

Reference:

Van Daele, S., Vander Beken, T., & Dorn, N. (2007). European waste disposal sector. In T. Vander Beken (Ed.), *The European waste industry and crime vulnerabilities* (pp. 17-142). Antwerp/Apeldoorn: Maklu.

Publisher:

<http://www.maklu.be/MakluEnGarant/index.aspx>

Ordering the book:

<http://www.maklu.be/MakluEnGarant/BookDetails.aspx?id=9789046601051>

PART I. European waste disposal sector

Stijn Van Daele, Tom Vander Beken and Nicholas Dorn

A. Acknowledgements

This study on the waste management industry could not have been realised without the help and expertise of several people. We are therefore indebted to those who were able and willing to guide us through the sector:

From the Belgian Federation of Environmental Management Companies (FE-BEM):

- Werner Annaert, general manager, and Baudouin Ska, adjunct manager, who provided information on the sector in general and who were willing to set up and assist in a number of contacts with company people.

From other European Environmental Management Federations:

- Markku Salo, JLY (Finnish Solid Waste Association)
- Ágnes Czibók, KSZGY SZ (Hungarian Association of Environmental Enterprises)
- Marian Kelly, ESA (Environmental Services Association UK)

From the Belgian federal police forces:

- Chief Commissioner Frans Geysels, head of the Environmental Department of the Judicial Police
- Chief Inspector Rudy Cools

The people from the consulted companies in the various areas of waste management, who spent their time and efforts, answering our questions.

B. Descriptive phases

I. Sector analysis

1. Sector features

1.1. Definition of the sector

In order to examine European waste management, one must first of all properly delineate the object of the study. Defining waste is hereby an important issue. Looking at the Council Directive on waste¹ and its annexes, a functional definition has been given to waste, mainly because in the end, every product can be waste and vice versa. Therefore, an artificial line has to be drawn where an object stops being a product and starts being waste.

As a result of this functional waste definition, the European waste sector is characterised by **heterogeneity**. In general, the waste management industry is the economic sector that gets involved after all 'productive' economic processes – when a product, or the remainder of it, becomes a burden. This is mostly accompanied by a reversal of the value chain. Throughout the literature, a distinction is often made between production, collection, transport and final treatment, the latter consisting of landfills, waste-to-energy incineration (WTE) and recycling. Differences also exist in relation to specific economic sectors. From this perspective, the NACE classification, set up by the European Community and providing a list of codes to categorise all economic activities, may be used to delineate waste management activities. As with all classification systems, however, there are many definitional, technical, data quality and interpretive difficulties.

Coverage of waste management in relation to all economic activities would go far beyond the scope and resources of this study. Therefore, it was decided to limit the scope of this study. Three aspects have been chosen that give a sense of the breadth of waste management, and of the risks, regulatory pressures and seriousness of crime risks.

- As a first focus point, the choice has been made to describe the collection, transport and treatment of **municipal solid waste**. This includes households and similar waste. We decided not to consider the collection, transport and treatment of these waste streams when done 'at source'. The reason to do so is that waste is often reused and/or recycled at its place of production, which means that it never becomes waste in the legal sense.²

¹ A first definition has been established by the Council Directive 75/442/EEC on waste, *Official Journal* L194, 25/07/1975, 39-41. Several amendments have been established. Therefore, the decision has been made to clarify issues, resulting in Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, *Official Journal* L114, 27/04/2006, 9-21

² Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, *Official Journal* L114, 27/04/2006, 9-21

- Secondly, special attention has been given to **hazardous waste** streams. This has been done because hazard and risk have become ever more important, both socially and environmentally. As the management of these streams comes under greater scrutiny, and practices that formerly were ignored or quietly tolerated become more closely monitored and constrained, so do the pressures on management of hazardous waste increase.
- Thirdly, this study includes the **nuclear waste** industry. Reasons to do so were the political and environmental impact of nuclear waste management, the specific security issues and its specific place at the top end of the scale of hazardous waste.

NACE Rev.2, which is a revision of the existing NACE classification, has been drafted and should come into effect from 2007.³ In the new classification, attention has been paid to the above-described distinction between collection, treatment en recovery of waste. The waste management industry is defined by Code 38 of the new classification:

Figure 1: NACE Rev.2 on the waste management industry⁴

NACE 38	Waste collection, treatment and disposal activities; materials recovery
38.1	Waste Collection
38.11	Collection of non-hazardous waste
38.12	Collection of hazardous waste
38.2	Waste treatment and disposal
38.21	Treatment and disposal of non-hazardous waste
38.22	Treatment and disposal of hazardous waste
38.3	Materials recovery
38.31	Dismantling of wrecks
38.32	Recovery of sorted materials

From a classificatory point of view, we are now situated at a change point. NACE Rev 1.1, the current standard,⁵ is not very clear on the waste disposal sector. NACE Rev.2 is clearer (it includes hazardous, which itself may be taken to include aspects of nuclear), but data are not yet available and will not be for a

³ COMMISSION OF THE EUROPEAN COMMUNITIES, *Proposal for a Regulation of the European Parliament and the Council establishing the statistical classification of economic activities NACE Rev.2 and amending Council Regulation (EEC) N° 3037/90 and certain EC Regulations on specific statistical domains*, Brussels, COM (2006) 39 final, 2006/0011 (COD), 06/02/2006, 58p.

⁴ EUROSTAT, *NACE Rev.2 structure and correspondences with NACE Rev 1.1 and ISIC Rev.4*, Statistical Office of the European Communities, 20/01/2006, <http://forum.europa.eu.int/irc/dsis/nacepacon/info/data/en/NACE%20Rev%202%20structure%20and%20correspondences%20NACE%20Rev%201%201%20and%20ISIC%20Rev%204.pdf>, p.27

⁵ Commission Regulation (EC) No. 29/2002 of 19 December 2001 amending Council Regulation (EEC) No. 3037/90 on the statistical classification of economic activities in the European Community, *Official Journal* L 6, 10/1/2002, 3

few years. It is also not yet clear how the NACE Rev.2 implementation will effect actual application of the European Regulation on waste statistics. In this study, we try to use data based in existing classification systems where relevant, we also use other data and sources on municipal, hazardous and nuclear waste management.

1.2. Description of the sector

1.2.1. Market players

Many persons/entities in the industry have only a partial involvement in waste management. Moreover, the waste chain itself contains several aspects. This creates some uncertainty when describing the players in the waste market.

About 1.3 billion tonnes of waste is generated throughout the European Union each year. Thereof, about 26% is produced in the manufacturing industry, compared to 14% municipal solid waste.⁶ This results in an annual EU-25 average of over 500kg municipal waste per capita and 3500kg per inhabitant per year, taking into account both industrial and municipal waste.⁷ This indicates that the first sector of this study constitutes only about 40% of the total waste produced. This still excludes for example agricultural waste. Taking into account all possible waste streams, 3 billion or more tonnes of waste are generated yearly.⁸ National waste definitions may vary to a large extent, undercutting the value of comparisons of national amounts of waste. For example, in the case of hazardous waste, several classifications have been used.⁹ Fortunately, this should change in the future with the implementation of the EU Directive on Waste Statistics.¹⁰

Hazardous waste streams constitute about 1% of the total amount of waste generated.¹¹ The European Environment Agency (EEA) reported that 17 of its member countries contain 2,163 companies that manage facilities or landfill sites for hazardous waste treatment. In most countries, companies manage several facilities. Therefore, the number of locations is higher than the number of com-

⁶ COMMISSION OF THE EUROPEAN COMMUNITIES, *Communication from the Commission: towards a thematic strategy on the prevention and recycling of waste*, Brussels, 2003,

http://www.eu.int/eur-lex/en/com/cnc/2003/com2003_0301en01.pdf

⁷ EUROSTAT, *Europe in figures: Eurostat yearbook 2005*, Luxembourg, Office for Official Publications of the European Communities, 2005, p.200

⁸ EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.151

⁹ BRODERSEN, J., CROWE, M. and JACOBSEN, H., *Hazardous waste generation in EEA member countries*, Copenhagen, European Environment Agency, 2002, p.10-13

¹⁰ Regulation (EC) No 2150/2002 of the European parliament and the council of 25 November 2002 on waste statistics, *Official Journal* L332, 9/12/2002, 1-36

¹¹ EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.155

panies. In total, 2,114 locations were reported by 16 EEA member countries.¹² Germany and Italy are by far the two countries with the highest numbers of locations. Other countries such as Iceland, Liechtenstein and Luxembourg reported only very few facilities. The reason is that these are small countries with only a small amount of hazardous waste, which is treated in neighbouring countries.¹³

The quantities of radioactive waste generated annually are very small compared to those of hazardous waste and other non-radioactive waste.¹⁴ Each year, slightly less than 40,000m³ of radioactive waste is produced in Europe.¹⁵ This comes to about 0.01% of the total amount of waste by volume. Moreover, 90% of that proportion is low-level waste. Due to its special nature, however, it is mostly considered separately from other wastes. Radioactive waste contains three large types, namely low-level, intermediate-level and high-level wastes. While the high-level wastes are almost exclusively generated in nuclear power plants, the other types may also be generated in hospital and industry processes.¹⁶

As for the legal nature of the market players, industrial waste is often been treated by private actors. Municipal solid waste however, is mainly a responsibility of the public authorities.¹⁷ Privatisation tendencies, especially by means of outsourcing, have increased from the 1990s on, resulting in a growing market share by private parties.¹⁸ This creates a network of public and private actors. Privatisation tendencies vary from about 5% to almost 100%, depending on the country and the stage of the waste chain that is regarded.¹⁹ This difference could well decrease in the future, as privatisation tendencies rise. One should not forget that waste has become a full scale business only relatively recently.

¹² Sweden did not provide data concerning the locations of hazardous waste treatment, although it noticed 131 companies. This explains the fact that the given data do not correspond with the idea that the number of locations should be higher than the number of companies.

¹³ WEISSENBACH, T., *Waste management facilities*, Copenhagen, European Environment Agency, 2001, 36p.

¹⁴ EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.159

¹⁵ WEBSTER, S., *Nuclear Safety and the Environment, Fifth Situation Report: Radioactive Waste Management in the Enlarged European Union*, European Commission, Directorate-General Energy, EUR 20653, 2003, 37p.

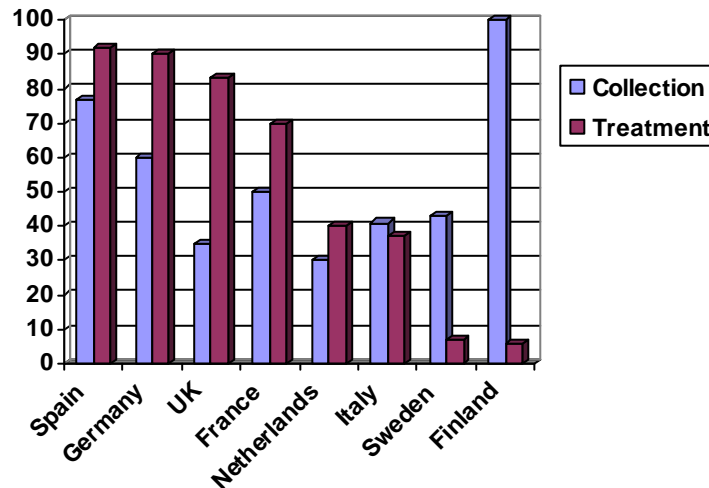
¹⁶ WORLD NUCLEAR ASSOCIATION, *Waste Management in the Nuclear Fuel Cycle*, WNA, February 2006, <http://www.world-nuclear.org/info/inf04.htm>

¹⁷ COMMISSION OF THE EUROPEAN COMMUNITIES, *Communication from the Commission: towards a thematic strategy on the prevention and recycling of waste*, Brussels, 2003, http://www.eu.int/eur-lex/en/com/cnc/2003/com2003_0301en01.pdf

¹⁸ HEMMER, D., HÖFERL, A., *Privatisierung und Liberalisierung öffentlicher Dienstleistungen in der EU-15: Abfallwirtschaft*, Wien, Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OCPP), 2003, 35p.

¹⁹ E-mail conversations with Federations of waste management companies from the United Kingdom (ESA), Finland (JLY), Hungary (KSZGYSZ) and the Czech Republic (CAOH), 08/02/2006-17/02/2006

Figure 2: Percentage of MSW (Municipal Solid Waste) market outsourced to private contractors²⁰



This proportion is not fundamentally different for hazardous waste companies. For nuclear waste, however, the situation is different. Because of the sensitivities around nuclear waste (long duration of radioactivity in some cases, security issues overlapping with military and terrorist considerations, the mixture of such issues with big money and public disquiet), nuclear waste management has been left almost exclusively to public authorities. Although several subcontractors are private actors, privatisation tendencies of the nuclear industry, and of long-term nuclear waste storage facilities, are quite limited so far. However, this will probably change in the future. Despite serious opposition, the U.S. Nuclear Regulatory Commission issued a construction and operating license for a private nuclear waste storage facility in Utah.²¹ Also in Europe, namely in Finland, the influence of private companies in nuclear waste management has increased, as the private company Posiva will start building a long-term nuclear waste storage facility by 2010, in order to be operational by 2020.²² Predictably, privatisation of nuclear facilities – and hence of responsibility for fuel wastes and decommissioning wastes – characterises part of the UK industry. Ever more private parties make their entrance in the nuclear waste market, which is nevertheless to a large extent influenced by public authorities.

²⁰ HALL, D., *Waste management companies in Europe*, Public Services International Research Unit, European Federation of Public Service Unions, 2006, http://www.epsu.org/IMG/pdf/EN_PSIRU_waste_management_in_EU_Feb_06.pdf, 15p.

²¹ X., *NRC grants license for private nuclear waste site*, Reuters, 22/02/2006, http://today.reuters.com/news/articleinvesting.aspx?type=bondsNews&storyid=2006-02-22T184705Z_01_N22224019_RTRIDST_0_UTILITIES-NUCLEAR-WASTE.XML

²² NUCLEAR ENERGY AGENCY, COMMITTEE ON RADIOACTIVE WASTE MANAGEMENT, *Radioactive Waste Management in Finland*, Radiation and Nuclear Safety Authority, 2005, http://www.stuk.fi/ydinturvallisuus/ydinjatteet/ydinjate/en_GB/ydinjate/_files/73810475841424335/default/radioactive_waste_management_in_finland.pdf, 10p.

Considering the broader arena of environmental policies, state expenditures in the EU-25 were around 167 billion euros in 2001. This equalled about 1.8% of the Global Domestic Product, of which 0.8% was paid by specialised producers, 0.6% by the public sector and 0.4% by the industry.²³ Of course, these costs are not exclusively linked to waste management. They can only give an indication about the division of the costs between the different actors. Operating costs in the waste area have significantly increased during the past decade. However, caution is needed to interpret this, as waste management activities have increased as well, with 11% per annum.²⁴ This could well explain this increase.

The waste management market is not an isolated market. Waste management is often considered together with energy and wastewaters. It is not surprising that some companies are also active in those waste-related domains. Sita, Onyx and RWE are the biggest multi-utilities, while other companies may be considered as real waste specialists.²⁵

Where criminality exists within waste management, it may have implications for the rate of bankruptcies and the flow of newcomers into the industry. Honest companies have to lower their prices in order to compete with illegal disposers, for the latter have lower costs. The market may become less attractive to new entrepreneurs. At least a part of them decide to stay out of the market because they fear that unfair competition makes it too difficult to survive.²⁶

During the last few decades, the waste management industry has undergone some big changes. Starting from a closed market, it has **opened up** to a large extent. This opening up, however, has been accompanied by changes within the sector itself. Several smaller firms have been taken over by larger companies or have merged into larger firms.²⁷ In this way, the sector has become more stable.²⁸ This stability may be undermined by the growing economic pressure on the sector.

In summary, increasing amounts of waste are generated each year. Of all waste streams, about 1% is hazardous waste and 0.01% is nuclear waste. National and industrial differences occur in the area of privatisation, employment and pro-

²³ OLSSON, N., *Environmental Protection Expenditure in Europe by public sector and specialised producers 1995-2002*, Luxembourg, Office for Official Publications of the European Communities, 2005, 12p.

²⁴ ECOTEC, *Analysis of the EU Eco-industries, their employment and export potential*, Birmingham, Ecotec, 2002

²⁵ AFVAL OVERLEG ORGAAN, *De afvalmarkt; ontwikkelingen 2003*, Utrecht, AAO, p.26

²⁶ VAN DEN ANKER, M.J.J. and HOOGENBOOM, A.B., *Schijn bedriegt: overheid, bedrijfsleven en gelegenheidsstructuren voor criminaliteit op de hergebruikmarkt*, 's Gravenhage, VUGA, 1997, p.146-147

²⁷ COOKE, A., and CHAPPLE, W., Merger activity in the waste disposal industry: the impact and the implications of the Environmental Protection Act, *Applied Economics*, 2000, Vol.32, no.6, 749-755

²⁸ Interview with Werner Annaert, general manager of FEBEM, the Belgian Federation of Environmental Management Companies, 03/02/06

vided services. In respect with globalisation trends, these differences will in the future decrease; although national policies will certainly still play a role.

1.2.2. Activities: nature of the core product or service

Looking at the waste management industry in its broad sense, the product can have several qualities. Although the European Directive on Waste states that ‘...of which the holder discards or intends to discard’ is a necessary characteristic,²⁹ this does not mean that the result is always the same. Waste can be **reused** or **recycled** into raw material for other industries, but waste can also be incinerated in **Waste-to-Energy incineration** plants (WTE), or be **landfilled**. The value of waste is therefore not intrinsic, but depends on what can be done with it.

One approach to waste management is to consider it as a service industry. As waste often has a negative value, it is possible to turn normal market principles upside down. This means that the value of waste lies in fact not really in the product itself, but in the service that is offered. The European waste definition mentions the intention to *discard* of materials as a necessary defining factor. In this approach, the filling-in of this intention constitutes the service provided. Depending on the collection efforts, the environmental hazards and risks, the relevant treatment and policy guidelines, prices for wastes and for their disposal may differ widely. The more complex the definitional, regulatory, disposal and pricing issues, the greater the possible incentives for fraud will be.

This is also true for waste streams that have a positive value and that can be considered as products themselves. The product, however, has an unclear nature. Volumes, weight and characteristics can be manipulated easily. Moreover, those characteristics can often not be distinguished with the naked eye. Thus, one has to rely on the willingness of the supplier to reveal the proper nature of the goods. Profit issues may lead to fraud of the papers that should identify the waste characteristics (for example, consignment notes in the case of transport), because of the illegibility of the market.

As the level of hazard of wastes increases, so does the price for its management or recycling. For hazardous waste streams which cannot be reused or recycled, disposal costs rise because of technical requirements and environmental risks. For certain types of hazardous and nuclear wastes however, reprocessing possibilities cause an increase in the price of waste itself.³⁰ Thus, higher environmental risks command correspondingly high prices, both for the separation/disposal/recycling services and for some of the products thereof.

1.2.3. Sub-sectors

²⁹ Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, Official Journal L114, 27/04/2006, 9-21

³⁰ SCHAPER, A., SCHMIDT, G. and BÄHR, R., *Emerging Nuclear Energy Systems, their Possible Safety and Proliferation Risks*, Luxembourg, European Parliament, 1999, p.34-35

Sub-sectors can be divided into three groups, namely activities, territory and characteristics of the waste streams.

The waste management industry can be divided into several sub-categories according to the concrete activities. Mostly, collection and sorting, transport, recycling and treatment are distinguished.

Because of specific regulations concerning international transport and transnational disposal of waste, the waste management industry could contain both a national and a transnational dimension.

Specific characteristics of the waste streams may lead to specific methods for collection, transport and disposal. The obvious example in this perspective may be hazardous waste, and more specific, nuclear waste. Nevertheless, also other waste streams, such as electronic, organic and plastic waste may ask for specific methods of handling, just as end-of-life vehicles and hazardous waste.

1.2.3.1. Sub-sectors according to activities

Activities within the waste management industry include **collection** and **sorting**, **transport** and **treatment**. This is the case for municipal waste as well as hazardous waste and nuclear waste. The larger, international firms often provide all three services at the same time. However, smaller firms, which constitute the majority of the sector, are often performing only one or two activities, mostly recycling.

Although responsibility for municipal waste still mostly remains with public authorities, collection is mostly a market enterprise, due to growing privatisation tendencies and the fact that industries are already held responsible for their waste collection themselves. This may lead to a reduction of the waste collection cost for municipalities. In the 1990s, waste collection still consumed 30-60% of their available revenues.³¹

Treatment can be subdivided into recycling, reuse and disposal. Recycling means 'reprocessing in a production process of the waste materials for the original purpose or for other purposes including organic recycling but excluding energy recovery.'³² The sector segment of recycling is structured quite different than the rest of the waste industry. The recycling business alone has a turnover of 4.5 billion euro.³³ As several players within the waste management industry are not

³¹ WORLD BANK ENVIRONMENT DEPARTMENT, *Environmental assessment sourcebook II: sectoral guidelines*, Washington, World Bank, 1991, p.212

³² CONSLEG, *European Parliament and Council Directive 94/62EC of 20 December 1994 on packaging and packaging waste*, Luxembourg, Office for the Official Publications of the European Communities, 2004, p.7

³³ EUROSTAT, *European Business: facts and figures, data 1998-2002*, Luxembourg, Office for Official Publications of the European Communities, 2004, p.234

defined or registered as such in NACE-type classification system – waste management constituting only a part of their activities – it is not possible to determine the exact number of market players. In the recycling business, for example, enterprises with less than 50 employees account for 62.5% of the value added generated in 2001. This was the highest share of any manufacturing NACE division. At the same time, large enterprises (250 employees or more) accounted for only 11.5% of the value added generated. This was the smallest of any manufacturing NACE division.

Notwithstanding these figures, this does not mean that the waste management industry in general is an economic sector made up of small companies. For example in the Netherlands, data indicate that large companies are active in the whole waste chain (collection, transport, recycling, disposal), while the smaller companies are almost exclusively active in the recycling business.³⁴ Moreover, the composition of the market is related to the nature of the recycled goods. For example, paper is internationally oriented, while this is less the case for organic waste. Besides, the market of animal carcasses is almost monopolistically, while for example municipal waste is characterised by a competitive market.³⁵ Thus, the market is very heterogeneous.

One of the results of this partial filling-in of the waste chain is the fact that **brokers** play a role. They often operate in a closed market in order to maintain themselves within the sector. Moreover, they are very often not registered as active in the waste management sector as such, for waste management only fulfils one of their tasks.³⁶ Because they do not necessarily become waste owners in a legal sense, they have no need to comply with licensing restrictions.

Finally, disposal is the operation in which waste can no longer be used again and is to be discarded. A list of methods which are considered to be disposal operations is provided by the European Council Directive on Waste,³⁷ and includes landfill, release into seas, incineration and permanent storage.

As both collection and treatment involve transport, the latter cannot be considered a distinct section of the waste management industry. Nevertheless, the amount of transported waste should not be underestimated, for about 15% of all cargo transport involves waste. Transport regulations are different for recovery and disposal. Additional measures have to do with the possible hazard of waste.³⁸

³⁴ SENTERNOVEM, *De afvalmarkt 2005: tussen Duits stortverbod en open grenzen*, Utrecht, Senternovem, 2006, p.10

³⁵ Interview with Werner Annaert, general manager of FEBEM, the Belgian Federation of Environmental Management Companies, 03/02/06

³⁶ VAN DEN ANKER, M.J.J. and SNELS, W.C.E., *Wie betaalt, bepaalt: over intermediaire organisaties, milieucriminaliteit, organisatiecriminaliteit en integriteit in het complexe milieuveld*, 's Gravenhage, Elsevier bedrijfsinformatie, 1999, p.36-38

³⁷ Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, Official Journal L114, 27/04/2006, 16

³⁸ BLOKLAND, H., *Waste Shipment Regulation*, presentation held at FEAD congress, Budapest, 2005

In summary, the waste chain contains three main aspects: collection, transport and treatment. While some companies provide all three tasks, others provide only one or two of them. The latter is often accompanied by the presence of brokers. Company size differs according to actual activities and cost-effectiveness. This creates a very heterogeneous sector.

1.2.3.2. Sub-sectors according to territory

Waste and its management may have an impact in the field of environment and public health. Therefore, protection against foreign waste streams is often necessary. Traditionally, poorer, often African countries protested against the dumping of (hazardous) waste, coming from industrialised countries on their soil. This practice was referred to as 'waste colonialism'.³⁹ Under impulse of the African states, this led to the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.⁴⁰ The most important matters discussed in this convention deal with:⁴¹

- Reducing Transboundary movements of waste to a minimum
- Treatment and disposal of hazardous waste as close as possible to the source of generation
- Reducing and minimising hazardous waste generation at source

More recently, waste-exporting countries as well have been focusing on reducing the export of waste streams.⁴² One reason to do so has been the technological investments made by these countries. As high-tech waste treatment facilities are more expensive, from a national point of view it may make sense to use these facilities to the full, rather than seeing national waste streams be exported to older, cheaper facilities in neighbouring countries.

Thus, both from an importing and from an exporting perspective, recent policy evolutions emphasise a more national, close-to-origin oriented approach. For municipal waste, this mainly has to do with technological investments. For hazardous waste, public health protection plays a more important role. Long term evolutions however indicate that European regulations are striving to harmonise the national legislative measures.⁴³ Bringing this into practice, thus countering the protectionist attitude of several countries, may be achievable once the front-runners in the field of technological and environmental investments are able to get their investments repaid without protectionism. A first step in this direction

³⁹ PORTER, G., BROWN, J.W. and CHASEK, P., *Global environmental politics 3rd ed.*, Boulder, Westview Press, 2000, p.105

⁴⁰ Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *United Nations – Treaty Series*, 1992, Vol.1673, I-28911, 126-161

⁴¹ CHASEK, P., *Earth Negotiations, analyzing thirty years of environmental diplomacy*, Tokyo, United Nations University, 2001, p.116

⁴² ERMAROCA, F., Community Legislation and Jurisprudence in the Area of Waste Management: Recent Developments, *Reciel*, 1998, Vol.7, no.3, 274-282

⁴³ SENTERNOVEM, *De afvalmarkt 2005: tussen Duits stortverbod en open grenzen*, Utrecht, Senternovem, 2006, p.31

may be the free trade of combustible waste in 2006, while landfill of those waste streams becomes prohibited in more and more countries.⁴⁴

Nuclear waste transports are traditionally dealt with as much as possible in a national perspective. Nevertheless, reprocessing possibilities have increased the options to transport radioactive materials throughout Europe.⁴⁵

There are **regional as well as national differences**. The amounts of waste generated differ between the old and new EU member states.⁴⁶ However, a steady evolution towards a more homogeneous waste market is occurring. One source estimates an annual waste market growth of about 20%.⁴⁷ Nevertheless, not all new member states take part in this expansion. For example Estonia and the Slovak Republic are characterised by a decrease of waste amounts, according to available statistics.⁴⁸ Whether these data are credible is another matter.

The use of nuclear power plants differs widely across Europe. In France, almost 80% of electricity is coming from nuclear power plants, while this is reduced to 0% in for example Italy.⁴⁹

1.2.3.3. Sub-sectors according to characteristics of waste streams

Municipal and non-hazardous industrial waste seems to constitute somewhat the standard waste stream. However, this does mostly apply to legislative aspects, as the bulk of this stream is subject to the minimum set of rules.

Besides, special regulations concerning collection, transport and disposal may apply to specific waste streams. These regulations supplement the EU Council Directive on waste, as is the case for radioactive waste, waste resulting from quarries, animal carcasses and other types of agricultural waste, waste waters and decommissioned explosives.⁵⁰ Moreover, some particular waste streams may first of all be subject to the Directive, but are subject to additional regulations as well. This is the case for hazardous waste, but also for specific waste streams, which do not always fall under the scope of hazardous waste legislation, such as

⁴⁴ AFVAL OVERLEG ORGAAN, *De afvalmarkt; ontwikkelingen 2003*, Utrecht, AAO, p.25

⁴⁵ NUCLEAR ENERGY AGENCY, *Country Profiles*, OECD, <http://www.nea.fr/html/general/profiles/waste>

⁴⁶ EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.154

⁴⁷ E-mail from Ágnes Czibók, International Relations Manager of the Hungarian Association of Environmental Enterprises, 09/02/2006

⁴⁸ EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.152

⁴⁹ X., *Nuclear Europe: Country Guide*, BBC, 16/02/2006, <http://news.bbc.co.uk/1/hi/world/europe/4713398.stm>

⁵⁰ Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, Official Journal L114, 27/04/2006, 9-21

packaging and packaging waste, end-of-life vehicles and sulphur in liquid fuels.⁵¹

Hazardous waste management is not a homogenous industry. Its heterogeneity may differ from characteristics such as solid or liquid waste, but also characteristics that are linked to the producing sector. Electrical and chemical wastes constitute two large parts of the hazardous waste industry, both demanding a quite different approach.

Special attention can also be paid to nuclear waste. Although nuclear waste looms large in policy terms (and social/culture, see section below), such wastes are not very large in volume terms, when compared with other forms of waste, hazardous and non-hazardous.⁵² Much of the world's nuclear waste arises from the generation of electricity where, by volume, fossil fuels of course generate the greatest amount of waste. Nuclear wastes are of course volumetrically tiny compared with fossil fuels, so in those terms they would not show on such a chart.

In business terms, however, nuclear wastes are 'big' and are becoming more so. This is due to three main features:

- All aspects of management are highly expensive (some more than others). The costs arise because radioactive wastes from ongoing electricity generations and other uses of nuclear materials are highly dangerous over many hundreds of years, the appropriate means of disposal is a matter of controversy (as mentioned above), reprocessing only marginally reduces radioactivity (even though it may recover some reusable elements), and even 'temporary' storage (which may last many decades) is not without difficulties, dangers, needs for monitoring and security and attendant financial costs.
- The waste outputs from existing and operational nuclear facilities are financially significant, on both a European and global basis.
- Additional wastes are being generated as nuclear facilities come to the end of their economic/safe lives, and have to be decommissioned, entire facilities then becoming waste.

Looking at the waste streams characteristics, a distinction can be made between municipal and similar wastes, hazardous wastes and nuclear wastes. These streams are characterised by **different environmental impacts** and **different policies**. Therefore, we have chosen to include aspects of each in this study.

1.2.4. Economic weight of the sector

⁵¹ EUROPEAN COMMISSION DIRECTORATE GENERAL ENVIRONMENT, *Study on investment and employment related to EU policy on air, water and waste*, Luxembourg, Office for Official Publications of the European Communities, 2000, 72p.

⁵² As a reference point, the average French citizen generates about 10 tonnes of all kinds of waste per year, of which radioactive wastes account for about one kilogram. This is 1% of toxic waste, which itself is 1% of *all* wastes. 90% of this kilogram is short live radioactive waste and is disposed of on an industrial basis; the 10% remaining are long live waste.

1.2.4.1. Turnover

It is estimated that the turnover of the European municipal waste market will rise from 31.6 billion euro in 2002 to about 37.9 billion euro in 2009.⁵³ Because waste generation in manufacturing industries almost doubles the municipal waste generation, one might expect a much higher turnover than the figures given. The two biggest companies in Europe are Sita and Onyx. They are a part of respectively the groups Suez Lyonnaise and Vivendi. They have a turnover of about 6 billion euro each.⁵⁴ However, as these companies are multi-utilities, one should take into account that their turnover is not exclusively waste-related.

Hazardous waste only constitutes about 1% of the total amount of waste. Nevertheless, the hazardous waste industry accounts for slightly more than 10% of the market by value.⁵⁵ This is caused by the higher economic value inherent to this waste stream and the technological investments that deal with it in an environmentally sound way.

The European nuclear industry has an annual turnover of 45 billion euro.⁵⁶ Nevertheless, the proportion of this which is waste-related constitutes only a fraction of this sum. The United Kingdom Atomic Energy Authority (UKAEA), which is a world leader in decommissioning activities and nuclear clean-up, has an annual turnover of about 600 million euro.⁵⁷ This is only 10% percent of the turnover of 'regular' waste companies. Nevertheless, taking into account the small proportion of nuclear waste in relation to other waste streams, it becomes clear that nuclear waste is big in business terms.

1.2.4.2. Employment

Employment in the waste sector is often considered as a part of environmental employment. Definitional and statistical matters may influence data in this matter. As these figures cover waste-related employment in general, both municipal and hazardous waste are included.

⁵³ FROST & SULLIVAN, *Municipal waste management in Europe, 2002* cited in AFVAL OVERLEG ORGAAN, *De afvalmarkt; ontwikkelingen 2003*, Utrecht, AAO, p.26

⁵⁴ HEMMER, D., HÖFERL, A., *Privatisierung und Liberalisierung öffentlicher Dienstleistungen in der EU-15: Abfallwirtschaft*, Wien, Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OCPP), 2003, p.6

⁵⁵ WASTEONLINE, *Hazardous: Introduction*, s.d., Waste online, http://www.wasteonline.org.uk/resources/Wasteguide/mn_wastetypes_hazardous.html

⁵⁶ X., *General information about nuclear energy*, Ecolo, http://www.ecolo.org/documents/documents_in_english/ENC-InfoFile.htm

⁵⁷ UNITED KINGDOM ATOMIC ENERGY AUTHORITY, *Quick Facts*, UKAEA, http://www.ukaea.org.uk/about/quick_facts.html

Figure 3: waste-related employment in old European Member States⁵⁸

Waste management	Employment
Austria (1)	3,100
Finland	3,600
France	71,500
Ireland (2)	1,000
Netherlands	43,000
Portugal	1,100
Spain	37,000
Sweden (2)	4,700
UK	65,000
(1) only private sector (2) only public sector	

Employment levels in the waste management sector are expanding. Waste recovery and recycling offer good prospects for growing employment in the future.⁵⁹ Especially within the new EU member states, where the waste market grows very rapidly, this will have a serious impact:

Figure 4: Employment assessment of Business-As-Usual and Economic Theory models^{60 61}

Activity	Number of jobs in 2000		Number of jobs in 2020 according to BAU model		Number of jobs in 2020 according to ET model	
	minimum	maximum	minimum	maximum	minimum	maximum
Mixed collection	36,276	58,042	27,720	44,352	17,070	27,312
Separate collection glass	432	605	2458	3441	3774	5284
Separate collection paper	99	148	983	1,475	1,510	2,264

⁵⁸ Data have been collected from EUROPEAN COMMISSION, DIRECTORATE GENERAL ENVIRONMENT, *Study on investment and employment related to EU policy on air, water and waste*, 2000,
http://www.europa.eu.int/comm/environment/enveco/industry_employment/investment_and_employment.htm and from WASTE WATCH, *Jobs from Waste: Employment Opportunities in Recycling*, Waste Watch, 1999,
http://www.wasteonline.org.uk/resources/WasteWatch/JobsFromWaste_files/page4.html

⁵⁹ ECOTEC, *Analysis of the EU Eco-industries, their employment and export potential*, Birmingham, Ecotec, 2002, p.6

⁶⁰ HALL, D., *Waste management companies in Europe*, Public Services International Research Unit, European Federation of Public Service Unions, 2006,
http://www.epsu.org/IMG/pdf/EN_PSIRU_waste_management_in_EU_Feb_06.pdf, 15p.

⁶¹ While a business-as-usual model predicts future evolutions on a basis of economy as it is now, the economic theory model takes into account the expected economic growth as well

Separate collection organic	2,676	2,676	24,166	24,166	35,825	35,825
Compost plants	284	284	2,560	2,560	3,795	3,795
Recycling	3,085	3,702	30,725	36,870	47,175	56,610
Landfill	8,380	11,732	6,930	9,702	4,268	5,975
Incineration	328	656	1,118	2,236	556	1,112
Total	51,560	77,844	96,661	124,802	113,972	138,176

Employment in the nuclear waste industry lies considerably lower than in the rest of the waste industry. The UKAEA, which is one of the market leaders in nuclear waste management, employs about 2,300 employees.⁶² Compared with the more than 100,000 employees of SITA,⁶³ this is not that much. However, bearing in mind the fact that nuclear waste accounts for only 0.01% of the generated amount of waste, this difference becomes understandable.

⁶² UNITED KINGDOM ATOMIC ENERGY AUTHORITY, *Quick Facts*, UKAEA, http://www.ukaea.org.uk/about/quick_facts.html

⁶³ SITA, *Kerncijfers*, Sita, <http://www.sita.be/sitabelgiumweb/sitabelgiumwebportal.nsf/fosyindex?readform>

1.2.5. The sector within the global commodity chain

The global market for waste services has been estimated at 115 billion euros, with Europe accounting for 39 billion and the US for 52 billion.⁶⁴ Considering their industrialisation rate, it may be not that surprising that **Europe and the US** together account for almost **80% of the waste service market**.

On a global scale, Waste Management and Allied Waste are the two biggest companies, with a turnover of respectively 12.5 billion euros and 6.3 billion euros. These are US companies who sold their European interests respectively to Shanks and Sita.⁶⁵ Waste management in Europe can in fact only be compared with that in other industrialised areas. The European economy as well as the mentality and facilities concerning waste cannot be compared with those from industrialising regions, where technological facilities, legal definitions, environmental law enforcement and waste disposal service delivery, are organised differently than in Europe and the United States.

Looking at the place of waste in the chain of goods, the waste management industry takes a unique place. Looking at the lifetime of a single product, the waste sector is situated at the end of the chain. However, one could also take into account the continuity of economy. In that context, the waste sector is found at a pivotal point. The waste industry is not only responsible for looking after the final destination of goods, when they are no longer wanted; more and more the sector creates a **change in the commodity chain**. In case of recycling, the sector is responsible for a new input in the chain of goods and for a restarting of the production process. In case of incineration, the sector constitutes a central role in the transition from the manufacturing industry to the energy sector.

The commodity chain is in reality not a straight line with a strict beginning and a clear end. It is to some extent more like a circle. At the 'end', which is also a new beginning, the waste sector plays a new role. Its function is therefore to make the chain continue, to start over again, or to take care of the transition into another sector.

The role of the waste management industry is the same for all three subjects of this study. Recycling, reprocessing and environmentally sound development are important for bulk waste, hazardous waste and nuclear waste, very often leading to reintegration of waste into the production process. However, for nuclear energy, at least for high level waste involving long-lasting isotopes, reprocessing may be much more limited. It is said by critics to be uneconomic and sometimes leads to the relocation of nuclear waste in insecure facilities in other countries or regions.⁶⁶

⁶⁴ OECD SECRETARY-GENERAL, Waste Contract Design and Management for Enhanced Waste Minimisation: a Synthesis Report, *OECD Papers*, 2004, Vol.4, no.4, 15

⁶⁵ WASTE MARKET COUNCIL, *Waste market: public companies and developments*, Utrecht, AOO, 2002, p.16

⁶⁶ GREENPEACE, *Reprocessing*, Greenpeace International, <http://www.greenpeace.org/international/campaigns/nuclear/reprocessing>

Summarising, although waste is often regarded as end-of-life products, this may be modified, resulting in waste being situated at the beginning of a new production cycle as well as at the end of the previous one.

2. Market features

2.1. Access to the market

2.1.1. Knowledge

In the past, waste companies were mostly small enterprises, often family businesses of people with a lower education. In less than 30 years, however, this has changed dramatically.⁶⁷ ⁶⁸ Waste management industry has become big business and profits as well as burdens have seriously increased. The growing legal framework certainly constitutes one of these burdens.

Licences are needed for waste collection services and waste brokers, but also in cases of storage, treatment, and disposal and recovery facilities.⁶⁹ These permits are linked to the environmental hazard, measured by for example emission of pollutants into the air, and they also focus on the qualifications of applicants and holders. Additional permits are required in cases of hazardous waste, for example for its incineration, and so is the case for nuclear waste.⁷⁰

The European legislative framework creates a set of minimum rules. Therefore, member states that are willing to go further may do so. International companies have to be aware of regulations within the country they operate. By 2003, twelve EU countries established a national waste management plan or strategy.⁷¹

Next to permissions concerning collection, transport and treatment, there is also a requirement that operators observe regulations related to specific waste streams, such as take-back legislation for vehicles, packaging, batteries and electronic equipment.⁷²

⁶⁷ BRUINSMA, G., 'De afvalverwerkingsbranche' in *Inzake opsporing: enquêtecommissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 261-310

⁶⁸ EUROPEAN COMMISSION, DIRECTORATE GENERAL EDUCATION AND TRAINING, *Leonardo Da Vinci Awards, 2004: 32 success stories*, European Commission, http://europa.eu.int/comm/education/programmes/leonardo/new/awards_en.pdf, 68p.

⁶⁹ EUROPEAN COMMISSION, DIRECTORATE GENERAL ENVIRONMENT., *Handbook for Implementation of EU Environmental Legislation: Waste*, <http://europa.eu.int/comm/environment/enlarg/handbook/waste.pdf>

⁷⁰ Council Directive 94/67/EC of 16 December 1994 on the incineration of hazardous waste, *Official Journal* L365, 31/12/1994, 34-45

⁷¹ EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.162

⁷² TOFFEL, M.W., The Growing Strategic Importance of End-of-Life Product Management, *California Management Review*, 2003, Vol.45, no.3, 102-129

The more danger and risks are involved (or rather recognised), the more knowledge is needed. In case of hazardous and especially nuclear waste, knowledge is needed concerning environmentally sound ways of dealing with high and low level wastes – which currently are matters of contention. Moreover, knowledge is needed as well to protect employees.

In summary, through all three waste streams discussed, knowledge is needed concerning how and where to apply for licenses, and concerning the specific licensing requirements. For hazardous and nuclear waste, these licensing issues are stricter. Moreover, additional knowledge is also needed to protect the environment and employees.

2.1.2. Capital

There are no minimum solvability requirements for waste companies. The necessary capital in the sector is thus **not strictly regulated** and depends on the concrete activities within the sector, the number of employees and the technological investments.

Especially in the sorting industry, the practical financial recourses needed may be quite low. In the collection business, costs are related to transport expenses, such as fuel, oil, tyres, insurance, licenses and repairs. Disposal costs depend on the manpower and equipment needed.⁷³

Hazardous waste costs more to dispose of than municipal waste. This is caused by environmental and technological requirements. Additionally, sorting of mixed waste streams increases the costs.⁷⁴

Nuclear waste management has long-term costs to cover as well.⁷⁵ Although only a small proportion of nuclear waste is high-level waste, the management of this proportion requires extreme caution. Long-term storage requirements are a matter of contention, leading to increasing amounts continuing to be stored in ways originally intended to be short-term. The potential and in some respects unknown dangers of various disposal methods (for example, the performance of container flasks over 500 years), combined with increasing amounts of waste, result in ever growing cost levels. It is mostly the taxpayer who has to pay for

⁷³ MYLES, A.E., *A Guide to Understanding Solid-Waste Costs*, Mississippi State University Extension Service, <http://msucares.com/pubs/publications/p1638.htm>

⁷⁴ BIZHELP24, *Managing Waste: Hazardous*, ROK Connect, 2005, http://www.bizhelp24.com/business_law/managing-waste-hazardous.shtml

⁷⁵ FRIENDS OF THE EARTH, *Written Evidence from Friends of the Earth to the House of Commons Environmental Audit Committee Inquiry regarding the Comprehensive Spending Review*, FOE, 2001, http://www.foe.co.uk/resource/evidence/comprehensive_spending.html and

ZELLER, L., *High Level Nuclear Waste Shipments: Radioactive and Deadly*, Blue Ridge Environmental Defense League, 2002, http://www.bredl.org/pdf/HLNW_Shipments.pdf 6p.,

this waste.⁷⁶ Inevitably, present generations and possibly future generations will carry financial burdens for nuclear waste.⁷⁷

In every part of the waste sector, a growing emphasis on protection of the environment creates incentives to invest larger sums of money. In order to comply with these requirements, licensing procedures increasingly include minimum requirements concerning the financial capacity of applicant companies.⁷⁸

2.1.3. Contacts

In the first place, starting a waste management company requires contacts in a way that one should know how and where to apply for the necessary licences. Contact with these licensing authorities may trigger inspections and/or discussions concerning capacity to comply with the conditions of permits and with actual compliance performance and record-keeping.

Secondly, gaining access to the market requires contacts with potential clients. For short-term operations and single operation contracts, a competitive advantage may be feasible for newcomers, as they may have a more flexible time scheme. In the case of long-term contracts, however, one should know when an existing contract between a public authority and an incumbent waste contractor comes to an end, and how and where to apply. For newcomers, this might be harder to achieve.

Because of the higher value of hazardous waste and the high technological requirements, hazardous waste companies are particularly in need of stable contracts. Not only is the number of hazardous waste companies small compared with municipal waste, so is the number of clients. The latter are often manufacturing industries. Thus, a good relationship with these industries is necessary, especially taking into account that long-term contracts are not common in hazardous waste management.⁷⁹

The nuclear industry is, despite privatisation tendencies, still influenced by the public sector. In this select club, which is increasingly internationalising, social and market contacts are dense.

⁷⁶ VAN DEN BERG, R.J. and DAMVELD, H., *Discussions on Nuclear Waste, a Survey on Public Participation, Decision-making and Discussions in Eight Countries*, Amsterdam, Laka Foundation, <http://www.laka.org/teksten/afval/2-discussions-00/Discussions.pdf>, 121p.

⁷⁷ UK NIREX, *Schemes for financing radioactive waste storage and disposal final report for the European Commission on 'Schemes for Financing Radioactive Waste Storage and Disposal'* (contract B4-3070/96/000754/MAR/C3 dated 30 December 1996) on behalf of other consortium members DBE, PricewaterhouseCoopers, Sofres Conseil, C & E Consulting and Engineering, ANDRA, COVRA, ENRESA and ONDRAF/NIRAS, March, p.162

⁷⁸ EUROPEAN COMMISSION, DIRECTORATE GENERAL ENVIRONMENT., *Handbook for Implementation of EU Environmental Legislation: Waste*, <http://europa.eu.int/comm/environment/enlarg/handbook/waste.pdf>

⁷⁹ ENVIRONMENT AGENCY, *Hazardous Waste Management Market: Pressures and Opportunities*, R&D Technical Report P1-484/TR, Bristol, Environment Agency, p.41

Additional regulations, such as take-back laws, require contacts with for example actors within the production industry. As collectors are in this way dependent on the producers, it is important for them to maintain good and, if possible, long-lasting contacts. These may vary from short-term contracts, joint ventures and industry consortiums, to vertical integrations. This is also a major concern of law enforcement people.⁸⁰

2.1.4. Staff

The staff required to run a waste management company varies with the nature of the business as well as its scale. In a narrow sense, companies in for example the recycling business do not require a large staff. Containers can be for rent, thus only requiring truck drivers to deliver them and some staff to work on the collected waste. This may involve sorting, selling some of it as secondary raw materials and driving non-recoverable waste to waste disposal sites. In this case, staff requirements are low. Therefore, it is not surprising that companies with less than 50 employees account for 62.5% of the generated value added in the recycling business.⁸¹ Taking into account the minimum requirements, one could even assume that these companies can be run by less than 10 people. These **micro-companies generate 21.5% of the value added in recycling industry in the old EU.**

In a broad sense, if the company is involved in all three activities, collection, transport and treatment, then staff requirements will increase dramatically. Considering recent evolutions and commitments to decrease landfill activities in the future,⁸² waste management involves a growing need of technological treatment. Composting facilities are among the cheapest. Incineration facilities and mechanical-biological treatment require more investments in new technological methods.

Companies that are active in collection, transport and final treatment of waste characteristically employ 250 or more people. Because the balance between technological investments and employees is particularly important in waste treatment, companies which are only involved in for example waste incineration have high employment rates as well. This creates a market in which a limited number of big, multinational companies constitute the top level. Alongside them, there is plenty of room for many smaller companies, especially in the fields of collection, transport and recycling.⁸³ Hazardous and nuclear waste companies

⁸⁰ Interview with Chief Commissioner Frans Geysels, Belgian federal police, environment department, 03/09/2004

⁸¹ EUROSTAT, *European Business: facts and figures, data 1998-2002*, Luxembourg, Office for Official Publications of the European Communities, 2004, p.234

⁸² BUCLET, N. and GODARD, O., 'Municipal Waste Management in Europe: a comparison of national regimes' in *Municipal waste management in Europe: a comparative study in building regimes*, BUCLET, N. and GODARD, O. (eds.), Dordrecht, Kluwer, 2000, 203-224

⁸³ VAN DEN ANKER, M.J.J. and HOOGENBOOM, A.B., *Schijn bedriegt: overheid, bedrijfsleven en gelegenheidsstructuren voor criminaliteit op de hergebruikmarkt*, 's Gravenhage, VUGA, 1997, p.145

require higher technological facilities. This is mostly accompanied by higher staff levels as well.

Personnel skills also depend on the activity of the companies. For solid household waste collection, semi-skilled or unskilled labour forces are cheaper and therefore desirable.⁸⁴ For treatment, especially in case of hazardous and nuclear waste, an increased technological knowledge is required.

2.2. Market conditions

2.2.1. Market structure

In theory, the structure of the waste management industry is a market of **competition**, especially taking into account liberalisation and the growing tendency towards privatisation. In practice, however, a limited number of big players cover most of the market and public authorities may still account for a variable share as well. The two biggest companies, the groups Suez and Vivendi, which contain the respective waste companies Sita and Onyx, together employ more than 120,000 people.⁸⁵

In order to answer the environmental question properly, technological requirements increase. Therefore, a policy to emphasise environmental efforts above pure economical value is necessary, especially related to international transport of waste. Germany for example wanted to ensure the utilisation of its high technological waste incinerators and therefore prohibited the shipment of waste to foreign, mostly Belgian, cement kilns.⁸⁶ Liberalisation of the waste market clearly has its boundaries.

In 2000, 304 Waste-to-Energy units were operational in Europe, with a capacity of 50.2 Megatons per annum. This capacity is to be doubled by 2010, indicating a seriously growing demand for high-tech treatment methods.⁸⁷ Therefore, it is important to reduce landfill options, by economic means or through policy.

On company level, there are possibilities for various contracts between public authorities and private companies with incentives towards waste reduction.⁸⁸ It is important to establish a regime of certainty through strict regulation, partnership

⁸⁴ MYLES, A.E., *A Guide to Understanding Solid-Waste Costs*, Mississippi State University Extension Service, <http://msucare.com/pubs/publications/p1638.htm>

⁸⁵ HEMMER, D., HÖFERL, A., *Privatisierung und Liberalisierung öffentlicher Dienstleistungen in der EU-15: Abfallwirtschaft*, Wien, Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OCPP), 2003, p.6

⁸⁶ ERMAROCA, F., *Community Legislation and Jurisprudence in the Area of Waste Management: Recent Developments*, *Reciel*, 1998, Vol.7, no.3, 274-282

⁸⁷ SÍPILÁ, K., *Municipal and commercial solid waste for pyrolysis (oils) and gasification markets*, Paper presented on the PGBW expert meeting in Strasbourg, 30.09.2002, <http://www.ienica.net/usefulreports/pyrolysis5.pdf>, 33p.

⁸⁸ OECD SECRETARY-GENERAL, *Waste Contract Design and Management for Enhanced Waste Minimisation: a Synthesis Report*, *OECD Papers*, 2004, Vol.4, no.4, 1-69

working both between private and the public sector on the one hand and between the different tiers of government on the other, transparency towards the public and an integrated approach across waste streams.⁸⁹

Environmental concerns play even stronger on the hazardous waste market. Nevertheless, limiting hazardous waste is difficult. Hazardous waste volumes depend on the economic performance of the main producing industries: chemical and pharmaceutical, construction and demolition, engineering, waste treatment and petrochemical.⁹⁰ An increased amount of hazardous waste, combined with increased regulation, will lead to growing costs.⁹¹

In comparison with municipal waste, the hazardous waste market is per definition a smaller market from a geographical point of view. International regulations have led to a limitation of transnational shipments of hazardous waste streams.

The involvement of the public sector in nuclear waste management creates a different market. Companies are closely linked with or part of the public sector, therefore operating in a market which is oriented in a less competitive way.

Thus, although the market is structured in a competitive way, the expansion has been limited by environmental issues. The **influence of the environment** on the waste market is carried out by economical and or political means.

2.2.2. Market saturation

Waste streams are growing. Central and Eastern European Countries have encountered seriously lower waste generation rates than the Western European countries in the beginning of the 1990s, mainly due to economic restructuring.⁹² From the end of the 1990s on, and especially with the enlargement of the EU, this difference has been reduced in general.⁹³ However, some Eastern European countries still manage to keep their waste generation on a lower level.⁹⁴ In any case, the composition of waste in Western European and Central and Eastern European countries differs:

⁸⁹ SLR, Delivering Key Waste Management Infrastructure: Lessons Learned from Europe, The Chartered Institution of Wastes Management, 2005, 64p.

⁹⁰ EUROPEAN ENVIRONMENT AGENCY, *Environment in the European Union at the turn of the century*, Luxembourg, Office for Official Publications of the European Communities, 1999, 44p.

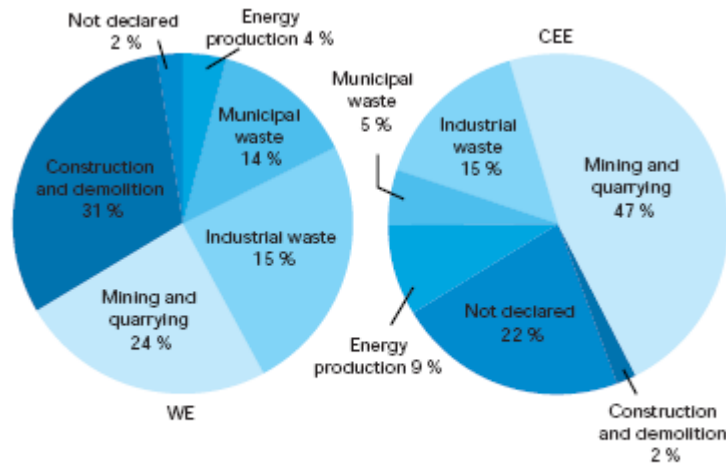
⁹¹ ENVIRONMENT AGENCY, *Hazardous Waste Management Market: Pressures and Opportunities*, R&D Technical Report P1-484/TR, Bristol, Environment Agency, p.1

⁹² COMMISSION OF THE EUROPEAN COMMUNITIES, *Communication from the Commission: towards a thematic strategy on the prevention and recycling of waste*, Brussels, 2003, http://www.eu.int/eur-lex/en/com/cnc/2003/com2003_0301en01.pdf

⁹³ BEIGL, P., WASSERMANN, G., SCHNEIDER, F. and SALHOFER, S., *Forecasting Municipal Solid Waste Generation in Major European Cities*, Institute of Waste Management, Vienna, 2004 <http://www.iemss.org/iemss2004/pdf/regional/beigfore.pdf>

⁹⁴ EUROSTAT, *Waste generated and treated in Europe: data 1995-2003*, Luxembourg, Office for Official Publications of the European Communities, 2005, p.16

Figure 5: Total waste generation by sector in WE and CEE⁹⁵



Notes: Figure for WE does not include Belgium, Iceland, Luxemburg, Norway, Sweden, Spain, Switzerland. Figure for CEE does not include Bulgaria, Czech Republic, Estonia, Hungary, Poland, Slovak Republic and Slovenia.

Alongside this general increase, the waste market is undergoing some major changes. Environmental issues gain more and more importance. Nowadays, landfill still represents the majority of waste treatment of operations. However, intentions to massively reduce this rate exist.⁹⁶ Landfill of biodegradable municipal solid waste is to be reduced to 75% of the 1995 levels in 2006, 50% in 2009 and only 35% in 2016.⁹⁷ There is not yet a saturation of the market, as the turnover of the waste industry increases with 10% annually. Pre-treatment of waste might create new opportunities for waste management companies.⁹⁸

Moreover, there's a growing emphasis on separate collection of all sorts of both industrial and municipal wastes. Paper and cardboard, plastics, organic waste, electronic waste and hazardous waste are increasingly collected separately, thus creating new and specialised market activities. If not collected separately, these waste streams may be sorted after collection, leading to growing employment possibilities as well. The EU policy on air, water and waste is estimated to pro-

⁹⁵ EUROSTAT, 2002, New Cronos Database, cited in EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.154

⁹⁶ ERMAROCA, F., Community Legislation and Jurisprudence in the Area of Waste Management: Recent Developments, *Reciel*, 1998, Vol.7, no.3, 274-282

⁹⁷ HEERMANN, C., Using Mechanical-Biological Treatment for MSW in Europe, *Biocycle*, 2003, Vol.44, no.10, 58-62

⁹⁸ ERMAROCA, F., Community Legislation and Jurisprudence in the Area of Waste Management: Recent Developments, *Reciel*, 1998, Vol.7, no.3, 274-282

vide half a million additional jobs per annum.⁹⁹ For waste alone, this comes to a possible 117,000 jobs.

Figure 6: Investment and employment related to EU environmental policy (1990-2010)¹⁰⁰

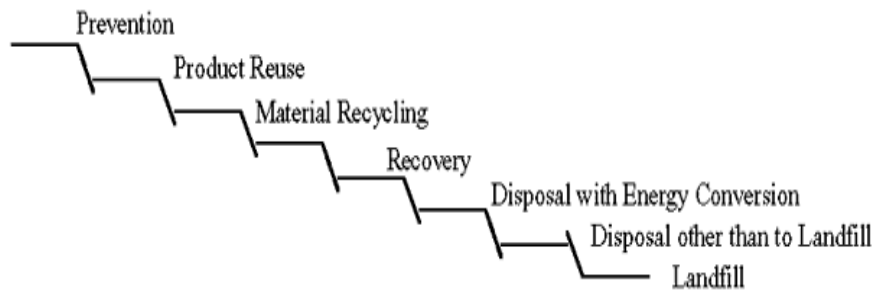
	Investment (Capital Expenditure) (M Euro)	Operating Expenditure (M Euro)	Annual Expenditure (M Euro)	Annual Expenditure as % of GDP	Annual Expenditure per capita (Euro)	Annualised tangible employment (FTF linked to the directives)	Employment as % of EU-15 unemployment
<u>The Air Sector</u>							
<u>Directives</u>							
Sulphur in Liquid Fuels	10,000	500	1,500	0.02%	4	14,100	0.1%
National Emissions Ceilings	34,100	4,100	7,600	0.10%	20	78,200	0.5%
Large Combustion Plants	19,400	1,500	3,600	0.05%	10	37,900	0.3%
Volatile Organic Compounds	500	100	200	0.00%	0	1,700	0.0%
Subtotal air	64,400	6,300	12,800	0.17%	34	132,700	0.9%
<u>The Water Sector</u>							
<u>Directives</u>							
Urban Wastewater Treatment	152,200	2,400	17,900	0.24%	48	152,400	1.0%
Drinking Water	12,100	500	1,700	0.02%	5	16,300	0.1%
Nitrate	-	600	600	0.01%	2	1,000	0.1%
Subtotal water	164,300	3,500	20,300	0.27%	54	178,700	1.2%
<u>The Waste Sector</u>							
<u>Directives</u>							
Hazardous Waste Incineration	700	<100	100	0.00%	0	1,100	0.0%
Packaging and Packaging Waste	29,100	3,800	6,800	0.09%	18	97,400	0.7%
End of Life Vehicles	500	900	1,000	0.01%	3	18,900	0.1%
Sub-total Waste	30,200	4,800	7,900	0.10%	21	117,400	0.8%
All Directives/Sectors	258,874	14,596	41,000	0.54%	110	428,800	2.9%

⁹⁹ EUROPEAN COMMISSION DIRECTORATE GENERAL ENVIRONMENT, *Study on investment and employment related to EU policy on air, water and waste*, Luxembourg, Office for Official Publications of the European Communities, 2000, p.30

¹⁰⁰ EUROPEAN COMMISSION DIRECTORATE GENERAL ENVIRONMENT, *Study on investment and employment related to EU policy on air, water and waste*, Luxembourg, Office for Official Publications of the European Communities, 2000, p.24

Thus, from an economic and employment point of view, the waste market is still expanding. From an environmental point of view, however, saturation does exist. The limits of what nature can handle concerning pollution and waste are about to be reached.¹⁰¹ Therefore, new solutions are needed. Considered as the best option, there is an ever growing pressure to reduce waste. The generated waste is then being dealt with according to principles of minimum environmental impact. This means that several measures are preferred above waste disposal. Moreover, landfill is the least favourable option for waste management. A scale of these options is presented by the Lansink ladder, named after the Dutch politician who introduced the idea:

Figure 7: Lansink's Ladder - Preferences for Waste Treatment¹⁰²



This so-called environmental saturation plays even a stronger role for hazardous waste, because the environmental pressure becomes ever higher. This is also the case for nuclear waste, where waste reduction often leads to decommissioning of nuclear power plants.¹⁰³ Nevertheless, taking into account the lifespan of nuclear waste, this does not reduce economic activity in nuclear waste management yet.

2.2.3. Competitive issues

Recent increase of environmental legislation (cfr. infra) most likely had an influence on the market conditions as well. The necessity of **technological investments** in the area of waste treatment, combined with a liberalisation of the market, gave the larger companies a competitive advantage. This is confirmed by the observation of growing merger activity. Although recession constrained the general rate of merger activity, this was not the case in the waste management

¹⁰¹ MEADOWS, D.H., MEADOWS, D.I., RANDERS, J. and BEHRENS, W., *The Limits to Growth: a report for the Club of Rome's project on the predicament of mankind*, New York, Universe books, 1972, 199p.

¹⁰² Motie Lansink, vergaderjaar 1979-1980, 15 800, nr.21, Tweede Kamer, The Netherlands, figure adopted from WASTEWATCH, FRIENDS OF THE EARTH and UK WASTE, *Beyond the bin: the economics of waste management options*, Waste online, http://www.wasteonline.org.uk/resources/WasteWatch/BeyondTheBin_files/page8.html, 17p.

¹⁰³ X., *Nuclear Europe: Country Guide*, BBC, 16/02/2006, <http://news.bbc.co.uk/1/hi/world/europe/4713398.stm>

industry. Larger companies are in a stronger position to operate effectively within the stricter legislative framework.¹⁰⁴ This may continue in the short-term future, as targets within European regulations between 2005 and 2020 are demanding.

Moreover, recent **privatisation and liberalisation** tendencies cause public authorities to participate in outsourcing contracts. Small ventures, active in household waste collection and sorting, may not be able to provide waste services for whole cities and can only take part in minor contracts. This makes them unattractive for public authorities, pushing them out of the market.¹⁰⁵

For hazardous and nuclear waste companies, the competitive advantage of larger companies is not that much linked to contracting opportunities. For them, the technology requires capital-intensive facilities in order to stay profitable.

2.2.4. Pricing

Pricing in the waste management industry is constituted by two major issues. On the one hand, there is the **service price**, the price that people and companies have to pay for the disposal of their waste. The determination of this price is the responsibility of the service providing company, which, of course, has to keep the price on a competitive level. It is influenced mainly by the efforts that have to be made in this perspective.¹⁰⁶

Concerning the service price, the type and distance of transport is taken into account. Especially the difference between national and international transport may count, for the latter is much more strongly regulated. Also the type of treatment determines the price to some extent. In general, polluters pay more for a healthy environment. High-tech treatment methods may be profitable in the long term, for they gain energy out of waste; however the investments have to be paid back in the short term.

On the other hand, next to the service price, there is also the actual waste price, the **product price**. One could say that this may strictly vary from a positive value to a zero value. Regarding a positive value waste situation, the price is mostly determined by the waste supplier. The more the resale value of the waste falls, the more the waste becomes a burden, and the more influence the waste manager exercises.

¹⁰⁴ COOKE, A., and CHAPPLE, W., Merger activity in the waste disposal industry: the impact and the implications of the Environmental Protection Act, *Applied Economics*, 2000, Vol.32, no.6, 749-755

¹⁰⁵ WOLSINK, M. and DE JONG, P., Waste sector structure: institutional capacity for planning waste reduction, *Tijdschrift voor economische en sociale geografie*, 2001, Vol.92, no.2, 148-163

¹⁰⁶ WORLD BANK ENVIRONMENT DEPARTMENT, *Environmental assessment sourcebook II: sectoral guidelines*, Washington, World Bank, 1991, p.208-212

Linked to rising technology and regulations, EU member states are expected to have additional financial burdens in the waste area soon. In the period 1990-2010, member states are expected to spend more than 30 billion euros on investments. Additionally, another 4.8 billion euros is needed to get this technology operational and, finally, the member states will need to spend almost another 8 billion euros on annual expenditures. These expenses are added to current costs of waste management and arise directly as a result of the Directives on Hazardous Waste Generation, on Packaging and Packaging waste and on End-of-Life Vehicles.¹⁰⁷ It is clearly the Packaging and Packaging Waste Directive which takes the biggest bite out of the budget. As this Directive is applicable to various waste streams, including municipal waste, it is very likely that these expenditures are to be paid for by everyone, for example by means of rising prices.

3. Conclusion

The striking characteristic of the waste management industry is its **heterogeneity**. First of all, a distinction can be made between the different stages of waste management: collection, transport and treatment. Secondly, it is possible to distinguish several waste streams. In this study, we have chosen to describe municipal and similar waste, hazardous waste and nuclear waste. However, it has to be said that this does not cover all waste streams. Thirdly, and this is closely related to national differences, huge variations in the extent of privatisation exist. Furthermore, the waste management sector is situated at a pivotal point of the global commodity/value chain.

In the market features, efforts have been made to describe competences and resources required to enter the sector. From a theoretical point of view, the market has opened up during the past decades and has become more accessible. However, **professionalisation and technological requirements** limit this accessibility. Looking at the different stages of the waste chain, these access conditions are especially important for treatment facilities. Difficulties for neophytes to enter the market increase together with the degree of hazard, from municipal, through hazardous to nuclear.

¹⁰⁷ EUROPEAN COMMISSION DIRECTORATE GENERAL ENVIRONMENT, *Study on investment and employment related to EU policy on air, water and waste*, Luxembourg, Office for Official Publications of the European Communities, 2000, p.31

II. Environmental Scan and Cluster analysis

1. Environmental Scan

In this part of the study, the broader context of the European waste disposal sector will be described. This broader framework contains first of all some general evolutions from within the community. These evolutions take place in each part of society. Therefore, the PEST-method will be used. Hereby, the following influences are described: political influences (P), economic influences (E), social influences (S) and technological influences (T).

Reason to perform this analysis is that by doing so, some macro-level trends can be found. The idea is then to be able to distinguish some possible future trends as well which offer the opportunity to anticipate on certain evolutions.

1.1. Political factors

1.1.1. Environmental policy

1.1.1.1. Club of Rome

The Club of Rome is an independent think tank which was founded in the 1960s. Although its direct influences on policy making may be rather limited, it is a respected organisation which exercises an indirect pressure. The Club focuses on the world problematique. This concept is created by the Club and represents a complex set of the most crucial problems facing humanity.¹⁰⁸ These problems are situated in different areas: politics, economics, society, technology, psychology, culture and environment. During the high days of the welfare state, the Club produced a report entitled 'The Limits to Growth'.¹⁰⁹ Herein, a world model has been drafted in which the expected evolutions are presented.

Demographic, technological and financial systems are growing exponentially. One should realise, however, that Earth itself is limited, not only geographically, but also metaphorical. Thus, the exponential growth of these systems will meet **Earth's limits** quite soon. The report mentioned the year 2100 as possible date for ending growth, even within a more optimistic approach. Blind optimism in increasing technology is not realistic. Taking into account rising life expectancy, the report concluded that measures were to be taken as soon as possible.

¹⁰⁸ CLUB OF ROME, World Problematique, Hamburg, Club of Rome, http://www.clubofrome.org/about/world_problematique.php

¹⁰⁹ MEADOWS, D.H., MEADOWS, D.I., RANDERS, J. and BEHRENS, W., *The Limits to Growth: a report for the Club of Rome's project on the predicament of mankind*, New York, Universe books, 1972, 199p.

The view of the Club is not one-sided pessimistic. Nevertheless, measures are to be taken in order to establish an equilibrium that is suitable for both mankind and our planet. The limits which are recognised by the report deal especially with the limits of our resources. Energy resources and food production will decrease dramatically because of population growth and further industrialisation.

Although the report emphasised the limits of our resources, these resources can be opened up to our environment in general. It gives our environment a role, other than the perception that it can be exploited according to our own will.

In 2005, the Club of Rome met again to discuss the long-term sustainability of world evolutions. The Club indicates that resource consumption has continued to develop in a critical way since the 1970s.¹¹⁰

Together with the growth, the urgency of changing things increases exponentially as well. This will have its implications on the waste management industry too. At the moment, environmental and economical interests are still contradictory to a large extent. Following the idea of the Club of Rome, the future of the environment will in the long run end growth, and will therefore influence economy. As the environmental situation becomes more critique, one can assume that a shift of interests will take place, giving the environment a dominant situation over the economy.

1.1.1.2. UN convention on climate change

Due to global warming, the importance of environmental issues has been recognised once again. This resulted in the UN convention on climate change in 1992.¹¹¹ Stabilisation of greenhouse gases is to be achieved by means of anticipation, minimisation and prevention. Moreover, the adverse effects of climate change are to be mitigated. **Sustainable development** is to be attempted. In order to do so, parties to the convention have engaged in several commitments.

On the one hand, data on greenhouse gas emissions are to be gathered in a proper way. On the other hand, more active measures have to be taken. Thus, environmental programmes have to be set up, by which specific areas, such as coastal zones en dry areas are protected against natural disasters, an appropriate environmental policy has to be integrated in social, economical and political society, and technological and scientific efforts to reduce the greenhouse gas emissions have to be supported.

The immediate impact of the convention on the waste management industry is rather limited. Indirectly, however, two remarks can be made. First, greenhouse

¹¹⁰ CLUB OF ROME, *The Club of Rome meets again in Virginia, USA: worldwide think tank calls for more awareness for long-term issues*, Hamburg, Club of Rome, 06/10/2005, <http://www.clubofrome.org/news/news.php?id=49>

¹¹¹ United Nations framework convention on climate change, United Nations, 09/05/1992, <http://unfccc.int/resource/docs/convkp/conveng.pdf>, 33p.

gases can be considered as waste. Although polluting emissions are not included in the subject of this study, and even though they are excluded from the EU directive on waste,¹¹² they can be considered as waste from an ideological point of view. Secondly, waste treatment facilities, especially incineration plants, are influenced by this convention in the way that their emissions have to be limited as well.

Further elaboration of this convention has been worked out in 1997, by means of the Kyoto protocol.¹¹³ In this protocol, a more practical elaboration of the ideas, as set in the UN convention on climate change, has taken place. Aim of the protocol is a 5% reduction of greenhouse gas emissions between 1990 and 2010. Therefore, energy-saving and use of renewable energy, reforms of the transport and energy sector, promoting sustainable forms of agriculture and, finally, financial incentives and reducing market imperfections in order to achieve this are to be established.

Related to waste management, attention has been paid to limitation of methane emissions.¹¹⁴ Moreover, of course, the emphasis and environmental consciousness influence the waste perception as well.

1.1.1.3. NGOs

In a general perspective, policy-making becomes more and more involved by non-governmental organisations or NGOs.¹¹⁵ They address every conceivable issue and operate almost everywhere. Because of their ideological interests, they can command great legitimacy and are sometimes even more trusted than national authorities. Nevertheless, their independence is always limited to some extent. On the one hand, they are controlled by public authorities through means of registration and financial oversight. On the other hand, about 40% of their finances come from public grants.¹¹⁶

Working methods, structures and area of expertise of NGOs differ largely. A part of them focus on environmental issues. They represent the **environmental consciousness** and look after the interests of present and future generations. One of the issues in which NGOs influence the European policy is nuclear energy. Focusing on the existing disadvantages and possible risks of nuclear energy, nu-

¹¹² Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, Official Journal L114, 27/04/2006, 9-21, art.2.1a

¹¹³ Kyoto Protocol to the United Nations framework convention on climate change, 11/12/1997, <http://unfccc.int/resource/docs/convkp/kpeng.pdf>, 23p.

¹¹⁴ EUROPEAN COMMISSION DIRECTORATE GENERAL ENVIRONMENT, *The Kyoto protocol: a brief summary*, European Commission, 23/12/2005, <http://europa.eu.int/comm/environment/climat/kyoto.htm>

¹¹⁵ PAUL, J.A., *NGOs and Global Policy-Making*, New York, Global Policy Forum, 2000, <http://www.globalpolicy.org/ngos/analysis/anal00.htm>

¹¹⁶ PAUL, J.A., *NGOs and Global Policy-Making*, New York, Global Policy Forum, 2000, <http://www.globalpolicy.org/ngos/analysis/anal00.htm>

clear power is considered as one of the undesirable ways of energy generation.¹¹⁷ This has led to a reduction of nuclear energy generation by means of closing down nuclear power plants.

1.1.2. Enlargement and free movement of goods

With the 2004 enlargement of the European Union, questions were raised on its impact on the environment. Public opinion in the EU-15 was concerned about the environmental legacy of the Soviet era. The new member states in turn worried about the costs of complying with the environmental legislation of the EU. In reality, it has turned out that the prospects of EU membership raised the profile of environmental policies in the new member states.¹¹⁸ Modern and more efficient industries and less pollution are beneficial both for the new member states and the other EU countries. Moreover, the new member states offer the Union a rich source of biodiversity which enrich the European environment and reduce pressures on local ecosystems.

Environment is a field where the new member states bring their standards up to EU levels, largely at their own expenses. This results in positive benefits for their own citizens and for other EU countries as well.

Alongside the enlargement of the European Union, evolutions also indicate a **growing openness** within the EU. The Treaty of Rome (1957), as amended by the Single European Act (1986) and the Maastricht Treaty (1992), put forward the idea of a single integrated European market.¹¹⁹ Hereby, the idea of free movement of goods, services, people and capital was created. Therefore, border controls within the EU are to be replaced by more stringent controls at the outside borders of the Union. Also environmental considerations are taken into account in the development of a European marketplace.¹²⁰

In relation to waste management, the free market of goods is still tempered to some extent. There is an enforced limit on the exports of waste. The reasons behind this are manifold. First, member states with a stricter regulation want to avoid businesses to escape those regulations by exporting to other countries. For example, German authorities have prohibited the exports of waste to foreign cement kilns, in order to keep their high-tech, more expensive incineration plants

¹¹⁷ EUROPEAN COMMISSION DIRECTORATE GENERAL ENERGY AND TRANSPORT, *Green Paper: towards a European strategy for the security of energy supply*, COM (2000) 769 final, Luxembourg, Office for Official Publications of the European Communities, 2001, p.31-34

¹¹⁸ KOK, W., *Enlarging the European Union: achievements and challenges*, European University Institute, Robert Schuman Centre for Advanced Studies, 26/03/2003, http://europa.eu.int/comm/enlargement/communication/archives/pdf/report_kok_en.pdf, p.55

¹¹⁹ Consolidated version of the Treaty establishing the European Community, *Official Journal* C325, 24/12/2002, 33-184

¹²⁰ VAN CALSTER, G., 'Public environmental law in the European Union', in *Public environmental law in the European Union and the United States*, SEERDEN, R., HELDEWEG, M. and DEKETELAERE, K., (eds.), The Hague, Kluwer International, 2002, 465-515

operational and competitive.¹²¹ Second, the import of waste has been limited because of environmental protectionism. Alongside that, waste is to be dealt with as close as possible to the place of origin, because this generates less environmental damage in the waste management process.¹²²

The maintenance of the internal borders in relation to waste management is even stronger for hazardous and nuclear wastes. This is accompanied by enhanced controls on hazardous waste shipments, which have been established by the so-called Post-Seveso Directive.¹²³ This directive has been realised after the Seveso scandal, in which barrels containing dioxin wastes were, unmonitored, transported from the Italian town Seveso to France.¹²⁴

Two remarks can be made in this field. First, the municipal waste market is becoming more open, especially concerning incineration. This is related to insufficient incineration capacity in Europe.¹²⁵ Secondly, one should realise that the nearest treatment facility is not always situated in the same country, especially for companies that are set up near the border.

One could say that environmental issues have hampered the European freedom of goods in waste management in the past. On the one hand, this is maintained with the enlargement of the EU, focusing on a national approach of environmental problems. On the other hand, openness also makes its entrance in the environmental area, for example concerning incineration of municipal waste.

1.1.3. Consequences

The environmental policy brought sustainable development on the agenda and increased the concern that mankind cannot freely spoil nature's balance. Hence, the profits that can be gained are situated on a long-term environmental level. The enhancement of the environmental interests unfortunately had other consequences as well. Regulating the environment created opportunities for environmental crimes, illegal waste management being one of them. The demands and controls of sustainable development require investments, creating an industry based on **service and environmental costs**. In escaping these costs, but benefiting from the acceptance of higher prices, larger profits can be made through the illegal circuit. The higher the level of regulation, the more investments are re-

¹²¹ ERMAROCA, F., Community Legislation and Jurisprudence in the Area of Waste Management: Recent Developments, *Reciel*, 1998, Vol.7, no.3, 274-282

¹²² HEMMER, D., HÖFERL, A., *Privatisierung und Liberalisierung öffentlicher Dienstleistungen in der EU-15: Abfallwirtschaft*, Wien, Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OCP), 2003, p.4

¹²³ Council Directive 84/631/EEC of 6 December 1984 on the supervision and control within the European Community of the transfrontier shipment of hazardous waste, *Official Journal* L326, 13/12/1984, 31-41

¹²⁴ DE VILLENEUVE, C.H.V., *Waste movements : EC and outside*, Brussels, Commission of the European Communities, found at International Network for Environmental Compliance and Enforcement, <http://www.inece.org/1stvoll/villeneu.htm>

¹²⁵ SENTERNOVEM, *De afvalmarkt 2005: tussen Duits stortverbod en open grenzen*, Utrecht, Senternovem, 2006, p.23-28

quired from legal entities in the sector and, therefore, the more profits can be made illegally.

The enlargement of the European Union and the free movement of goods could constitute such an effort. Open borders, including for environmental issues, could reduce the national differences concerning the relevant legislation and limit crime opportunities from that perspective. This is now increasingly being realised for municipal waste. Expanding this to hazardous and nuclear waste is not easy. This requires trust and should not lead to cheaper member states becoming dumps for the rest of Europe. Establishing proper agreements on dealing with waste in the most cost-effective way without victimising certain member states, is an important challenge in this field. The efforts, made both by the old and the new member states, to meet the set standards, may be promising from that perspective.

1.2. Economic factors

1.2.1. Globalisation and economic growth

Increased mobility and, alongside that, economic and social cross-border activity increased dramatically during the past decades. From an economic perspective, globalisation can be described as the increase in speed and quantity of flows between states or regions.¹²⁶ These flows consist of people, goods, and information. This has implications on the environment as well.

The increasing differences between north and south are also noticeable in environmental and waste management issues. The well-known saying ‘the north gets richer, the south gets poorer’ can be translated as well into ‘the north gets cleaner, the south gets dirtier’.¹²⁷ This has several reasons. Mobility has increased the possibilities to export waste to foreign, preferably politically unstable countries. Especially within the northern, industrialised countries, room has been generated for sustainable development. Despite the establishment of the Basel Convention, exporting waste remained a lucrative activity. Alongside that, globalisation has created different attitudes in the north and the south. Products that are replaced here often lead a second life in less industrialised countries, after which the product is not transported back to the north. Thus, one could say that the waste of the rich is dumped on the poor.¹²⁸

¹²⁶ JOHNSTON, A. and POWLES, E., ‘The kings of the world and their dukes’ dilemma: globalisation, jurisdiction and the Rule of Law’ in *Globalisation and Jurisdiction*, SLOT, P.J. and BULTERMAN, M. (eds.), The Hague, Kluwer Law International, 2004, 14-15

¹²⁷ AGARWAL, R. and SARKAR, P., *The globalisation of waste*, New Delhi, Toxics Link, 2002, http://www.toxicslink.org/docs/06057_Globalisation_of_Waste.pdf, 6p.

¹²⁸ SHIVA, V., *Poverty and Globalisation*, New Delhi, AG Biotech, 15/05/2000, http://www.biotech-info.net/poverty_globalisation.html

The product life-cycle has become global and subject to supply and demand.¹²⁹ Maximisation of profits often leads to production in countries where it is cheaper, due to lower loans and use in industrialised countries, because of higher demand. One could add that finally, waste streams lead again to poorer countries, because regulation is less strict and some waste can be used again as second-hand goods. This generates extra profits.

As a result of globalisation, international free-trade agreements prohibit or limit protectionist measures. They may hereby also restrict environmental protectionism. Thus, companies in countries with higher internal environmental standards suffer from competitive disadvantages compared with foreign companies. Nevertheless, free-trade agreements do not exclude environmental protection, as they may include environmental safeguard clauses.¹³⁰

Alongside globalisation in general, economic growth plays a major role as well. Analyses have assessed that the growth of the gross domestic product can account for 68 to 90 percent of the increase of waste.¹³¹ This led to a 10 percent waste increase in the beginning of the 1990s. Unfortunately, waste generation causes additional costs, and therefore limits the economic growth. Especially for packaging waste, waste generation is related to consumption levels. Decoupling waste generation from economic growth is one of the main challenges of present economics, both from an economic and an environmental point of view.¹³² For water, resource and energy, some degree of decoupling has yet been realised. For air pollutants, decoupling has occurred in exceptional cases. Even where certain degrees of decoupling has been realised, its extent is mostly insufficient.¹³³ Therefore, a lot of work is still to be done in the framework of sustainable development.

¹²⁹ AGARWAL, R. and SARKAR, P., *The globalisation of waste*, New Delhi, Toxics Link, 2002, http://www.toxicslink.org/docs/06057_Globalisation_of_Waste.pdf, 6p.

¹³⁰ KÖLLIKER, A., 'Globalisation and National Incentives for Protecting Environmental Goods: Types of Goods, Trade Effects, and International Collective Action Problems' in *A Handbook of Globalisation and Environmental Policy: National Government Interventions in a Global Arena*, WIJEN, F., ZOETEMAN, K. and PIETERS, J. (eds.), Cheltenham, Elgar, 2005, 77-78

¹³¹ ISAKSEN, V., Waste generation and economic growth, EEA, European Topic Centre on Resource and Waste Management, 1999, <http://waste.eionet.eu.int/articles/0000232.html>

¹³² MCGLADE, J., *European packaging waste trends and the role of economic instruments*, speech held at European Voice conference, Brussels, 1-2 March 2004, European Environment Agency, http://org.eea.eu.int/documents/speeches/01-03-2004-files/EEA_01-03-2004.pdf, 13p.

¹³³ RUFFING, K.G., *Keeping track of decoupling*, OECD observer, environment directorate, 2001, http://www.oecdobserver.org/news/fullstory.php/aid/615/Keeping_track_of_decoupling.html

1.2.2. Privatisation and the free market

Alongside globalisation, capitalist economies are characterised by their opportunities for private sectors and by their openness towards a free market. For the old EU member states, this has been realised gradually. For the new member states, on the other hand, the shift towards an open market occurred more swiftly and was accelerated after the fall of the Soviet Union. This swift privatisation has been accompanied by a variety of difficulties.¹³⁴ For example, proper regulations concerning bankruptcy procedures, taxation rules and book-keeping methods were absent at first. Also environmental issues were insufficiently regulated by then. As one of them, the environmental condition at the time of property transfer needed to be clarified. During property transfer, the environmental conditions are to be taken into account for price determining. Risk sites are especially those who contained chemical, steel making, electronic manufacturing, and waste storage or disposal sites.¹³⁵

Despite the longer history of the free market, privatisation in Western Europe is still proceeding. Sectors that have long been considered to be public per definition are now subject to the private market, public transport, electricity and waste management being three of the main examples. Very often, the end responsibility of these services still lies within the public authorities and it is only the implementation that has been left over the private industries. Continuation of the service is therefore guaranteed. Gradations of privatisation, for example in the waste management area, differ largely.¹³⁶

In public services, privatisation is very often achieved through means of public-private partnerships. Hereby, a relationship between the public and private sector has been set up, characterised by a relatively long duration, funding by public and private funds, an important role for the economic operator and a distribution of risks between the public and the private sector.¹³⁷ For public services, such as waste management, these partnerships are mostly set up on a local level.

Nevertheless, privatisation is not exclusively to be favoured. Regarding the public services, a too large extent of privatisation can result in reduction of competitiveness, for some services cannot be competitive in a proper way. Alongside many other things, exploitation of privatisation is said to be one of the problems

¹³⁴ GOLDENMAN, G., *Environmental liability and privatization in Central and Eastern Europe*, London, Graham and Trotman, 1994, p.27

¹³⁵ GOLDENMAN, G., *Environmental liability and privatization in Central and Eastern Europe*, London, Graham and Trotman, 1994, p.64

¹³⁶ HEMMER, D., HÖFERL, A., *Privatisierung und Liberalisierung öffentlicher Dienstleistungen in der EU-15: Abfallwirtschaft*, Wien, Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OCPP), 2003, 35p.

¹³⁷ COMMISSION OF THE EUROPEAN COMMUNITIES, Green paper on public-private partnerships and community law on public contracts and concessions, Brussels, COM(2004) 327 final, 22/04/2004, http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/com/2004/com2004_0327en01.pdf, 22p.

for the EU, which makes it hard to stay economically interesting on a global level.¹³⁸

Moreover, privatisation can conflict with environmental interests. From an economic point of view, future operations and their environmental controls have greater priority than remedying pollution problems from the past, for the latter demand unrewarded costs.¹³⁹

Alongside privatisation, the free market has another consequence as well. Very often, larger firms have competitive advantages over smaller ones. This can result into mergers. Economic recession however constrains the general rate of merger activity. Yet, merger activity continued longer in the waste management industry, compared with other sectors.¹⁴⁰ This may be explained by the waste management market becoming a full-scale market only more recently. However, also economic pressure through environmental legislation constitutes a possible explanation.

1.2.3. Consequences

Economic growth is nearly always accompanied by increased waste generation. Although the possibilities to enter the waste market for new companies are reduced, due to increasing requirements, this does not count for illegal dealing with waste. The increased waste generation guarantees an important market with future expectations, from an economic point of view that is. Investing in the waste market is likely to be profitable in the long-term as well, making it even more attractive.

Privatisation has an important influence on the sector as well. As stated above, the final profits of waste management should be sought indirectly, in the area of environmentally sound development. Making it a full-scale market has cut the economic activity loose from these indirect profits, and brought it into the economic atmosphere and short-term profits. This shift sustained the discrepancy between economy and ecology, as the ecologically desirable solutions are the least profitable from an economic point of view. This created incentives to deal with waste illegally, hereby avoiding environmental restrictions.

As for globalisation, growing mobility increased the transporting possibilities for waste. Due to the emphasis on the environmental interests, transporting wastes to less environmentally controlled areas abroad has become attractive. As waste

¹³⁸ FIGUEREIDO, I., Speech held in the European Parliament, Strasbourg, 09/03/2005, consulted at http://www.europarl.eu.int/omk/sipade3?L=EN&OBJID=94922&LEVEL=5&SAME_LEVEL=1&NAV=S&LSTDOC=N

¹³⁹ GOLDENMAN, G., *Environmental liability and privatization in Central and Eastern Europe*, London, Graham and Trotman, 1994, p.27-28

¹⁴⁰ COOKE, A., and CHAPPLE, W., Merger activity in the waste disposal industry: the impact and the implications of the Environmental Protection Act, *Applied Economics*, 2000, Vol.32, no.6, 749-755

generation in developing countries is much more limited than in the industrialised countries, this different focus is no more than logic. Because of the risk that the industrialised countries would hence use third world countries as dump sites, the latter tried to protect themselves by putting pressure on realising the Basel Convention. This reduced legal opportunities for exporting waste outside of the European Union. Unfortunately, as legislation and enforcement focuses may differ, it has become highly profitable to try exporting wastes illegally. The lacking focus on environmental law enforcement in the countries of destination and possible opportunities for corruption due to huge wage differences, the risks of being caught have been reduced dramatically. Also for economic crimes, globalisation has increased opportunities, by means of financial offshore countries and possibilities to set up very complex and almost unverifiable financial networks.

1.3. Social factors

1.3.1. Environmental consciousness and consumption society

Belief in the unlimited resources of nature has fallen during the second half of the 20th century. Initiated by the report of the Club of Rome (see above), this environmental criticism has expanded to a creation of environmental consciousness. The implications of human development on nature became visible and caused people to think on the possible future results.¹⁴¹ Environmental awareness is improving. Nevertheless, this is not yet accompanied by actual differences in commercial behaviour.¹⁴²

One could say that people are concerned about the environment, but still, they are not willing to take concrete action. Reasons for this could be that they feel their investments are not being paid back or that personal action cannot make a difference. Another possibility is that people cannot contribute in sustainable development unless a shift of mentality takes place. Particularly for waste management, consumption society and its widespread application hamper the environmental interests. Changing this cannot be achieved in a top-down process. So far, changes in (municipal) waste management have not resulted in a reduced product waste.¹⁴³ Thus, although people have the impression that their efforts do not make much difference, it is precisely there that a change has to be established. People still have to be convinced that waste reduction is not only good for the environment, but that it saves money as well. Unfortunately, recycling seems to be out of our heads if it requires some efforts.

¹⁴¹ LEAR, L., Rachel Carson and the awakening of environmental consciousness, Washington, National Humanity Center, George Washington University, 2002, <http://www.nhc.rtp.nc.us:8080/tserve/nattrans/ntwilderness/essays/carson.htm>

¹⁴² SUZUKI, K., FUTAGAMI, T., OGURA, S., HARA, M., OHKAWA, T. and YASUI, I., *Change in environmental consciousness and behavior led by information*, Tokyo, Japan Science and Technology Agency, http://www.yasuienv.net/CREST/1_list/1128.pdf

¹⁴³ SPIEGELMAN, H. and SHEEHAN, B., *Unintended Consequences: Municipal Solid Waste Management and the Throwaway Society*, Product Policy Institute, 2005, <http://www.productpolicy.org/assets/resources/UnintendedConsequences-MSWandEPR.pdf>, 23p.

1.3.2. Risk society and public opinion

Since the 1970s on, the welfare state has become under pressure. More and more emphasis has been put on risk management instead of welfare. This risk management is encountered in several areas, environment being one of them. People want to be exposed to minimal risks, unless these risks are worthwhile.

Risk always contains a certain degree of uncertainty. Moreover, in some areas, such as environment, risks are not clearly visible and are per definition only discovered in the long run. Thus, risk perception is performed in another way. In such cases, experts or people assumed to be experts, play a persuasive role. For example for waste incineration, experts exist in both camps. Defenders see incineration as an alternative both for waste and energy management. Moreover, they consider it to be clean as well, because generating energy through waste incineration is less polluting than by means of traditional use of fossil fuels. Opposing experts on the other hand focus on the increased risks for public health by means of carcinogenic emissions.¹⁴⁴

This subjective risk perception can especially be seen in nuclear waste management. This forms a major environmental concern for most European citizens. The long-term perspective of radioactive waste creates a situation in which 92% of the European citizens feel the need to work on long-term solutions and not leave these to future generations.¹⁴⁵ Nevertheless, two out of three believes it to be the responsibility of each individual Member State to manage its own high-level radioactive waste.¹⁴⁶ This indicates that people are not willing to bear the nuclear risks of others.

A part of this attitude may as well be explained by the fact that people are aware of environmental issues on a general level, but are not willing to bear the implications on a personal level. This can be seen not only for nuclear waste, but also for incineration and landfill sites of municipal and hazardous waste. Plans for new sites very often lead to protests of the locals.¹⁴⁷ This indicates that people do not want to become the personal victim of a collectively generated risk. Overcoming this discrepancy between **collective risk and individual implications** is a challenge within the social dimension of environmental issues.

¹⁴⁴ LARAÑA, E., Reflexivity, Risk and Collective Action over Waste Management: a Constructive Proposal, *Current Sociology*, 2001, Vol.49, no.1, 23-48

¹⁴⁵ EUROPEAN COMMISSION DIRECTORATE GENERAL ENERGY AND TRANSPORT, *Special Eurobarometer 227: Radioactive waste*, European Commission, 2005, http://europa.eu.int/comm/energy/nuclear/waste/doc/2005_06_nuclear_waste_en.pdf, p.70

¹⁴⁶ EUROPEAN COMMISSION DIRECTORATE GENERAL ENERGY AND TRANSPORT, *Special Eurobarometer 227: Radioactive waste*, European Commission, 2005, http://europa.eu.int/comm/energy/nuclear/waste/doc/2005_06_nuclear_waste_en.pdf, p.76

¹⁴⁷ X., *Alarm over toxic pollution brings Mafia into focus*, The Sydney Morning Herald, 04/09/2004, <http://www.smh.com.au/articles/2004/09/03/1093939148436.html?from=storylhs>

Remarkable is the fact that, for existing sites, opposition against nuclear power plants is in fact the lowest in the more immediate environment.¹⁴⁸ Reasons behind this may be twofold. On the one hand, people living close to nuclear power plant can often benefit from the economic advantages of the facility, for example employment. This can be translated in a moderating estimate on the risks. Another possibility is that people can by no means neglect all risks. Therefore, they may be more interested than others in the real risks. By doing so, they may be willing to gather information themselves and are therefore not depending on experts.

The presence of economic benefits can certainly influence the public opinion on risks. On the other hand, however, access to information can be considered as equally important, especially considering long-term risks.

1.3.3. Consequences

With the risk society becoming real, a distinction has to be made between individual risks and collective risks. While the first are carried by the individual, the latter are the responsibility of the community as a whole. When collective risks are translated into individual risks, this often leads to resistance from the individuals who become individual victims of a collective risk. An important example can be found in waste management, municipal and other. People want their waste to be disposed of and want electricity (which accounts for most of the nuclear waste at the moment), but are not eager on having dump, storage or incineration sites close to their homes. The demand for risk reduction indirectly fancies illegal activities, as hereby, risk management is performed in a way that is often invisible in the short-term.

1.4. Technological factors

1.4.1. Promising possibilities

Technology has increased enormously during the past decades. A major increase can be attributed to the evolving information technology. As a result of this increase, some promising evolutions can be distinguished.

As an important consequence of technological increase, methods have been developed to **measure the environmental impact** of certain activities, for example use of pesticides.¹⁴⁹ This seems obvious, but still contains important in-

¹⁴⁸ QUERNER, I., 'The need for Alternatives to the Expected Utility Approach in Environmental Risk Economics or 'Who is Afraid of Russian Roulette?'' in *Valuing the Environment: Methodological and Measurement Issues*, PETHIG, R. (ed.), Dordrecht, Kluwer academic, 1994, 83-128

¹⁴⁹ KOVACH, J., PETZOLDT, C., DEGNI, J. and TETTE, J., *A method to measure the environmental impact of pesticides*, New York, Cornell University, <http://www.nysipm.cornell.edu/publications/eiq/>

formation. First of all, measuring pollution makes environmental problems visible. This means that it is not only an ideological concern to promote sustainable development. The need for this can be confirmed by facts and figures, making it impossible to totally ignore the problem. Moreover, the achieved results can be measured as well. This means that efforts can be reflected into actual improvements, which may provide a motivational factor to reduce negative environmental impacts. Also law enforcement agencies can use these techniques, measuring actual damage. Hence, this gives them a quantitative instrument in the fight against environmental crime.

Another promising evolution consists of the increasing methods to **reduce waste**.¹⁵⁰ An important way to achieve this is the promotion of reuse and recycling. This can reduce waste generation. Alongside that, other possibilities, such as mechanical-biological treatment, exist as well.¹⁵¹ Applicable mostly to municipal waste, technological insights provide the possibility to treat waste in a mechanical-biological way. By doing so, reduction of environmental impacts can be maximised.

Increasing technology is accompanied by other evolutions as well. Growing complexity for operating and maintenance requires increased training. Increasing professionalism cannot be achieved without investments. Hence, costs in personnel have risen, making it important maintaining employee turnover as low as possible.

1.4.2. Reality

Despite the possibilities provided by technology, reality is often less positive. The other side of the coin of technology is well filled, especially in relation to waste management. Although optimists believe that technology could in the future provide the solution for various problems, including environmental risks, the present situation still indicates the opposite.

Despite possibilities to reduce the amount of waste, the generation of waste, especially hazardous, has risen. Products have become more sophisticated and technologically intensive. This results in a higher amount of waste generation during the manufacturing process. A further increase is expected for glass, cardboard and plastic, but also for electronic waste and particularly for hazardous waste.¹⁵² The amounts of generated wastes for example for a toothbrush, a mobile phone and a personal computer rise to respectively 1.5kg, 75kg and

¹⁵⁰ X., *Waste Reduction Technology Programs*, WRT, 2005, <http://www.wastereduction.org/programs.html>

¹⁵¹ HEERMANN, C., Using Mechanical-Biological Treatment for MSW in Europe, *Biocycle*, 2003, Vol.44, no.10, 58-62

¹⁵² MONKHOUSE, C. and FARMER, A., *Applying Integrated Environmental Assessment to EU Waste Policy: a Scoping Paper for the European Forum on Integrated Environmental Assessment (EFIEA)*, Institute for European Environmental Policy, 2003, <http://www.ieep.org.uk/publications/pdfs/2003/efieafinalreport.pdf>, p.4

1,500kg.¹⁵³ Surely, a computer is much bigger than a toothbrush, but this difference is reduced dramatically comparing a toothbrush with a mobile phone. Yet, the latter results in a waste multiplication by 50. High levels of sophistication often cause lower resource efficiency, increasing waste generation.

Another trend is closely related to consumption society. Complexity of products makes reparation more expensive, both in terms of personnel costs due to professionalism and costs of materials and equipment, due to technological sophistication. This, in combination with mass production, makes it often easier to replace goods than to repair them.¹⁵⁴ Thus, consumption society results in increasing waste generation.

The growing complexity of products also creates possibilities to compose working items out of waste. Hence, consumption society is characterised by a shift from reparation of products towards reuse and recycling.

1.4.3. Consequences

Both technological requirements and possibilities have increased during the past decades. On the one hand, this increased the investments for legal waste management, creating incentives for illegal activity. Moreover, growing technology resulted in increased waste generation as well and, therefore, criminal opportunities. On the other hand, technological evolutions also increased the possibilities to detect and measure the impact of environmental crimes, making them more visible.

¹⁵³ COMMISSION OF THE EUROPEAN COMMUNITIES, *Communication from the Commission: towards a thematic strategy on the prevention and recycling of waste*, Brussels, 2003, www.eu.int/eur-lex/en/com/cnc/2003/com2003_0301en01.pdf, p.12

¹⁵⁴ LUBER, A., *Way past acceptance*, e-broadbandnews, 29/03/2001, <http://www.e-broadbandnews.com/Archives/Commentary/20010329.htm>

2. Cluster analysis

In this part, the immediate external environment of the European waste management industry will be described. Attention will be paid to the relevant actors and their relationship with the waste management sector.

2.1. Supporting and related sectors

2.1.1. Supply and input of the waste management industry

Concerning the supporting and related sectors of the waste management industry, three main examples can be distinguished.

In the first place, the inputs of waste into waste management should be considered. Such inputs constitute a necessary precondition of the waste management industry.

Waste is generated in virtually all economic sectors (electric information-processing and trading may be exceptions as regards their main productive processes, although even they need capital resources and operational facilities that imply waste outputs). The variety of waste supplying sectors provides the waste management industry with a unique role within the economy. On the one hand, it is a hidden part of every sector, as the waste management industry only becomes active when the actual production process has been finished. Thus, it has no explicit role in the production process itself. On the other hand, waste management is implicated by or foreseen in each and every sector within the economy. After all, all production processes create a variable amount of waste.

Next to the supply of waste, **technology supply** is important as well. Technological issues deal with collection, sorting, transport and treatment methods. For collection and transport, technology mainly contains modified trucks, containers and fuel. For sorting and treatment, similar technological needs exist. Additional technology is required, for example in sorting facilities or incineration installations. Finally, even for wastes destined for landfill, technological facilities are increasingly utilised, for example mechanical-biological methods to reduce waste volumes.¹⁵⁵

Suppliers of security and safety are important actors, particularly in cases where it is profitable or politically attractive to steal waste, for example hazardous and/or nuclear waste. In the case of nuclear waste, several safeguards are required. They include declarations on status, design information, and material accountancy, containment and surveillance (C/S) techniques, inspections, and detection of undeclared activities. Material accountancy is carried out on a first

¹⁵⁵ HEERMANN, C., Using Mechanical-Biological Treatment for MSW in Europe, *Biocycle*, 2003, Vol.44, no.10, 58-62

level at each nuclear facility by the operators. Methods to do so depend on the kind of facility. The components of the verification are technical equipment, which is installed by verification authorities, so-called containment and, finally, surveillance techniques. The technology includes seals, detectors, monitors and cameras recording any action occurring in a particular area of a nuclear installation.¹⁵⁶

Thus, inputs into waste management can be divided in three large groups. The supply of waste itself comes from all economic sectors. For the waste management processes, supply of technology plays a role. Finally, and this is particularly the case for hazardous and, even more, nuclear waste, this process is monitored by suppliers of security.

2.1.2. Transport sector

The transport sector maintains an important relation with the waste management sector. First of all, **waste is involved in about 15% of all cargo transports**. Secondly, although waste used to be mostly transported by specialised companies, this is no longer the case. Waste is increasingly considered as a full-scale activity of regular transport companies.¹⁵⁷ Especially smaller companies use transport companies, while bigger companies often have their own transport division. Thirdly, as stated above, since most waste is not dealt with at its place of origin (except some agricultural and mining wastes), transport is a significant aspect of the waste industry.

Waste-related transport mostly happens by road, by train or by ship. The transport sector is a largely privatised sector, where flexibility and security play an important role. Unlike the waste sector, the transport sector does have minimal capital requirements to enter the market. With the freedom of movement of goods, persons, capital, and services, the transport sector has been increasingly regulated in a European framework.¹⁵⁸ Thus, waste transports are subject to both transport and waste regulations.

2.1.3. Energy sector

¹⁵⁶ SCHAPER, A, SCHMIDT, G and BÄHR, R, *Emerging Nuclear Energy Systems, their Possible Safety and Proliferation Risks*, Energy and Research Series, ENER 111 EN, Luxembourg: European Parliament, 2001 http://www.europarl.eu.int/workingpapers/ener/pdf/111_en.pdf, p.71

¹⁵⁷ VAN DEN ANKER, M.J.J. and HOOGENBOOM, A.B., *Schijn bedriegt: overheid, bedrijfsleven en gelegenheidsstructuren voor criminaliteit op de hergebruikmarkt*, 's Gravenhage, VUGA, 1997, 352p.

¹⁵⁸ BUCQUOYE, A., VERPOEST, K., DEFROYTIER, M. and VANDER BEKEN, T., 'European road transport of goods' in *Organised crime and the vulnerability of economic sectors: the European transport and music sector*, VANDER BEKEN, T. (ed.), Antwerp, Maklu, 2005, 57-193

Another sector which is closely related to the waste management industry is the energy sector. A first relation is constituted by **policy**. Waste and energy are often mentioned and discussed together, as they are both important issues in the area of environmental development.¹⁵⁹ At the same time, their importance is increasing. Waste reduction on the one hand, and fulfilling the need of increasing energy on the other, are two of the main environmental challenges at the moment. One way to achieve some success in the accomplishment of these challenges has been performed by combining those two. Increasingly, waste is being transformed to energy by means of **Waste-to-Energy incineration**. WTE technology may be applied especially in two means. One method, which is mostly applied in the Scandinavian countries, is to produce hot water for district heating. Other European countries mainly apply WTE to generate steam for electricity production.¹⁶⁰ Although some smaller plants have been closed down, because they could not meet the EU emission standards, there is a growing emphasis on WTE incineration. By doing so, one brings the energy sector and the waste management industry closer together in a practical way.

Two evolutions take place in the energy sector. In the first place, there is an ever increasing need for energy.¹⁶¹ Secondly, because the energy supply cannot fulfil this need, energy prices are rising and it is highly probably that they will continue to do so in the future.¹⁶²

Special attention can be paid to the link between the sector and the nuclear waste industry. Civil applications of nuclear power are mostly energy related (next to a relatively small part in the industry and scientific/medical sector). The nuclear power/waste industry is a relatively restricted club, both in terms of the countries involved and in terms of numbers of main contractors. One reason for this is that the costs of entry are high and getting higher.

Over the years, new nuclear power plants have become progressively more capital intensive, taken longer to build than other conventional power generating facilities, involved increasingly prescriptive and cumbersome procurement, and entailed longer and costlier regulatory and licensing procedures. All these factors tend to increase financial and commercial risks, and delay innovation. On average, the capital costs for building new nuclear plants of current reactor design are 2-4 times higher than fossil-fuelled plants. The challenge for the industry is to reduce these costs to a generally competitive level. Without innovation, nuclear power is unlikely to meet this challenge.¹⁶³

¹⁵⁹ For example in the Eurostat classification

¹⁶⁰ RYLANDER, H. and HAUKOHL, J., Status of WTE in Europe, *Waste Management World*, ISWA, 2002, Vol.2, no.3

¹⁶¹ UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE, *Trends in Europe and North America: The Statistical Yearbook of the Economic Commission for Europe 2003*, United Nations, <http://www.unece.org/stats/trends/ch9.htm>

¹⁶² PIEBALGS, A., *The European Initiative on Energy Efficiency*, Speech at Joint meeting ITRE – National Parliaments, Brussels, 24/01/06

¹⁶³ TURKENBURG, W., 'Nuclear energy and sustainable development' in *Technology Assessment HTR*, Petten, ECN, 1996, 36p.

The energy sector is linked to the waste management sector in several ways. The energy sector is under financial pressure, as supply and demand are no longer complementary to each other. Solutions have to be worked out, with respect for the environmental-economical balance.

2.1.4. Conclusion

Regarding the supplying sectors of the waste management industry, three aspects are important. The supply of waste is a necessary condition for the existence of the waste management sector. Because waste is produced in every economic sector, the supply of waste links the waste management industry with all other aspects of economy. Secondly, supply of technology is important. With the growing emphasis on environmentally sound waste management, the need for technology can be expected to increase further. Thirdly, supply of security and safety is important, not only to protect waste, but also to ensure the safety of the people dealing with it.

Concerning related sectors, transport and energy call for attention. In case of the transport sector, 15% of all transport involves waste. The energy sector is linked to the waste sector in policy terms, as waste and energy are often mentioned together in the framework of environmentally sound development. Moreover, through means of waste-to-energy incineration, a practical link exists.

2.2. Government

In the area of waste management, governmental issues play an important role. Waste is a functional concept, not an essential aspect of physical substances. As environmental issues play an ever-growing role, waste streams are increasingly regulated, reconstructing waste at the intersection of economic and ecological interests. As the focus on these interests may differ to a large extent between countries and regions, legislation to harmonise them is a delicate matter.

2.2.1. United Nations

2.2.1.1. United Nations Environment Programme (UNEP)

The goal of the United Nations Environment Programme is to provide leadership and encourage partnerships in caring for the environment. It also aims at improvement of life quality, without compromising that of future generations.¹⁶⁴ It thus focuses on environmental development in a broader way. It is clear that waste management and evolutions only constitute a part of this broader ap-

¹⁶⁴ UNITED NATIONS ENVIRONMENT PROGRAMME, *About UNEP*, United Nations, www.unep.org

proach. As its activities are very closely linked to environmental issues, special attention has been drawn to hazardous and nuclear materials (including waste).

The possible hazards of chemical substances have been documented in-depth. In doing so, the artificial distinction between waste, raw materials and new products and material has been left behind, with the focus turning to the environmental impact of chemicals in general.¹⁶⁵ With reference to hazardous waste, the United Nations Environment Programme pays special attention to environmental sound management and transport minimisation.¹⁶⁶ From this perspective, the Basel Convention (see below) is a central reference point.

For nuclear waste, there is an emphasis on the need for safe management, transport, storage and disposal, with a view to protect human health and the environment.¹⁶⁷

One of the strong points of the United Nations Environment Programme is that it emphasises environmental interests and tries to activate the environmental consciousness of other actors. The 2005 annual report pays attention, among other things, on cleaner production and on tackling the growing challenge of plastic waste management.¹⁶⁸

2.2.1.2. Basel Convention

In the area of waste management, the most important outcome of the United Nations Environment Programme has been the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.¹⁶⁹ The purpose of the Convention was to prevent developing countries becoming huge landfill sites for improperly managed hazardous waste. The shipments from industrialised to developing countries took place to a large extent during the 1970s and 1980s.¹⁷⁰ Waste issues began to gain importance on the political agenda of the industrialised countries much sooner than in the develop-

¹⁶⁵ UNITED NATIONS ENVIRONMENT PROGRAMME, *UNEP Activities in Chemicals*, United Nations, <http://www.unep.org/themes/chemicals>

¹⁶⁶ UNITED NATIONS ENVIRONMENT PROGRAMME, *Environmentally Sound Management of Hazardous Wastes Including Prevention of Illegal International Traffic in Hazardous Wastes*, United Nations, <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=52&ArticleID=68&l=en>

¹⁶⁷ UNITED NATIONS ENVIRONMENT PROGRAMME, *Safe and Environmental Sound Management of Radioactive Wastes: Programme Area*, United Nations, <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=52&ArticleID=70&l=en>

¹⁶⁸ UNITED NATIONS ENVIRONMENT PROGRAMME, *UNEP Annual Report 2005*, United Nations, 2006, <http://www.unep.org/Documents.Multilingual/Default.Print.asp?DocumentID=67&ArticleID=5125&l=en>

¹⁶⁹ Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *United Nations – Treaty Series*, 1992, Vol.1673, I-28911, 126-161

¹⁷⁰ CHASEK, P., *Earth Negotiations, analyzing thirty years of environmental diplomacy*, Tokyo, United Nations University, 2001, 291p.

ing countries. As the latter were faced with strong economic incentives to accept those waste streams, hazardous waste polluted them, especially African countries. During the 1980s, however, there was a growing demand to prohibit these exports. Finally, following an initiative of the African states, the Basel convention was signed in 1989. It came into effect in 1992.¹⁷¹

The most important provision of the convention is the right to ‘...prohibit the import of hazardous wastes or other wastes for disposal...’¹⁷² It is the aim to reduce both generation and transport of hazardous wastes to a minimum and to manage the produced hazardous waste in an environmentally sound manner. The convention also defines a list of illegal trafficking examples:

*Illegal traffic occurs if the transboundary movement of hazardous wastes is taking place under the following conditions: without notification pursuant to the provisions of the Convention to all States concerned; without the consent of a State concerned; through consent obtained by falsification, misrepresentation or fraud; when movement does not conform in a material way with the documents; or when movement results in deliberate disposal of hazardous wastes in contravention of the Convention and of general principles of international law. Common methods of illegal traffic include making false declarations or manifests, the concealment, mixture or double layering of the materials in a shipment and the mislabelling of individual containers.*¹⁷³

However, implementation of this convention is difficult. The developing countries (or at least some political/economic actors therein) may have the political will to react against the dumping of hazardous waste. However the translation of this political will into practice, by means of law enforcement, is another matter. The convention was strengthened in 1995 to ban exports to non-OECD countries, but this will only be achieved through time, resources and strong governmental commitment.¹⁷⁴ In 2004, a manual for the law enforcement agencies was drafted in order to improve the implementation of the convention.¹⁷⁵ Taking into account the fact that a large amount of waste shipments from Western European countries passes through pseudo-legal or even illegal circuits,¹⁷⁶ implementation may be expected to continue to be rather challenging.

¹⁷¹ PORTER, G., BROWN, J.W. and CHASEK, P., *Global environmental politics*, 3rd ed., Boulder, Westview Press, 2000, 286p.

¹⁷² Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *United Nations – Treaty Series*, 1992, Vol.1673, I-28911, 126-161

¹⁷³ SECRETARIAT OF THE BASEL CONVENTION, *What is illegal traffic?* Geneva, United Nations Environment Programme <http://www.basel.int/legalmatters/illegaltraffic/index.html>

¹⁷⁴ UNITED NATIONS SYSTEM-WIDE EARTHWATCH, *Implementing the Basel Convention*, United Nations, <http://earthwatch.unep.net/emergingissues/hazardousw/baselconvention.php>

¹⁷⁵ UNITED NATIONS ENVIRONMENT PROGRAMME, *Guidance elements for the detection, prevention and control of illegal traffic in hazardous wastes: draft training manual for the enforcement of laws implementing the Basel Convention*, United Nations, 2004, UNEP/chw.7/24 <http://www.basel.int/meetings/cop/cop7/docs/24e.pdf>

¹⁷⁶ COCHEZ, T., *Vlaanderen dumpst 100.000 ton afval in derde wereld: pseudolegaal circuit maskeert illegale afvalstromen*, De Morgen, 30/01/06

2.2.2. Lomé IV Convention

Signed in 1989 and being revised several times in the meantime, the Lomé IV Convention establishes an agreement between the African, Caribbean and Pacific countries (ACP) and the European Economic Community. It is said to be the world's most sweeping ban on waste trade.¹⁷⁷ It does not focus on waste management within the ACP countries. In this way, it differs from the Barbados Programme of Action.¹⁷⁸ Its strong point is the fact that it involves the European Community. Whereas the industrialised countries displayed little enthusiasm for the Basel Convention, in the Lomé IV Convention of 1995 they committed themselves to banning the export of hazardous and radioactive wastes to ACP countries.¹⁷⁹

2.2.3. Non-Proliferation Treaty

In relation to technologies and materials that might be used for weapons purposes, the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)¹⁸⁰ is a landmark. Its objectives are to prevent the spread of nuclear weapons and weapons technology, to foster the peaceful uses of nuclear energy, and to further the goal of achieving general and complete disarmament. The Treaty establishes a safeguards system under the responsibility of the International Atomic Energy Authority (IAEA), which also plays a central role under the NPT in areas of technology transfers for peaceful purposes.

¹⁷⁷ GREENPEACE, *The International Trade in Wastes, Waste Trade Update*, 1990, Vol.5

¹⁷⁸ UNITED NATIONS GENERAL ASSEMBLY, *Report of the Global Conference on the Sustainable Development of Small Island Developing States*, Bridgetown, Barbados, 1994, United Nations, A/conf.167/9 <http://www.un.org/documents/ga/conf167/aconf167-9.htm>

¹⁷⁹ VELDKAMP, A.M.E., 'Grensoverschrijdende overbrenging van afvalstoffen' in *Strafrechtelijke aanpak van grensoverschrijdende milieucriminaliteit, capita selecta*, HENDRIKS, L.E.M., BIEZVELD, G.A. and VAN RIJSWICK, H.F.M.W. (eds.), Zwolle, Tjeenk Willink, 1996, 43

¹⁸⁰ INTERNATIONAL ATOMIC ENERGY AGENCY, 1970, *Information Circular, Treaty On The Non-Proliferation of Nuclear Weapons, Notification of the entry into force*, INFCIRC/140, 22 April 1970, Vienna, IAEA, 5p.

2.2.4. European Union

2.2.4.1. Definition

As waste itself is a heterogeneous concept, it is, for policy reasons, necessary to establish a waste definition and classification. The European Union did so in 1975, by means of the Council Directive on Waste.¹⁸¹ This was well before waste became an economic, ecological and political hot topic. The key issue in the waste definition is ‘discarding or the intention or requirement to discard’. Moreover, several specific waste streams have been excluded. Attention has been paid to some specialised categories of material that are deemed to be waste, such as:

- Q2 Off-specification products
- Q3 Products whose date for appropriate use has expired
- Q4 Materials spilled, lost or having undergone other mishap
- Q5 Materials contaminated or soiled as a result of planned actions
- Q6 Unusable parts
- Q7 Substances which no longer perform satisfactorily
- Q8 Residues of industrial processes
- Q9 Residues from pollution abatement processes
- Q10 Machining/finishing residues
- Q11 Residues from raw materials extraction and processing
- Q12 Adulterated materials
- Q13 Any materials, substances or products whose use has been banned by law
- Q14 Products of which the holder has no further use
- Q15 Contaminated materials, substances or products resulting from remedial action with respect to land

There are two important residual categories:

- Q1 Production or consumption residues not otherwise specified
- Q16 Any materials, substances or products which are not contained in the above categories

Obviously, **room for interpretation** has been left open. The evolution of political attention, technical possibilities and opening of new markets for recovery and disposal operations further complicate definitional matters. In order to harmonise all changes made to this Directive, a new Directive was drafted in 2006.¹⁸²

Alongside the definition of waste in general, and only in 1991, a definition of hazardous waste has been established.¹⁸³ Here, the basic parameters for waste are

¹⁸¹ Council Directive 75/442/EEC on waste, *Official Journal* L194, 25/07/1975, 39-41

¹⁸² Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, *Official Journal* L114, 27/04/2006, 9-21

¹⁸³ Council Directive 91/689/EEC of 12 December 1991 on hazardous waste, *Official Journal* L377, 31/12/1991, 20-27

the same as for the 1975 Directive, to which has been added a rather complex definition of hazard. This has been achieved by means of three lists. It is a combination of a waste stream/constituent of one of the first two lists (Annexes I & II) with one of the characteristics as described in the third (Annex III) which defines waste as hazardous. Annex III refers to substances which are explosive, oxidising, highly flammable, flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, teratogenic, mutagenic, releasing toxic gases in contact with water, air, or acid, or ecotoxic.

2.2.4.2. Statistics

Two difficulties occur when it comes to waste statistics. On the one hand, member states may implement the Waste Directive differently, creating different national standards. Some countries therefore have, statistically speaking, higher degrees of waste production, due to different waste definitions.¹⁸⁴ This has been the case for example for the Netherlands.¹⁸⁵ In order to overcome this problem, the EU elaborated a legal framework on waste data gathering: The Regulation of the European Parliament and of the Council of 25 November 2002 on waste statistics.¹⁸⁶

As this regulation applies from 2006 on, measuring its results is not yet possible. Growing possibilities to compare national figures are expected. However, there is need for caution. The unclear nature of waste streams is not only a policy issue. It is also inherent to waste itself. Wastes are often mixed and it may be difficult and expensive to describe them in detail. There is often a non-defined residual fraction, even after sorting activities have taken place. For liquid waste streams, sorting is particularly difficult.

Because of these encountered inherent difficulties, indirect data may be gathered as well. In this perspective, two systems can be distinguished. The European Pollutant Release and Transfer Register (PRTR) will replace the European Pollutant Emission Register (EPER). Its aim is to go online by 2009 and report data from 2007 on.¹⁸⁷ It will provide inventory information about releases of pollutants from specific industrial facilities and activities. In this way, it is expected to raise government efforts to achieve integrated environmental management and to promote pollution prevention.¹⁸⁸ Because the PRTR reports on pollution in gen-

¹⁸⁴ VAHVELAINEN, S., Industrial and consumption waste. How to meet the indicator needs. Experiences from Finland, *Statistical Journal of the UN Economic Commission for Europe*, 2002, Vol. 19, no.1-2, 65-78

¹⁸⁵ EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.153

¹⁸⁶ Regulation (EC) No 2150/2002 of the European parliament and the council of 25 November 2002 on waste statistics, *Official Journal L332*, 9/12/2002, 1-36

¹⁸⁷ HELFFERIG, B., and MIKKELSEN, L., *Industrial pollution: new European register adopted*, European Commission Press Center, IP/05/854, Brussels, 06/07/2005

¹⁸⁸ SHESHINSKI, R.H., Indirect data collection for waste statistics and waste indicators, *Statistical Journal of the UN Economic Commission for Europe*, 2002, Vol.19, no.1-2, 53-63

eral, this is not a waste registry. However, indirect data on waste can be achieved as well, as the waste management sector is included in the industrial sector.

Alongside the PRTR, there is a European System for the Collection of Economic Information on the Environment (SERIEE). It has been applied in the mid-90s and provides information on the broader environmental issue, including waste, green industries and environmental expenditures.¹⁸⁹

These instruments gather data in an indirect way. In doing so, they overcome some of the difficulties facing waste data gathering. However, a disadvantage could be that waste constitutes only a part of the data, and therefore drawing hard and fast conclusions from such indirect data sources would not be appropriate.

2.2.4.3. Specific legislation

Concerning specific waste streams, a considerable amount of legislation has been adopted. The subjects of those directives cover a wide area: shipment,¹⁹⁰ recycling, waste reduction, bio-fuels, batteries, end-of-life vehicles, electronic waste, landfill reduction... National implementation of this legal framework differs between countries.¹⁹¹

These directives are mostly to be implemented between 2005 and 2015. Several countries have failed to implement the most immediate measures in time. Therefore, one can expect that the near future of the waste management industry will undergo quite some changes.¹⁹²

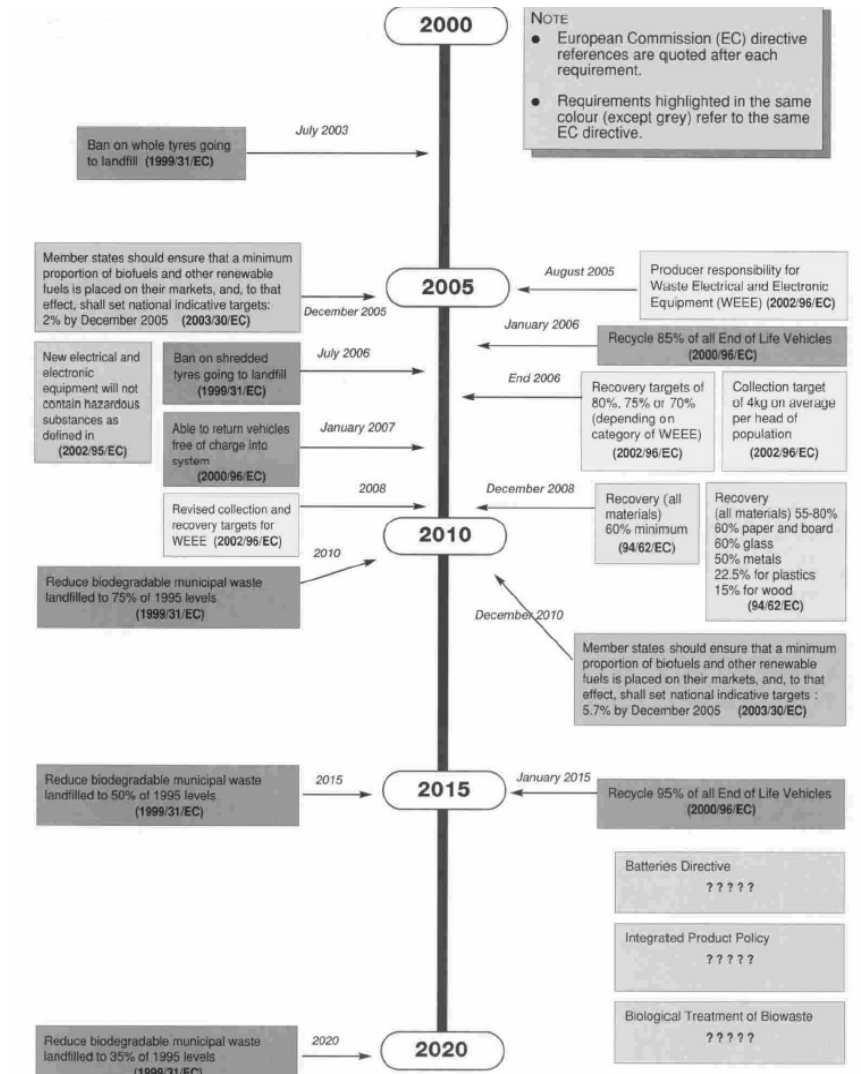
¹⁸⁹ EUROSTAT, *SERIEE: European System for the collection of economic information on the environment*, Luxembourg, Office for Official Publications of the European Communities, 2002, 194p.

¹⁹⁰ Council Regulation (EEC 259/93) on the supervision and control of shipments of waste within, into and out of the European Community, *Official Journal* L030/1, 06/02/1993, 1-28

¹⁹¹ LINDSTRÖM, M., ATTILA, M., FITCH, T. and PENNANEN, J., *Waste-related Conditions in Environmental Permits*, Amsterdam, IMPEL European Union Network for the Implementation and Enforcement of Environmental Law, 2005, 83p.

¹⁹² European Court Reports 2003 I-05639, 2003 I-06053 and 2003, I-03373, found at 'Eurobrief', *European Environmental Law Review*, 2004, Vol.13, no.4, 126-128

Figure 8: Target dates for the different waste directives¹⁹³



¹⁹³ LISNEY, R., RILEY, K. and BANKS, C., From Waste to Resource Management, *Management Services*, 2003, Vol. 47, no. 12, 10

2.2.4.4. Nuclear waste policy

The nuclear waste policy of the European Union has been set out by several legal measures. The Council Regulation on shipments of radioactive substances between Member States regulates the transport of radioactive waste.¹⁹⁴ This regulation gives the possibility, and the responsibility, to the member states to control the shipments of radioactive substances across its territory. Other proposals have been put forward in relation to management of nuclear waste and safety of nuclear installations.¹⁹⁵ Both proposals emphasise improving and controlling standards, independent verification and the creation of adequate financial resources for future nuclear waste storage. The management of radioactive waste is linked to the respective risks. For Low-level and Medium-level nuclear waste, countries need access to assessment, separation, short term storage, recycling and disposal sites. For High-level waste, long term (500+ years) storage options are still being debated, meanwhile the amount of nuclear waste at interim storage facilities keeps growing.

2.2.5. Conclusion

Both the European and the United Nations have adopted a waste management policy. The United Nations focuses especially on the impact of waste management on the environment. Special attention has been paid to waste dumping in third world countries. The European Union focuses on waste reduction, sound environmental development, recycling and the contribution to European global competitiveness. Moreover, attention has been paid to a more practical focus on waste, its definition and data gathering.

2.3. Financial and legal players

2.3.1. Permit systems

From the 1990s onwards, administrative control increased in the waste business. Nowadays, licences are needed for all sorts of activities within the waste sector: collection, sorting, transport, recycling and treatment.¹⁹⁶

The role of the local authorities in this perspective is threefold:

¹⁹⁴ Council Regulation (Euratom) No 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States, *Official Journal* L148, 196/06/1993, 1-7

¹⁹⁵ Proposal for a Council Directive (Euratom) on the management of spent nuclear fuel and radioactive waste, COM/2003/0032 final – CNS 2003/0022 and Proposal for a Council (Euratom) Directive Setting out basic obligations and general principles on the safety of nuclear installations, COM/2003/0032 final – CNS 2003/0021, Brussels, 30/01/2003, http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/com/2003/com2003_0032en01.pdf

¹⁹⁶ EUROPEAN COMMISSION, DIRECTORATE GENERAL ENVIRONMENT, *Handbook for Implementation of EU Environmental Legislation: Waste*, <http://europa.eu.int/comm/environment/enlarg/handbook/waste.pdf>

- the issuing of licences for waste management facilities and activities
- monitoring and inspection to ensure that licence conditions are being adhered to
- taking enforcement action if they are not

The goal of this licensing system is the prevention of pollution of the environment, prevention of harm to human health and the prevention of adverse effects upon the amenities of the community. This explains the wide variety of required permits, especially taking into account the diversity of the waste management industry and the various requirements during the different stages of the waste cycle. The nature of the permits differs: some regulate operational procedures, while others only set out environmental standards that leave room for some discretion on how to meet them.

Licensing is quite demanding in case of waste treatment facilities. Technical issues and judgements are very important. This type of licensing involves more competences than a merely administrative task. There is need for specific licence conditions, related to the types and quantities of allowed waste, as well as safety and security considerations, technical issues and operating methods.¹⁹⁷

In this perspective, the role of waste brokers can be mentioned. These people bring supply and demand of the waste chain together. However, as they do not legally become owners of waste, they have no obligation concerning licences, and thus do not have to comply with permit regulations. This gives them no doubt a competitive advantage and introduces the possibility that they sometimes might play an ambiguous role.¹⁹⁸

In both the hazardous waste and the nuclear waste industry, additional requirements are linked to environmental issues and health conditions. In the nuclear industry, licensee self-assessment can be found. This contains all sorts of activities a licensee undertakes to identify opportunities for improvements in licensing.¹⁹⁹ Thus, companies themselves are to some extent responsible for the future licensing policy.

The implications at a national level of European legislative measures concerning waste licensing are not always obvious to operators. There is still a **lack of clarity**, making it hard for honest companies to comply with the required licences.²⁰⁰ In some cases, this may lead to forms of 'law evasion', avoiding confrontation with the law, because of its unclear character.

¹⁹⁷ EUROPEAN COMMISSION, DIRECTORATE GENERAL ENVIRONMENT., *Handbook for Implementation of EU Environmental Legislation: Waste*, <http://europa.eu.int/comm/environment/enlarg/handbook/waste.pdf>

¹⁹⁸ BRUINSMA, G., 'De afvalverwerkingsbranche' in *Inzake opsporing: enquêtecommissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 261-310

¹⁹⁹ NUCLEAR ENERGY AGENCY, *Nuclear Regulatory Review of Licensee Self-Assessment (LSA)*, Paris, OECD, 2003, p.9

²⁰⁰ Interview with Werner Annaert, general manager of FEBEM, the Belgian Federation of Environmental Management Companies, 03/02/06

Moreover, the new EU Directive on Services has its implications for the waste management sector as well. The waste disposal sector is excluded from the principle of ‘country of origin’ to a limited extent. This means that waste management companies still have to comply with waste disposal regulations of the country in which they provide their services. The areas which are not specifically related to waste do fall under the scope of this principle, as set in the EU Directive on Services.²⁰¹ The upshot is that, when waste management companies make a bid for a contract in an EU member state other than that in which they are established, some aspects of the contract may be governed by the country of origin principle, whilst others escape it. This could imply that a mix of national rules could apply to one and the same contract. Clarity is hereby hampered once again.

It has been alleged that, during the 1990s, public authorities turned a blind eye and sometimes even facilitated harmful and illegal waste disposal methods. This happened first of all as public authorities saw no other opportunity and tolerated some illegal practices in the private sector. Secondly, public waste disposal companies were doing the same, creating a view that illegal disposal is allowed. This clearly frustrated those legal business entities that tried to comply with the regulations.²⁰²

Nowadays, an increasing number of countries deal with various kinds of pollution through one permit system. Centralised permit-issuing, public participation and increased administrative controls have been established in several countries.²⁰³

2.3.2. Law enforcement

Law enforcement is as important as the legislative framework. In the area of waste management, attention can be paid to three related issues.

In the first place, as environmental legislation is a complex matter, control by regular law enforcement agencies is difficult to achieve. Environmental legislation is only partly constituted by penal law. Environmental crimes may be considered to be victimless crimes, because an individual, short-term victim cannot be distinguished. A lack of knowledge by the victim clearly reduces the scope for complaints. Thus, environmental crimes are often discovered by accident, or not discovered at all. From that perspective, the regular law enforcement agencies are in a difficult position.

²⁰¹ EUROPEAN FEDERATION OF PUBLIC SERVICE UNIONS, *The EU Directive on Services – a wholesale attack on basic services in Europe*, Brussels, EPSU, 2005, 5p.

²⁰² GERRITSEN, J., *Overheid bevordert milieucriminaliteit: rapport over markt afvalverwerking*, SDN, 1997, <http://www.sdn.nl/milieu12.htm>

²⁰³ SEERDEN, R., HELDEWEG, M. and DEKETELAERE, K., ‘Comparative Remarks’ in *Public environmental law in the European Union and the United States: a comparative analysis*, SEERDEN, R. and HELDEWEG, M. (eds.), The Hague, Kluwer Law International, 2002, 563-583

Secondly, environmental enforcement is split across two different fields: penal law enforcement agencies and administrative agencies. Because of the division of powers, cooperation may be laborious. In various European countries, the public prosecutor is responsible for the preliminary investigation. However, his or her competencies rarely extend to giving instructions to public authorities. The **bifurcation of administrative law and penal law** may hamper environmental crime investigations.²⁰⁴

Administrative enforcement is often related to the authority that grants the licences. Therefore, judicial review may be possible if the administrative enforcement bodies do not act. However, commentators opine that penal law neither is used as an *ultimum remedium*, nor does it lead to direct lessening of environmental pollution.²⁰⁵

Some commentators believe that these problems could to some extent be solved by a regime of self-regulation. From one perspective, this could be a good option, because actors within the sectors have access to more information than outsiders. However, in a closed sector, such as the waste management industry, such a mechanism has turned out in the past to be risky.²⁰⁶ A system of corporate environmental care should not lead to immediate penal reactions. If too much pressure is put on the crime-fighting aspect, the mechanism may lose its preventive function: for example employees might avoid reporting their own faults, because they fear penal sanctions will be imposed.²⁰⁷ However it has to be asked if the present (often quite tolerant) regime has resulted in many self-reports.

Although the problems described above count for all waste streams, some specific problems can be distinguished. In cases of hazardous waste, both 'absolute entries' and 'mirror entries' exist. The latter are only defined as hazardous if the concentration of hazardous substances exceeds a certain proportion.²⁰⁸ Therefore, it is always necessary to take samples, requiring equipment and costs.

Nuclear waste is easier to detect, if one can measure the amount of radiation by a Geiger counter. Of course this requires the presence of such an instrument. However, it is also important that it is transported in a proper way. Therefore, radioactive waste is mostly transported in specially designed casks.²⁰⁹ In France and

²⁰⁴ FAURE, M.G. and HEINE, G., *Criminal Enforcement of Environmental Law in the European Union*, The Hague, Kluwer International, 2005, p.89-90

²⁰⁵ SEERDEN, R., HELDEWEG, M. and DEKETELAERE, K., 'Comparative Remarks' in *Public environmental law in the European Union and the United States: a comparative analysis*, SEERDEN, R. and HELDEWEG, M. (eds.), The Hague, Kluwer Law International, 2002, 579

²⁰⁶ BRUINSMA, G., 'De afvalverwerkingsbranche' in *Inzake opsporing: enquêtecommissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 261-310

²⁰⁷ WALING, C., *Bedrijfsinterne milieuzorg: de keerzijde van transparantie*, *Justitiële verkenningen*, 1999, Vol.25, no.2, 44-50

²⁰⁸ Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste, *Official Journal* L226, 06/09/2000, 1-32

²⁰⁹ URANIUM INFORMATION CENTRE, *Transport of Radioactive Materials*, Nuclear Issues Briefing paper no.51, Melbourne, UIC, 2005, <http://www.uic.com.au/nip51.htm>

other countries there has been debate about the safety of such containers when conveyed over public transport systems.

Environmental law enforcement issues encounter problems because of the discrete competences of judicial agencies and administrative authorities. Moreover, additional issues, related to the specific waste streams, are important as well.

2.3.3. Conclusion

From a legal point of view, the most important limits on the waste sector are set by permit systems. Law enforcement is a delicate issue. The nature of environmental crime as apparently ‘victimless crime’ makes it hard to detect. Moreover, the complex relationship between administrative and penal authorities, and that between national and international rules, may create zones of legal uncertainty.

2.4. Social and other organisations

2.4.1. Federations

In most EU member states, waste management companies are to some extent represented by national federations. Since 1999, eighteen of these have come together in the European Federation of Waste Management and Environmental Services (FEAD).²¹⁰ Some of the national federations have been active for nearly 40 years,²¹¹ while others only exist for less than 10 years.²¹² They count for an increasing proportion of the market by turnover, varying from 50% to 80%.²¹³ Taking into account that larger firms take part in these federations more actively than small firms, this market proportion may overestimate the proportion of companies in the federations. Members of the federations maintain a **Code of Conduct**, indicating that there is a will to change the image of the sector.²¹⁴ However, these federations very rarely report crimes. This may result from two possible causes: either, despite their position as a federation, they are not aware of criminal activities within their sector; or they are aware but are not willing to inform enforcing authorities. In that case, crime is being dealt with internally. (It has to be said that in few industries a federation would ‘blow the whistle’ on its own members; and if so, as national federations come together in a European grouping, whether any temptation for national players to inform on competitors from other EU member states might diminish.)

²¹⁰ FEAD: European Federation of Waste Management and Environmental Services, <http://www.fead.be>

²¹¹ E-mail from Marian Kelly, Policy Executive of the UK Environmental Services Association, 17/02/2006

²¹² E-mail from CAHO, the Czech Association of Waste Companies, 08/02/2006

²¹³ E-mail conversations with Federations of waste management companies from the United Kingdom (ESA), Finland (JLY), Hungary (KSZGYSZ) and the Czech Republic (CAOH), 08/02/2006-17/02/2006

²¹⁴ Interview with Werner Annaert, general manager of FEBEM, the Belgian Federation of Environmental Management Companies, 03/02/06

The growth of most federations and the recent nature of some of them also indicate that the waste management industry is evolving from a closed, fragmented industry, to a more open and more transparent sector. Needless to say, the federations do not directly control their members and they certainly cannot influence non-members very much. Although exceptions exist, the proportion of non-members mostly consists of rather small companies.

2.4.2. ISWA

Next to the national federations and FEAD, the International Solid Waste Association (ISWA) exists as well.²¹⁵ This is an international, independent organisation, working in the public interest to promote and develop worldwide sustainable waste management. Its members vary from individuals to public and scientific institutions, to companies, consultants and manufacturers. Emphasised topics include technical matters, such as landfill and thermal treatment, but the organisation also pays attention to other aspects, such as waste reduction and the public will to do so.²¹⁶

For it is an independent association, ISWA is less economic driven than the waste company federations. The organisation mainly focuses on the environmental impacts, problems and possible solutions of waste management.

2.4.3. EEB

The European Environmental Bureau (EEB) is a European organisation which aims to promote knowledge and understanding of the current and potential EU **environmental and sustainable development** policies, so that this will lead to mobilisation for continuous improvement.²¹⁷ The EEB brings together about 130 non-governmental organisations from 24 European countries. In order to achieve its goals, the EEB maintains consultative relations with the European Commission, the European Parliament, the Economic and Social Committee of the European Union, but also with the Council of Europe, the OECD and the UN Commission on Sustainable Development.

In the area of waste, attention is paid to waste reduction and prevention, proper implementation of legal measures and clarification of the difference between recovery and disposal. From a more legislative point of view, there is an emphasis on revision of the Waste Shipment Regulation, establishment of a biowaste Directive and to coordinate its members' activities in the area of battery regulations.²¹⁸

²¹⁵ ISWA: International Solide Waste Association, <http://www.iswa.org>

²¹⁶ ISWA GENERAL SECRETARIAT, *Annual Report 2005*, Copenhagen, ISWA, 24p.

²¹⁷ EEB: European Environmental Bureau: Federation of Environmental Citizens Organisations, <http://www.eeb.org>

²¹⁸ HONTELEZ, J., *EEB Work Programme 2006*, Brussels, European Environmental Bureau, 65p.

However, waste only constitutes a part of the EEB activities. The EEB also focuses on air pollution, biodiversity, climate change and energy, environmental fiscal reform, natural resources, soil protection urban environment, water, and much more. Thus the EEB is characterised by a broad environmental approach.

2.4.4. Conclusion

Social organisations look at waste from various perspectives. Waste companies are brought together in national federations and the European federation FEAD. The aim is to give the waste management sector a face and to look after the economic interests of the sector. The international solid waste association ISWA also contains waste management companies, but focuses more on environmental development and waste management and practical issues, so other actors, such as scientific institutions, consultants and manufacturers, take part in the organisation. Finally, the European Environmental Bureau EEB provides a third approach on the waste management sector. Bringing together several NGOs and maintaining consultative relationships with the European authorities, the EEB represents environmental interests.

2.5. (Organised) crime

Crime is involved in several aspects of the waste management industry. Two large groups of criminal activities can be distinguished. On the one hand, there is traditional environmental crime, for whom waste functions as an instrument of crime (improper disposal, etc). On the other hand, there is a recent evolution towards using the organisational and commercial structures of the waste industry as an instrument to commit other (non-waste) crimes.

2.5.1. Waste as purpose

Ever since waste management became an expensive process, illegal means of disposal have become lucrative activities. The distinction between the waste streams according to their gradations in hazard may be interesting from an environmental point of view. From a crime-fighting point of view, involvement of crime is mostly determined by the potential profits. Crime can take place through illegal trafficking, illegal dumping or, as is often the case, both.

2.5.1.1. Illegal dumping and storage of waste

In cases of municipal waste, one should take into account the fact that disposal of municipal waste is not difficult and hence not recompensed in the market as well, as disposal of hazardous wastes. Therefore there are few incentives to commit crimes involving municipal waste unless a large amount of waste can be

dealt with, for it increases the profits to a reasonable high level. This has been the case in Italy, where organised crime groupings buy rural and closed mines to establish illegal storage of waste.²¹⁹ Other cases occur in so-called landscaping projects, where construction and demolition wastes are dumped during the project.²²⁰ Double profits can be gained if some removed soil, rocks or minerals can be sold, creating a pit to dump waste.²²¹

Considering hazardous waste, however, waste management expenses per metric ton are much higher, making it more lucrative for criminals to get involved.²²² Proper incineration of a ton of hazardous waste costs between 100 and 400 Euros. This makes it much cheaper to mix it with other, less hazardous or non-hazardous waste streams and to try to dispose of it as non-hazardous waste. This is possible because the European Waste Catalogue defines some substances only as hazardous in cases of a certain concentration.²²³ Another possibility is to mix it with other resources and to use it as raw material, for example in the construction business. In that case, double profits rise: not only has the waste been disposed, the costs for raw material will be cut as well. Because of different law enforcement regulations and the high profits, compensating for transport costs, third world countries are very vulnerable to illegal dumping activities, especially countries within an unstable political and/or economical context.²²⁴

Because of the possibilities of mixing wastes, special attention should be given to **liquid waste streams**.²²⁵ Not only can they easily be mixed, detection cannot be achieved with the naked eye and sampling is more expensive, because of the technology involved for identification. Besides, liquid waste streams will, in case of illegal dumping, sink into the ground, possibly making them invisible for the public and causing serious environmental damage. The only ways to detect them are complaints from people about odour, or soil sampling, resulting in sanitation costs mostly borne by taxpayers.

Nuclear waste dumping is another issue. In the zone around the Tsjernobyl power plant, about 800 sites exist where nuclear waste has been dumped.²²⁶

²¹⁹ SOYLAND, S., *Criminal Organisations and Crimes Against the Environment*, Turin, UNICRI, 2000, 71p.

²²⁰ ENVIRONMENT AGENCY, *Britain's £ million dumping scams exposed on TV*, UK environment agency, 2005, http://www.environment-agency.gov.uk/news/1034469?lang=_e

²²¹ KAMERLING, R.N.J. and PHEIJFFER, M., *Vijftien over fraude: Hoe houden wij ons milieu schoon? in gesprek met B. Bruin RA*, Amsterdam, Koninklijk Nivra, 1999, 49-62

²²² FRÖHLICH, T., *Organised environmental crime in the EU Member States: Final report*, Kassel, BfU, 2003, p.22

²²³ Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste, *Official Journal* L226, 06/09/2000, 1-32

²²⁴ ELMI, A.M., *Somalia's Degrading Environment: Legal and Moral Perspectives of Deforestation and Hazardous Waste Dumping in Somalia*, Environment and Development Challenges News, 2001, <http://www.edcnews.se/Reviews/Elmi2001.doc>

²²⁵ Interview with Chief Commissioner Frans Geysels, Belgian federal police, 15/02/2006

²²⁶ MCMAHON, R., *UN: Security Council Considers Move For More Counterterrorism Help*, Radio Free Europe, Radio Liberty, 05/03/2004, <http://www.rferl.org/featuresarticle/2004/03/a0b6f867-ae5b-46fb-8037-5451eef26081.html>

Nuclear waste dumping poses a threat to the environment. Additionally, risks of terrorists using this waste to make a so-called dirty bomb exist.²²⁷ This is not a nuclear device, but a conventional explosive, accompanied by radioactive materials, so the explosion would spread an amount of radioactive debris. Although the concept is quite simple, dirty bombs have not been used in practice so far.

2.5.1.2. Illegal trafficking of waste

Waste generation in the EU results in transport, of which approximately only 5% is to some extent monitored.²²⁸ Because of the minor value of municipal waste, trafficking of these streams is not that profitable but several attractive waste streams can be identified. Firstly, because of the costs to dispose of hazardous waste streams legally are very high, incentives exist to forge documents and try to export the waste to third world countries.²²⁹ Of the about 150 million metric tons of hazardous waste generated in Europe each year, only 15% is recycled or disposed of within the EU. Since the establishment of the Basel Convention, export of hazardous waste to non-OECD countries is prohibited. Nevertheless, bringing this into practice is very difficult. Environmental law enforcement in countries of destination very often suffers from greater restrictions in the area of manpower and means than in the industrialised countries. This creates a climate where the risks are very low, once the shipment has left its country of origin.

In theory, every country of transit should be notified about trans-shipment. However, this is hard to bring to practice. When the shipment is transported by ship, documents accompanying a shipment are often sent afterwards. By the time the documents arrive in the exporting harbour, the ship is already on its way to its destination. Controlling these shipments is time-expensive and the results are unclear. When the shipment is transported by railways, it is even harder to do check. Agencies typically do not know which route is going to be followed, once the waste has left their country, so they are uncertain which countries should be notified.²³⁰

Secondly, special attention should be paid to **waste streams subject to take-back legislation**. These systems are often in hands of the sector itself and create opportunities to achieve additional profits. Although a sum of money is charged for the recycling activities of, for example, a fridge, the products themselves are often exported and resold on the second-hand market.²³¹ Promotion of the second-hand market is in itself favourable, but makes it hard to defend a recycling contribution.

²²⁷ BLAIR, B.G., *Terrorism Project: what if the terrorists go nuclear?*, Washington, Center for Defense Information, 01/10/2001, <http://www.cdi.org/terrorism/nuclear.cfm>

²²⁸ VERHEUGE, E., *In-, uit- en doorvoer van afvalstoffen*, Belgian federal police, 2002, 29p.

²²⁹ FRÖHLICH, T., *Organised environmental crime in the EU Member States: Final report*, Kassel, BfU, 2003, p.22

²³⁰ Interview with Chief Commissioner Frans Geysels, Belgian federal police, 15/02/2006

²³¹ RREUSE, *The management of WEEE: a guide for local and regional authorities*, Rreuse, http://rreuse.org/24/doc/00029_Brochure_ACRR_Part_II.pdf, 40p.

However, considering the global nature of markets, one could wonder whether a solution can be imagined, let alone implemented. The differences between more and less financially well-off individuals, groups and countries undermine any firm distinction between waste and second-hand material.

Similar issues arise with nuclear waste. Reprocessing facilities are rare. Most Western European Countries ship their nuclear waste for reprocessing to the United Kingdom and France. Russia occasionally receives eastern European spent fuel for reprocessing. Reprocessing does not yield products whose values compensate for the costs of the reprocessing. However, countries send nuclear spent fuel for reprocessing to delay having to deal with the nuclear waste themselves - in effect they are dumping their nuclear waste problem onto France, UK and Russia, who accept these imports for a fee. Most of the nuclear wastes arising from reprocessing will stay in France, UK and Russia forever.²³² Reprocessing is thus used as a justification for transnational nuclear waste exports and for profitable business, rather than because it solves fundamental problems with the waste.

Radioactive wastes are also transported illegally. During a time span of ten years, the Illicit Trafficking Database of the International Atomic Energy Agency (IAEA) noticed 662 confirmed incidents of illegal radioactive materials trafficking.²³³

Illegal trafficking of waste can be divided into trafficking which breaks the laws of exporting, transshipment and importing states, and trafficking which may appear legal in the initial stages but whose illegality declares itself in the final stages. In the first case, waste is smuggled abroad, mostly to be dumped illegally as well. In the second case, the shipment has been declared and authorised under certain conditions which, however, are not met. Crimes take place in all waste streams, but especially when the profits are higher, for example in case of hazardous and/or nuclear waste.

2.5.2. Waste management as means

The aspects of waste management-related crime have evolved to some extent. Whereas in the past, waste was mostly the purpose by means of disposal and transport, this has changed more recently. In that case, the business waste functions as a means to maximise other profits.

2.5.2.1. Combining waste and products

²³² GREENPEACE INTERNATIONAL, *Reprocessing*, Greenpeace, <http://www.greenpeace.org/international/campaigns/nuclear/reprocessing>

²³³ INTERNATIONAL ATOMIC ENERGY AGENCY, *Illicit Nuclear Trafficking: Facts and Figures*, Vienna, IAEA, 2004, http://www.iaea.org/NewsCenter/Features/RadSources/Fact_Figures.html

In several cases, waste management can be combined with production processes. This creates two ways of profiting. On the one hand, waste is disposed of in a cheaper way, as described above. On the other hand, as wastes are sometimes mixed with raw materials, the volume of these materials increases, and thus they are cheaper for the production company. As long as the loss of quality stays covert, this offers opportunities to maximise profits. This may for example especially appear in the construction business, where concrete and waste may be mixed, or waste may be dumped in construction pits or even in the foundations of buildings.

Attention should be paid to specific forms of petrol fraud as well.²³⁴ Certain types of waste can be mixed with fuels. In this way, **refuse derived fuel (RDF)** is generated.²³⁵ By doing so, a threefold profit is gained. The waste is disposed of, the petrol production is augmented and one can charge consumers a level of taxes corresponding to the augmented amount, whilst the swindlers only have to pay taxes on the real fuel they themselves purchased. Thus, not only is waste combined with a product, also tax evasion is taking place in this case.

2.5.2.2. *Economic crime*

Waste-related crimes in the economic crime sphere can have several forms. One option is the violation of permit conditions. Two possibilities can be distinguished.²³⁶ People can collect, transport, dispose of waste without having a license at all. The absence of such a permit limits their activities on the market. However, this absence also gives them a more secret nature, because they are not registered as active in the waste business. Another possibility is for licensed waste companies to operate beyond the scope of their permits. Under impulse of economic incentives, companies explore the borders of their permits, and because risks are low and financial incentives high, they may choose to cross these borders. Corruption of administrative personnel can be mentioned as well.²³⁷

Another option of economic crime is to distort competition by making agreements. Because of the unclear nature of waste and the various factors that play in pricing issues, customers have little idea about the normal price. Thus, people can only compare prices. However, if all companies work together and system-

²³⁴ NATIONAL CRIMINAL INTELLIGENCE SERVICE, *UK Threat Assessment: The Threat from serious and organised crime 2004/5 – 2005/6*, NCIS, 2003

²³⁵ FRÖHLICH, T., *Organised environmental crime in a few Candidate countries: Final report*, Kassel, BfU, 2003, p.25 and BLOCK, A.A. and BERNARD, T.J., Crime in the waste oil industry, *Deviant Behavior*, 2000, Vol.9, no.2, 113-129

²³⁶ VAN DEN ANKER, M.J.J. and HOOGENBOOM, A.B., *Schijn bedriegt: overheid, bedrijfsleven en gelegenheidsstructuren voor criminaliteit op de hergebruikmarkt*, 's Gravenhage, VUGA, 1997, p.267-270

²³⁷ BRUINSMA, G., 'De afvalverwerkingsbranche' in *Inzake opsporing: enquêtecommissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 261-310

atically raise their price, customers have no choice than to pay it.²³⁸ After all, their waste has to be disposed of, so they are depending on the industry. Fragmentation and diversification of the market makes pricing agreements less likely, so this opportunity may be reduced.

Within the waste management industry, as in other industries, more general forms of corporate crime may exist: insurance fraud, subsidy fraud, VAT fraud and other fiscal and employment offences.²³⁹ These crimes are encountered especially with rather small companies on the waste market that have been founded recently or, on the contrary, exist for a very long time.²⁴⁰

2.5.2.3. *Concealing crimes*

Although the literature does not mention this, it is possible that the waste industry may be used to conceal other crimes. One should not forget that the waste management industry deals with serious amounts of waste, of which the source is difficult to detect. Thus, a large amount of goods with an unclear composition and an almost indefinable source exist. This may create opportunities to conceal crimes and for example to destroy evidence of crimes. This may vary from tools used to commit crimes, such as arms that have been improperly used, to unwanted results of crimes (including the occasional dead body, according to media reports). The key issue here is to keep the evidence undetected until the source is untraceable. In some cases, such as incineration, the evidence may literally disappear into the air. However, this is not even necessary. As long as there are no direct links to the people who disposed of it, the goal is achieved from the moment the evidence is included in the big mass of waste, coming from many different sources.

From this perspective, people involved in waste management may have an advantage. First of all, they may pretend not to notice the specific products. In this way, the moment of traceable detection can be passed with few or no risks. Secondly, these people know best how to pack the specific evidence in order to keep it undetected as long as possible. This may vary according to the amount and transport of the waste. Transport over a longer distance may disguise origins more thoroughly. However, during transport, the risks of being controlled are higher. Finally, people involved in the waste management industry not only have the option to pretend to not notice the presence of certain evidence; it is also possible to insert the items into the waste chain later on, in which case even if it is found its origins may be hard to establish.

²³⁸ JACOBS, J.B., FRIEL, C. and RADICK, R., *Gotham unbound: how New York City was liberated from the grip of organized crime*, New York, New York University Press, 1999, p.86-95

²³⁹ GOBERT, J. and PUNCH, M., *Rethinking corporate crime*, London, Butterworths, 2003, 379p.

²⁴⁰ VAN DEN BERG, E.A.I.M., *Afvalcriminaliteit*, WODC, http://www.wodc.nl/images/afval_Volledige%20tekst_tcm11-9148.pdf, 10p.

2.5.3. Role of the sector

Fraud destabilises all sorts of systems, financial ones, but also social and structural ones. The role of the waste management industry itself in crime may be as victim, perpetrator or facilitator. First of all, a firm in the waste sector can become a **victim of crime** by others. Companies set up to deal with waste in an illegal way have a competitive advantage over the companies that are treating waste in a legal way. The cost reduction makes it possible for those companies to offer lower prices, damaging the competitive level of compliant firms.

In certain cases, companies from within the waste management industry **commit crimes** as well. Because of unclear regulation and lots of grey zones, legal waste management companies get involved in forms of creative entrepreneurship. Companies experience higher profits if they act illegally. In some cases, legal entities are forced into crime because of the involvement of other, criminal organisations in the waste industry. Some companies, balancing on the financial border between failure and success, face the choice between themselves getting engaged in criminal activity and in this way improve its competitiveness, or shutting up shop. From this perspective, a victim role may evolve into a crime-committing role.

The waste management industry can also function as a **facilitator of crime**. The sector is organised in a rather enclosed way, although this is diminishing. This is not only the case for newcomers, but for law enforcement agencies as well. Thus, once inside the market, the risks of getting caught are acceptable for criminals. This low-risk operating opportunity creates incentives to try to enter the market.

2.5.4. Internal versus external organised crime

Traditionally, environmental crime within municipal and hazardous waste has been considered as an aspect of corporate crime: legal companies trying to enrich themselves by using illegal methods.²⁴¹ The closed market atmosphere has limited the involvement of external organised crime groups in the past.

Two exceptions to this perspective should be mentioned. On the one hand, criminal groups may become active in disposal of hazardous and municipal waste. This has already happened in the past with collection of municipal waste.²⁴² Nowadays, Italian organised crime groups have become active in illegal trafficking and dumping of (hazardous) waste.²⁴³ An estimated 13 million tons of toxic waste disappeared in the hands of criminal organisations in Italy in 2003. The specific nature of this crime makes legal waste business more and more a victim of crime, for they encounter difficulties in competing with prices offered by illegal groupings.

So far, involvement of organised crime groups in the waste management sector is rather limited. However, one could probably only say that involvement of criminal organisations in other European countries has not yet been widely noted. Opening up the market has the side-effect that external (for example criminal) organisations can enter the market more easily as well. Permit systems may or may not need to be clarified in order to deal with this situation. However, in case of public sector contracts (for example regarding municipal or nuclear wastes), the European and national public procurement laws apply, at least above certain financial thresholds. A question may be asked about the possibility of 'smurfing' large financial sums into a number of low-value contracts, in order to reduce scrutiny of suitability of waste management contractors. Environmental issues increase the amounts of money involved in the waste management industry: not only do opportunities to enter the market rise, the market has been made more attractive as well.

A specific situation is found in the nuclear waste area. For example in Russia, where the boundaries between organised crime and regular society became unclear during the 1990s, examples have shown that supply-driven economies, such as for example the nuclear waste industry, can be influenced by organised crime networks.²⁴⁴ These networks have no environmental or legal concerns and can therefore dispose of nuclear waste in a cheap way. Because of the transna-

²⁴¹ BRUINSMA, G., 'De afvalverwerkingsbranche' in *Inzake opsporing: enquêtecommissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 261-310

²⁴² JACOBS, J.B., FRIEL, C. and RADICK, R., *Gotham unbound: how New York City was liberated from the grip of organized crime*, New York, New York University Press, 1999, p.80-95

²⁴³ DI LELLO FINUOLI, G., 'Crime environnemental organisé: l'exemple de l'Italie' in *Environmental Crime in Europe: rules of sanctions*, COMTE, F. and KRÄMER, L. (eds.), Groningen, Europa law publishing, 2004, 103-109

²⁴⁴ LEE, R.W., *Smuggling Armageddon: the nuclear black market in the former Soviet Union and Europe*, Houndmills, Macmillan, 1998, p.47-57

tional shipments of nuclear waste under the excuse of reprocessing and the ambiguity over transporting it back to the country of origin afterwards,²⁴⁵ the hypothesis cannot be excluded that organised crime groups are indirectly involved in nuclear waste management in the rest of Europe as well.

2.5.5. Conclusion

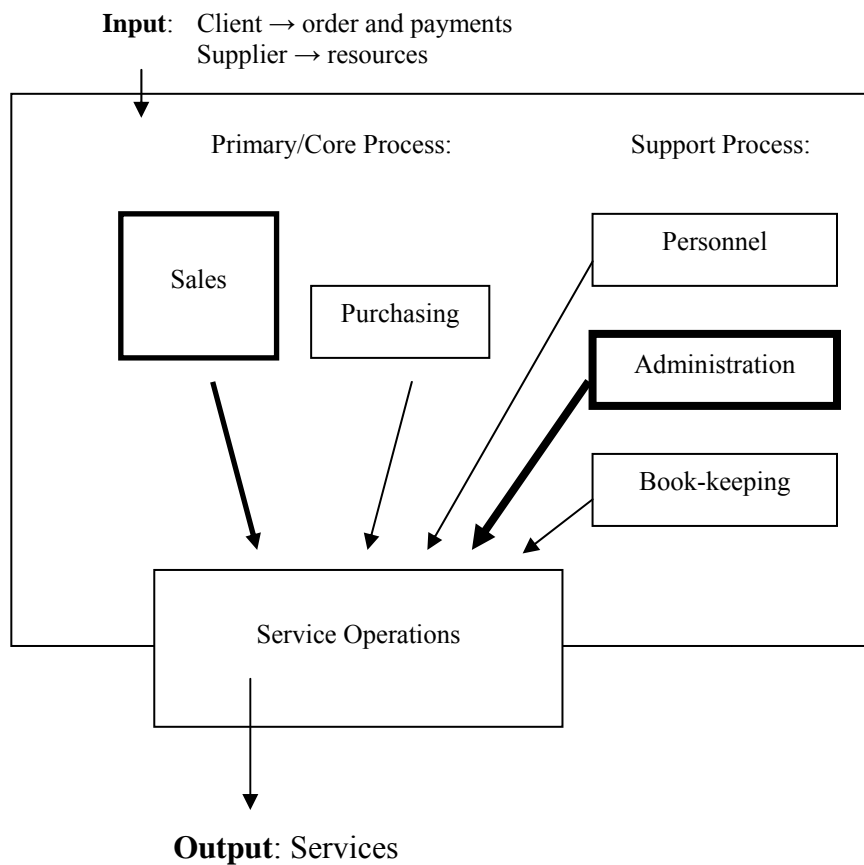
Involvement of crime in the waste management sector occurs in many ways. First of all, crime can be committed in order to dispose of waste in a cheap way. This is often accompanied by illegal transports of waste to low-risk regions. Additionally, the waste industry can be used indirectly as a channel to gain other profits. Then, the characteristics of the sector are used to minimise risks.

Traditionally, waste-related crime was committed by apparently legal organisations. This was facilitated by the characteristics of the sector. While some companies committed crimes, their illegal competitive advantage victimised other companies. In particular cases, involvement of criminal organisations from outside the waste industry has also been noted. Because of the growing attractiveness of the sector, this involvement is expected not to decrease.

²⁴⁵ GREENPEACE INTERNATIONAL, *Reprocessing*,
<http://www.greenpeace.org/international/campaigns/nuclear/reprocessing>

III. Reference model analysis

1. Model



Traditionally, commentaries on criminality in the waste management industry have focused upon two possibilities. In both cases, the focus has been on the disposal of waste: as a service that has been criminalised (e.g. improper disposal); or as a product that becomes adulterated (e.g. improper admixture and reuse). Depending on the waste streams concerned, the economic logic may be reversed, as what was waste is turned into something with a positive value, or at least the appearance thereof.

However, starting not from criminality but from the waste industry more broadly, and giving the business processes a closer look, it becomes clear that,

since producing waste does not constitute the aim of the business, it should be considered primarily as a service industry. Perhaps, due to public opinion, legislative activity and industry competition in reputation and marketing terms, all or parts of the industry is moving or will move towards recycling and creating new materials; however that goal has yet to be achieved as far as the majority of volumes and turnovers are concerned. The waste management industry today remains primarily a service industry, not a production industry. This makes the above described model applicable.²⁴⁶

Because of the heterogeneity of the waste management industry, this model varies to some extent. First, there is the division between the different stages of the waste management process. For companies that are mainly active in the collection business, the filling-in of these processes will in practice turn out to be different than for companies which deal with final treatment of waste. Nevertheless, the importance of the different processes can be roughly the same, as the influences of the surrounding factors (such as cluster, sector and environment) do not differ.

Within the waste management industry, additional differences exist between large firms and smaller companies, especially concerning support processes. In large companies, administration, personnel management and book-keeping constitute separate divisions. In smaller enterprises, however, this is not the case. There, support processes are often taken care of 'after work' by the business manager. This no doubt generates an additional burden on behalf of the manager, requiring extra effort.

2. Business processes

2.1. Purchasing

***Purchasing** generally refers to the buying of goods and services for use by the company or organisation. The activities constitute of determining which commodities, raw materials or services are the best; choose suppliers of the product or service: negotiate lowest price and award contracts that ensure that the correct amount of the product or service is received at the appropriate time.²⁴⁷ Acquisition of goods of the right quality, at the right time and in a cost-effective manner leads to the least expenses.²⁴⁸*

In the case of waste collection and transport, investments have to be made in **equipment**. Some of these matters are strictly related to the waste business and cannot be left out. Examples vary from trucks and containers to modified trucks

²⁴⁶ SCHOLZ-REITER, B. and STICKEL, E., *Business process modelling*, Berlin, Springer, 1996, 332p.

²⁴⁷ BUREAU OF LABOR STATISTICS, US DEPARTEMENT OF LABOR, *Occupational Outlook Handbook*, 2004-2005, <http://www.bls.gov/oco/ocos144.htm>

²⁴⁸ US MATERIALS MANAGEMENT OFFICE, *Purchasing*, <http://www.rock-hill.k12.sc.us/departments/operations/purcha.htm>

for refuse collection. Here, large companies may have a competitive advantage. Certain goods, such as trucks, are cheaper when they are bought in greater numbers. Reason for this lies in the organisation of the automobile business, where sellers are typically paid on commission.²⁴⁹ Therefore, it is more profitable to sell several vehicles at a slightly cheaper price than to sell a more limited number of cars. For larger companies, the right way to buy such goods is in multiples. Moreover, this confirms the uniformity of the company in terms of public appearance and servicing and staff training costs.

When situated in the area of waste treatment, purchasing is organised in a similar way. Only this time, it is not the amount that counts, but the size of the infrastructure. Investments include technological issues for treatment of waste in cases of incineration or other high-tech treatment, such as biomechanical treatment. Because each installation contains the same basic technology, prices between small and large facility equipment will not differ that much. Thus, if it is possible to use larger technological instruments (read: if you have the capacity to man every part of it), this is a favourable option. Also in cases of landfill, expenses are not left out. Land and sanitation costs may be the most important investments.

Turning to hazardous waste streams, additional purchasing efforts have to be made, especially in the field of **safety**. Storage methods are more demanding, since the environmental impact of for example leakage is more than serious. Combustion methods demand more investment, because the emission of dangerous gases has to be limited. Finally, in order to be able to perform these activities properly, prior sorting is required, in order to remove from the mixture any wastes that should not be incinerated.

For hazardous waste in general, but especially for nuclear waste, purchasing efforts have not only to be made in the safety area, but in the field of **security** as well. As the waste composition becomes more valuable, risks of appropriation of the waste increase dramatically. Nuclear companies have to spend on security teams as well as on technology. These teams must be able to prevent terrorist and other criminal attacks.²⁵⁰

²⁴⁹ BUREAU OF LABOR STATISTICS, US DEPARTEMENT OF LABOR, *Occupational Outlook Handbook*, 2004-2005, <http://www.bls.gov/oco/ocos144.htm>

²⁵⁰ ALLIANCE FOR NUCLEAR RESPONSIBILITY, *Factsheet #2 Security: Just the Facts: The Five Fatal Flaws of Nuclear Power*, San Luis Obispo CA, Alliance for Nuclear Responsibility, pp 1-2. <http://a4nr.org/articles/fatalFlaws/2.security.pdf/download>

2.2. Sales

*Sales refer to the primary duty, regardless of the type of product or service, to interest potential clients in the merchandise and to address any of the client's questions and concerns. Obtaining new account is an important part of the sales activity. The basic principle is that a sale can only be recognised when a transaction is realised, or can easily be so.*²⁵¹

For smaller companies, commercial activities mainly consist of individual, single ('one-off') contracts. Therefore the primary incentive of these companies is to become well-known within the market segments they are active in. It is their task to be competitive and in this way make their name on the market. Compliance with environmental issues may or may not be seen as offering a commercial advantage. At the very least, the firm must have the appearance of being 'clean'. The extent to which such an appearance may be probed and tested depends on the sensitivities of customers for these services, as much as on the regulatory regime.

Larger companies have possibilities to achieve more long-term contracts. Contracts for about ten years with a value of 100 million euro are possible.²⁵² These possibilities have increased through privatisation of refuse collection,²⁵³ for this market segment is quite stable and predicable. However, in reality, as competition in this area is very hard, the term of the contracts stays somehow limited.²⁵⁴ In this way, the authorities keep open the possibilities to change contractors if prices fluctuate.

Pricing issues depend on lots of aspects of waste streams. In relation to the amount of waste, both weight and volume have to be taken into account. Also the type of waste plays an important role. Nuclear or other hazardous wastes have a much higher price per volume than for example regular household waste. In cases of non-hazardous wastes, whether or not the waste streams are sorted influences the price.

This creates a list of rather 'fuzzy' issues. A central issue in product control in the area of waste is the **identity of the waste**. Types of waste, volumes and weights are hard to monitor and waste management companies depend on the information of their client. Although methods exist to do so themselves, applying

²⁵¹ INVESTOR WORDS, *Sales*, WebFinance, 2005, <http://www.investorwords.com/4365/sales.html>

²⁵² INDAVER, *Indaver en van Gansewinkel sluiten meerjarig verwerkings contract met een waarde van 100 miljoen €*, Indaver, 28/12/2005, http://www.indaver.be/Single_news_item.14.0.html?&cHash=bc519ae678&tx_ttnews%5BbackPid%5D=18&tx_ttnews%5Btt_news%5D=116

²⁵³ HEMMER, D., HÖFERL, A., *Privatisierung und Liberalisierung öffentlicher Dienstleistungen in der EU-15: Abfallwirtschaft*, Wien, Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OCPP), 2003, 35p.

²⁵⁴ Interview with Werner Annaert, general manager of FEBEM, the Belgian Federation of Environmental Management Companies, 03/02/06

these methods in practice is often not done. Comparing waste shipments with the administrative declarations may be difficult in light of the possibility of contamination of low-hazard waste by high-hazard elements.

From a policy point of view, the **environment** – or rather public concern about it – can be considered as a **new, additional client** in the waste management industry. Nevertheless, environmental issues are still governed by economics. It is therefore important that environmental issues gain influence in the waste management practice as well. Public authorities are, because of their limited economic interests, in the best position to enhance this influence. Short-term contracts, if they are organised in a way emphasising waste reduction, can create incentives for waste companies to cooperate with production industry to realise this.²⁵⁵

Authoritative sources suggest that, in order to achieve waste reduction results, waste management companies need time and possibilities to cooperate with manufacturing industry. This means that the contract term should be at least long enough for the service provider to benefit from its waste minimisation efforts.²⁵⁶ As foreseen by European public procurement directives, outsourcing of public contracts can include clauses and targets on waste minimisation as well as on price. Waste reduction can be advanced by cooperation contracts between waste management companies and manufacturing industry. Means of cooperation include the establishment of consortia in the area of take-back legislation.

As some industrial waste streams may become more hazardous, the sales situation may change to some extent, taking on costs and risks of environmental security. This means that disposal of hazardous waste becomes more expensive. Waste management companies can react on this in two ways. They may try to keep business on a competitive level, which may sometimes result in criminal behaviour. The environmental damage then increases more dramatically than for non-hazardous wastes. Another possibility may be that, as people might be more aware of environmental risks when dealing with hazardous wastes, the scrutiny of companies may increase, making environmental sainthood a necessary part of a company's image. The latter may be the case for example in nuclear waste management, which constitutes a unique position in waste management industries, precisely because of the general acceptance that the environmental risks are grave.

²⁵⁵ WOLSINK, M. and DE JONG, P., Waste sector structure: institutional capacity for planning waste reduction, *Tijdschrift voor economische en sociale geografie*, 2001, Vol.92, no.2, 148-163

²⁵⁶ OECD SECRETARY-GENERAL, Waste Contract Design and Management for Enhanced Waste Minimisation: a Synthesis Report, *OECD Papers*, 2004, Vol.4, no.4, 1-69

2.3. Book-keeping

*A discipline involving the recording of financial events in a series of separate and specified accounts is referred to as **book-keeping**. Such accounts may be kept manually within separate books of account or they may be kept on a computerized basis.²⁵⁷ It thus constitutes all financial transactions and record keeping that are handled, ranging from expenditures, receipts, accounts payable and receivable, and profit and loss.²⁵⁸*

Books in waste management companies are registered in two ways. First, both purchased products and sold services are subject to written preparations. For purchases, this implies the existence of order forms. For contracts, the first registration is performed by a tender. Thus, book-keeping divisions have, alongside regular invoices, preceding information concerning their purchases and provided services. This has to do with the prices involved in waste management, although most industries use this method nowadays. Secondly, the increase of information technology applications registers financial transactions electronically, and makes them easier to control. Exceptions so far may be Eastern Europe, where the recent transitional period postponed automatisation and increased controls to some extent, provides opportunities for all sorts of fraud.²⁵⁹

Book-keeping contains bottlenecks as well. For most clients, waste disposal is not a part of their core business. Thus, payment for waste disposal services often depends on the presentation of their financial reports. The proportion of defaulters may be slightly higher than in most industries.²⁶⁰

2.4. Administration

Administration refers to back office and administrative support activities ranging from data entry and processing data management, dispatching, IT support, etc. It consists of the performance or management of transactions and other matters, and the making and implementing of major decisions.²⁶¹

In a time span of less than thirty years, administration levels have significantly increased in the waste management industry. Licences are needed for all actors within the sector, not only according to the type of waste, but also according to

²⁵⁷ PEARSON EDUCATION, *Glossary*, 2004, <http://wps.pearsoned.co.uk/wps/media/objects/1065/1090612/glossary.html>

²⁵⁸ BUREAU OF LABOR STATISTICS, US DEPARTEMENT OF LABOR, *Occupational Outlook Handbook*, 2004-2005, <http://www.bls.gov/oco/ocos023.htm>

²⁵⁹ Interview with Werner Annaert, general manager of FEBEM, the Belgian Federation of Environmental Management Companies, 03/02/06 and confirmed by Nils Bagelius, Management Consultant at the Stockholm International Banking Institute

²⁶⁰ Interview with an operational manager of a waste management company, 22/03/2006

²⁶¹ X., *Administration*, Answers Corporation, 2006, <http://www.answers.com/topic/administration>

the type of transport (especially in cases of international transport) and even depending on the kind of treatment that will be applied.

Waste itself is very often difficult to identify. Therefore, the accompanying matters, such as **consignment notes and labels** become important. In fact, especially in cases of liquid and/or mixed wastes, these forms are the only easy way to define the waste stream. With the increase of the legislative framework, the administration gained even more importance. Through this, a serious overhead cost is created. One should not forget that these administrative controls ask for ever more manpower and resources (for example computers) without actually producing anything – except perhaps the means to enter regulated markets, to promote quality assurance and to give content to marketing claims.

Moreover, these administrative rules also create specific possibilities for fraud. In the case of waste types, hazardous wastes can be mixed with other, non-hazardous waste, in order to avoid stricter regulations and to be able to deal with it as regular waste. In the field of treatment, rules are more lenient when it comes to waste which is meant to be recycled than for wastes that are to be disposed of. Therefore, wastes may be declared to be transported towards recycling facilities, which is not always the case.

Additionally, fraud also occurs in the area of international transports. As the international transports of hazardous wastes are regulated by the Basel Convention and other, derived measures,²⁶² it may be interesting to forge shipping documents in order to export wastes and avoid application of the prescribed rules.

Thus, administrative issues have risen seriously, although the rewards are minimised. This makes this part of the business process difficult to sustain.

2.5. Personnel management

Personnel management refers to human resources, training, labour relations, recruitment of new personnel, etc. In an effort to improve morale and productivity on the workplace and to limit decay of moral standards, these activities are directed at helping the organisation effectively use employee skills, provide training opportunities to enhance those skills and boost employees' satisfaction with their jobs and working conditions.²⁶³ It contains matters such as communication, team developing, conflict managing, coaching, giving and receiving

²⁶² UNITED NATIONS SYSTEM-WIDE EARTHWATCH, *Implementing the Basel Convention*, United Nations, <http://earthwatch.unep.net/emergingissues/hazardousw/baselconvention.php>

²⁶³ BUREAU OF LABOR STATISTICS, US DEPARTEMENT OF LABOR, *Occupational Outlook Handbook*, 2004-2005, <http://www.bls.gov/oco/ocos021.htm>

*constructive feedback and motivating and guiding individuals and/or groups to achieve specific goals.*²⁶⁴

Personnel management in the waste sector is not an easy task, and one may assume that this will not become easier in the near future. Actual personnel control may be difficult in areas where personnel are functioning away from the company itself. In the waste management industry, this is mostly the case in the collection and transport stages, which occur per definition out of office. Only sorting, recycling and treatment are activities that take place within the company, making it easier to control the behaviour of the employees.

Training becomes ever more important, since regulation standards and minimum requirements have significantly increased. Thus, expectations have risen. However, so has professionalism. This could well influence matters such as job satisfaction. On the one hand, additional expectations may cause the feeling of more burdens to work properly. On the other hand, people could also correspond more positively, as they are more respected for their professionalism and their capabilities to cope with the long-term environmental and governance issues as well as the short-term waste removal.

Sorting becomes more important, from the waste producing source onwards. This means that some waste streams have become much cleaner, because they are separated from the rest of the waste. For municipal waste, examples may be glass and plastics. Thus, collection and treatment of these streams became cleaner as well, which might to some extent lead to increased job satisfaction.

In cases of hazardous waste, job satisfaction may be linked to the **exposure to hazard**. Thus, proper protection measures are required, by means of clear labelling of waste streams, or by means of protective clothing. The latter will especially be important when the gradation of hazard is unclear, for example because of mixture of wastes.

The same counts for nuclear wastes, taking into account the additional risks of ionising radiation. From this perspective, the Euratom Directive of 13 May 1996 laid down the basic standards for the protection of both workers and the general public.²⁶⁵ Not only in ways of obvious risks have measures been taken to protect against radiation. Also in areas where radioactive waste may sometimes appear, such as the scrap sector, efforts have been made to minimise radiation risks.²⁶⁶

Thus, personnel management is characterised by both higher expectations and a higher degree of professionalism, compared with for example 15 years ago.

²⁶⁴ CENTER FOR EDUCATIONAL DEVELOPMENT AND ASSESSMENT, *Personnel Management*, CEDA meta-profession project, http://www.cedonet.com/meta/personnel_management.htm

²⁶⁵ Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation, *Official Journal* L159, 29/06/1996, 1-114

²⁶⁶ Interview with Chief Commissioner Frans Geysels, Belgian federal police, 15/02/2006

Alongside personnel management in the narrow sense, the corporate culture may play an important role as well, for it may influence the attitude of employees.²⁶⁷ This could cause incentives towards crime directly and indirectly. Indirectly, because managers of waste companies are mostly a part of them for quite some time. Therefore, they have experienced the upcoming load of legislative measures, which are mostly not that profitable from the point of view of existing processes and accustomed practices. Thus, managers of these companies may unconsciously pass on their attitude towards legislation to their employees. Besides, there may also be a direct influence. Because waste regulations are mostly very unclear, it is normal that companies try to explore and exploit the borders of this regulation. This could create the idea with employees that regulations should not be followed that strictly.

In the area of hazardous and, especially, nuclear waste, the situation appears to be somewhat different, due to greater risks involved. However, this does not mean that there is no scope for scientific uncertainty and managerial and staff ambivalence. Any appraisal of risks will be controversial, partly because of entrenched political, economic and value positions to be found in the public arena, and partly because of the difficulty of defining *low probability* of crime and other adverse events: how low does *low probability* have to be, to be regarded as *zero probability* for all practical purposes? In a spirited exchange of views in the US, a panel of advisers expressed concern about terrorist action against pooled nuclear waste, leading to radioactive fires,²⁶⁸ whilst the regulator referred to such scenarios as ‘improbable’.

2.6. Services operations

*Production refers to the actual making and delivering of finished or non-finished goods aimed at the customer's needs. Here, this can be translated to **services operations** meaning the actual making and delivering of services aimed at the customer's needs.*

Until the end of the 1980s on, the services provided by the waste management industry concerned mainly the disposal of waste, putting away the client's trash. The logics of the sector were almost purely economic.

As the waste industry is in fact a service industry, the provided service has to be tuned to the demands of the client. Nevertheless, some limits and changing demands are inevitable. For waste collection, these limits are related to the amount of collection activities within a certain time span and to the volume of the waste collection.

²⁶⁷ COOLS, M., *Werknemerscriminaliteit: criminaliteit tegen bedrijfsactiva strafbare gedragingen gepleegd door werknemers in grote bedrijven*, Brussels, VUB Press, 1994, 287p.

²⁶⁸ COMMITTEE ON THE SAFETY AND SECURITY OF COMMERCIAL SPENT NUCLEAR FUEL STORAGE, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report*, Washington, National Academies Press, 2006, 126p. selected pages available online, <http://darwin.nap.edu/books/0309096472/html/25.html>

From the client-side, demands are influenced by for example the type of climate, as hot climates imply more frequent collection, due to odour inconvenience.²⁶⁹ Also densely populated areas, where people have no proper waste storage facilities, ask for a more frequent waste collection, especially if combined with a warmer climate. Not only the frequency of waste collection, but also the amount of waste to be collected may vary. Determining factor in this case may be the economic activity of the client. Restaurants and grocery shops generate more waste than households and administrative offices. A forthcoming solution can be the availability of different types and sizes of rubbish skips.

With more recent evolutions in policy issues, the provided service has changed to some extent. Nowadays, next to the waste disposal itself, another service has made its entrance on the market, namely the absence or minimisation of environmental hazard. It is thus the purpose of the waste management industry to provide the service of waste disposal and at the same time to cause the least possible damage to the environment. Thus, another client has been added to the waste business.

Yet, this client fulfils a rather unique role. On the one hand, it is some sort of ideological client, represented by an environmental consciousness. On the other hand, the actual client may even not exist yet. As environmental issues are situated in the long-term perspectives, future generations may constitute the additional clients. It is mostly these generations in whose interest the environmental damage should be limited.

Nowadays, the practice of for example waste management has been limited in several areas. One of the limits occurs in the field of space restrictions, especially in the case of landfill. Conditions for landfill sites are related to both geographical and environmental factors. Environmental limits also influence other treatment methods, such as incineration.

Although people are aware of their environmental inheritance towards future generations, the economic interests are very often otherwise. One should not forget that environmental issues imply huge investments, for which only a marginal short-term result is received in return. From an environmental point of view, the best waste is no waste.²⁷⁰ It is clear that this differs from the historical economic perspective of the waste management sector, however there may yet be a synthesis. A forward-looking crime vulnerability analysis will have to look at these possibilities.

²⁶⁹ WORLD BANK ENVIRONMENT DEPARTMENT, *Environmental assessment sourcebook II: sectoral guidelines*, Washington, World Bank, 1991, p.211-212

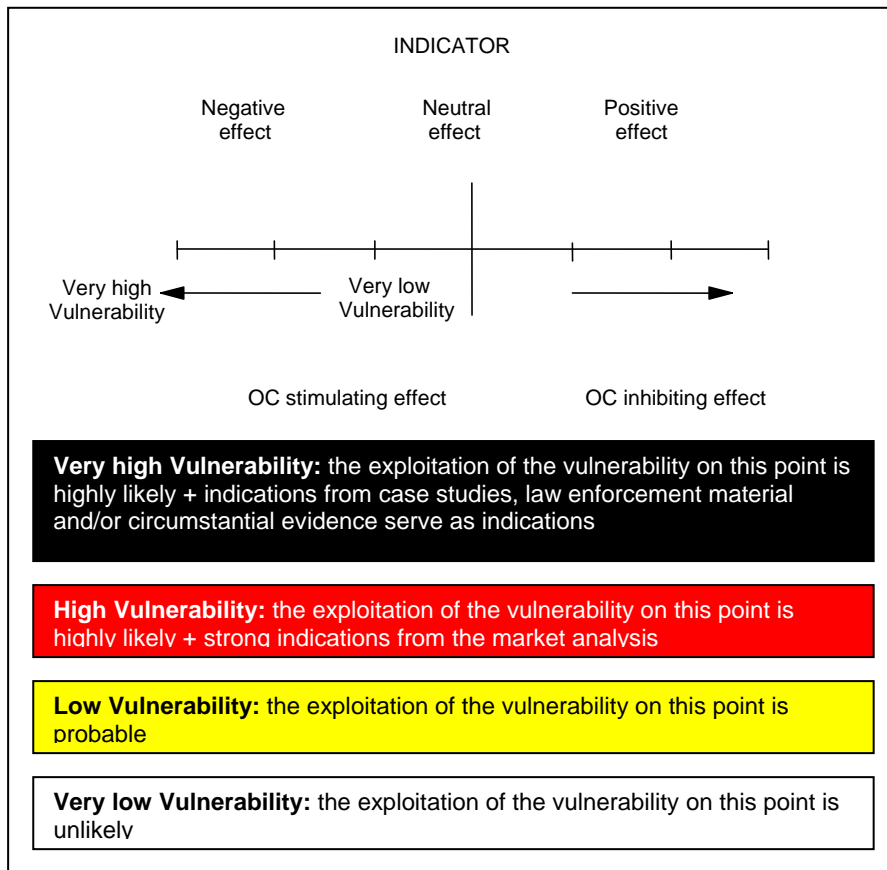
²⁷⁰ BORZAGA, C., OLABE, A., GREFFE, X., *The Third System, Employment and Local Development, Vol.2: Key Sectors*, European Commission, Employment, Social Affairs and Equal Opportunities, http://europa.eu.int/comm/employment_social/empl_esf/3syst/vol2_en.pdf

C. Analytical phases

During the analytical phases, it is the intention to use the gathered information to assess the vulnerability of the sector. This is performed in two ways, by means of a width scan and a depth scan.

Within the width scan, the information which is gathered on the meso- and macro-level (sector analysis, environmental scan and cluster analysis) is translated into the developed indicators. For the depth scan, the micro-level information is used to point out the vulnerability of the relevant business processes of the waste management industry. Although the term ‘indicator’ is used, this should be considered in a more moderate way, as they are sensitising issues, rather than deterministic ones.

Scoring is divided into four possibilities and can be situated as follows:



The scoring technique which is applied cannot be considered as a mathematical issue. They are the outcome of balanced decision-making. Hence, the use of four

scores rather simplifies the outcome and cannot be regarded without taking into account the reasons behind these decisions.

I. Width scan

In the width scan, the information which was gathered, processed and ordered on the meso- and the macro-level, is used to perform the vulnerability assessment in width. The developed indicators have been structured and grouped into a diagram, containing four major branches. These branches are made up of indicators which may be, in turn, broken down into sub-indicators. These branches are:

- Branch 1: Nature of the Product
- Branch 2: Threshold
- Branch 3: Alternative Markets
- Branch 4: International Context

After discussing the separate branches and their relevant indicators, the four branches have been brought together in a large diagram, providing an overview of the vulnerability of the sector as a whole.

1. Branch 1: Nature of the product

The indicator ‘Nature of the Product’ refers to a series of qualities, which can be divided into six subdivisions.²⁷¹ Within the context of the waste management industry, as the ‘product’, the service of waste management should be regarded.

1.1. Product integrity

‘Integrity of the product’ refers to the degree to which the quality or physical nature of the product/service can be manipulated or counterfeited. The methodology argues that low corruptibility results in low vulnerability, as it makes deception or fraud harder.

As in this case, there has been dealt with a service industry, ‘counterfeiting’ should be regarded as fraud and giving the service another view.

²⁷¹ These subdivisions are ‘integrity of the product’, ‘product mobility’, ‘elasticity’, ‘compatibility’, ‘product differentiation’ and ‘stability of the value’

For waste, two possibilities of counterfeiting exist. On the one hand, waste management can be performed under cover of the second-hand market. Although the second-hand market is a legal alternative, it may be abused by criminal groupings. Taking into account the several stages of waste management, this counterfeiting almost exclusively takes place within transport stage. As transport is involved between most other stages, this offers the opportunities to outrun the principle which states that waste should be dealt with as close as possible to its place of origin, creating possibilities to deal with waste in an improper way.

On the other hand, within waste management itself, counterfeiting may occur as well, especially considering the gradations of hazard. Hazardous, particularly liquid wastes can be easily mixed with other, non-hazardous wastes, in order to keep the gradation of hazard under the legal limits. Then, waste is considered to be non-hazardous and it can be transported more freely and be treated in a less regulated way.²⁷²

Because of these two possibilities to counterfeit the waste management service, the indicator ‘integrity of the product’ could be labelled as **highly vulnerable**.

1.2. Product mobility

‘**Product mobility**’ is taking into account the number of places where the product can or must be traded and can be transported with low visibility. The methodology follows the reasoning that the more a product is mobile, the higher its vulnerability, because this mobility hampers controls.

A distinction has to be made between the different stages of waste management. Looking at collection and transport, one could say that waste management is executed everywhere, for every shop, every company, even every household. Considering the further stages of waste management, however, the places involved are much more limited. Moreover, the places in which further treatment takes place are registered as such, concentrating waste management activities to a large extent. The visibility (both legally as literally) of those facilities limits the possibilities for exploitation by organised crime groups.

The methodological framework of this study argues that high mobility results in a high vulnerability, because it makes products less visible during transport stages. In this case however, the existing mobility is inevitably linked to the nature of the industry. A service industry is always related with high levels of mobility. Waste transports are inevitable for the continuity of the waste management chain. Taking this into account, and regarding the growing visibility and decreasing mobility in the later waste management stages, the choice has been made to award this indicator with a **low vulnerability** score.

²⁷² This was confirmed by both law enforcement agencies and company people during interviews on respectively 15/02/2006 and 22/03/2006

1.3. Product elasticity

With ‘**elasticity**’, the change in demand when the price fluctuates is meant. A product is characterised by high elasticity if a 1% rise of the price results in a drop of demand by 1% or more. The MAVUS methodology indicates that high elasticity results in low vulnerability. Reason behind this is the fact that elasticity functions as an informal regulating mechanism, making it more difficult to fraud.

The waste management industry is characterised by a low elasticity. Waste prices do not considerably influence waste generation. Waste prices have risen during the past decades, and so have the amounts of waste. Although people can be aware of the costs of waste generation, it is hard to act accordingly. While the end-user has to pay the price for waste management, waste generation finds its origin already to a large extent during the production process, for example for packaging and packaging waste. For nuclear waste, the increasing need for energy creates a low degree of elasticity.

Moreover, price increases are often explained by ways of sound environmental protection and development. The growing environmental consciousness of people leads to a more general acceptance of a higher price for a greener future, and hence, a higher cost for proper waste management.

Alongside that, waste management cannot be replaced. Some alternatives exist, such as recycling for municipal and reprocessing for nuclear waste. Yet, these activities can only account for a part of waste management, and are mostly even considered as aspects of waste management. Thus, emphasising these options only shifts the focus of waste management; it does not make waste management replaceable.

Elasticity of the waste management service thus appears to be very low. The methodology states that a low elasticity results in high vulnerability, as it makes the product interesting as means of payment or as investment for criminal organisations. Moreover, with a very elastic product, specific vulnerabilities towards criminal activity, such as price fixing, increase. Therefore, we could give the indicator ‘elasticity’ the notion of **very high vulnerability**.

1.4. Product compatibility

‘Compatibility’ refers to the degree to which the qualities of the product are compatible to other illegal activities. The road map for vulnerabilities states that high levels of compatibility will lead to high vulnerability, since the criminal entrepreneur then has the options to use the product/service in criminal strategies as well, making infiltration attractive.

Hereby, a distinction has to be made between environmental crimes dealing with waste on the one hand and compatibility of waste management with other crimes on the other hand. For the first case, cases are known in which waste is dumped, trafficked and stored illegally. Methods to do so differ according to the nature of the waste streams and so do the risks to be caught.

However, looking at the compatibility of crime with waste management itself, this is much more limited. A possible example could be the option to conceal crimes. Hereby, the waste management could be used to make evidence disappear. The combination of not notifying (or pretending not to notify) and the heterogeneity of wastes creates a situation in which only per definition suspicious goods lead to concern. Moreover, the source of the evidence is untraceable.

Given that there is only one possibility of compatibility with other crimes – concealing crimes – and that the compatibility for waste management is lower than for waste itself, this indicator could be awarded a score of **low vulnerability**.

1.5. Product differentiation

‘Product differentiation’ deals with the degree to which it is possible to identify common goods and the degree of homogeneity and heterogeneity of the service. The vulnerability that stems from this characteristic can be related to specific crime types: heterogeneity makes it economically interesting to illegally copy brand products, whilst homogeneity hampers the traceability of it.

The waste management industry is characterised by a high degree of heterogeneity. Various waste streams for example require different methods and different ways of treatment. Moreover, the same accounts for the several stages of waste management, in which a variety of activities takes place. Finally, on a European level, national differences exist as well. The combination of these variations results in different prices, different legislation, different work-capital proportion and different technology. This means that, for criminal groupings, several types of investments and organisations have to be set up in order to gain numerous profits. This makes it a less interesting investment and lowers the vulnerability of entering the legal sector.

However, criminal groupings can, by deliberately staying out of the legal sector, avoid this heterogeneity and cut corners to deal with waste illegally, making their costs much lower and, thus, their profits higher.

Because of the heterogeneity of the waste management industry and the difficulties to become active in the whole series of activities, infiltration in the legal industry is less likely. Hereby, **two options** could be followed. As one could argue the framework of the study at this stage mainly focuses on the vulnerability of licit sectors, the choice can be made to consider infiltration risks outweighing the black market opportunities. This would then result in a very low vulnerability score. On the other hand, if one chooses to take illegal waste management itself into account as well, one could say that criminals have the possibility of cutting corners, overruling the difficulties which accompany heterogeneity. This indicator could then be given a high vulnerability score.

1.6. Value stability

Finally, **‘stability of the value’** refers to the degree to which the product retains its physical value for a short or a longer period. The MAVUS methodology states that stability can function both as a restriction for organised crime (as preservation takes expensive measures) or as an opportunity (as it may be interesting as an investment).

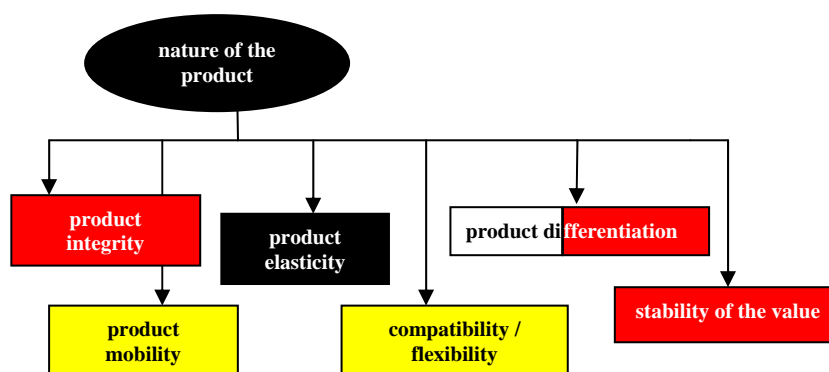
For waste management, several issues are hereby taken into account. Waste itself does not perish. Thus, if stored properly, further treatment can be postponed without loss of value. Alongside that, prices for waste management are quite stable and slightly rising over time. On the one hand, this is linked to the stable price of waste itself. On the other hand, this can be considered as a consequence of the environmental efforts to be made. Because of the investments made in this perspective, achieving long-term and/or repetitive contracts becomes ever more important.

Environment is an important issue in waste management, leaving not much room for dramatic price drops. Although this has led to cases of price fixing in the past, the growing openness and concurrency nowadays stabilises this value. Additionally, technological requirements related to the environment are ever increasing, resulting in a slight but continuing increase of costs, and hence, prices.

Because these growing costs related to environmental issues, improper waste management becomes more attractive. Taking into account the stability of the market as well, one could conclude that the waste management market is becoming a highly attractive way of investment for criminal groupings. Therefore, this indicator can be awarded a score of **high vulnerability**.

1.7. Nature of the product: conclusion

Due to the inevitable relationship between our ‘product’, which is the waste management service, and waste itself, and taking into account the heterogeneity and inelasticity of both waste itself and the service, the indicator ‘**nature of the product**’ appears to be responsible for vulnerabilities, both in the licit segment of the sector and in the illicit segment. Therefore, this indicator can be given a notion of **very high vulnerability**.



2. Branch 2: Threshold

The second branch ‘threshold’ describes the barriers to enter the market. This branch is operationalised by an economic component and an institutional component. The economic component describes the economic market, while the institutional component refers to regulations and enforcement.

2.1. Regulations and enforcement

Within the indicator ‘threshold’, the limits to enter the legal sector are described. Hence, the high quantity and quality of both regulations and enforcement are considered to heighten the threshold. This in turn lowers the vulnerability, as it then becomes harder for illegal entrepreneurs to enter the legal market.

2.1.1. Regulations

This sub-indicator is further divided into two parts: one refers to the quantity of the regulations, the other to the quality.

2.1.1.1. Quantity

Within the item '**quantity of the regulation**', questions have been addressed as to whether there is sufficient legislation, dealing with all aspects of the sector. 'Sufficient' hereby means that all issues are regulated, without leaving loopholes that could be exploited by organised crime groups.

Within the waste management industry, a whole series of legislation exists, regulating waste management in general, including the different stages. Both penal law and administrative law are hereby important. Permit systems exist in which collection, storage, transport and treatment of waste are subject of regulations. These permit systems are more strict when dealing with hazardous waste and nuclear wastes. Also the regulations concerning consignment notes are stricter for hazardous and nuclear waste than for municipal waste.

Alongside that, legislation concerning specific waste streams exists as well. This is very often related to environmental harm reduction through means of limiting waste generation and increasing reuse and recycling. Examples of waste streams subject to these regulations are packaging and packaging waste, electronic waste and end-of-life vehicles.

A possible loophole exists when taking into account waste brokers. Most regulation deals with obligations and restrictions for the owner of waste. For brokers, however, waste does not legally become their property. Hence, they mostly escape from a direct legislative influence.

Due to the variety and large scope of the legislative framework, and taking into account the limited, though existing loopholes, one could give the indicator 'quantity of regulation' a **low vulnerability** score.

2.1.1.2. Quality

Existence of legislation as such is not enough when evaluating regulations. Therefore, '**quality of the regulation**' is important to be examined as well.

In relation to waste management, this leads to different results. Waste is defined in a functional way. This has created a situation in which it is not always clear as to whether a product is waste or not. This leaves much room for interpretation. Also the gradation of hazard leads to indistinctness, especially related to so-called mirror entries. These are only considered to be hazardous over a certain

concentration. As the options for transport and treatment are linked to this classification, incentives exist to mix hazardous with non-hazardous waste, in order to achieve a waste stream which is considered to be non-hazardous.

Alongside that, the waste market is becoming more and more internationally oriented, for example in relation to incineration of municipal waste. However, national waste classifications still differ to a large extent.

Indistinctness can be found on national levels as well, for example in the Italian case. Deregulating digging sites and petroleum coke, and a particular interpretation of the waste definition,²⁷³ created the risk of becoming a safe haven for polluters.²⁷⁴ Also in other member states, indistinctness in the definition of waste resulted in convictions by the European Court of Justice.²⁷⁵

One of the major problem areas, especially in the international field, concerns liability, which often differs between countries. The Romanian-Hungarian Aurul case could be seen as a classic example. Hereby, about 100,000 cubic metres of tailing water containing free cyanide was spilled into a river system in north-west Romania, causing an environmental catastrophe on Hungarian soil. Liability issues and legal differences however caused some sort of stalemate in the discussion about responsibility and sanctions.²⁷⁶

More uniformity and clarity are wishful, concerning both the definition of waste and the specific waste streams, particularly concerning the gradations of hazard. Therefore, the 'quality of the regulation' can be assessed as **highly vulnerable**.

2.1.1.3. Regulations: conclusion

Taking into account the combination of considerable quantity and the occurrence of vagueness of regulation, the indicator '**regulations**' could be given the notion of **high vulnerability**.

²⁷³ AMENDOLA, G., 'Need for a strengthening of criminal environmental law? The Italian case' in *Environmental Crime in Europe: rules of sanctions*, COMTE, F. and KRÄMER, L. (eds.), Groningen, Europa law publishing, 2004, 177-195

²⁷⁴ FERRIGNO, R., *A case study on the implementation of EU environmental legislation*, European Environment Bureau, 2003, <http://www.eeb.org/activities/waste/ITALY-waste-report-March2003.pdf>

²⁷⁵ ERMAROCA, F., Community Legislation and Jurisprudence in the Area of Waste Management: Recent Developments, *Reciel*, 1998, Vol.7, no.3, 274-282

²⁷⁶ BANDI, G., 'Liability and sanctions, criminal liability in Hungary' in *Environmental Crime in Europe: rules of sanctions*, COMTE, F. and KRÄMER, L. (eds.), Groningen, Europa law publishing, 2004, 127-142

2.1.2. Enforcement

Creating legislation is one thing, applying them is another. Therefore, it is important to consider enforcement in the framework of the legislative aspect. Because enforcement means the practical application of the law, it has an important impact on the legal framework. Again, the division has been made between quantity and quality.

2.1.2.1. Quantity

‘Quantity of enforcement’ refers to the degree of control a sector can expect to be confronted with. The more regular the controls are, the bigger the chance of detecting irregularities and the more knowledge is gained about the evolution of the sector.

Within the waste management sector law enforcement by police stays rather limited to the transport stage. The impact of this should not be underestimated, as transport controls reveal information on both the preceding and the following stages, through means of consignment notes and identification forms. Nevertheless, this only provides information on the in- and output of waste management companies. The number of controls dealing with waste transports is limited, so chances to get caught are not that big.

Further controls are established by administrative authorities. In this way, other stages of waste management are subject to a periodic degree of control as well. The frequency of controls depends on the waste stream. For nuclear waste, external controls are present almost permanently. For hazardous waste, environmental controls are performed once in a few months, while municipal waste is controlled less often. Alongside that, informal controls exist as well. These are mostly either executed by federations (on an economic level) and NGOs (on an environmental level).

Environmental crimes can be placed in the group of so-called victimless crimes. Environmental crimes are rarely revealed after actual complaints. The collective and unclear victimisation gives law enforcement agencies no easy starting point for investigations. They mostly have to rely on indirect information and own initiatives, making it hard to work in an efficient way. As a result of this nature, the occurrence of these crimes is often only revealed after several years, such as in the Belgian Mellery-scandal,²⁷⁷ where lacking regulation resulted in the acquittal of the suspects. Alongside that, measuring the impact of these crimes is even more difficult.

²⁷⁷ Interview with Chief Commissioner Frans Geysels, Belgian federal police, environment department, 15/02/2006

In order to perform controls, the presence of specific equipment and training is needed. Hence, profound controls of waste transports cannot be included in routine traffic controls. Alongside that, this equipment cannot always be present. This has as result that controls often require a numerous time span, because of which the image of these controls are negative for the companies, in a way that they mean loss of time and money.

The frequency of law enforcement controls is limited. This creates opportunities for illegal activities, but is slightly compensated by administrative controls. Yet, the specific nature of environmental crimes hampers establishment of proper controls. Hence, this indicator can be awarded a score of **high vulnerability**.

2.1.2.2. *Quality*

‘Quality of enforcement’ takes into account the actual practice of controls. The higher the quality will be, the lower the vulnerability towards organised crime. For waste management, bottlenecks are encountered during the investigation and control, but also during prosecution and trial.²⁷⁸

Both penal and administrative controls share one problem. They are oriented on a national level, while the waste market itself has increasingly opened up in an international context. Therefore, the controlling agencies increasingly have to deal with waste streams which are beyond their scope. The national legislative differences do not only hamper the regular companies in their international development, they also provide opportunities for irregularities by offering possibilities to enter the market in a less visible way.

More specific for the administrative bodies, it can be considered a negative aspect that the institutions which control and evaluate permit conditions are often the same that issue the permits. This gives the people dealing with permit matters many powers in a procedure which takes place mainly behind closed doors. This makes them highly vulnerable towards corruption.

Finally, judging the quality of informal controls is very hard. Although federations do influence the activities of their members, they have no control over non-members and cannot gain access to inside company information. Moreover, they have no possibility of coercive measures. Although they represent the economic interests of the sector, they can nevertheless be believed to influence decision-making and they have a moral function over their members. In any case, people from within the sector are not supportive towards the threat of immediate penal sanctions.²⁷⁹ NGOs in turn can only look after the outside information of the

²⁷⁸ VELDKAMP, A.M.E., ‘Grensoverschrijdende overbrenging van afvalstoffen’ in *Strafrechtelijke aanpak van grensoverschrijdende milieucriminaliteit, capita selecta*, HENDRIKS, L.E.M., BIEZEVELD, G.A. and VAN RIJSWICK, H.F.M.W. (eds.), Zwolle, Tjeenk Willink, 1996, 56-58

²⁷⁹ WALING, C., *Bedrijfsinterne milieuzorg: de keerzijde van transparantie, Justitiële verkenningen*, 1999, Vol.25, no.2, 44-50

waste management industry. They can put pressure on the legislator to enhance environmental protective measures, but cannot directly influence the waste management industry.

Because of the indistinctness for most levels of controls, the indicator ‘quality of enforcement’ can be awarded a **very high vulnerability** score.

2.1.2.3. Enforcement: conclusion

The amount of enforcement possibilities in the waste management sector is quite differentiated. Alongside the, rather limited, controls by police, enforcement is also performed by administrative authorities and on an informal level. On a quality level, these controls unfortunately all have their disadvantages. Police controls can only be performed in specific moments of waste management, mostly being transport, administrative controls could be subject to certain degrees of corruption and finally, the quality of informal controls is unclear as well, due to their nature. Therefore, the indicator ‘**enforcement**’ can be said to be **very highly vulnerable**.

2.1.3. Regulations and enforcement: conclusion

The indicator ‘**regulations and enforcement**’ can certainly be described as one under pressure. Loopholes, indistinctness, fragmentation and conflicting interests seem to characterise it. Nevertheless, pointing the finger at the authorities would certainly be too easy, as the materials they are dealing with are extremely complex, making it difficult to draw lines and to enhance the decisions. Hence, a **high vulnerability** score can be given.

2.2. The market

As a part of the indicator ‘threshold’, the sub-indicator ‘market’ describes the economic barriers to enter the market. Hereby, a division has been made between ‘market structure and market concentration’ on the one hand and ‘required capability’ on the other.

2.2.1. Market structure and market concentration

As concerns the market structure, this indicator will be further assessed by splitting it up into three sub-indicators.

2.2.1.1. Market type

Examining the **'market type'** a difference can be made between monopoly, monopolistic competition, oligopoly and open market. Hereby, each structure can create opportunities for organised crime. Whereas a monopoly gives more opportunities, for example for price fixing, an open market could create more incentives and pressures for illegal activities, in order to cope with fierce competition. Related to entrance to the market for newcomers, especially open markets are considered to be more vulnerable, for the market has few barriers in that case.

In relation to waste management, the three discussed waste streams are part of different market types. The municipal waste market is characterised by a growing openness, companies on the hazardous waste market constitute more of an oligopoly, and the nuclear waste market is tending towards a monopolistic market, which is very specific because of the influence of the public authorities. However, the same goes for the clients on all three markets. Hence, the number of players diminishes as a higher degree of hazard is involved.

For the nuclear waste industry, waste management forms an important part of the industry. The public concern and the link, mainly with the public energy sector create a specific situation. Nuclear waste companies are either thoroughly controlled by several instances, or are part of public authorities. Depending on the size of the markets, as the nuclear waste market is at the moment still mostly oriented nationally, there is room for one or several players. In any case, the nuclear waste market is a monopoly or a monopolistic market.

Concerning hazardous, and even more for municipal waste, the market is oriented in a more competitive way. This creates incentives for companies to deal with waste illegally, in order to gain higher profits. In the future, this competition is even more likely to increase, as an internationalisation of the market will become more intense. For hazardous waste, the number of players is slightly more limited.

The methodological framework of this study links competition to higher vulnerability, as this puts financial pressures on the market players, creating incentives to augment profits in illegal ways. Due to the different nature of the waste markets, **several options** can be given here.

For nuclear waste management, the monopolistic market results in a low vulnerability. For other waste streams, higher levels of competition lead to higher vulnerability, following the methodology. These streams are also characterised by a certain amount of moderating effects. Cases are known of companies that, in the past, were able to deal with waste in an illegal way, because they nearly obtained a monopoly, making it almost impossible for the authorities to control them.²⁸⁰

The vulnerability which has been described for this indicator is linked to growing forms of competition. Particularly for the waste management industry, this is not an exclusively negative impact. The opening up of the market during the past

²⁸⁰ KAMERLING, R.N.J. and PHEIJFFER, M., *Vijftien over fraude*, Amsterdam, Koninklijk Nivra, 1999, p.49-62

decades has resulted in a higher level of control and a broader insight in the waste management industry, reducing the opportunities for improper waste management. Thus, the vulnerability, related to the market structure has shifted and should be dealt with accordingly.

2.2.1.2. Saturation of the market

‘Saturation of the market’ is a rather positive indicator which defines one of the difficulties for new companies, both legal and illegal, to enter the market. It makes infiltration by illegal entities harder, and hence, lowers the vulnerability.

For the waste management sector, saturation is increasing. On an economical level, market is still expanding, due to increased waste generation. Nevertheless, this expansion mostly comes to the benefits of the already existing companies, because of their competitive advantages. Newcomers have limited chances to succeed entering the market and evolutions on the market are mostly characterised by mergers.

On an environmental level, saturation exists even to a larger extent. Environment plays an increasing role, putting pressure on waste generation and waste management to deal with waste in an environmentally sound way.

The methodology considers low saturation as highly vulnerable and vice versa. Reasons for this lie in the fact that a high degree of saturation makes it difficult for new competitors to enter. As this is the case for illegal entities as well, infiltration of the market then becomes less likely. Because of the existing saturation on an environmental level and increasing saturation on an economic level, this indicator can hence be given a notion of **low vulnerability**.

2.2.1.3. Competition

The level of **‘competition’** indicates the performance pressure on especially new and smaller companies in order to maintain themselves on the market. If competition is very high, risks of becoming more susceptible to illegal coping strategies will increase, and so will vulnerability.

In relation to waste management, two evolutions have been noticed: the number of new companies has been on a low level and the degree of mergers has been higher more persisting than in other sectors.

These pressures can result to criminality in several ways: companies can deal with waste illegally to increase their profits, particularly new and small companies can decide to act improperly in order to be able to survive, and companies can commit crimes because they feel harmed by criminal competitors.

The waste management industry is characterised by an important evolution in this area. Merger activity has created a situation in which a small amount of players constitute a large market share.²⁸¹ Thus, competition is mitigated by growing concentration. This concentration is used to assess the indicator competition. Thus, for the largest share of the market, concentration is substantial. For the remaining part, however, this is not the case. Due to competition levels, infiltration of the market by criminal entities is more likely to happen in the segment of smaller companies. When this specific section is taken into account, this indicator could be given a score of high vulnerability. However, one could also consider the market as a whole. As the segment of small companies represents only a limited market share, the overall vulnerability related to competition could be judged as lowly vulnerable.

2.2.1.4. Market structure and market concentration: conclusion

This indicator has been split up into three parts. As a combination of the vulnerabilities of ‘market type’ (high vulnerability), and considering the moderating effects of ‘market saturation’ and ‘competition’ (both low vulnerability), the indicator **‘market structure and market concentration’** can be awarded a score of **low vulnerability**.

2.2.2. Required capability

The indicator ‘required capability’ refers to the necessary abilities of the entities in the sector to successfully set up and continue economic activity. This is further broken down into two corner-stones: ‘knowledge’ and ‘access to production factors’. The methodology indicates that, the higher the required capability, the more difficult it will become to enter the market and, hence, the less opportunities criminal groupings will have to do so. This can be applied for knowledge as well as for access to production factors.

2.2.2.1. Knowledge

With ‘knowledge’, the more socio-economic conditions for market entrance are examined. This is done by dividing this into an internal and an external aspect. While ‘experience’ describes the knowledge which is necessary internally to be economically active, ‘contacts’ deals with the required external relationships.

2.2.2.1.1. Experience

²⁸¹ For example in the UK, about 4,500 waste management companies exist. However, the 5 largest account for about 40% of the market (Financial Times, 11/04/2006). In Belgium, federation data indicate that about 70 companies represent nearly 90% of the market.

‘Experience’ describes the necessary economic knowledge. On the waste market, a difficult balance has to be found between competitive pricing and maximum profits. This is even harder than in other sectors, because of the nature of waste. Prices are depending on visible and less visible characteristics of the waste streams. They are open to a certain degree of interpretation.

The complexity of the waste market plays an important role as well. The combination of the different stages of waste management with the several waste streams creates a situation in which a proper insight is needed.

Finally, the sector has been changing. Nowadays, environmental issues and controls have narrowed the room for movement and increased the necessity of experience in order to survive on the market. This plays even stronger in more strictly regulated waste streams, such as hazardous and nuclear waste.

Because of these three aspects, experience is considered to be increasingly important. This makes it harder for illegal entrepreneurs to enter the market. This is not equal for all waste streams. For nuclear waste, experience is extremely important, due to the specific nature of radioactive waste. This may be more moderate for hazardous and particularly municipal waste. As the waste management industry in general is more and more focusing on environmental issues, hereby requiring increased levels of expertise, the vulnerability in this field may vary from very low to low vulnerability.

2.2.2.1.2. Contacts

With the indicator **‘contacts’**, the required socio-economic network is referred to. The more important this network is, the lower the possibilities to enter the market, and therefore, the lower the vulnerability.

Waste management requires several contact points, during the actual practice of waste management and beyond. First, clients are important. Because waste management constitutes a service industry, making the company visible and attractive to possible clients is necessary. Second, contacts with other actors in the waste management industry are important as well. Collection, transport, storage and treatment are often performed by different entities. This is particularly the case for new companies, as they do not yet have the possibilities to fill in the whole waste chain. Finally, also in the supporting activities, contacts are needed. As permits are needed for all waste management activities, one should know and be able to contact the institutions to apply for them.

At first sight the necessity of a substantial socio-economic network could lead to a conclusion of low vulnerability, as it makes entrance to the market more difficult. However, the need for such a network can be compensated by the use of waste brokers. They can provide the new competitors on the market with the necessary contacts and advice. This reduces the scope of the required socio-

economic network. Moreover, these brokers have been stated to be one of the vulnerable actors in the waste management industry throughout literature.²⁸²

One could state that the situation concerning brokers makes the hazardous and municipal waste industry vulnerable. Therefore, the indicator ‘contacts’ could be awarded with a high vulnerability score. However, this is not applicable for nuclear waste. Therefore, vulnerabilities related to contacts can be interpreted in different ways.

2.2.2.1.3. Knowledge: conclusion

The required experience and the required socio-economic network could at first sight lead to a very low vulnerability of the indicator ‘**knowledge**’. However, taking into account the possibilities to overcome the number of necessary contacts and the vulnerability linked to this, the decision has been made to moderate this score to a **low vulnerability**.

2.2.2.2. Access to production factors

This indicator describes the three economic pillars of all economic activity: work, raw materials and capital. Again, the road map for vulnerability studies indicates that higher requirements restrict the possibilities for illegal competitors to infiltrate the market. Thus, requirements form an important barrier and lower the vulnerability.

2.2.2.2.1. Work

The indicator ‘**work**’ refers to the quantity and quality of the required staff. The higher the requirements are, the more difficult the access to the market will be, resulting in a lower vulnerability. The waste management industry is not really labour intensive. Although the market leaders have high numbers of employees, the actual requirements are low. Small companies could function properly as well, particularly at stages where less technology is needed, such as collection and storage.

Qualification requirements of employees vary largely depending on the different waste stages and waste streams. For municipal waste storage, minimum requirements are not that big. However, for treatment of waste, particularly hazardous and nuclear, higher levels of technology and skills are required, making it necessary to invest in long-term planning and training.

²⁸² BRUINSMA, G., ‘De afvalverwerkingsbranche’ in *Inzake opsporing: enquêtecommissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 283-284

Because of the generally low level of required skills and number of employees, this matter has been defined as a point for attention, for which we could award it with a high vulnerability score. However, this should not be regarded one-sided as skills and amounts of employees may rise in certain stages of waste management such as treatment, and in dealing with specific waste, such as hazardous and nuclear waste. This leads to a rather nuanced view on this indicator.

2.2.2.2.2. *Capital*

‘Capital’ deals with the necessary funds to set up and maintain a business. Hereby, it is argued that, the higher the requirements, the more difficult it will be to infiltrate the market and, therefore, the lower the vulnerability. In relation to waste management, there are no official minimum requirements for setting up a waste management company. Nevertheless, from an economical point of view, such minima do exist for entities within the sector. Waste management has become more expensive due to increasing environmental issues. Investments in technology are needed, helping to improve the degree of professionalism and automatisisation.

This is particularly true for hazardous and nuclear waste. For hazardous waste, sorting out the different components of the waste streams and the environmentally sound treatment of waste asks for financial inputs. Additionally, nuclear waste management has to cover future costs as well. The amount of high-level radioactive waste is small but increasing and demands long-term solutions for proper waste management and radiation protection.

Investments to enter the waste management sector are increasing, and will continue to do so if the focus on the environment is held or growing. This creates a threshold to enter the legal waste management sector and would lead to a low vulnerability score. However, this should be given a closer look. It is exactly criminal competitors who are not limited by these requirements. Escaping the input of funds forms a part of their strategy and of their profits. This difference may be explained by looking at the difference between waste as a method to commit crimes, and waste as a purpose. Whereas waste as a method includes the assumption that there is an infiltration into the legal sector, one could conclude to a lower vulnerability, due to these requirements. If illegal waste management in itself is considered to be the purpose of criminal acts, one could conclude the contrary, as the increasing investments for legal companies give illegal entities an important competitive advantage, resulting in a very high vulnerability.

A distinction has to be made between illegal waste management in itself, and infiltration into the legal sector. The increasing financial requirements to enter the legal waste management industry, although informal, make infiltration by criminal groupings more difficult. However, exactly these requirements create incentives for per definition illegal waste management. This situation forms a part of the black and grey market, which is discussed later on. Hence, the choice can be made to leave this aspect out for now. Yet, this still leaves **two options**

open. As there are no formal minimal financial requirements, there are no obligations to maintain a deposit to cover eventual environmental damage. Taking into account the long-term impact of this damage, one could therefore conclude a very high vulnerability. Yet, the informal financial aspects have increased during the years, creating a growing informal barrier to enter the market. Following this pathway, one could award this indicator a low vulnerability score as well.

2.2.2.2.3. Raw materials

The indicator '**raw materials**' aims at the necessary quantity and quality of natural and other resources to set up and maintain economic activities. As the waste management industry is a service industry, raw materials in the strict sense are no point of examination. As another possibility of resources, the required technology can be considered. Technological requirements in the waste management industry can be linked to the labour force to some extent. Considering waste treatment and more demanding waste streams, such as hazardous and nuclear waste, increasing amounts of technology are required in order to deal with waste in an environmentally sound way.

Alongside that, also in the less demanding stages, such as collection, sorting and storage of municipal waste, an increasing amount of technology is required. Automatisation processes provide the opportunity to reduce labour costs and to cope with the stricter environmental regulations, creating greater efficiency.

The importance of technology is increasing in all stages of waste management and for all discussed waste streams. This hampers entrance onto the market. As technological requirements have an adverse on market infiltration, this indicator has been given the notion of **very low vulnerability**.

2.2.2.2.4. Access to production factors: conclusion

The indicator ‘**access to production factors**’ has been characterised by a highly nuanced view. Although raw materials and capital are constitute particular points of attention, they have been said to be lowly vulnerable, because they form an adequate threshold to enter the regular market. Because of the limited requirements for labour forces in certain, though not all, stages of waste management and specific waste streams, this has been said to be highly vulnerable.

In combination with the other indicators, the access to the productions factors and the respective evolution within these factors has increased the threshold to enter the legal market. Therefore, this indicator is defined as **lowly vulnerable**. Nevertheless, attention should be paid to providing incentives for illegal waste management.

2.2.2.3. Required capability: conclusion

Within the threshold, both knowledge and access to production factors appeared to be lowly vulnerable towards organised crime. As these factors could be placed at the same level and their content does not contradict, the vulnerability of the indicator ‘**required capability**’ can be defined as low. Due to the partial pressures and possibilities on this, assessing it as very low would be inappropriate. Therefore, this indicator has been stated to be **lowly vulnerable**.

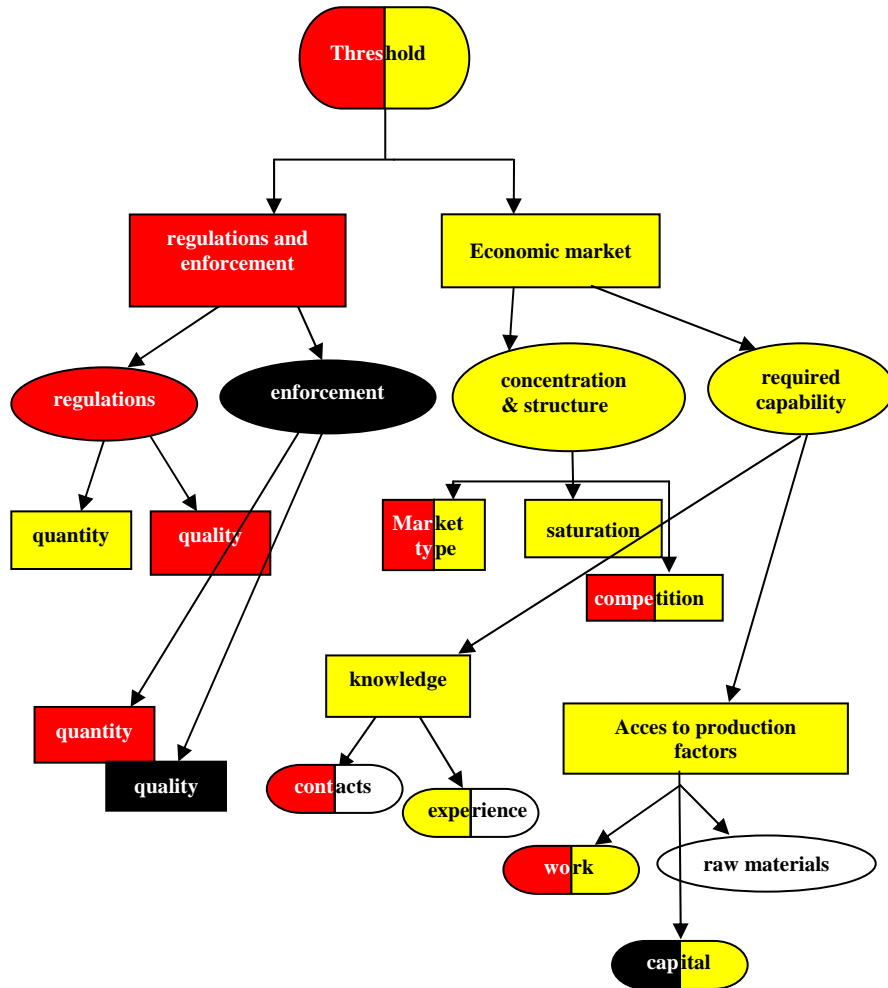
2.2.3. Economic market: conclusion

The ‘**economic market**’ is characterised by two sub-indicators. For the required capabilities, a growing need for knowledge and access to production factors has been perceived. This lowers the vulnerability. The concentration and structure of the market are characterised by a more open market, which offers opportunities for organised crime groups to enter the market. This should not be regarded in an exclusively negative way, as the increasing competition broke up the very enclosed organisation of the sector. Therefore, this indicator has been awarded a **low vulnerability** score.

2.3. Threshold: conclusion

The second branch, ‘**threshold**’ is characterised by two main indicators. On a legal level, the threshold has been said to be highly vulnerable. On an economic level, however, a low vulnerability has been observed. Depending on the focus one wants, both the market and the legal framework can be considered to be the most important aspect. Depending on this focus and the interaction between these two aspects, the threshold can be awarded two scores. If regulations and

enforcement are considered to be most important, vulnerability will be high, while vulnerability may as well be low if the economic market is considered to be primordial.



3. Branch 3: Alternative markets

The third branch, ‘alternative markets’ assesses the surrounding markets, dealing with the same goods as the sector under study. It is divided into two parts: legal alternatives and the black market.

3.1. *Legal alternatives*

For the indicator ‘legal alternatives’, it is argued in the methodology that, the more alternatives exist for organised crime groups within the same area of the described sector, the less likely their involvement in the market under study will be, as in that case, vulnerability will be split up into the several sectors.

Legal alternatives for waste management are limited. As the sector under study is a service industry, the service itself cannot be replaced. An existing possibility is approaching the sector differently, by means of the second-hand market. With the expanding consumption society, an increasing amount of goods is thrown away while still usable. This has led to a growing industry of second-hand goods. This has been done both nationally and internationally. From a national point of view, cases of exploitation by organised criminal groups have not yet been found. It is mostly a market of retailers which often form part of social projects.

From an international point of view, this situation is somehow different. Second-hand goods can be more freely transported than waste, especially out of Europe. Moreover, the demand for second-hand goods in developing countries sustains this practice. Unfortunately, this opens up opportunities for criminal action as well. Waste can be transported under cover of second-hand goods, hereby avoiding exporting prohibitions.²⁸³ Once reached the country of destination, the possibility of dumping still exists.

As the second-hand market is to some extent interwoven with the waste market, the two entities cannot be fully distinguished. Therefore, full-scale legal alternatives do not exist, and this indicator has been given a **high vulnerability** score.

3.2. *Black market*

The indicator ‘**black market**’ refers to illegal market activities and forms an important alternative for the development of organised crime activities. Illegal markets tend to be subject to the same economic principles as the regular market. It is considered as an entry gate to legal activities.

²⁸³ Confirmed by the Belgian federal police force, 15/02/2006

The size of the black market in this perspective cannot be assessed. Environmental crimes have very high dark number rates, for they are considered as victimless crimes. Hence, increased cases of environmental crime do not necessarily reflect similar trends in crime itself.

Nevertheless, figures have appeared of even nearly 50% of international waste transports being illegal.²⁸⁴ Coming from Belgium, this may be an overestimate when talking on a European level, as Antwerp is, together with Rotterdam, one of the major harbours in the European Union for waste shipment departures abroad. Dutch figures indicate a more moderate view, with 20% of waste transports in six European harbours being illegal.²⁸⁵ Yet, a study of the European Network for the Implementation and Enforcement of Environmental Law, executed in thirteen European countries, indicated again 50% of the controlled international waste transports as illegal.²⁸⁶

Alongside that, waste transports only constitute one of the stages in waste management. This estimate does therefore not give an indication on the black market concerning the other stages of waste management. Nevertheless, certain cases indicate black market activity in other stages as well. In Italy, almost one third of the so-called special wastes are disposed of illegally, where the so-called 'ecomafia' is involved in environmental crimes.²⁸⁷

Concerning the related nature of the black markets, one can state that, at source, waste management mostly constitutes a licit activity, may it be externally, by waste management companies or internally, by manufacturing companies. Afterwards, it may become illegally during the transport stage, for example during international transports. Another possibility is that transport still occurs in a legal way and that waste becomes illegal through means of its storage or dumping.

The profits to be gained by illegal waste management are rising dramatically, as increasing requirements impose additional financial burdens on legal activity. Hence, illegal waste management contains competitive advantages.

Another option which should be taken into account is the possibility of transporting waste internationally by means of a so-called grey market. Hereby, waste is shipped as product for the second-hand market. In itself, this is not illegal. If this has been a deliberate choice in order to surpass the border controls in this way, it becomes clear that the end result will be the same: illegal waste management abroad.

²⁸⁴ X., 'Afval naar derde wereld amper gecontroleerd', *De Standaard*, 30/01/2006

²⁸⁵ MINISTERIE VAN VOLKSHUISVESTING, RUIMTELIJKE ORDENING EN MILIEUBEHEER, Twintig procent afvaltransporten illegaal, VROM, <http://www.vrom.nl/pagina.html?id=18200>, 16/07/2004

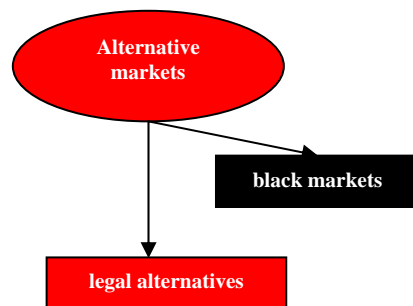
²⁸⁶ IMPEL, Impel-TFS Seaport Project II: 'international cooperation in enforcement hitting illegal waste shipments', project report September 2004 – May 2006, consulted at www.vrom.nl/get.asp?file=docs/pers/Eindrapport_Europees_Zeehavenproject.pdf

²⁸⁷ DI LELLO FINUOLI, G., 'Crime environnemental organisé: l'exemple de l'Italie' in *Environmental Crime in Europe: rules of sanctions*, COMTE, F. and KRÄMER, L. (eds.), Groningen, Europa law publishing, 2004, 103-109

Taking into accounts the estimated proportion of illegal transports and the attention which should be paid on both grey and black economic activities, and considering the competitive advantages of illegal waste management, the indicator ‘black market’ has been awarded a score of **very high vulnerability**.

3.3. *Alternative markets: conclusion*

The ‘**alternative markets**’ have been characterised by an absence of proper legal alternatives for waste management on the one hand and a substantial black and grey market on the other. Hence, these alternatives constitute a bottleneck in waste management. This lack of alternatives may even fortify the above discussed inelasticity of the sector. Therefore, we have awarded this indicator a **high vulnerability** score.



4. Branch 4: International context

The fourth and final branch, ‘**international context**’, describes the vulnerabilities, related to the context outside Europe. This becomes increasingly important, as globalisation limits the impact of geographical boundaries. The main question from this perspective is: how do policy and economic developments outside the scope of the responsible authorities, hamper effective problem-solving concerning control?

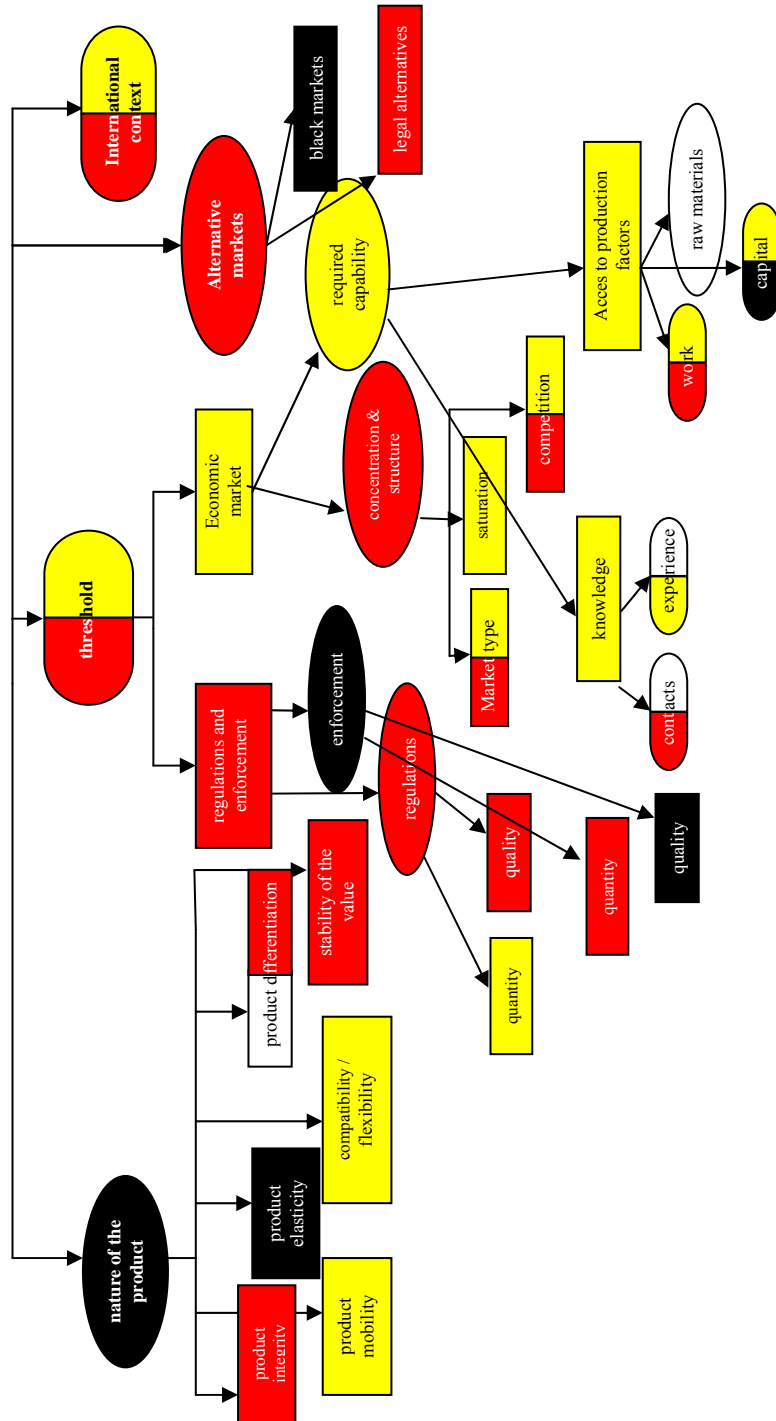
In relation to waste management, an important difference can be made between industrialised and developing regions. Within the industrialised regions, emphasis is increasingly put on the environmental aspect of waste management. Due to pollution and environmental issues, the need is felt that waste generation causes limits in economic growth. In the developing regions, waste management is more accepted as a side effect of growing economy. In general, the image of waste is less negative and, if the problem of waste generation is recognised, the means to realise efforts for proper waste management are often lacking.

This results in an ambiguous global view. The risk of becoming dump site countries made the developing regions insist on limiting waste trafficking, by means of the Basel Convention. This reduces the opportunities to export hazardous wastes in a legal way. However, the establishment of this convention has not been accompanied by sufficient controls, for example because of unstable political situations. Not only could this result in fewer controls, the vulnerability for corruption of officials plays a role as well, due to different financial standards. This leaves opportunities open for criminals to export wastes in illegal means. Semi-legal alternatives, such as the second-hand market, have even increased these opportunities.

This indicator can be assessed in two ways. On the one hand, globalisation and growing mobility lead increased opportunities for international waste transports and reduced possibilities to control them properly. Hence, opportunities for illegal activities have risen, indicating a possible high vulnerability. On the other hand, an increased cooperation between the authorities throughout the world has increased as well. If this would result in proper levels of international regulations and enforcement, a lower vulnerability would be achieved.



5. Width scan - Overview



II. Depth scan

Within this stage, the information, gathered, processed and meaningfully ordered in the reference model analysis, is used to perform the vulnerability assessment in depth. It is the intention to evaluate the distinguished business processes, by using micro-level indicators. In doing so, the business processes which deserve closer attention from a prevention perspective, can be pinpointed. The micro-level indicators are being judged individually and scored, from very low vulnerability (VLV) to very high vulnerability (VHV).

Five micro-indicators have been distinguished. ‘Costs’ are defined as the monetary value of the necessary economic means to perform business activities. ‘Transparency’ refers to standardisation of procedures, disclosure of information and clear ownership. With ‘solvency’, the financial ability to pay debts when they are due is meant. ‘Corporate culture’ can be defined as a framework of values and norms that functions as a model for behaviour. It is lowly vulnerable if a climate of compliance is created. Finally, ‘chain integration’ refers to the level of integration of the different business processes. Hereby, an important concern is to whether three requirements can be fulfilled, namely the customer’s needs, cost-effectiveness and flexibility to respond to changes.

1. Purchasing

Purchasing in waste management consists mainly of achieving technology. The costs of this business process do not offer possibilities for crime and fraud. The prices for technology may be unclear, but are always to be competitive, both for the providing company and for the client, which is in this case the waste management company. Taking the possible indistinctness and variations into account, the sub-indicator costs can be said to be lowly vulnerable.

The business process is characterised by a high degree of transparency as well, as there is clear ownership of technology, throughout the several stages of the waste management chain. In relation to the corporate culture, purchasing does not create specific vulnerabilities either. Companies need to be both competitive and offering good quality. A high degree of cost-effectiveness, which reflects the chain integration, is thus necessary.

As all relevant actors in relation to purchasing are characterised by a low or very low vulnerability in the waste management industry, the indicator ‘**purchasing**’ can be awarded a score of **very low vulnerability**.

<ul style="list-style-type: none"> • PURCHASING 	
<ul style="list-style-type: none"> ○ Costs ○ (transaction) Transparency ○ Corporate Culture ○ Chain Integration 	<p style="text-align: center;"> LV VLV VLV VLV </p>

2. Sales

During the sales process, a slightly more nuanced view has been perceived. Again, the costs for this process are rather low. An offer without engagement has to be drafted. This of course takes time, people and hence money, which increases the costs without certainty of reward. Nevertheless, the use of standard forms and calculation methods limit these costs to a large extent. Competitiveness, which reflects the chain integration, is extremely important in this area. Attaining contracts increases cost-effectiveness. Those aspects lower the vulnerability of this business process.

Transaction transparency is very low. On the one hand, pricing is very unclear. Several factors are hereby taken into account, such as volume and weight of the streams, and the sort of waste streams, including caloric value and possibilities for recycling. The combination of these factors requires a large degree of experience and capabilities to walk the line between profit and competitiveness. Especially the uncertainty, which accompanies the offers without engagement, emphasises competitiveness.

Alongside the unclear pricing factors, waste collection companies are, for their pricing process, depending on the information which is provided to them by their customers. In case of separated amounts of, especially liquid wastes, not all amounts can be sampled, due to economic reasons, as samples cost more than 100€ each. This makes it not remunerative to control each amount. This limits the control by companies and increases the vulnerability towards abuse.²⁸⁸

Yet, as this is only one aspect of this business process, the business process 'sales' can be awarded a score of **low vulnerability**.

²⁸⁸ Information provided by a hazardous waste manager during an interview on 22/03/2006

• SALES	
<ul style="list-style-type: none"> ○ Costs ○ (transaction) Transparency ○ Corporate Culture ○ Chain Integration 	LV VHV LV VLV

3. Book-keeping

Transparency of the book-keeping process in the waste management industry is high. Both for incoming and outgoing resources, double sources exist, by means of offers. This is related to the nature of the prices which are involved. Hence, if irregularities exist, they have to be confirmed by the second referring document. Alongside that, an increased degree of automatisation exists, leaving even less room for fiddling practices. Exceptions may be certain transitional regimes, where both controls as automatisation of processes are less formalised.

The corporate culture is of course based on profit-making. Yet, opportunities to fraud in this way are limited. Differences between purchases and services are clear and controls are increasingly performed by a growing degree of chain integration through automatisation and efficiency efforts.

Solvency in this point may result in a higher vulnerability. On the one hand, formal minimum requirements for waste management companies do not exist. Therefore, financial liability for environmental crimes is hard to sustain. On the other hand, specific solvency issues exist as well concerning the clients of the waste management industry. This service is quite expensive for them, but does not constitute one of their prior processes. For this reason, payments are subject to two possible timing strategies, linked to their moments of financial reporting. Payments are often executed at the end of the booking year, when there is money available, or in the beginning of the new one, as new resources have become available and the urgency to pay off debts has increased. Due to this evolution, payments are unequally spread over the year, putting higher pressure on the solvency of waste management companies.

Although solvency is a key issue in the book-keeping process, this is more of a bottleneck for waste management companies than an actual opportunity for organised crime groups. Therefore, this business process can be perceived as **lowly vulnerable**.

• BOOK-KEEPING	
<ul style="list-style-type: none"> ○ (transaction) Transparency ○ Solvency ○ Corporate Culture ○ Chain Integration 	VLV HV LV VLV

4. Administration

The importance of this business process has dramatically increased during the past decades, as formal and informal requirements have become more demanding. As a result of this increase, the costs have risen as well, due to higher overheads. People, active in IT and administration, have become more important, without leading to a growth of direct profits. Because of that, chain integration of the administration is quite low as well. Cost-effectiveness is becoming more limited and the demands of the clients, cheap disposal of their wastes, are harder to fulfil.

Because of the growing involvement of administration, transparency of the waste management practice has increased. The increased requirements hence had a positive effect on the industry as well. Therefore, once companies consider these efforts as inevitable, this will result in a trademark of which they are proud and companies then make it a part of their image towards the outside world.

The two evolutions that occur here can result in two ways of assessing vulnerabilities. On the one hand, higher degrees of administration will tend legal companies to be more open and become conscious about their role within the environmental development. However, the costs that accompany these requirements create incentives to avoid these efforts and to deal with waste in a less regulated way. Hereby, higher profits can be achieved, making it attractive for illegal activities and, hence, increasing the vulnerability. Thus, the positive aspects will only be found when the costs and investments are considered to be inevitable.

• ADMINISTRATION	
<ul style="list-style-type: none"> ○ Costs ○ Transparency ○ Corporate Culture ○ Chain Integration 	HV LV LV HV

5. Personnel management

Costs, transparency and chain integration of personnel management are rather lowly vulnerable. The waste management industry is not that labour intensive, keeping personnel costs quite low. Recruiting happens mostly on a basis of educational level. This has increased during the past years because of increased professionalism and automatisisation. Nevertheless, personnel management is characterised by high degree of cost-effectiveness, keeping the right people on the right place. Transparency towards the outside world may appear to be rather low, but this forms a part of every industry. Internally, however, larger companies – those with more employees – have often set clear standards on safety, security and behaviour of employees,²⁸⁹ creating internal transparency.

Corporate culture in the waste management industry is more vulnerable towards crime. The reigning ideas on the waste management practice and its surrounding activities could well influence attitude of the employees. If not stressed otherwise, they could have the impression that regulations are not that strict, resulting in improper waste management without consent or knowledge of their supervisors. Nevertheless, corporate culture could turn into a positive aspect as well. As companies may consider their environmental and administrative investments as an advantage for their public image, they could well emphasise this in their corporate culture, supporting this image.

Taking into account the possible weaker points in corporate culture, this process can still be given the notion of **low vulnerability**, as corporate culture forms only a part of personnel management.

• PERSONNEL MANAGEMENT	
○ Costs	LV
○ (transaction) Transparency	LV
○ Corporate Culture	HV
○ Chain Integration	LV

6. Service operations

The business process ‘service operations’ has been distinguished as the most vulnerable one. First of all, the costs of waste management have increased, due to increased requirements and growing professionalism. If entities manage to deal with waste in an illegal way, they can avoid costs and requirements, resulting in higher profits. Estimates indicate that profits through illegal waste management lie about three to four times higher than for legal activities.²⁹⁰

²⁸⁹ Information obtained from Dirk Reynaert, Environmental manager of Sita Recycling Services Belgium, 16/05/2006

²⁹⁰ BRUINSMA, G., ‘De afvalverwerkingsbranche’ in *Inzake opsporing: enquêtecommissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 266

Transparency is not always high as well. Depending on the sort of waste streams, sub-contractors enter the market, making it sometimes hard to detect the ultimate source and destination of the streams. Alongside that, the final treatment of waste can differ as well. In itself, this constitutes no problem. However, sometimes these differences are not that clear, because of economic reasons and restrictions. Already mentioned here is the example of waste that can be transported as second-hand goods, in this way avoiding exporting restrictions. Limitations differ as well between wastes for landfill and wastes for incineration. The latter can be transported throughout Europe more freely. Thus, leaving final treatment unclear creates economic advantages.

Chain integration is low, as cost-effectiveness and the client's needs are not completely fulfilled.²⁹¹ Cases of the past indicate that, in order to compete with this, illegal activities can offer 'solutions' for some companies.

The reason for increasing prices for waste management has mainly been the growing importance of environmental issues. Unfortunately, environmental profits are not translated into economic winnings. This creates conflicting interests between economy and ecology, taking away the economic support for environmental issues. This could also be found in the corporate culture, where economy is prior to the environment.

Taking into account the conflicting interests and the difficult balance of waste management, this indicator can be given a score of **very high vulnerability**.

• SERVICES OPERATIONS	
○ Costs	HV
○ (transaction) Transparency	HV
○ Corporate Culture	HV
○ Chain Integration	VHV

²⁹¹ VAN DEN ANKER, M.J.J. and HOOGENBOOM, A.B., *Schijn bedriegt: overheid, bedrijfsleven en gelegenheidsstructuren voor criminaliteit op de hergebruikmarkt*, 's Gravenhage, VU-GA, 1997, 267-269

7. Depth scan – overview

<i>BUSINESS PROCESSES</i>	<i>Vulnerability score</i>
<ul style="list-style-type: none"> • PURCHASING 	
<ul style="list-style-type: none"> ○ Costs ○ (transaction) Transparency ○ Corporate Culture ○ Chain Integration 	<p style="text-align: center;">LV VLV VLV VLV</p>
<ul style="list-style-type: none"> • SALES 	
<ul style="list-style-type: none"> ○ Costs ○ (transaction) Transparency ○ Corporate Culture ○ Chain Integration 	<p style="text-align: center;">LV VHV LV VLV</p>
<ul style="list-style-type: none"> • BOOK-KEEPING 	
<ul style="list-style-type: none"> ○ (transaction) Transparency ○ Solvency ○ Corporate Culture ○ Chain Integration 	<p style="text-align: center;">VLV HV LV VLV</p>
<ul style="list-style-type: none"> • ADMINISTRATION 	
<ul style="list-style-type: none"> ○ Costs ○ Transparency ○ Corporate Culture ○ Chain Integration 	<p style="text-align: center;">HV LV LV HV</p>
<ul style="list-style-type: none"> • PERSONNEL MANAGEMENT 	
<ul style="list-style-type: none"> ○ Costs ○ (transaction) Transparency ○ Corporate Culture ○ Chain Integration 	<p style="text-align: center;">LV LV HV LV</p>
<ul style="list-style-type: none"> • SERVICES OPERATIONS 	
<ul style="list-style-type: none"> ○ Costs ○ (transaction) Transparency ○ Corporate Culture ○ Chain Integration 	<p style="text-align: center;">HV HV HV VHV</p>

D. Bibliography

AFVAL OVERLEG ORGAAN, *De afvalmarkt; ontwikkelingen 2003*, Utrecht, AAO, 32p.

ALLIANCE FOR NUCLEAR RESPONSIBILITY, *Factsheet #2 Security: Just the Facts: The Five Fatal Flaws of Nuclear Power*, San Luis Obispo CA, Alliance for Nuclear Responsibility, p. 1-2, <http://a4nr.org/articles/fatalFlaws/2.security.pdf/download>

BANDI, G., 'Liability and sanctions, criminal liability in Hungary' in *Environmental Crime in Europe : rules of sanctions*, COMTE, F. and KRÄMER, L. (eds.), Groningen, Europa law publishing, 2004, 127-142

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *United Nations – Treaty Series*, 1992, Vol.1673, I-28911, 126-161

BEIGL, P., WASSERMANN, G., SCHNEIDER, F. and SALHOFER, S., *Forecasting Municipal Solid Waste Generation in Major European Cities*, Institute of Waste Management, Vienna, 2004 <http://www.iemss.org/iemss2004/pdf/regional/beigfore.pdf>

BIZHELP24, *Managing Waste: Hazardous*, ROK Connect, 2005, http://www.bizhelp24.com/business_law/managing-waste-hazardous.shtml

BLAIR, B.G., *Terrorism Project: what if the terrorists go nuclear?*, Washington, Center for Defense Information, 01/10/2001, <http://www.cdi.org/terrorism/nuclear.cfm>

BLOCK, A.A. and BERNARD, T.J., Crime in the waste oil industry, *Deviant Behavior*, 2000, Vol.9, no.2, 113-129

BLOCK, A.A., *Perspectives on organizing crime: Essays in opposition*, Dordrecht, Kluwer, 1991, 264p.

BLOKLAND, H., *Waste Shipment Regulation*, presentation held at FEAD congress, Budapest, 2005

BORZAGA, C., OLABE, A., GREFFE, X., *The Third System, Employment and Local Development, Vol.2: Key Sectors*, European Commission, Employment, Social Affairs and Equal Opportunities, http://europa.eu.int/comm/employment_social/empl_esf/3syst/vol2_en.pdf

BRODERSEN, J., CROWE, M. and JACOBSEN, H., *Hazardous waste generation in EEA member countries*, Copenhagen, European Environment Agency, 2002, 117p.

BRUINSMA, G., 'De afvalverwerkingsbranche' in *Inzake opsporing: enquête-commissie opsporingsmethoden, Deel II onderzoeksgroep Fijnaut: branches*, BRUINSMA, G. and BOVENKERK, F., The Hague, SDU, 1996, 261-310

BUCLET, N. and GODARD, O., 'Municipal Waste Management in Europe: a comparison of national regimes' in *Municipal waste management in Europe: a comparative study in building regimes*, BUCLET, N. and GODARD, O. (eds.), Dordrecht, Kluwer, 2000, 203-224

BUCQUOYE, A., VERPOEST, K., DEFROYTIER, M. and VANDER BEKEN, T., 'European road transport of goods' in *Organised crime and the vulnerability of economic sectors: the European transport and music sector*, VANDER BEKEN, T. (ed.), Antwerp, Maklu, 2005, 57-193

BUREAU OF LABOR STATISTICS, US DEPARTEMENT OF LABOR, *Occupational Outlook Handbook, 2004-2005*, <http://www.bls.gov/oco/ocos144.htm>

BUREAU OF LABOR STATISTICS, US DEPARTEMENT OF LABOR, *Occupational Outlook Handbook, 2004-2005*, <http://www.bls.gov/oco/ocos023.htm>

BUREAU OF LABOR STATISTICS, US DEPARTEMENT OF LABOR, *Occupational Outlook Handbook, 2004-2005*, <http://www.bls.gov/oco/ocos021.htm>

CENTER FOR EDUCATIONAL DEVELOPMENT AND ASSESSMENT, *Personnel Management*, CEDA meta-profession project, http://www.cedanet.com/meta/personnel_management.htm

CHASEK, P., *Earth Negotiations, analyzing thirty years of environmental diplomacy*, Tokyo, United Nations University, 2001, 291p.

COCHEZ, T., *Vlaanderen dumpst 100.000 ton afval in derde wereld: pseudolegaal circuit maskeert illegale afvalstromen*, De Morgen, 30/01/06

Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste, *Official Journal* L226, 06/09/2000, 1-32

COMMISSION OF THE EUROPEAN COMMUNITIES, *Communication from the Commission: towards a thematic strategy on the prevention and recycling of waste*, Brussels, 2003, http://www.eu.int/eur-lex/en/com/cnc/2003/com2003_0301en01.pdf

COMMISSION OF THE EUROPEAN COMMUNITIES, Green paper on public-private partnerships and community law on public contracts and concessions, Brussels, COM(2004) 327 final, 22/04/2004, http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/com/2004/com2004_0327en01.pdf, 22p.

COMMISSION OF THE EUROPEAN COMMUNITIES, *Proposal for a Regulation of the European Parliament and the Council establishing the statistical classification of economic activities NACE Rev.2 and amending Council Regulation (EEC) N° 3037/90 and certain EC Regulations on specific statistical domains*, Brussels, COM (2006) 39 final, 2006/0011 (COD), 06/02/2006, 58p.

Commission Regulation (EC) No. 29/2002 of 19 December 2001 amending Council Regulation (EEC) No. 3037/90 on the statistical classification of economic activities in the European Community, *Official Journal L 6*, 10/1/2002, 3

COMMITTEE ON THE SAFETY AND SECURITY OF COMMERCIAL SPENT NUCLEAR FUEL STORAGE, *Safety and Security of Commercial Spent Nuclear Fuel Storage: Public Report*, Washington, National Academies Press, 2006, 126p. selected pages available online, <http://darwin.nap.edu/books/0309096472/html/25.html>

CONSLEG, *European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste*, Luxembourg, Office for the Official Publications of the European Communities, 2004, 22p.

Consolidated version of the Treaty establishing the European Community, *Official Journal C325*, 24/12/2002, 33-184

COOKE, A., and CHAPPLE, W., Merger activity in the waste disposal industry: the impact and the implications of the Environmental Protection Act, *Applied Economics*, 2000, Vol.32, no.6, 749-755

COOLS, M., *Werknemerscriminaliteit: criminaliteit tegen bedrijfsactiva strafbare gedragingen gepleegd door werknemers in grote bedrijven*, Brussels, VUB Press, 1994, 287p.

Council Directive 75/442/EEC on waste, *Official Journal L194*, 25/07/1975, 39-41

Council Directive 91/689/EEC of 12 December 1991 on hazardous waste, *Official Journal L377*, 31/12/1991, 20-27

Council Directive 94/67/EC of 16 December 1994 on the incineration of hazardous waste, *Official Journal L365*, 31/12/1994, 34-45

Council Directive 96/29/Euratom of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation, *Official Journal L159*, 29/06/1996, 1-114

Council Regulation (EEC 259/93) on the supervision and control of shipments of waste within, into and out of the European Community, *Official Journal L030/1*, 06/02/1993, 1-28

Council Regulation (Euratom) No 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States, *Official Journal* L148, 196/06/1993, 1-7

DE VILLENEUVE, C.H.V., *Waste movements : EC and outside*, Brussels, Commission of the European Communities, found at International Network for Environmental Compliance and Enforcement, <http://www.inece.org/1stvol1/villeneu.htm>

DI LELLO FINUOLI, G., 'Crime environnemental organisé: l'exemple de l'Italie' in *Environmental Crime in Europe : rules of sanctions*, COMTE, F. and KRÄMER, L. (eds.), Groningen, Europa law publishing, 2004, 103-109

Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, *Official Journal* L114, 27/04/2006, 9-21

ECOTEC, *Analysis of the EU Eco-industries, their employment and export potential*, Birmingham, Ecotec, 2002, 103p.

EEB: European Environmental Bureau: Federation of Environmental Citizens Organisations, <http://www.eeb.org>

ELMI, A.M., *Somalia's Degrading Environment: Legal and Moral Perspectives of Deforestation and Hazardous Waste Dumping in Somalia*, Environment and Development Challenges News, 2001, <http://www.edcnews.se/Reviews/Elmi2001.doc>

ENVIRONMENT AGENCY, *Britain's £ million dumping scams exposed on TV*, UK environment agency, 2005, http://www.environment-agency.gov.uk/news/1034469?lang=_e

ENVIRONMENT AGENCY, *Hazardous Waste Managment Market: Pressures and Opportunities*, R&D Technical Report P1-484/TR, Bristol, Environment Agency, 93p.

ERMAROCA, F., Community Legislation and Jurisprudence in the Area of Waste Management: Recent Developments, *Reciel*, 1998, Vol.7, no.3, 274-282

EUROPEAN COMMISSION DIRECTORATE GENERAL ENERGY AND TRANSPORT, *Green Paper: towards a European strategy for the security of energy supply*, COM (2000) 769 final, Luxembourg, Office for Official Publications of the European Communities, 2001, 105p.

EUROPEAN COMMISSION DIRECTORATE GENERAL ENERGY AND TRANSPORT, *Special Eurobarometer 227: Radioactive waste*, European Commission, 2005, http://europa.eu.int/comm/energy/nuclear/waste/doc/2005_06_nuclear_waste_en.pdf, 80p.

EUROPEAN COMMISSION DIRECTORATE GENERAL ENVIRONMENT, *Study on investment and employment related to EU policy on air, water and waste*, Luxembourg, Office for Official Publications of the European Communities, 2000, 72p.

EUROPEAN COMMISSION, DIRECTORATE GENERAL EDUCATION AND TRAINING, *Leonardo Da Vinci Awards, 2004: 32 success stories*, European Commission, http://europa.eu.int/comm/education/programmes/leonardo/new/awards_en.pdf, 68p.

EUROPEAN COMMISSION, DIRECTORATE GENERAL ENVIRONMENT, *Handbook for Implementation of EU Environmental Legislation: Waste*, <http://europa.eu.int/comm/environment/enlarg/handbook/waste.pdf>

European Court Reports 2003 I-05639, 2003 I-06053 and 2003, I-03373, found at 'Eurobrief', *European Environmental Law Review*, 2004, Vol.13, no.4, 126-128

EUROPEAN ENVIRONMENT AGENCY, *Environment in the European Union at the turn of the century*, Luxembourg, Office for Official Publications of the European Communities, 1999, 44p.

EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, 344p.

EUROPEAN FEDERATION OF PUBLIC SERVICE UNIONS, *The EU Directive on Services – a wholesale attack on basic services in Europe*, Brussels, EPSU, 2005, 5p.

EUROSTAT, 2002, New Cronos Database, cited in EUROPEAN ENVIRONMENTAL AGENCY, *Europe's environment: the third assessment*, Luxembourg, Office for Official Publications of the European Communities, 2003, p.154

EUROSTAT, *Europe in figures: Eurostat yearbook 2005*, Luxembourg, Office for Official Publications of the European Communities, 2005, 310p.

EUROSTAT, *European Business: facts and figures, data 1998-2002*, Luxembourg, Office for Official Publications of the European Communities, 2004, 432p.

EUROSTAT, *NACE Rev.2 structure and correspondences with NACE Rev 1.1 and ISIC Rev.4*, Statistical Office of the European Communities, 20/01/2006,

EUROSTAT, *SERIEE: European System for the collection of economic information on the environment*, Luxembourg, Office for Official Publications of the European Communities, 2002, 194p.

EUROSTAT, *Waste generated and treated in Europe: data 1995-2003*, Luxembourg, Office for Official Publications of the European Communities, 2005, 131p.

FAURE, M.G. and HEINE, G., *Criminal Enforcement of Environmental Law in the European Union*, The Hague, Kluwer International, 2005, 187p.

FEAD: European Federation of Waste Management and Environmental Services, <http://www.fead.be>

FERRIGNO, R., *A case study on the implementation of EU environmental legislation*, European Environment Bureau, 2003, <http://www.eeb.org/activities/waste/ITALY-waste-report-March2003.pdf>

FIGUEREIDO, I., Speech held in the European Parliament, Strasbourg, 09/03/2005, consulted at http://www.europarl.eu.int/omk/sipade3?L=EN&OBJID=94922&LEVEL=5&SAME_LEVEL=1&NAV=S&LSTDOC=N

FRIENDS OF THE EARTH, *Written Evidence from Friends of the Earth to the House of Commons Environmental Audit Committee Inquiry regarding the Comprehensive Spending Review*, FOE, 2001, http://www.foe.co.uk/resource/evidence/comprehensive_spending.html

FRÖHLICH, T., *Organised environmental crime in a few Candidate countries: Final report*, Kassel, BfU, 2003, 625p.

FRÖHLICH, T., *Organised environmental crime in the EU Member States: Final report*, Kassel, BfU, 2003, 726p.

FROST & SULLIVAN, *Municipal waste management in Europe, 2002* cited in AFVAL OVERLEG ORGAAN, *De afvalmarkt; ontwikkelingen 2003*, Utrecht, AAO, p.26

GERRITSEN, J., *Overheid bevordert milieucriminaliteit: rapport over markt afvalverwerking*, SDN, 1997, <http://www.sdn.nl/milieu12.htm>

GOBERT, J. and PUNCH, M., *Rethinking corporate crime*, London, Butterworths, 2003, 379p.

GOLDENMAN, G., *Environmental liability and privatization in Central and Eastern Europe*, London, Graham and Trotman, 1994, 242p.

GREENPEACE INTERNATIONAL, *Reprocessing*, Greenpeace, <http://www.greenpeace.org/international/campaigns/nuclear/reprocessing>

GREENPEACE, *The International Trade in Wastes, Waste Trade Update*, 1990, Vol.5

HALL, D., *Waste management companies in Europe*, Public Services International Research Unit, European Federation of Public Service Unions, 2006, http://www.epsu.org/IMG/pdf/EN_PSIRU_waste_management_in_EU_Feb_06.pdf, 15p.

HEERMANN, C., Using Mechanical-Biological Treatment for MSW in Europe, *Biocycle*, 2003, Vol.44, no.10, 58-62

HELFFERIG, B., and MIKKELSEN, L., *Industrial pollution: new European register adopted*, European Commission Press Center, IP/05/854, Brussels, 06/07/2005

HEMMER, D., HÖFERL, A., *Privatisierung und Liberalisierung öffentlicher Dienstleistungen in der EU-15: Abfallwirtschaft*, Wien, Österreichische Gesellschaft für Politikberatung und Politikentwicklung (OCPP), 2003, 35p.

HONTELEZ, J., *EEB Work Programme 2006*, Brussels, European Environmental Bureau, 65p.

IMPEL, Impel-TFS Seaport Project II: 'international cooperation in enforcement hitting illegal waste shipments', project report September 2004 – May 2006, 132p.

INDAVER, *Indaver en van Gansewinkel sluiten meerjarig verwerkings contract met een waarde van 100 miljoen €*, Indaver, 28/12/2005, http://www.indaver.be/Single_news_item.14.0.html?&cHash=bc519ae678&tx_ttnews%5BbackPid%5D=18&tx_ttnews%5Btt_news%5D=116

INTERNATIONAL ATOMIC ENERGY AGENCY, 1970, *Information Circular, Treaty On The Non-Proliferation of Nuclear Weapons, Notification of the entry into force*, INFCIRC/140, 22 April 1970, Vienna, IAEA, 5p.

INTERNATIONAL ATOMIC ENERGY AGENCY, *Illicit Nuclear Trafficking: Facts and Figures*, Vienna, IAEA, 2005, http://www.iaea.org/NewsCenter/Features/RadSources/Fact_Figures.html

INVESTOR WORDS, *Sales*, WebFinance, 2005, <http://www.investorwords.com/4365/sales.html>

ISWA GENERAL SECRETARIAT, *Annual Report 2005*, Copenhagen, ISWA, 24p.

ISWA: International Solide Waste Association, <http://www.iswa.org>

JACOBS, J.B., FRIEL, C. and RADICK, R., *Gotham unbound: how New York City was liberated from the grip of organized crime*, New York, New York University Press, 1999, 329p.

JOHNSTON, A. and POWLES, E., 'The kings of the world and their dukes' dilemma: globalisation, jurisdiction and the Rule of Law' in *Globalisation and Jurisdiction*, SLOT, P.J. and BULTERMAN, M. (eds.), The Hague, Kluwer Law International, 2004, 13-54

KAMERLING, R.N.J. and PHEIJFFER, M., *Vijftien over fraude*, Amsterdam, Koninklijk Nivra, 1999, 235p.

KOK, W., *Enlarging the European Union: achievements and challenges*, European University Institute, Robert Schuman Centre for Advanced Studies, 26/03/2003, http://europa.eu.int/comm/enlargement/communication/archives/pdf/report_kok_en.pdf, 84p.

KÖLLIKER, A., 'Globalisation and National Incentives for Protecting Environmental Goods: Types of Goods, Trade Effects, and International Collective Action Problems' in *A Handbook of Globalisation and Environmental Policy: National Government Interventions in a Global Arena*, WIJEN, F., ZOETEMAN, K. and PIETERS, J. (eds.), Cheltenham, Elgar, 2005, 53-86

KOVACH, J., PETZOLDT, C., DEGNI, J. and TETTE, J., *A method to measure the environmental impact of pesticides*, New York, Cornell University, <http://www.nysipm.cornell.edu/publications/eiq/>

LARAÑA, E., Reflexivity, Risk and Collective Action over Waste Management: a Constructive Proposal, *Current Sociology*, 2001, Vol.49, no.1, 23-48

LEAR, L., Rachel Carson and the awakening of environmental consciousness, Washington, National Humanity Center, George Washington University, 2002, <http://www.nhc.rtp.nc.us:8080/tserve/nattrans/ntwilderness/essays/carson.htm>

LEE, R.W., *Smuggling Armageddon: the nuclear black market in the former Soviet Union and Europe*, Houndmills, Macmillan, 1998, 200p.

LINDSTRÖM, M., ATTILA, M., FITCH, T. and PENNANEN, J., *Waste-related Conditions in Environmental Permits*, Amsterdam, IMPEL European Union Network for the Implementation and Enforcement of Environmental Law, 2005, 83p.

LISNEY, R., RILEY, K. and BANKS, C., From Waste to Resource Management, *Management Services*, 2003, Vol. 47, no. 12, 8-14

MCGLADE, J., *European packaging waste trends and the role of economic instruments*, speech held at European Voice conference, Brussels, 1-2 March 2004, European Environment Agency, http://org.eea.eu.int/documents/speeches/01-03-2004-files/EEA_01-03-2004.pdf, 13p.

MCMAHON, R., *UN: Security Council Considers Move For More Counterterrorism Help*, Radio Free Europe, Radio Liberty, 05/03/2004, <http://www.rferl.org/featuresarticle/2004/03/a0b6f867-ae5b-46fb-8037-5451eef26081.html>

MILLER, E.A., *Russian control over energy raises questions about Georgia's direction*, Eurasianet, 28/10/2003, <http://www.eurasianet.org/departments/rights/articles/eav102803b.shtml>

MINISTERIE VAN VOLKSHUISVESTING, RUIMTELIJKE ORDENING EN MILIEUBEHEER, *Twintig procent afvaltransporten illegaal*, VROM, <http://www.vrom.nl/pagina.html?id=18200>, 16/07/2004

MONKHOUSE, C. and FARMER, A., *Applying Integrated Environmental Assessment to EU Waste Policy: a Scoping Paper for the European Forum on Integrated Environmental Assessment (EFIEA)*, Institute for European Environmental Policy, 2003, <http://www.ieep.org.uk/publications/pdfs/2003/efieafinalreport.pdf>, 39p.

MYLES, A.E., *A Guide to Understanding Solid-Waste Costs*, Mississippi State University Extension Service, <http://msucare.com/pubs/publications/p1638.htm>

NATIONAL CRIMINAL INTELLIGENCE SERVICE, *UK Threat Assessment: The Threat from serious and organised crime 2003*, NCIS, 2003

NATIONAL CRIMINAL INTELLIGENCE SERVICE, *UK Threat Assessment: The Threat from serious and organised crime 2004/5 – 2005/6*, NCIS, 2003

NUCLEAR ENERGY AGENCY, COMMITTEE ON RADIOACTIVE WASTE MANAGEMENT, *Radioactive Waste Management in Finland*, Radiation and Nuclear Safety Authority, 2005, http://www.stuk.fi/ydinturvallisuus/ydinjatteet/ydinjate/en_GB/ydinjate/_files/73810475841424335/default/radioactive_waste_management_in_finland.pdf, 10p.

NUCLEAR ENERGY AGENCY, *Country Profiles*, OECD, <http://www.nea.fr/html/general/profiles/waste>

NUCLEAR ENERGY AGENCY, *Nuclear Regulatory Review of Licensee Self-Assessment (LSA)*, Paris, OECD, 2003, 51p.

OECD SECRETARY-GENERAL, *Waste Contract Design and Management for Enhanced Waste Minimisation: a Synthesis Report*, *OECD Papers*, 2004, Vol.4, no.4, 1-69

OLSSON, N., *Environmental Protection Expenditure in Europe by public sector and specialised producers 1995-2002*, Luxembourg, Office for Official Publications of the European Communities, 2005, 12p.

PEARSON EDUCATION, *Glossary*, 2004,
<http://wps.pearsoned.co.uk/wps/media/objects/1065/1090612/glossary.html>

PIEBALGS, A., *The European Initiative on Energy Efficiency*, Speech at Joint meeting ITRE – National Parliaments, Brussels, 24/01/06

PORTER, G., BROWN, J.W. and CHASEK, P., *Global environmental politics*, 3rd ed., Boulder, Westview Press, 2000, 286p.

Proposal for a Council Directive (Euratom) on the management of spent nuclear fuel and radioactive waste, COM/2003/0032 final – CNS 2003/0022 and Proposal for a Council (Euratom) Directive Setting out basic obligations and general principles on the safety of nuclear installations, COM/2003/0032 final – CNS 2003/0021, Brussels, 30/01/2003,
http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/com/2003/com2003_0032en01.pdf

Regulation (EC) No 2150/2002 of the European parliament and the council of 25 November 2002 on waste statistics, *Official Journal* L332, 9/12/2002, 1-36

RUFFING, K.G., *Keeping track of decoupling*, OECD observer, environment directorate, 2001,
http://www.oecdobserver.org/news/fullstory.php/aid/615/Keeping_track_of_decoupling.html

RYLANDER, H. and HAUKOHL, J., Status of WTE in Europe, *Waste Management World*, ISWA, 2002, Vol.2, no.3

SCHAPER, A., SCHMIDT, G. and BÄHR, R., *Emerging Nuclear Energy Systems, their Possible Safety and Proliferation Risks*, Luxembourg, European Parliament, 1999, 112p.

SCHOLZ-REITER, B. and STICKEL, E., *Business process modelling*, Berlin, Springer, 1996, 332p.

SECRETARIAT OF THE BASEL CONVENTION, *What is illegal traffic?* Geneva, United Nations Environment Programme
<http://www.basel.int/legalmatters/illegtraffic/index.html>

SEERDEN, R., HELDEWEG, M. and DEKETELAERE, K., 'Comparative Remarks' in *Public environmental law in the European Union and the United States: a comparative analysis*, SEERDEN, R. and HELDEWEG, M. (eds.), The Hague, Kluwer Law International, 2002, 563-583

SENTERNOVEM, *De afvalmarkt 2005: tussen Duits stortverbod en open grenzen*, Utrecht, Senternovem, 2006, 34p.

SHESHINSKI, R.H., Indirect data collection for waste statistics and waste indicators, *Statistical Journal of the UN Economic Commission for Europe*, 2002, Vol.19, no.1-2, 53-63

SIPILÄ, K., *Municipal and commercial solid waste for pyrolysis (oils) and gasification markets*, Paper presented on the PGBW expert meeting in Strasbourg, 30.09.2002, <http://www.ienica.net/usefulreports/pyrolysis5.pdf>, 33p.

SITA, *Kerncijfers*, Sita, <http://www.sita.be/sitabelgiumweb/sitabelgiumwebportal.nsf/fosyindex?readform>

SLR, *Delivering Key Waste Management Infrastructure: Lessons Learned from Europe*, The Chartered Institution of Wastes Management, 2005, 64p.

SOYLAND, S., *Criminal Organisations and Crimes Against the Environment*, Turin, UNICRI, 2000, 71p.

SPIEGELMAN, H. and SHEEHAN, B., *Unintended Consequences: Municipal Solid Waste Management and the Throwaway Society*, Product Policy Institute, 2005, <http://www.productpolicy.org/assets/resources/UnintendedConsequences-MSWandEPR.pdf>, 23p.

SUZUKI, K., FUTAGAMI, T., OGURA, S., HARA, M., OHKAWA, T. and YASUI, I., *Change in environmental consciousness and behavior led by information*, Tokyo, Japan Science and Technology Agency, http://www.yasuienv.net/CREST/1_list/1128.pdf

TOFFEL, M.W., The Growing Strategic Importance of End-of-Life Product Management, *California Management Review*, 2003, Vol.45, no.3, 102-129

TURKENBURG, W., 'Nuclear energy and sustainable development' in *Technology Assessment HTR*, Petten, ECN, 1996, 36p.

UK NIREX, *Schemes for financing radioactive waste storage and disposal final report for the European Commission on 'Schemes for Financing Radioactive Waste Storage and Disposal'* (contract B4-3070/96/000754/MAR/C3 dated 30 December 1996) on behalf of other consortium members DBE, PricewaterhouseCoopers, Sofres Conseil, C & E Consulting and Engineering, ANDRA, COVRA, ENRESA and ONDRAF/NIRAS, March, 173p.

UNITED KINGDOM ATOMIC ENERGY AUTHORITY, *Quick Facts*, UKAEA, http://www.ukaea.org.uk/about/quick_facts.html

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE, *Trends in Europe and North America: The Statistical Yearbook of the Economic Commission for Europe 2003*, United Nations, <http://www.unece.org/stats/trends/ch9.htm>

UNITED NATIONS ENVIRONMENT PROGRAMME, *Safe and Environmental Sound Management of Radioactive Wastes: Programme Area*, United Nations,
<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=52&ArticleID=70&l=en>

UNITED NATIONS ENVIRONMENT PROGRAMME, *About UNEP*, United Nations,
<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=43>

UNITED NATIONS ENVIRONMENT PROGRAMME, *Environmentally Sound Management of Hazardous Wastes Including Prevention of Illegal International Traffic in Hazardous Wastes*, United Nations,
<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=52&ArticleID=68&l=en>

UNITED NATIONS ENVIRONMENT PROGRAMME, *Guidance elements for the detection, prevention and control of illegal traffic in hazardous wastes: draft training manual for the enforcement of laws implementing the Basel Convention*, United Nations, 2004, UNEP/chw.7/24
<http://www.basel.int/meetings/cop/cop7/docs/24e.pdf>

UNITED NATIONS ENVIRONMENT PROGRAMME, *UNEP Activities in Chemicals*, United Nations, <http://www.unep.org/themes/chemicals>

UNITED NATIONS ENVIRONMENT PROGRAMME, *UNEP Annual Report 2005*, United Nations, 2006,
<http://www.unep.org/Documents.Multilingual/Default.Print.asp?DocumentID=67&ArticleID=5125&l=en>

UNITED NATIONS GENERAL ASSEMBLY, *Report of the Global Conference on the Sustainable Development of Small Island Developing States*, Bridgetown, Barbados, 1994, United Nations, A/conf.167/9
<http://www.un.org/documents/ga/conf167/aconf167-9.htm>

UNITED NATIONS SYSTEM-WIDE EARTHWATCH, *Implementing the Basel Convention*, United Nations,
<http://earthwatch.unep.net/emergingissues/hazardousw/baselconvention.php>

URANIUM INFORMATION CENTRE, *Transport of Radioactive Materials*, Nuclear Issues Briefing paper no.51, Melbourne, UIC, 2005,
<http://www.uic.com.au/nip51.htm>

US MATERIALS MANAGEMENT OFFICE, *Purchasing*,
<http://www.rock-hill.k12.sc.us/departments/operations/purcha.htm>

VAHVELAINEN, S., *Industrial and consumption waste. How to meet the indicator needs. Experiences from Finland*, *Statistical Journal of the UN Economic Commission for Europe*, 2002, Vol. 19, no.1-2, 65-78

VAN CALSTER, G., 'Public environmental law in the European Union', in *Public environmental law in the European Union and the United States*, SEERDEN, R., HELDEWEG, M. and DEKETELAERE, K., (eds.), The Hague, Kluwer International, 2002, 465-515

VAN DEN ANKER, M.J.J. and HOOGENBOOM, A.B., *Schijn bedriegt: overheid, bedrijfsleven en gelegenheidsstructuren voor criminaliteit op de hergebruikmarkt*, 's Gravenhage, VUGA, 1997, 352p.

VAN DEN ANKER, M.J.J. and SNELS, W.C.E., *Wie betaalt, bepaalt: over intermediaire organisaties, milieucriminaliteit, organisatiecriminaliteit en integriteit in het complexe milieuveld*, 's Gravenhage, Elsevier bedrijfsinformatie, 1999, 409p.

VAN DEN BERG, E.A.I.M., *Afvalcriminaliteit*, WODC, http://www.wodc.nl/images/afval_Volledige%20tekst_tcm11-9148.pdf, 10p.

VAN DEN BERG, R.J. and DAMVELD, H., *Discussions on Nuclear Waste, a Survey on Public Participation, Decision-making and Discussions in Eight Countries*, Amsterdam, Laka Foundation, <http://www.laka.org/teksten/afval/2-discussions-00/Discussions.pdf>, 121p.

VELDKAMP, A.M.E., 'Grensoverschrijdende overbrenging van afvalstoffen' in *Strafrechtelijke aanpak van grensoverschrijdende milieucriminaliteit, capita selecta*, HENDRIKS, L.E.M., BIEZVELD, G.A. and VAN RIJSWICK, H.F.M.W. (eds.), Zwolle, Tjeenk Willink, 1996, 39-60

VERHEUGE, E., *In-, uit-, en doorvoer van afvalstoffen*, Belgian federal police, 2002, 29p.

WALING, C., *Bedrijfsinterne milieuzorg: de keerzijde van transparantie*, *Justitiële verkenningen*, 1999, Vol.25, no.2, 44-50

WASTE MARKET COUNCIL, *Waste market: public companies and developments*, Utrecht, AOO, 2002, 43p.

WASTE WATCH, *Jobs from Waste: Employment Opportunities in Recycling*, Waste Watch, 1999, http://www.wasteonline.org.uk/resources/WasteWatch/JobsFromWaste_files/page4.html

WASTEONLINE, *Hazardous: Introduction*, s.d., Waste online, http://www.wasteonline.org.uk/resources/Wasteguide/mn_wastetypes_hazardous.html

WEBSTER, S., *Nuclear Safety and the Environment, Fifth Situation Report: Radioactive Waste Management in the Enlarged European Union*, European Commission, Directorate-General Energy, EUR 20653, 2003, 37p.

WEISSENBACH, T., *Waste management facilities*, Copenhagen, European Environment Agency, 2001, 36p.

WOLSINK, M. and DE JONG, P., Waste sector structure: institutional capacity for planning waste reduction, *Tijdschrift voor economische en sociale geografie*, 2001, Vol.92, no.2, 148-163

WORLD BANK ENVIRONMENT DEPARTMENT, *Environmental assessment sourcebook II: sectoral guidelines*, Washington, World Bank, 1991, 283p.

WORLD NUCLEAR ASSOCIATION, *Waste Management in the Nuclear Fuel Cycle*, WNA, February 2006, <http://www.world-nuclear.org/info/inf04.htm>

X., 'Afval naar derde wereld amper gecontroleerd', *De Standaard*, 30/01/2006

X., *Administration*, Answers Corporation, 2006, <http://www.answers.com/topic/administration>

X., *Alarm over toxic pollution brings Mafia into focus*, The Sydney Morning Herald, 04/09/2004, <http://www.smh.com.au/articles/2004/09/03/1093939148436.html?from=storylhs>

X., *General information about nuclear energy*, Ecolo, http://www.ecolo.org/documents/documents_in_english/ENC-InfoFile.htm
X., *NRC grants license for private nuclear waste site*, Reuters, 22/02/2006, http://today.reuters.com/news/articleinvesting.aspx?type=bondsNews&storyid=2006-02-22T184705Z_01_N22224019_RTRIDST_0_UTILITIES-NUCLEAR-WASTE.XML

X., *Nuclear Europe: Country Guide*, BBC, 16/02/2006, <http://news.bbc.co.uk/1/hi/world/europe/4713398.stm>

X., *Waste Reduction Technology Programs*, WRT, 2005, <http://www.wastereduction.org/programs.html>

ZELLER, L., *High Level Nuclear Waste Shipments: Radioactive and Deadly*, Blue Ridge Environmental Defense League, 2002, http://www.bredl.org/pdf/HLNW_Shipments.pdf 6p.