Imperial College London Centre for Environmental Policy Environmental Quality Research Group

Evaluating the contribution of Cohesion Fund interventions in waste management to achieving the environmental acquis (2000-2006)

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Introduction

 Imperial College London embodies and delivers world class scholarship, education and research in science, engineering medicine and business, with particular regard to their application in industry, commerce and healthcare.





The **Centre for Environmental Policy** at Imperial provides a unique research interface between science and technology and the economic and policy context in which it is developed and applied.

• The Environmental Quality Research Group focuses on the integrated scientific study of the environment with emphasis on waste, water and wastewater management. Complemented by the development and application of tools in sustainability analysis, multi-criteria optimisation and lifecycle assessment.



Earth a closed system

Materials can be transformed or transported within the system, but they cannot be made or destroyed.

1st law of thermodynamics applied to materials referred to as 'law of conservation of matter ' or Material Balance Principle.



Imperial College London **Cohesion policy in the EU**

2000-06

• Aimed to strengthen the economic, social and territorial cohesion of the Union

- 17 countries got Cohesion or ISPA funding
- Cohesion funding → acquis communautaire for environment and especially solid waste management sector

Aim and Scope



To assess the **contribution** of the Cohesion Fund and ISPA to **achieving the Acquis Communautaire** in the field of environment at an EU country level

- Limited to the fields of water quality and management (including wastewater treatment), and solid waste collection and treatment
- · Based on all funded projects within these 3 sectors: water,

wastewater and solid waste per country

London The Cohesion Countries

	Area	Population		Density (c	anita/km2)	GDP (2010 estimated: Euros)				
Country	Alea	Fopt		Density (C		РРР		Nomir	nal	
	km2	2000	2006	2000	2006	Total (billion)	Per capita	Total (billion)	Per capita	
Bulgaria	110,994	8,190,876	7,718,750	74	70	68.11	9,044	33.57	4,458	
Croatia	56,594	4,497,735	4,442,884	79	79	54.96	12,445	42.64	9,656	
Cyprus	9,251	690,497	766,414	75	83	16.32	19,886	16.31	19,873	
Czech Rep.	78,866	10,278,098	10,251,079	130	130	183.89	17,502	135.23	12,871	
Estonia	45,227	1,372,071	1,344,684	30	30	17.38	13,033	13.92	10,441	
Greece	131,990	10,903,757	11,125,179	83	84	223.86	20,011	214.94	19,215	
Hungary	93,030	10,221,644	10,076,581	110	108	132.05	13,187	90.76	9,064	
Ireland	70,273	3,777,565	4,208,156	54	60	121.29	27,067	143.75	32,154	
Latvia —	64,589	2,381,715	2,294,590	37	36	22.88	10,177	16.92	7,526	
Lithuania	65,000	3,512,074	3,403,284	54	52	42.10	12,864	28.39	9,296	
🍧 Ma <mark>lta</mark>	316	380,201	405,006	1203	1282	7.32	17,448	5.83	13,897	
Poland	312,679	38,653,559	38,157,055	124	122	507.65	13,327	329.75	8,656	
Portugal	92,090	10,195,014	10,569,592	111	115	173.86	16,343	161.40	15,172	
Romania	238,391	22,455,485	21,610,213	94	91	178.87	9,051	113.75	7,419	
Slovakia	49,035	5,398,657	5,389,180	110	110	84.99	15,671	60.71	11,194	
Slovenia	20,273	1,987,755	2,003,358	98	99	39.63	19,727	32.68	16,193	
e ãSpain	504,030	40,049,708	43,758,250	79	87	959.95	20,868	966.99	21,025	

London Objectives and EU Legislation

	EU Legislation (Primary)	EU Legislation (Important)	EU Legislation (Relevant)
Solid waste	Directive on waste & Waste disposal*	 Strategy on the prevention and recycling of waste Landfill of waste Waste incineration Shipments of waste WASTE FROM CONSUMER GOODS HAZARDOUS WASTE 	 Integrated pollution prevention and control: IPPC Directive Waste management statistics Competitiveness of the recycling industries

Indicators per sector



Imperial College London Methodology

- Countries' needs: the extent to which Member States failed to meet European environmental legislation in the solid waste sector
- Extent to which projects funded reduced the needs of each country in order to comply with European environmental legislation in this sector

Establish Country Pre-Investment state in waste management

- Examine the extent to which, prior to the expenditure, the country did not conform with European legislation in Solid Waste Management
- For consistency, the year 2000 (before the expenditure) was reviewed as a baseline for all, using Eurostat data and previous GHK reports (Medhurst, 2006).

Prepare Data for the evaluation

- All projects funded in the country were evaluated in terms of delivering benefits in relation to the waste sector.
- Integrated (mixed) projects delivering benefits in more than one sectors: if these projects had sub-projects, the subprojects were used to avoid double-counting, if single projects they were counted in multiple sectors based on benefits delivered.
- Both open and closed projects were included in the evaluation as it aimed to assess the potential of the contribution to countries' needs.

Calculate proportion of needs in waste sector supplied by projects

- The aggregation of provision in the waste sector through projects funded in the country was compared to the county's needs, to estimate the funds' contribution in the waste area examined.
- The prioritisation of activities within the waste sector were taken into account when establishing the overall contribution of the projects to that sector.
- · Data on the projects funded were provided by the European Commission

Imperial College London Methodology

1

Establish Country Pre-Investment state • To examine the extent to which the country, prior to the expenditure, failed to comply with European legislation, base data from the year 2000 (before the expenditure) was reviewed.

2

Prepare Data for the evaluation

3 Calculate proportion of country needs supplied by projects

- All projects were divided according to project types: Drinking Water, Wastewater, Mixed (further split as needed), Solid Waste, Other.
- Umbrella projects (master projects with sub-projects) with more than one subject type were used as sub-projects, to avoid double-counting.
- Both open and closed projects have been included in the evaluation which aims to assess the potential of the contribution to countries' needs.
- The aggregation of project data within project types was used to estimate the total provision of infrastructure for the areas examined.
- Data on the projects funded were provided by RGL. The primary data source for all other data used for the evaluation was the Eurostat database.

Countries' needs

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Imperial College London Projects per sector



	Number of projects	Number of closed /almost closed projects	Cost (€m)
- Ding	135	76	3,778
	346	210	8,475
SW-	198	117	4,159
other	207 (176+31)*	92 (74+18)*	7,062 (6,574+488)*

*Other-Mixed + Other-Other

London All projects per country



Imperial College London Projects for solid waste sector & per country



Solid Waste Projects

London Funding and Projects per country and per sector

Country (costs in €m)	Drinking Water		Waste	water	Waste Other		Tot	al		
	No of projects	Cost	No of projects	Cost	No of projects	Cost	No of projects	Cost	No of projects	Cost
Bulgaria			13	246	2	71	8	185	15	502
Croatia					1	12	1	37	2	49
Cyprus					1	54			1	54
Czech Republic	2	25	20	501	1	70	15	378	38	975
Estonia			6	75	4	43	8	113	18	231
Greece	7	401	22	352	26	479	18	277	73	1,509
Hungary			18	700	13	340	3	78	34	1,118
Ireland			3	554	1	8			4	562
Latvia			1	25	10	98	10	357	21	479
Lithuania			3	45	11	165	13	382	27	592
Maita					1	35			1	35
Poland	4	104	30	1,096	7	148	45	3386	86	4,734
Portugal	44	919	52	935	24	542	19	118	139	2,514
Romania			10	399	7	152	19	848	36	1,399
Slovakia	1	28	13	240	1	16	9	357	24	641
Slovenia			8	102	4	89	7	94	19	285
Spain	77	2,301	147	3,205	84	1,837	40	452	348	7,795
Total	135	3,778	346	8,475	198	4,159	207	7,062	€ 886 Э	-23,474

Imperial College London Appropriateness – National needs

• Sum of projects per sector used to assess contribution to national needs.



Notes:

*Figures for Bulgaria and Romania are indicated as estimated during the negotiation period.

Figures for EU-10 are those reported by the Member States in their Implementation Programmes (Art.17 reports)

Results

NATIONAL

REPORTS

Bulgaria Contribution Provided by the 2000 needed capacity of funded Indicators Ranking projects projects Disposal – Landfill Remediation/ No. of non-compliant landfills to be closed or 2 700 14 0.02 Closure remediated Annual landfill Capacity Disposal – new landfills 3,271,000 549,666 0.168 1 needed (t) Sorting 3 Weight (t) 238,219 33,500 0.118 Population not served by Waste collection Collection 2 1,638,175 17,645 0.107 facilities Biowaste recovery 2 Waste needing diversion (t) 0.58 301,523 17,500 Croatia

Indicators	Panking	Panking 2000 pooded capacity		Provided by	Contribution of
muicators	Kaliking				funded projects
Disposal – Landfill	sposal – Landfill Non-compliant Landfills needing		0.8	0.017	
Remediation/ Closure	I	closure/remediation (%)	47	0.8	0.017
Disposal – new landfills	2	Population without MSW collection and disposal at Compliant Landfill (%)	20	6	0.30
Collection	5	Population not served by waste collection facilities (%)	ation not served by waste collection facilities (%)		0.006
Recovery	3	Bio-waste not recovered (%)	24		0.013
Sorting	4	Population not served by sorting system (%)	90	0.3	0.003

Cyprus					
Indicators	Ranking	2000 needed capacit	ty	Provided by the projects	Contribution of funded projects
Waste collection	3	Need for collection of separate waste streams (tonnes/year)	-	0	0
Waste sorting	2	Waste landfilled in 2000 (tonnes/year)) 423,000	160,000	0.38
Recovery	2	Waste needing recovery based on 2020 targets (tonnes/year)	158,558	73,019	0.46
Disposal-New Sites	1	Waste needing landfill based on 2020 targets (tonnes/year)	311,032	88,000	0.28
Disposal – Site remediation	1	Number of disposal sites needing remediation	113	0	0
	Γ	Indicators Ranking	20	00 needed capacity	

	Indicators	Ranking	Ranking 2000 needed capacity		the projects	funded projects
Czech Republic	Upgrade disposal	2	Population needing upgrade	2,132,964	279,812	0.131
	Waste Sorting	1	Waste not sorted	1,591,786	208,818	0.131

Estonia					
Indicators	Ranking	2000 needed capacity		Provided by the projects	Contribution of funded projects
Disposal	2	Non-compliant Landfill closures needed	37	2	0.05
Disposal	2	Compliant Landfill creation needed	13	2	0.15
Recycling	1	Recycled Waste collection facilities needed	13	1	0.08

Indicators	Ranking	2000 needed capacity		Provided by the projects	Contribution of funded projects
Waste collection – Transfer stations	1	Generated waste not collected (tonnes)	667,050	300,700	0.451
Waste Sorting	1	Waste needing sorting (tonnes)	4,056,197	424,730	0.105
Recovery	2	Waste needing recovery (tonnes)	1,763,974	344,730	0.195
Disposal- New	1	Waste needing disposal (tonnes)	2,630,400	371,194	0.141
Closure/Remediation of Uncontrolled disposal sites	1	Number of landfill closures	2,626	40	0.015

Greece

Hungary					
Indicators	Indicators Ranking 2000 needed capacity		Provided by the projects	Contribution of funded projects	
Disposal (new compliant landfill)	Waste disposed in non-compliant al 1 landfills (minus recovery targets) 2,033,317 It landfill) (tonnes/y)		528,400	0.260	
Landfill closure/remediation	2	Non-compliant Landfill closures Needed (no.)	510	228	0.447
Sorting	3	Recyclables needing sorting (tonnes/y)	635,000	255,700	0.403
Recycling	2	Recycling needed (tonnes/y)	635,000	69,250	0.109
Biowaste recovery	2	Biowaste fraction of needing recovery (tonnes/y)	871,650	392,330	0.450

Ireland	Indicators	Ranking	2000 needed capacity	У	Provided by the projects	Contribution of funded projects
	Recovery	1	Waste landfilled (tonnes/yr)	2,093,000	835,000	0.399

Latvia]				
Indicators	Ranking	2000 needed capacity		Provided by the projects	Contribution of funded projects
Landfill Construction	1	Number of new regional landfills needed	10	7	0.7

	Indicators0	Ranking	2000 needed capacity		Provided by the projects	Contribution of funded projects
Lithuania	Landfill closure	2	Number non-compliant needing closure	700	423	0.60
	Sanitary landfill creation	1	Number landfills needed	10	5	0.50
	Diversion of biodegradable waste	2	35% of 1995 landfilled biodegradable tonnage (tonnes) 623,0		335,000	0.54
	Waste Sorting and recycling	3	EU MSW recycling target % of MSW	50%	14%	0.28

Malta

Indicators	Ranking	2000 needed capacity		Provided by the projects	Contribution of funded projects
Waste collection	2	Need for collection of separate waste streams (tonnes/year)	d for collection of separate waste streams (tonnes/year)		0
Waste sorting	2	Waste landfilled in 2000 (tonnes/year)	Waste landfilled in 2000 (tonnes/year) 130,877		0.28
Recovery	1 Waste needing recovery (tonnes/year)		35,800	35,000	0.98
Disposal	Usal 3 Waste needing landfill (tonnes		-	0	0
Remediation of disposal site	emediation of disposal site 1 Number of disposal sites needi		-	0	0
Other: illegal waste disposal prevention	1	Waste Illegally disposed (tonnes/year)	-	0	0

Indicators	Panking	2000 pooded conscitu	Provided by the	Contribution of	
	Natikitig			projects	funded projects
Collection	2	People not served by waste collection	17,394,101	1,805,934	0.10
Sorting	3	Need for recycling (t/year)	2,860,110	135,500	0.05
Recovery of biowaste	2	Bio-waste to be diverted from landfill (t/year)	2,547,517	69,600	0.03
Disposal- New Landfills	1	Need for Compliant Capacity (tonnes/year)	11,845,350	183,826	0.02

Poland

Portugal

Indicators	Ranking	2000 needed capacity		Provided by the projects	Contribution of funded projects
Waste collection	4	No. people not connected to waste collection system(PE)	40,181	0	0
Waste sorting	3	No. people generating landfilled waste in total waste(PE)	7,308,327	394,422	0.05
Recovery	1	No. people generating landfilled waste in total waste (PE)	7,308,327	5,570,947	0.76
Disposal	2	No. people generating landfilled waste in treated waste(PE)	7,279,523	950,000	0.13

	Indicators	Ranking	2000 needed capacity	2000 needed capacity		Contribution of funded projects
	Waste Collection	2	Waste needing Collection (tonnes)	2,047,205	0	0.00
Romania	Waste sorting	3	Waste needing sorting (tonnes)	1,232,048	82,000	0.07
	Recovery/Recycling	4	Waste needing recycling/Recovery(tonnes)	4,120,988	65,600	0.02
	Disposal-New	1	Waste needing disposal (tonnes)	6,280,437	43,718	0.01

Provided by the Contribution of Indicators Ranking 2000 needed capacity projects funded projects Population not served by waste collection Waste collection 2 139,306 0.25 34,826 (no) Waste needing sorting (tonnes/yr) Waste sorting 3 192,700 5,000 0.03 Recovery 4 Waste needing recovery (tonnes/yr) 380,758 77,500 0.20 Need for new landfill capacity 208,297 90,285 Disposal 1 0.43 (tonnes/year)

Slovenia

	Indicators	Panking	2000 peoded capacity		Provided by the	Contribution of
	mulcators	Natiking	2000 needed capacity	2000 needed capacity		funded projects
	Waste collection	5	Generated waste not collected (tonnes) 6,408,000		2,489,803	0.39
Spain	Waste sorting	Waste sorting 2 Waste needing sorting (tonnes) 9,738,5		9,738,500	1,872,773	0.19
	Recovery	1	Waste needing recovery (tonnes)	9,738,500	1,872,773	0.19
	Disposal (landfill) -New	4	Waste needing disposal (tonnes)	4,677,000	617,030	0.13
	Disposal (landfill)-closure	3	Number of landfill closures	850	763	0.90

Imperial College London **EU analysis**



Criteria and indicators for the analysis of the contribution to EU

Imperial College London Impact to the 17 beneficiary countries (%) in the solid waste sector



Imperial College London Benefits





- The highest percentage is 75.8% in Ireland and the lowest contribution is 8.5% in Croatia
- The highest impact on EU27 is 3.97% in Spain and the lowest is 0.01% in Malta.
- The whole contribution to EU17 based on population is 32.7%, while the ratio to EU27 is 11.9%.

Contribution to countries' needs



Cost of impact

• The highest cost per head to achieve 1% contribution to the country's environmental need is Slovakia, and the lowest is Croatia

Cost per head of contribution to countries



€ Spend per head /% contribution

Sustainabilty

- The methodology is robust but reliability of results depends on the quality of data supplied
- Eurostat data provide different results depending on the tables consulted [data below: 2004-7]
- For instance: Portugal and Spain per capita abstraction are higher than public water supply per capita values.



(1) Spain, France, Hungary, the Netherlands, Switzerland and Turkey, 2006; Finland and Iceland,

2005; Denmark, Estonia and the United Kingdom, 2004; Austria, Italy, Latvia and Luxembourg,

not available.

(2) Estimate.

Source: Eurostat (env_watq2_1)

Figure source:

http://epp.eurostat.ec.europa.eu/statistics_explained/images/b/b0/Total_freshwater_abstraction_by_public_water_supply%2C_2007_%281%29_%28m%C2%B3 _per_inhabitant%29.png

Imperial College London Why a needs assessment

- A target based evaluation would have been appropriate if all countries had the same needs, as they have the same targets
- For example, sub-standard landfills and dumpsites, and also closed but not remediated landfills, posed a significant environmental threat, that was addressed by the first type of interventions above.

Imperial College London Why a needs assessment

 More than 3,300 landfills in EU Member States were closed between 2004 and 2006. Such landfills were constructed without proper measures to reduce their potentially negative environmental impacts and have had to be closed or upgraded in order to comply with the minimum requirements of the EU Landfill Directive.

Imperial College London EU targets for the landfilling of biodegradable municipal waste, 2006



Source: Compiled by ETC/SCP based on data reported to the European Commission by EU Member States, as summarised in Ecologic and IEEP, 2009; personal communication from the European Commission, the Danish EPA and the Polish Ministry of the Environment in 2010; BAFU, 2008; UN-CSD18-Estonia, 2010; EC, 1999.

Imperial College London Why a needs assessment

- Actually not enough was done in this sector, as the European Commission has identified systemic failures in the implementation of the Landfill Directive,
 - with 13 non-conformity cases and
 - 11 bad application cases in 2009
 - as well as a large number of complaints related to illegal landfills and the failure of many Member States to improve the situation (European Commission, 2010).



- Same targets?
- Same problems?
- Same needs?



Solid waste generation data related to the effectiveness of the funds

Country	Waste generation per capita	CF (waste) (million euro)	CF (waste)
	(kg/person/yr)		(%)
Bulgaria	516	72.7	1.8
Croatia	N/A	10.7	0.3
Cyprus	680	49.9	1.2
Czech Rep.	334	66.4	1.6
Estonia	440	41.6	1.0
Greece	408	449.4	11.2
Hungary	445	329.7	8.2
Ireland	603	8.1	0.2
Latvia	270	91.8	2.3
Lithuania	363	155.7	3.9
Malta	547	32.2	0.8
Poland	316	145.3	3.6
Portugal	472	520.1	12.9
Romania	355	144.9	3.6
Slovakia	254	15.4	0.4
	540	22.2	

Imperial College London Closing the loop in the context of sustainable resources management



Imperial College London Conclusions and Recommendations

Broadly speaking, the investments are mostly directed to investments in heavy infrastructures (incineration, landfill conforming with the standards of the landfill directive, rehabilitation of existing landfills) and recycling plants in order to compensate their lack in treatment facilities, while ones which have already set up such facilities choose to develop new infrastructures for recycling or sorting wastes.

Waste infrastructures are very often thought mainly as waste *disposal* facilities such as landfills or incinerators. While such infrastructures are necessary, to be efficient, they have to be *integrated in a regional or* national *strategy, respecting the EU policy and legislation and including* measures and targets concerning waste prevention, *recycling, recovery,* disposal (as well as for progressive closing-down and/or rehabilitation of old waste dumps). The Structural and Cohesion Funds have undoubtedly stimulated the elaboration of **waste** *management plans in conformity with EU legislation.*

The way forward



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 As a society, we must develop and refine our ability to recognize systems, determine the appropriate scale of "wholeness", and sufficiently learn/understand the underlying components/connections.

 To achieve sustainability, our many ecological/environmental, economic, and social "issues" must be resolved.



