 6 countries only (EEA, 2009a). Yet it is still too early to interpret these signs as hints of decoupling between economic growth and waste generation; the slowdown of most developed economies may have played a role (Mazzanti and Montini 2009).

The target of establishing public control over the 'life cycle' of waste is fundamentally achieved, at least for municipal waste, though with some grey zones. All EU countries have put in place a complex system aimed at tracking waste, authorize transactions and treatment activities; regional plans are in place in all countries, and enable to keep records, at least in theory, of the destination of materials.

Nonetheless, there is evidence that a significant quantity of waste, mostly arising from the industrial and commercial sector, escapes control and ends in illegal forms. Although quantifying the phenomenon is quite tricky, many hints show that the share of illegal or irregular management practices is significant, leaving space for criminal organizations (D'Amato and Zoli 2012).

Reported illegal shipments of waste amount to 50,000 tons/year: a value that is growing over time, although this is more probably due to better monitoring than to an increase of the phenomenon (EEA 2009b). These figures, however, represent only the tip of the iceberg. In Italy alone – but the phenomenon is probably much more widespread – the difference between waste that is generated and that is legally disposed-of amounts to 14 million tons/year, 10% of the total (Legambiente and CCTA 2005).

This phenomenon seemingly regards waste originated by the productive system and particularly hazardous waste; however, it may indirectly concern MW also, as far as materials arising from the MW flow may turn into commercial waste when it passes the 'legal frontier' between waste categories.

Compliance with technical standards made considerable progress, yet is still incomplete even in the EU-15. Limiting our analysis to landfills, a number of countries still report the existence of uncontrolled sites or legal infringements (European Commission 2008).

Progress in the field of diverting waste flows from landfills has been remarkable in all countries between 1995 and 2005 (Table 1), with the most notable reduction taking place in Norway (-67%), followed by Germany, Austria, Belgium and Italy (all above 40%); yet a complete phase-out has been achieved only in Austria, Belgium, Sweden Netherlands, Germany; while Italy, UK, France and Spain are still landfilling a significant part (40–50% or more).

Landfill diversion has been achieved through a combination of strategies, that includes a variable mixture of direct recycling, indirect material recovery such as compost, refuse-derived fuels (RDF), inerts for construction industry; and finally energy recovery from mass-burning incineration. From Table 1, we clearly see that the achievement of the highest diversion rates is correlated with a combination of the above strategies, while concentrating on only one of them (material recycling or incineration), does not allow comparable results.

**Table 1 – Material and energy recovery, landfill diversion in selected EU and OECD countries**

Year	Incinerated %	Recycled %	Material recovery %	Landfilled		Δ landfill since 1995		
				%	kg/inh/y	%	kg/inh/y	
USA	2005	14%	24%	8%	54%	407	-3%	-
JPN	2005	74%	17%	0%	3%	14	-8%	-
AUT	2010	29,6%	30,1%	39,6%	0,7%	4	-42%	-201
BEL	2010	36,9%	39,9%	22,1%	1,4%	6	-42%	-192
CZ	2010	15,5%	14,2%	2,3%	67,7%	205	-32%	-97
DK	2010	54,2%	22,9%	19,3%	3,4%	23	-14%	-73
FIN	2010	22,1%	19,6%	13,2%	45,1%	212	-21%	-55
FRA	2010	34,0%	17,9%	17,1%	31,2%	166	-14%	-47
GER	2010	37,7%	44,6%	17,3%	0,3%	2	-46%	-243
GRE	2010	0,0%	17,3%	0,9%	81,8%	374		2
ITA	2010	15,1%	20,9%	13,1%	50,6%	254	-40%	-168
NL	2010	38,9%	32,9%	27,7%	0,4%	2	-30%	-155
NOR	2010	51,1%	27,1%	15,8%	6,1%	28	-67%	-427
POR	2010	20,8%	11,0%	7,5%	60,6%	314	-15%	114
SPA	2010	9,2%	15,1%	17,9%	57,9%	310	-26%	2
SWE	2010	49,1%	36,1%	13,7%	0,9%	4	-35%	-132
SUI	2005	50,0%	34,0%	16,0%	1,0%	3	-12%	-
UK	2010	11,6%	24,9%	14,1%	49,2%	255	-35%	-158

Source: our elaboration on Eurostat and Oecd.

This statement is further demonstrated by the Italian case, given the great regional disparities (Massarutto et al. 2011). If we break down the data at regional level, we find that the national average results from a number of regions (mostly in the North) that exhibit figures that are close to the central Europeans ones for both recycling and incineration, with landfill actually becoming a residual option; and other Regions, that despite some local success in separate collection and recycling, still landfill a significant part.

Management of selected material flows subject to EPR schemes shows an overall success. As far as packaging waste is concerned, the average EU figure is 77%, with notable differences between EU-15 and EU-12, but also with a remarkable convergence of EU-15 countries, with only a handful (Spain, UK, France and Portugal) still below 70%.

Finally, the polluter-pays principle is adopted by a combination of instruments aimed at guaranteeing full-cost recovery of waste management, but also include economic incentives of various nature.

The total cost may be recovered basically through three channels: the public budget, service use fees and contributions paid by industry, later on transferred onto commodity prices. Citizens pay, alternatively, as taxpayers, as service users or, finally, as consumers (Table 2).

Funding from the public budget is vanishing everywhere, and is now confined to fiscal incentives (mostly in the form of tax expenditures) aimed at subsidizing certain activities. Here and there, some minor contributions by municipal budget aimed at ensuring public waste operators balance are still present. Orphan waste (waste



**Table 2 – Recovery of total cost of MWM**

Source	Funding	Notes
Public Budget	General taxation	Still present in many countries, but generally fading everywhere. Taxation used for providing subsidies to some (eg. energy recovery).
	Environmental taxes (sometimes earmarked to waste management, e.g. for promoting recycling)	Landfill tax applied in most countries (but Germany) <ul style="list-style-type: none"> <li>• low (&lt; 20 €/t): SPA, FRA, POR</li> <li>• medium (20–45 €/t): ITA,</li> <li>• high (&gt;45 €/t): NL, UK, AUT, SWE, BEL</li> </ul> Incineration taxes applied only in Sweden
Waste producers	Directly: tariffs and charges raised directly by operators (may imply charging schedules that contain incentives to separate collection and discourage unsorted waste)	Tariffs directly charged by operators as for a commercial service (rare)
		Waste tax whose revenues are earmarked to MW operators Increasingly calculated on volumetric or fee-for-service base
	Indirectly: local taxes raised by municipality used to compensate service providers on a bulk base	Waste-only tax levied on a fiscal base but earmarked to waste management operators Charges including other local services: UK
Market prices	Fees paid by manufacturers and transferred on the price of marketed goods	Share of the total cost shifted onto industry varies among countries according to (i) allocation of responsibilities; (ii) severity of targets and (iii) scope of obligation to supply

abandoned illegally or originating from the rehabilitation of dumping sites) also require public spending, even if the general trend is to place the related burdens on service fees.

Service fees are sometimes incorporated in local taxes having the purpose of recovering the cost of multiple services (UK), yet in most cases they are dedicated solely to MWM.

Service fees are raised in many different forms, ranging from local taxes to tariffs charged directly by the operator. A more ‘commercial’ approach has been experimented in some countries (e.g. Italy) but is not the rule. Charges maintain everywhere a ‘fiscal’ nature (the obligation arises from the possession of premises, and not by the actual access to the service); nonetheless, they can be calculated with a combination of criteria, with some discretion for the municipality to choose the preferred one. Criteria range from lump-sum poll taxes to value of property and to indicators of waste generation. There is a growing diffusion of charges based on fee-for-service, with the aim of promoting separate collection and discouraging unsorted waste generation.

EPR schemes are funded by contributions paid by manufacturing industry. Since funds are used for purchasing materials collected separately, the price paid is a source of revenue for operators of municipal services, and contribute to reduce the bill paid by service users. The relative share of both channels varies in dependence of three basic factors.

The first factor concerns the way responsibilities are shared between service providers and industry. In Germany, for example, the system charges industry with the *full cost* of the 'dual system', including separate collection. In most of the other countries, industry bears only the *differential cost*, namely the additional cost that municipal operators encounter with respect to other ways of treating waste.

The second regards the range of activity of the system, that might include business waste or not, depending on how the national legislation has attributed the recovery targets (e.g. on individual base or collectively); in case it does, cross-subsidies in both directions may arise.

The third one concerns the system of economic incentives put in place with the aim of discouraging other forms of disposal (e.g. landfill bans, taxes on landfill and/or incineration etc). Landfill taxes are adopted by all countries but Germany, though with very variable rates; the highest fares can be found in the Netherlands (85 €/t), while Sweden, Austria, Belgium and recently the UK have set it at values above 40 €/t. In Italy, France and Spain it is in the range of 15–25 €. Other economic instruments are used in a less widespread way. For example, some countries have introduced a tax on incineration (e.g. Sweden), while others admit energy recovery from waste to the incentives paid to renewable energy sources (e.g. Italy).

The higher the cost of disposal, the lower is the minimum compensation that municipalities are ready to accept in order to engage in separate collection.

### 3 The dual regime: public service and the market

#### 3.1 Scope and extension of statutory responsibilities and legal monopoly

##### *Collection, separate collection and recycling*

The evolution of policy regimes influences the focus and extension of the public service domain. Once confined to the primary market (collection), it gradually extends to secondary market (disposal) through regional planning, and to the tertiary market (recovery and recycling) through the creation of CS implementing the EPR. The interaction between these spheres characterizes each country (also with significant regional differences within them).

Municipalities are obliged by the legislation to organize *collection services*. Usually, national laws and regional plans also set technical regulations (e.g. targets of separate collection).

Legal monopoly is universal for household and street waste, and extended to some business waste (small premises, laboratories etc). These premises are obliged to join the public service following its regulations and have the right to expect it to provide a solution, paying the corresponding levy.

Business waste producers have instead the status of 'eligible customers', i.e. they are free to choose the preferred supplier on the market (from a list of authorized operators), with the public service eventually providing a last-resort option. The national law limits the possibility of municipalities to extend the public service regime to business premises; this is an area of potential trade-off between the reasons of the market and those of service effectiveness, since waste producers eligible for the competitive market may exploit the possibility to use the public service facilities under the table (e.g. illegal dumping in street containers).

None of the countries covered in our study has engaged in attempts to extend the market domain to households; examples of this strategy are witnessed in the literature (e.g. Finland, some US states) but are quite uncommon (OECD 2000).

In turn, the EPR strategy has animated many initiatives that intercept selected waste flows before they enter the MW. Separate collections of many materials (e.g. batteries, pharmaceuticals, electronic waste) are organized and managed directly by the CS, originating a true 'dual' system'. Informal and voluntary activities (e.g. promoted by NGOs) are also increasingly diffused (Sharp and Luckin 2006).

As for packaging waste, in most countries responsibility for separate collection lies on municipalities, while CS are responsible for accepting materials and processing them for recycling. In practice, CS offer a framework contract to all collectors of separated waste, specifying quality standards and prices. In Germany, Austria and Sweden CS are responsible for separate collection also (and they have therefore to negotiate with local authorities the way to do so).

With the introduction of EPR, the public service domain has been extended to recycling. Public service obligations (achievement of prevention and recycling targets) have been attributed to industry, but the forms for guaranteeing their achievement vary from the creation of legal monopolies with compulsory adhesion (Italy) to market-based solutions (UK). In most countries the situation is mixed: some CS have enjoyed a de facto monopoly, guaranteed by the market power of their sponsors: this has been the case of the German DSD, adhesion to which was voluntary, yet strongly incentivized by the cartel of large retailers with the promise to boycott goods not provided with the 'green dot'. In this and other similar cases, the EU had to tolerate this patent violation of internal market rules for the sake of achieving environmental policy objectives (Buclet 2002).

Later on, this market structure has evolved towards a more competitive one; in many countries producers can now choose among different CS. As soon as competition was opened, either the materials industry or the most active players in the MWM sector created their own scheme. This process seems to be more advanced in the UK, also prompted by the adoption of market-based instruments (the 'packaging recovery notes'). In other countries (e.g. France) the system is mixed, with some CS acting as residual players offering a basic contract to all, and others that operate on a free market base and can offer alternative solutions where they find it convenient. In Germany, authorized CS compete with each other but share responsibility and costs on the base of the respective market quotas.

The competitive model has been adopted from the beginning in the 'second generation' of EPR, like in the case of electronic waste and used tyres.

*Treatment and disposal of residual waste*

In the treatment and disposal segment, the former free and relatively open market has been gradually substituted by a regulated market (subject to authorization) and finally by a planned market.

Waste owners (for MW, municipalities) have the duty to find a legal solution. They can either do it directly through their own facilities or have access to an authorized one managed by third parties. Yet, in order to enable all municipalities to fulfil their obligations, regional plans are in place.

Only a few countries have extended full public service obligations to facilities aimed at processing residual waste, but most of them have made steps in this direction. In the Netherlands, planning only concerns landfills (final disposal of residual waste), while all treatment facilities including incineration operate on a competitive base (even if most of them are publicly owned). In most of the other countries, the responsibility of local authorities is extended to disposal, following the prescriptions of plans; municipalities are often voluntarily associated in syndicates and consortia or other forms of intergovernmental agreements. Sometimes cooperation is facilitated or even made compulsory by regional authorities. In a few countries (Sweden, UK, Portugal) responsibility for putting in place disposal capacity is assumed by upper level authorities, giving rise to a neat separation between 'retail' services (collection), provided under the responsibility of municipalities, and 'wholesale' services (disposal), organized under the responsibility of regional authorities.

Regional and national differences depend ultimately on local traditions, yet our analysis suggests that it also depends (i) on the degree of pervasiveness and activeness and (ii) on the effectiveness of regional planning.

In principle, regional plans were intended mostly as overview and coordination instruments, identifying and allocating flows, dictating solutions, regulating prices: but leaving local authorities with the ultimate responsibility for implementation. The local market was expected to take the initiative. However, many countries have encountered at some stage a bottleneck; many local authorities were able to realize their own facilities or to associate to those having theirs, but many others did not, for a number of reasons, ranging from the difficulty to achieve the necessary economies of scale to the unpreparedness of local politicians, and sometimes to the vicious circle generated by the well-known 'nimby' and 'nimto' syndromes: people started refusing the location of new facilities, while politicians and administrators were often keen to postpone decisions.

Hence, depending on local authorities actual capacity to deliver, regions have come to play a more active role. This entails the stimulus to local initiative, eventually facilitating their association. Another typical regional action concerns the obligation placed on existing facilities to accept waste arising from a definite area, at a – more or less – regulated price. Regions also identify last resort opportunities in case of temporary or permanent incapacity; in some countries, and more notably in Italy, chronic failure of the ordinary system to provide solutions has led to the need to call up of disposal facilities in emergency.

Even if in principle municipalities are left free to choose the preferred solution, the market is clearly evolving towards a monopolistic structure (legal or de facto);

municipalities either use their own facilities or have long-term contracts with the closest ones. Transport costs are high enough to prevent bulk waste to be shipped outside the local (regional) market, except for those cases in which the lack of local alternatives provokes the need to address demand to external suppliers (as happened in the well-known disastrous case of Naples, part of whose waste is actually being exported to Germany and the Netherlands for incineration).

Large facilities – incinerators, mechanical-biological treatment (MBT) – normally operate as regional monopolists. Facilities have normally the legal obligation to receive waste from the concerned territory at regulated prices, according to the regional plan, but are also left some freedom to sell the spare capacity on the market: waste from other communities, commercial waste, residuals from sorting of packaging waste etc. This opportunity has been taken in particular where over-sized facilities are in place (particularly in the Netherlands, Belgium, Germany and France).

Treatment operators are later left with the responsibility of finding a destination for the by-products, either on the market for recyclables (compost, RDF, inerts for construction industry and pavements and so on), or on the disposal market, in case no further valorization is possible.

The situation is evolving also with respect to landfills: while in the past this was a typical competitive market, operated by private companies, they have been increasingly put under municipal control as long as it became difficult to locate new ones. With the phasing out of this technology, already achieved in some countries (Sweden, Germany, Austria and the Netherlands among those we have examined) landfills may become less strategic and return back to a competitive market model, as they continued to be in the field of business waste.

### 3.2 From separation to integration

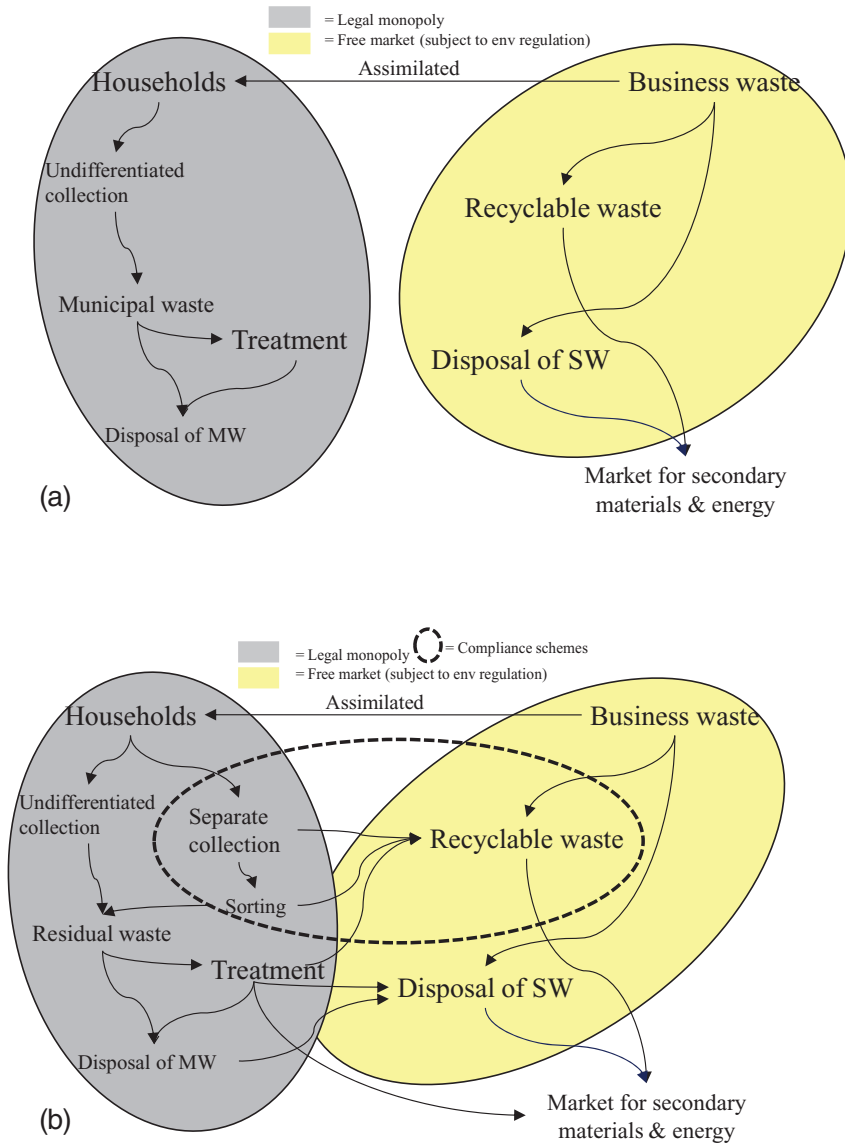
In all countries, hence, waste is handled under two competing institutional regimes: the public service regime and the market regime.

The *public service* regime applies to household waste, orphan waste (street cleaning etc) and assimilated commercial waste. The public service is organized as a legal monopoly and entails the definition of a public body responsible to deliver the service (usually municipalities, alone or associated) and an obligation of producers to use the service according to the prescribed regulation.

The *market regime* is applied to the remaining of commercial and business waste. Here the responsibility is placed on the producer, who discharges this responsibility by consigning waste to an authorized operator. The public sector in this regime acts basically as quality regulator, defining standards to be respected, norms regulating shipment of waste, authorizing operators and treatment facilities.

The boundary between both regimes was clearly set in the past, with limited crossovers, essentially limited to those few quantities of waste-derived materials that were recycled (Figure 1a).

Nevertheless, some important changes have occurred, modifying in a substantial manner this traditional segmentation.



**Figure 1 – Public service and market regimes: until landfill dominates (1a: left), and in the post-landfill scenario (1b: right).**

Source: our elaboration

The first change concerns treatment and disposal of undifferentiated waste. Most treatment solutions (from MBT to incineration) generate by-products that have some chance to be recovered in the materials market, such as compost from organic waste, combustibles that can be used as substitutes for coal in many industrial processes (rdf), ashes or other organic materials that could find a destination in other industrial

processes (e.g. inert materials for building industry). Even if this does not happen in practice, it allows waste-derived materials to change their legal status (waste processing is in fact an industrial activity like any other, and the residuals they produce, including the by-products they are unable to sell, can be handled as business waste).

The EU principles – forbidding ‘waste tourism’ but allowing the shipment of materials that can be valorized, including combustible waste – have encouraged the search for ‘creative’ ways of valorizing waste, even in industrial processes that are quite far – in geographical as well as technological sense

The second fundamental change concerns the role of ‘dual’ systems originated by EPR. Once residual and accessory, recycling becomes more and more central to the system. Industry-sponsored systems favour a shift of the focus from the origin of waste (urban vs. commercial) to the material content of commodities. This generates opportunities for addressing material flows jointly, regardless of their origin (e.g. plastics from urban separate collection can be treated in the same facilities together with homogeneous flows from industry and trade).

CS emerge as new and powerful actors on the demand side. In some countries (e.g. Germany) they are directly responsible for separate collection, and delegate it to specialized operators. They have to manage consistent material flows, some of which are recycled more or less directly after sorting (paper, glass, metals), while others require more complex processing and are destined to specialized downgrade recovery (converting mixed plastics into textile fibres, stuffing materials, inerts for road pavements, sound insulators etc).

A third driver of change concerns the ‘ultimate waste’ that originates from processing activities aimed at recycling: this waste often comes back to facilities that handle municipal waste (e.g. incinerators or landfills). National legislations have still different specifications concerning the degree to which energy recovery can be considered as a substitute for material recovery; a consistent quantity of sorted plastics, in particular, is destined to incinerators or to the production of combustibles.

This demand is often met by the spare capacity of facilities originally aimed at treating municipal waste.

As a result (Figure 1b), the boundary becomes permeable, with significant quantities of waste moving from one regime to the other. Waste arising from the public service regime is traded to the market for recovery, while the commercial waste system originates residuals that needs to be disposed of. Seemingly, a key to corporate success lies in the capacity to operate on both sides of the market (the regulated utility and the competitive industry of resource recovery and commercial waste handling), creating the opportunity of arbitrage and synergies.

Arbitrage between the public service and the market regime is not necessarily motivated by differentials of profitability, but also to less acknowledgeable reasons. A significant quantity of materials that are theoretically aimed for recovery are traded even when a market cannot be found – either because they can now be legally defined as industrial waste, or because it is not overall clear where the boundary stays between true disposal and many sorts of ‘downcycling’, such as the use of treated waste for road and railway pavements, construction industry or rehabilitation of contaminated sites.

Although the legal framework provides a definition of this boundary, this seems to be often conventional and open to abuse. Transforming MW into pseudo-recyclables, later to become commercial waste, has been a practical way to circumvent the self-sufficiency principle and often also bypass the legal ban to export waste to developing countries.

No surprise then if illegal waste management has become one of the most flourishing businesses in the hand of organized crime (EEA 2009, Legambiente and CCTA 2005). This phenomenon can be understood if one considers that the concerned value that justifies waste trading does not depend on the intrinsic value of traded materials, but is most of the times an 'artificial' value driven by the costliness of legal disposal and treatment, or from quantitative recovery targets placed on the industrial sector (Massarutto 2012). More than an impression exists on the fact that cost differentials by the shipment of waste are in most cases driven by asymmetric implementation of regulations, regulatory gaps and to the presence of uncontrolled sites, and do not reflect a real difference in territorial vocations or productivity (Brusco et al. 1995, D'Amato and Zoli 2012).

## 4 Perspectives for competition and regulation

### 4.1 Organization of MWM and patterns of private sector involvement

Public responsibilities can be fulfilled via several options ranging from direct management (in-house companies) to full delegation, from divesture to regulated competitive markets. National traditions of local service organization are varied, and no uniform model can be detected.

Things are made more complicated if we deepen our analysis by distinguishing arrangements occurring in the collection, treatment and recovery market, since the number of possible combinations increases. Table 3 summarizes the key information for each country.

The relative share of these options varies quite a lot from one country to another, but does not seem to have changed much over time.

Public undertakings dominate the market for collection in Germany, Sweden, Italy, Austria; while delegation to private companies is more frequent in France, Belgium, Spain, Portugal, the Netherlands and the UK (though the share of public operations even in these countries is remarkable: only in Spain and Portugal it is lower than 25%, while in the other countries it is close to 40–50%).

As for treatment facilities, public ownership and operation is dominant; operation can be delegated to private companies (under procurement or concession contracts).

The public-private divide, however, is of very little help in understanding the key features of the market (Bognetti and Obermann 2008, Florio and Fecher 2011). In fact, there are many different public arrangements (direct labour, public-law enterprise, private-law limited companies owned totally or partially by municipalities; public-public partnerships) as well as many different contractual solutions for involving the private sector, among which it is useful to distinguish: *outsourcing* (delegation of specific tasks



**Table 3 – Prevailing management forms in the countries analyzed**

	Collection	Treatment and Disposal	Recycling (packaging waste)
GER	Direct labour or municipal enterprises (35–40%) Procurement (60–65%) Separate collection: >90% delegated to privates on behalf of CS	Incineration: Public 31%, PPP 38%, Private 31% Mech. sorting and composting: public 44%, PPP 35%, private 21%	Green-dot systems in competition
AUT	Procurement (60%); Public enterprise (40%); Direct labour (Vienna)	Public enterprise, some PPPs	Green-dot system
UK	Former direct service: 50% Procurement: 50%	Concessions or PPP (dominant) Public enterprise (LAWDCs) (fading; only 9 remaining)	Free competition among authorized CS
SWE	Municipal enterprises + outsourcing	Intermunicipal or regional enterprises	Green-dot system
NL	(Inter)municipal enterprises (+ outsourcing) Delegation to private sector (management contracts): 36% of municipalities, 25% of households	Public enterprises or PPP. One plant owned and operated by private companies	Voluntary undertakings Free competition
BEL	Municipal enterprise (public or private law) (50%) Procurement (50%)	Municipal or intermunicipal enterprise PPP	Green-dot system
FRA	Direct management (42%); public enterprise (14%) Public procurement (41%); Full delegation (2%)	Direct management (associated) (19%) Public procurement (34%); Delegation (47%)	Competitive: a green-dot system offers a baseline framework contract
ITA	Direct labour (11%) Municipal enterprise (private law prevailing) (58%) Public procurement (31%)	Municipal or intermunicipal enterprise Some PPP Some concessions to private sector (landfills)	Monopolistic scheme with public status
SPA	Public procurement (76%) some municipal enterprises	Public procurement and PPP (79%); Some municipal enterprises	Green-dot system
POR	Municipal enterprises (13%) PPP (5%) Contracting out (82%)	Intermunicipal enterprises (dominant) Concessions to private sector (some)	Green-dot system

Source: our elaboration (see Antonioli and Massarutto, 2011 for a list of references for national case studies).

by an established public undertaking), *procurement* (delegation of service operation on a bulk base, but maintaining the public model in the external surface); *PPP* (creation of mixed-share companies for managing the service as a whole or specific facilities), *concession* (delegation of service operation and at least a significant part of the economic risk to a private company) and finally *full divesture* with competition in the market.

Direct labour organizations still exist in many countries, but play a residual role. They resist here and then, especially in important cities (e.g. Vienna, Amsterdam), where tradition of good service, reputation, political strength of unions is probably the best explanation. In some countries (Italy, UK among others) legislation has deliberately excluded them from managing services of general economic interest.

The trend characterizing public operators is clearly towards 'new public management' forms, either under public or increasingly private law establishments. In some countries (notably, Italy, and the Netherlands) some municipal enterprises have evolved towards a corporate model, growing through mergers and an aggressive strategy on the open market; In other countries we observe various forms of intermunicipal companies with complex governance structure that sometimes involve upper government layers (Portugal, Austria, Sweden Germany); PPPs with private sector are also frequent. The UK has introduced the possibility to create own limited companies for managing disposal facilities (LAWDCs), most of which later evolved towards PPP forms or were fully privatized.

A significant trend towards outsourcing is also clearly noticeable. Publicly-owned undertakings often delegate operational activities to private companies, retaining organizational and supervision competences, but relying on the private sector for labour-intensive phases as well as for the operation of the main facilities under different contractual schemes; traditional 'turnkey' contracts are frequently substituted by PPPs, project finance schemes and other similar mechanisms.

Delegation of collection to the private sector takes place more typically under procurement contracts, which are very diffused in all countries, but with higher shares in the UK, France, Austria, Sweden, Belgium, Portugal.

Tendering is sometimes compulsory even when in-house solutions are finally chosen (e.g. in the UK, and in Italy, where a recent reform has made provisions in this direction, yet still to be implemented), while in other countries obligation to tender applies only when municipalities wish to involve third parties, and has been introduced only recently (e.g. in France by the 'loi Sapin' in 1992), to face pressures from the European internal market regulation.

Private sector involvement in the industrial treatment (incinerators, mechanical sorting) most frequently takes place in the PPP form. The most notable exceptions are France and Spain, where the largest part of treatment capacity is privately owned and sold to MWM operations via procurement or delegation contracts.

Landfills are almost everywhere owned by municipalities, at least as far as they remain a bottleneck facility for urban waste disposal; a certain number of concessions (private facilities allowed to operate within the regulated market outlined in regional plans) is still in place here and there (e.g.. in Rome), yet declining. In turn, the fading out of landfills as a disposal solution opens further scenarios: the boundary between household and business waste vanishes (since it is strictly reserved to residuals after

treatment, that belong to the category of business waste). Private companies (but also former municipal companies) become the key actors, on a market base.

Two basic contractual schemes can be identified. In the first one, responsible authorities hold separate management agreements with collection and treatment operators.

This solution implies that the disposal authority has actually to decide which disposal solutions to adopt and play a more active role in the strategic decisions concerning service organization; in turn, it makes contracting out of collection easier (since contracts entail far smaller risks, can be more easily specified and released for shorter periods if collectors are not responsible for the destination of waste collected).

Private counterparts of the public sector in collection activities and in the sorting facilities are typically local SME. Landfill capacity is owned and directly controlled by local authorities as soon as scarcity rents begin to appear. Industrial treatment facilities are promoted by public operators, eventually in collaboration with private partners (PPPs, procurement), but maintaining public ownership and control. This scheme still survives where planning has been more effective in the top-down regulation (eg. Sweden, Austria, the Netherlands).

In the second scheme (more diffused in Spain, the UK and France), operators entrusted for managing collection services are also charged with the responsibility of ensuring its destination.

This model obviously encourages vertical integration, since the control of convenient disposal facilities ensures a formidable competitive advantage. Even if tenders do actually occur, they cannot be based on simple performance parameters and require careful specification of both quality performance and post-award renegotiation. Barriers to incumbent replacement in the next bids are high. In fact, the only way to impede monopolization of the market is to contract out single activities instead of integrated MWM, which in turn requires that the public sector is able to achieve economies of integration through planning.

#### 4.2 The increasing economic importance of waste management

The economic importance of MWM has been steadily increasing, reaching a turnover of nearly € 108 billion, providing 760,000 jobs (Table 4). A cross-temporal analysis is available for a few countries, but the evidence of the trend to increase is robust. Since 1996, the number of employees has increased by 56% in France and by 27% in Italy.

Despite the fact that public undertakings maintain the market leadership, most of the industry value added increment takes place in the private sector. This seeming contradiction can be understood by looking at the value chain of the industry, which is characterized (i) by a more complex structure, with intense specialization and division of labour; (ii) by the increasing need of professional operation, driving public enterprises towards corporate privatization; (iii) by the appearance on the scene of new actors on the demand side, namely the entities sponsored by industry for developing recycling markets under the EPR, and finally (iv) by an increased integration between MWM

**Table 4 – Key economic indicators of the waste management industry in the countries analyzed**

Country	N. of companies	Turnover	Employees
BEL	935	4.292	14.508
GER	1.567	20.542	99.784
SPA	2.089	4.557	40.248
FRA	5.425	16.822	65.000
ITA	5.837	19.013	134.480
NL	856	5.667	26.371
AUT	715	2.852	12.890
POR	820	1.322	14.513
SWE	727	2.658	13.161
UK	4.444	15.892	83.623
EU-27	36.400	108.000	760.000(*)

Source: our elaboration on Eurostat; (\*) Hall, 2010

and other waste markets, particularly in order to exploit the opportunities to valorize recovered materials.

The structure of the value chain has significantly changed, with an increasing importance of downstream phases – treatment, disposal, recovery – over collection; as a result, a low-skill labour-intensive local monopoly has been transformed into a capital-intensive business, with intense patterns of specialization and inter-industry trade.

The trigger of transformation has undoubtedly been the emerging bottleneck on the disposal side. Until landfills were cheaply available in the immediate surroundings of urban areas, the share of collection and street cleaning was above the 90% of the total value added; this share is now 50–60% or less, despite the increase in the technical complexity of collection and sorting operations. This difference is largely due to the increase of treatment and disposal costs (Massarutto et al. 2011, Eunomia-Ecotec 2003).

Until the 80s, the price of landfilling waste was equivalent to a few €/t (Ascari et al. 1992). Nowadays, the pure financial cost of managing a landfill site in compliance with the EU legislation can be estimated around 50 €/t (Massarutto et al. 2011); yet the market price can be even 3 times higher, due to environmental taxation and scarcity rents appropriated in various ways by site owners.

Gate fees vary quite a lot across Europe. A recent survey on 11 EU countries shows an average gate fee for incinerators of 92 €/t, with a range from 42 to 156. For landfills, the average price net of ecotaxes is 65 €/t, with a range from 21 to 138 (Andretta 2010). The lowest prices, however, concern the regulated prices applied within regional plans, while on the spot market prices are systematically above 100 €/t (Massarutto 2012). Other studies report even higher and more variable figures, for example in Germany, where disposal price in 2004 varied between 50 and 340 €/t (Gaubé and Weigand 2005).

In the past, the private sector was represented mainly by (i) external contractors to the local authority (mostly local SMEs), performing labour-intensive activities; (ii) supply of landfill capacity (typically from previously used quarries and mines) and (iii) supply of equipment.

The scope for private sector involvement is much larger today, since private companies do not only address the traditional low-value added and labour-intensive blue-collar activities outsourced by public bodies, but also strive for the emerging high-value added ones: management and organization of the system, supply of specialized equipment, technological treatment (incineration, upgrading and selection of waste-derived materials, processing of hazardous waste), recovery of materials, consultancies.

The industry exhibits clear signs of concentration. The size of MWM operators has been continuously growing and has, in some cases, reached a transnational dimension.

In all countries, the market is dominated by top-5 operators (among which we generally find also the top former municipal companies, such as Hera and A2A in Italy, AVR and Essent in NL); only a few companies, however, operate in more than one country. In general, these companies are also market leaders in the commercial waste business.

The turnover of the top-15 companies in the European market alone accounts for almost € 31 billion (1/3 of the total industry turnover); the top-3 companies alone – French multinationals Suez Environnement and Véolia, with the German Remondis, that has incorporated activities from the RWE group – alone represent a figure around 61% of this total; they operate in other countries either as partners to local authorities in PPP projects (especially in the field of treatment) or by buying shares of already existing operators. (Davies 2003, Hall 2007).

This aggregated data does not make it possible to extrapolate MWM from the total amount of waste, but is surely indicative of a trend towards concentration and integration.

Despite this concentration trend, SMEs continue to play a significant role, operating at the national or regional level, providing a full range of specialized activities, possibly as partners to bigger operators or to industry-sponsored CS: from kerbside collection to production of containers and equipment; from R&D to innovative recycling solutions; from marketing of recyclables to the recovery of ‘downgraded’ materials.

Vertical integration is clearly correlated to the increase – both dimensional and in the scope of activity – of the role of the private sector. The top players in each country are active in all segments of the industry, though not necessarily in the same place and with the same contract.

The path towards vertical integration is different when it concerns public enterprises or private companies. In the first case, the trigger has been the strategy aimed at increasing reliability of access to treatment solution and an internalization of the scarcity rents. In order to develop own facilities, municipalities had to ensure a larger territorial basin (hence, giving rise to regional concentration, often through innovative holding structures and facilitated by upper government levels).

Top companies control directly or indirectly a wide range of treatment facilities, especially those implying economies of scale and relevant sunk costs. They are often multiutilities with strong interest in the energy sector. The top companies have also engaged in partnerships with the private sector with the aim of enlarging their activity to the business waste market and exploit the many economies of scope that arise from the arbitrage.

In the private sector, the driver of vertical integration is more frequently the market power arising from the control of disposal capacity in certain regions, enabling private companies to compete for collection also. Here again the contemporary operation on the MWM and the business waste sector also enables to exploit successfully the many arbitrage opportunities.

The top players, either public or private, offer a wide basket of solutions that other public management systems acquire *à la carte*. We observe for instance mixed-venture companies for running treatment facilities (whose control remains in the local authority that sponsors the project, while the technical and financial engine is supplied by the large integrated company). Top companies may supply dedicated special treatment services for specific waste segments that local companies acquire.

This feature generates a sort of hierarchy internal to the public sector, with the larger companies growing and concentrating on high-value added phases, and smaller local companies maintaining easier tasks (and the final interface with local customers and politicians). We can speak in this case of ‘public-public partnerships’, although the former companies are often losing their genuine public nature.

Vertical integration and concentration is further prompted by the gradual shift of separate collection services from the public service to the market domain, through the action of CS. Particularly where CS are fully responsible for putting in place separate collections, they find it convenient to rely on single operators for the whole country. In Germany, for example, top-6 operators collect 63% of scrap materials, and often also control sorting and processing capacity downstream.

Another evident trend concerns the enlarging of the geographical scale of operations. While remaining a local utility, especially due to the bulkiness of waste and the incidence of transport costs, the MWM sector today involves transactions at the regional, national and even global scale (EEA 2009).

As for MWM, trading regards, in the first place, materials originated from separate collection and aimed for recycling. Between 1995 and 2007, scrap paper shipments within and outside the EU jumped from 8 to 20 million t/year; a similar trend can be noted for plastic waste (from 0.8 to 3.2 million t/year) and metals (from 23 to 40) (EEA 2009b). Undifferentiated waste aimed for energy recovery and RDF have also witnessed some cross-national trade, especially towards the countries (such as Germany and the Netherlands) having spare capacity in waste-to-energy facilities. Inter-regional waste flows can also be noticed, especially in those countries (such as Italy and Germany) where the price differential is high and/or an absolute scarcity of available sites has emerged. This phenomenon has been particularly acute in the late 90s.

Enlargement of geographical scale is parallel to horizontal integration towards the commercial waste market. The underlying economies of scope are quite straightforward.

Evidence suggests that only in a few cases can recovery be addressed to well organized and viable markets (electricity, glass, paper, metals). In most of the other cases, the spot market is very thin, prices very volatile, market conditions very unreliable and subject to hold-up. This applies above all for bulky materials with low value aimed for downcycling (compost, inerts for road construction, refuse-derived fuels etc), as well as for mixed plastics. Evidence shows that the costs sustained for disposing of materials

on the spot market can be up to 100% higher, considering either higher gate fees and transport costs (Andretta 2010, Massarutto et al. 2012).

MWM solutions that imply the need to market the resulting outputs perform much better, then, when the operator has full control over the subsequent destination of recovered materials, or has at least engaged in long-term agreement with users.

## 5 Conclusions and regulatory implications

In the past, municipalities had to organize collection services; public health reasons called for the specification of public service obligations concerning the obligation to collect all waste generated and the corresponding one of using the service according to regulations and recover the related cost. As for blue-collar activities with little economic complexity, this was suitable for contracting out under traditional procurement schemes.

Key competitive factors were cost effectiveness on the private side, and lower transactions costs for control on the public side.

As soon as disposal started representing a bottleneck, the public service approach has been extended to treatment and disposal. Regional planning gave rise to local markets, almost closed to external transactions. The plan provides for allocation of flows, with a combination of top-down decisions imposing technical solutions ex-ante and bottom-up initiatives validated ex-post. Plans were also supposed to regulate access price; the scant evidence in our possess suggests that this has been done only in a weak and ineffective way, constrained by the market power of the owners of existing facilities.

Key competitive factors became technical, financial and managerial capabilities, but also the capacity to attract local consensus: territorial loyalty, entrenchment in the local community fostering sense of belonging, readiness to share the economic rents with the local community and so on.

Finally, the emergence of recovery and recycling as a cornerstone of the MWM strategy started a new phase, in which public service obligations concern the achievement of targets concerned with material balance and resource efficiency. The dominant strategy here has been EPR, and the creation of regulated markets animated and prompted by industry-sponsored entities aimed at facilitating market development; initially their market power has been tolerated (or deliberately created, as in Italy) in the name of the superior reason of effective achievement of public policy targets, while in a more mature phase competition.

Key competitive factors have become innovative capacity to find recovery opportunities, economies of scale, capacity to operate across the boundaries of different management regimes.

Until these three spheres have remained independent from each other, their development has followed separate paths. Regional planning, in principle, had the aim to allocate flows at a regulated price. Municipalities could then make separate contracts for collection, which could remain a fairly competitive market.

The trends examined in this study clearly puts pressure on this model. The explosive development of the tertiary market (recovery of materials and energy) challenges the approach based on rigid self-sufficiency, increasing the scope for trading. Sometimes planning failures may have accelerated the crisis (since the incapacity to actually implement planning provisions forced municipalities to look for alternative solutions); a typical case concerns the excess of optimism on the possibility to valorize materials after treatment (e.g. selling compost and rdf produced by MBT plants), unsold by-products have often to be disposed of in the commercial waste market, instead of being recycled.

The emerging management paradigm is more visible in the countries where these challenges have been sharper, and probably still not where the 'old regime' has continued to deliver. Its most distinctive features concern multiple shifts:

- From simple activities, suitable for contracting out and tendering, to vertically-integrated local monopolies that take care of collection, treatment and disposal
- From a service whose emphasis was put on waste produced by households and assimilated producers from one focused on managing residual waste (i.e. waste that cannot be further valorized) of whatever origin, as a last-resort.
- From self-sufficient regional markets to trading of waste management services, driven by economies of scale in specialized treatment, shipment of by-products to external recovery or disposal, over- or under-supply of capacity, increasing patterns of division of labour

We can dare the hypothesis that planning played a fundamental role in the infancy phases of the disposal industry, and especially once the transition from landfill to more modern solutions had to be coordinated, also in order to reduce the economic risk of engaging in sunk-cost intensive solutions. The more mature the market becomes, the more professional management is needed, the more the planned system leaves space to operator-based integrated systems, with planning mainly limited to the definition of targets, regulation and, eventually, provision of last resort solutions.

This transformation has relevant implications for public policy.

First of all, it may create a trade-off between conflicting regulatory aims. On the one hand, enough disposal capacity should be in place, but all efforts are concentrated to minimizing its role. Since disposal facilities ultimately imply a fixed and sunk cost, this also raises the question about how to compensate the assumption of public service obligations and guarantee adequate revenues to recover costs. On the other hand, if this compensation is searched for by ensuring a legal monopoly on local waste to facility operators, this might weaken the incentives to engage in recycling and separate collection. This dilemma could be solved by allowing some competition among facilities, through a relaxation of the self sufficiency principle once a minimum of capacity has been put in place.

Second, it calls into question the dominant approach to liberalization that has characterized the local utility debate so far, namely competitive tendering for Demsetz-like concessions (OECD 2000). Vertical integration reduces the possibility to observe the conditions that guarantee optimal or even viable patterns of competition for the market (high number of suppliers with similar technology, low transactions costs, complete contracts, low barriers to entry/exit).



This insight is confirmed by the results of empirical studies aimed at evaluating the economic performance of alternative models. Evidence from some of the analyzed countries shows that some benefits from introducing competition are apparent in the segment of collection services (Szymansky 1993, Dijkgraf and Gradus 1993, Ohlsson 2003), but not necessarily for integrated management (Lombrano 2009, Simoes et al. 2012, Bel and Costas 2006).

MWM candidates instead for the application of regulatory approaches that are borrowed from other network industries, where regulation aims at solving trade-offs between universal service obligations and competition in the market (e.g. telecommunications) and the presence of bulky bottleneck facilities with substantial economies of scale and relevant fixed costs faces the challenge of competing alternatives, better ranked in the policy priority order not charged with public service obligations (e.g. renewable energy).

Third, it calls for a different segmentation of the market. While in the past the relevant distinction was the one between household and assimilated waste (public service) and business waste (market), it is now between waste that can be valorized in some way (market) and ultimate waste of whatever origin, with many materials shifting (often more than once) from one domain to the other.

Operating as a monopolist in the MWM allows a substantial market advantage, especially when there is capacity in excess that can be sold on the open market. Landfilling of ultimate waste offers a further opportunity, since facilities that are authorized for this purpose are normally the same as for commercial and industrial non-hazardous waste, and share a similar regulatory regime.

These opportunities are vital in order to achieve the required recycling and recovery targets, but also raise concerns because of the opportunity for abuse.

Finally, the 'new regime' open interesting challenges for public sector operators. The EU has started a policy in this field that limits substantially the degrees of autonomy left to public powers in the choice of management solutions, with a pro-competitive approach (Bauby 2011). Allowed public undertakings are limited to the in-house model, hence with clear limitations to their operation outside the strict regulated segment.

Yet our analysis clearly shows that some of the most successful companies, serious candidates to challenge big multinationals, are the heirs of former municipal enterprises, now frequently engaged in corporate growth, partial privatization (through strategic alliances or quotation), integration with energy and other utilities, and finally able to exploit synergies between municipal and business waste. If this is true, a rethinking of the EU policy in this field might be needed. Instead of being an alternative to private concessions, PPPs should be looked at as tools facilitating public-public cooperation and enabling the transformation of public companies into serious contenders to the already established private operators.

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