PlastiCircle: *Improvement of the plastic packaging waste chain from a circular economy approach*

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PlastiCircle Deliverable

D7.2 INITIAL ENVIRONMENTAL, ECONOMIC AND SOCIAL LCA

(ITENE)

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Abstract

This deliverable provides preliminary information on environmental, economic and social impact of plastic packaging waste management, including the following stages: collection, transport, recycling and end of life options. In the scope of the analysis cities of Valencia, Utrecht and Alba Iulia have been studied. Also, a European approach is shown in which an extrapolation of the results of the three cities have been done to see the approximate situation in Europe. In future deliverables of WP7, environmental, economic and social impacts before and after the pilots will be evaluated using PlastiCircle measurement tools.

Partners

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Publishable summary

PlastiCircle aims to develop and implement a holistic process to increase recycling rates of packaging waste in Europe. This will allow to reprocess plastic waste in the same value chain (i.e. Circular economy; closure of plastic loop). This process is based on four axes: collection (to increase quantity of packaging collected), transport (to reduce costs and fuel use of recovered plastic), sorting (to increase quality of recovered plastic), and valorisation in value-added products (i.e. foam boards, automotive parts like engine covers/bumpers/dashboards, bituminous roofing membranes, garbage bags, asphalt sheets/roofing felts and urban furniture like fences/benches/protection walls).

This deliverable presents preliminary LCA, LCC and SLCA results for the waste management systems in Valencia, Utrecht and Alba Iulia. Moreover, an extrapolation of the results has been calculated to show the results on the European level.

Introduction

Over the last two decades, European countries have increasingly shifted their focus with regard to municipal waste from disposal methods to prevention and recycling. Moving municipal waste management up the 'waste hierarchy'[1] is essential to extract more value from resources while reducing the pressures on the environment and creating jobs (EEA, 2016).

Although municipal waste represents only around 10 % of total waste(in weight) generated in the EU (Eurostat, 2016a) it is very visible, and prevention of this waste has the potential to reduce associated environmental impact not only during the consumption and the End-of-Life (EOL) phases but also throughout the whole life cycle of the products consumed. Countries that have developed efficient municipal waste management systems, generally perform better in overall waste management (EC, 2015) (EEA, 2016).

Waste policies and targets set at the EU level include minimum requirements for managing certain waste types. The most relevant targets for municipal waste are the Landfill Directive's (EC, 1999) landfill diversion targets for biodegradable municipal waste; the Packaging and Packaging Waste Directive's (1994) recycling targets now modified by Directive 2018/852/CE.; and the Waste Framework Directive's (EC, 2008) target on recycling and preparing for reuse (more precisely, the target applies to specific types of household and similar waste) (EC, 2011). (EC, 2015) Countries can choose between four different methods to monitor their progress towards the last target (EC, 2011).

In this briefing, the calculation of recycling rates follows the most common method

[1] The waste hierarchy prioritises waste prevention, followed by preparing for reuse, recycling, other recovery and finally disposal as the least desirable option.

around Europe, i.e. the recycling rate is defined as material from municipal waste recycled divided by municipal waste generated. In 2015, the European Commission proposed new targets for municipal waste of 60 % recycling and preparing for reuse by 2025 and 65 % by 2030. These are based on only one calculation method — roughly the one used in this briefing — with the option of time derogations for some countries (EC, 2015). In addition, new targets to reduce municipal waste disposed of in landfill and revised targets for packaging waste have been proposed (EEA, 2016).

1. ENVIRONMENTAL LIFE CYCLE ASSESSMENT

2.1 Introduction to environmental LCA

WP7 of PlastiCircle aims at comparing environment, economic and social impacts of the different waste management systems in Valencia, Alba Iulia, Utrecht and Europe, before and after the PlastiCircle project.

This initial deliverable presents a simple environmental and economic life cycle analysis which shows the stage of the waste management process which has higher impact over environment and economics. These results can be taken as a general baseline for the LCA in the pilot cities. However, a more complex and complete LCA will be delivered in month 44 and 45, when information before and after the pilot is collected using PlastiCircle measurement tools.

The LCA consists in a four-step process (Figure 1) where the potential environmental impacts are analysed in a life-cycle perspective. Such methodology is standardized through the ISO standards on LCA (ISO14040:2006a); (ISO14040:2006b). The four steps in LCA consist of: (1) Goal and Scope definition, (2) Inventory Analysis, (3) Impact Assessment, and (4) Interpretation of results.

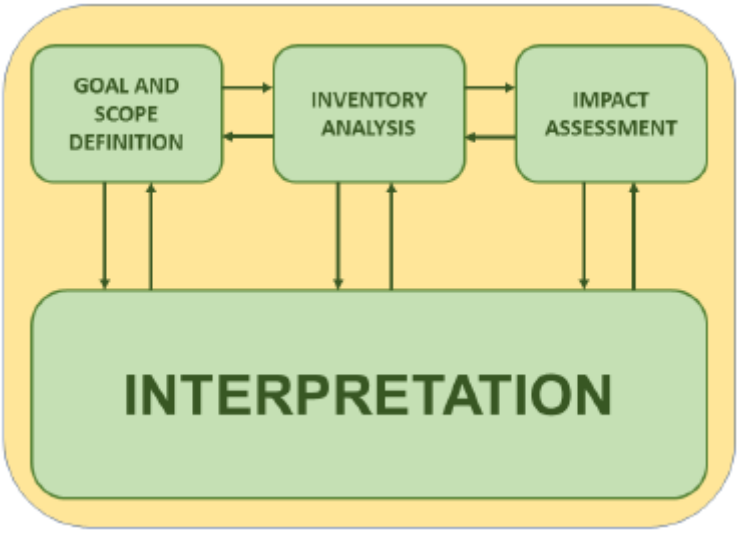

Figure 1. LCA stages

This deliverable has as main objective the definition of a preliminary LCA analysis, including the life cycle inventory for this initial stage. The data for the LCA for each value chain (see below) has been compiled in order to generate a life cycle inventory, which will be aligned with the goal and the scope of the LCA. This step has been carried out using spreadsheets and specific LCA software (SimaPro) which includes the results of potential environmental impacts that are calculated and interpreted with SimaPro software, respectively.

A LCA is usually made in a cradle-to-grave perspective. However, this methodology is quite flexible and allows avoiding certain parts of the life cycle for the sake of clarity by focusing on those aspects that are relevant for a certain group of stakeholders. In the case of the PlastiCircle project, main stakeholders are the

waste management companies. The LCA for the manufacturers that generate the recycled products will be provided in D7.4, D7.5 and D7.6. Due to lack of initial data and different ways of measurement by the waste management companies it will increase the uncertainty of the results. As data collected from cities is limited due to lack of standard measurement tools, data from EuroStat has been collected in order to have a consistent database to make the calculations.

It was decided to focus the LCA in a cradle-to-gate approach considering the end life of products as the "cradle".

2.2 Goal and scope

The main objective of this LCA is to make an environmental, economic and social comparison of the current plastic packaging management systems against the waste management system proposed in PlastiCircle. For this, a cradle to crave perspective has been considered, which considers the following stages: Generation of waste - Collection and transport of the waste – Sorting (which will be studied in the following deliverables) and Recovery options.

At the same time, this analysis has been carried out considering different approaches:

1. Locally: The "local level" approach has consisted in the evaluation of the environmental/economic and social impact associated with the management of plastic packaging management at a local level (Valencia, Utrecht and Alba Iulia) during 1 year.
2. At European level: This approach has been oriented towards the assessment of the environmental/economic and social impact associated with the management of plastic packaging management at a European level in 2015.

The primary audience for this deliverable are local governments and solid waste planners as well as industry stakeholder active in the field of plastic recycling, environmental organisations and LCA practitioners.
Data has been provided by waste managers from Valencia, Utrecht and Alba Iulia, as well as derivedfrom Eurostat.

2.3 System boundaries & assumptions

The focus of this LCA is on management plastic packaging waste from bring-banks in Valencia, Utrecht, Alba Iulia and Europe.

The data on plastic packaging waste, measured in metric tonnes entering the system, as well as the kilometres travelled by the trucks, have been collected from waste managers.

The data for landfill, recycling and incineration tonnes has been extracted from EuroStat data, calculating the tonnes in each country per inhabitant and multiplying it by the population in Valencia, Utrecht and Alba Iulia. The inputs to this processes has been extracted from SimaPro Software: ILCD 2011 Midpoint+.

The data for the European Union has been extrapolated form this data. A socioeconomic study has been done to study which are the countries with more socioeconomic similarities to Spain, the Netherlands and Romania in order to

extrapolate the results of these countries to the ones similar to them. This study can be found in section 2.9.

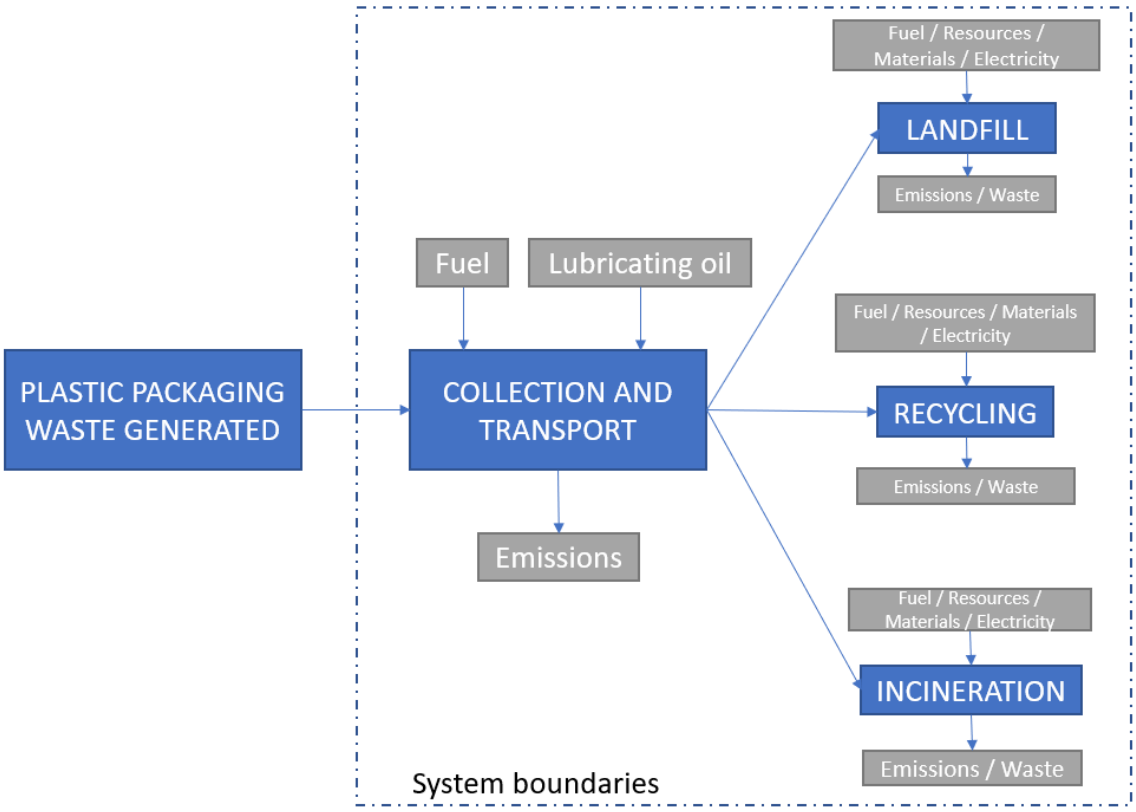

Figure 2. System boundaries

2.4 Life cycle inventory

Life Cycle Inventory (LCI) aims at identifying and quantifying the environmental burdens crossing system boundaries: it will result in a list of raw materials and energy inputs, and of individual emissions to air, to water and as solid waste. In the following, the direct environmental burdens (i.e. those associated with plastic waste management activities) were reported for each stage of the waste management chain as averaged from on site investigation data.

Table 1. Life cycle inventory

	unit	ALBA IULIA	UTRECHT	VALENCIA
packaging	tonnes	26,5	37,28	107,92
distance	km	160000	31817	440927,3
lubricating oil	l	0,014339623	0,010193133	0,003521127
Kgkm	kgkm	6,037735849	0,8534603	4,08568662
truck type		EURO 5	EURO 6	EURO 5
Landfill	tonnes	643,86	293,22	10217,22
Recycling	tonnes	572,73	4955,48	11556,76
Energy recovery	tonnes	9,81	4525,42	4491,38
TOTAL	tonnes	1226,4	9774,12	26265,36
Recycling	%	47%	51%	44%

Energy	%	1%	46%	17%
Landfill	%	53%	3%	39%

Table 2. Data per country and municipalities (Eurostat data)

Country	Generation (tonnes)	Energy recovery (%)	Recycling (%)	Landfilling (%)
Spain	1547932	17%	44%	39%
Netherlands	500677	46%	51%	3%
Romania	376858	1%	47%	53%
Country	**Generation (tonnes)**	**Energy recovery (tonnes)**	**Recycling (tonnes)**	**Landfilling (tonnes)**
Valencia	26265	4491	11556	10217
Utrecht	9774	4525	4955	293
Alba Iulia	1226	9	572	643

Table 3. Population data (Eurostat data)

	SPAIN	VALENCIA	NETHERLANDS	UTRECHT	ROMANIA	ALBA IULIA
population	46570000	790201	17118084	334176	19523621	63536

Collection and transport

The collection/compaction stage. The activity of three domestic-waste collectors was examined: the first operates in a Valencia (Spain), the second in Utrecht (Netherlands) and the third in Alba Iulia (Romania).

The major environmental burdens associated with waste collection systems will be due to the transport required, which consumes energy and results in significant air emissions.

The transport that has been taken into account includes the routes of collection of the trucks which collect plastic packaging waste and the route to the sorting plant.

Recycling

Recycling of mixed plastic packaging waste has been considered. The mix of mixed plastic includes Polyethilene high density, Polyvinilchloride, Polyethylene terephthalate, Polystyrene and Polypropylene. Data from SimaPro has been used to define the percentage of each plastic type and for recycling data.

Landfill

Landfilling is a unit process: wastes from the different recycling units form the inputs, along with some energy to run the process; the outputs are the final stabilised waste, the gaseous and aqueous products of decomposition, which emerge as landfill gas and leachate. In the specific case under study, the waste considered is plastic packaging. As a consequence, landfill gas and leachate are negligible since only 1-3% (Finnveden et al. 1995, Bez et al. 1998) of the hydrocarbon content can be degraded during the considered time period of 100 years.

Incineration

This unit process is an alternative option to waste valorisation by recovering energy. Data from SimaPro has been used to define the impact of combustion with energy recovery.

2.5 Functional unit

The functional unit is collection, transport and end of life options for 1 tonne of plastic packaging waste.

2.6 Valencia

2.6.1 Life cycle impact assessment results

A total of 16 several impact categories have been selected in this LCA, each of them representing a specific impact to the environment. The aim was to cover as much as different types of impacts as possible. This includes the harmful effects of effluent discharges and the emissions because of the energy use. The selection of these impact categories has been made in accordance with one of the available impact assessment methods included in SimaPro Software: ILCD 2011 Midpoint+.

In the graph the different impacts to environment by the several stages of the waste management systems can be seen. For Valencia case, although recycling has high impact over ozone depletion, land use, ionizing radiation HH and E, it can be seen that for the rest of impact types it has a positive and significant effect.

Collection and transport are mainly relevant in land use but also on marine and terrestrial eutrophication and on ozone depletion and acidification.

Energy recovery has a negative impact over climate change, human toxicity and freshwater ecotoxicity, but also minimal negative impact can be found for ozone depletion, particulate matter, ionizing radiation HH and E.

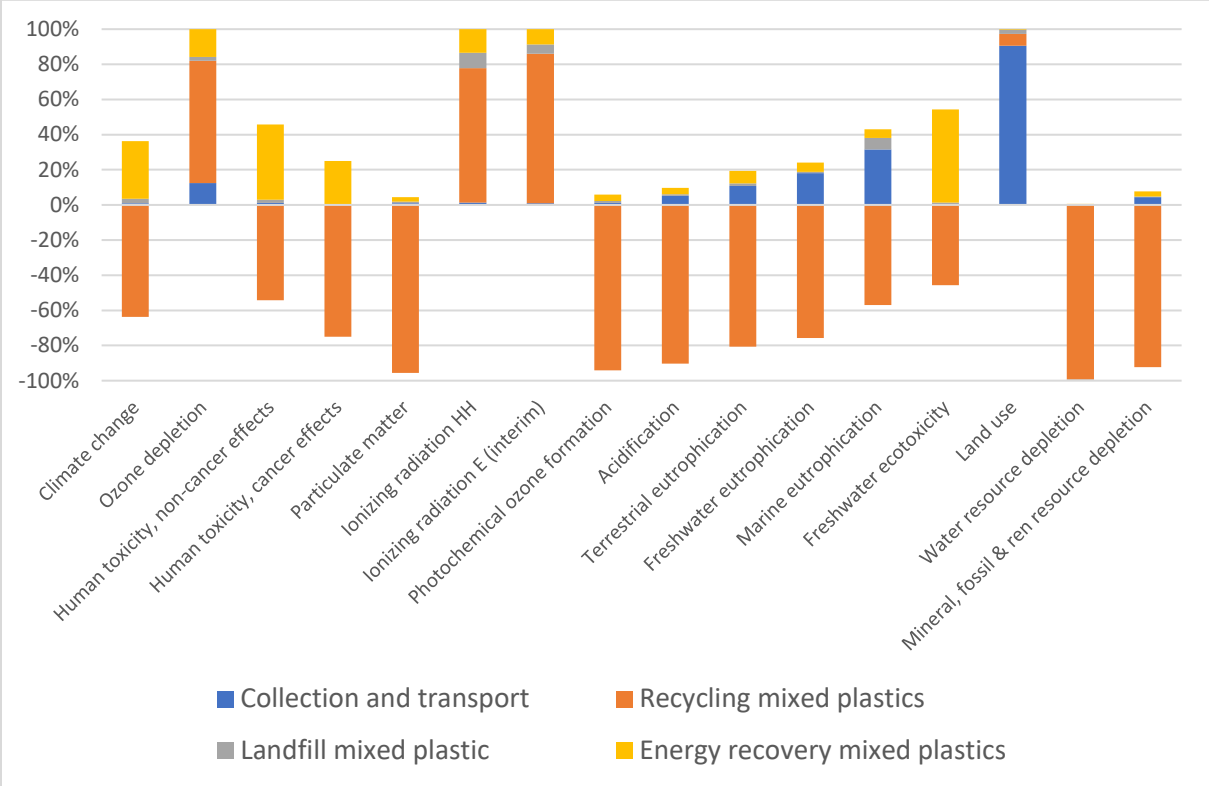

Figure 3. Valencia preliminary Waste Management System life cycle assessment

2.7 Utrecht

2.7.1 Life cycle impact assessment results

In the graph the different impacts to environment by the several stages of the waste management systems can be seen. For Utrecht's case, although recycling has high impact over ozone depletion, land use, ionizing radiation HH and E, it can be seen that for the rest of impact types it has a positive and significant effect.

Collection and transport are mainly relevant in land use but also on marine, terrestrial and freshwater eutrophication and on ozone depletion and acidification.

Energy recovery has a significant impact, since in Utrecht the energy recovery process is common for mixed plastics. It has a negative impact over all the impacts presented except for land use and minimally over water resource depletion.

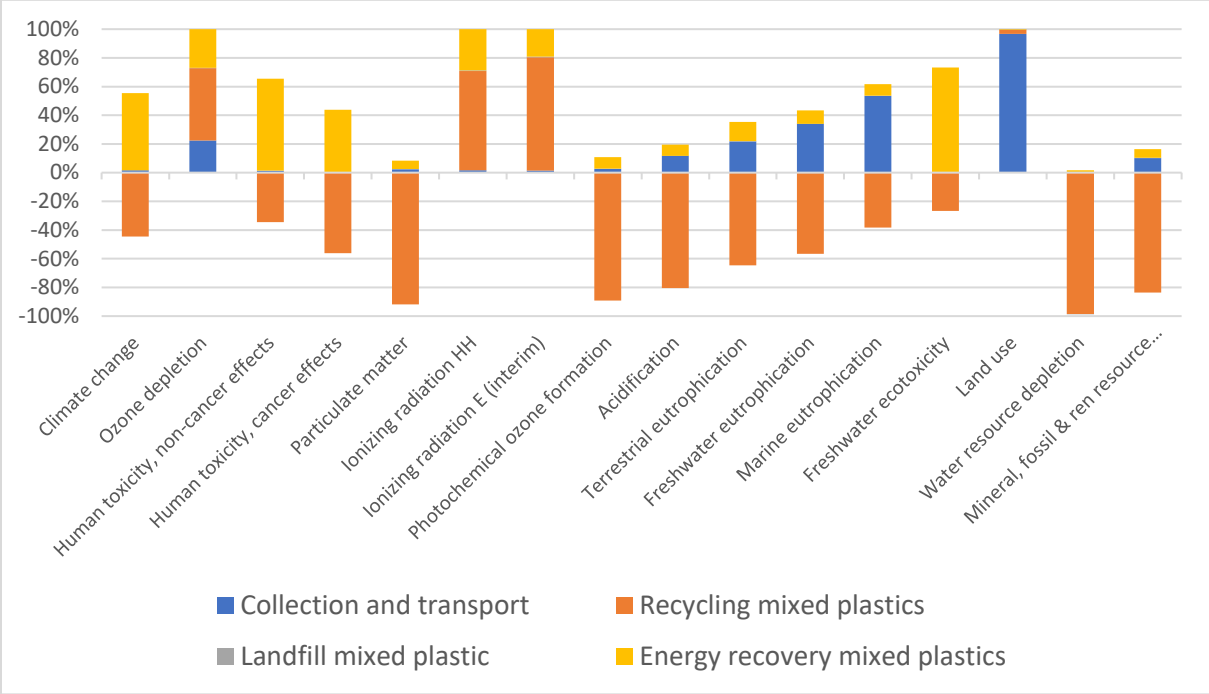

Figure 4. Utrecht preliminary Waste Management System life cycle assessment

2.8 Alba Iulia

2.8.1 Life cycle impact assessment results

In the graph the different impacts to environment by the several stages of the waste management systems can be seen. For Alba Iulia's case, although recycling has high impact over ozone depletion, land use, ionizing radiation HH and E, it can be seen that for the rest of impact types it has a positive and significant effect.

Collection and transport are relevant in land use, marine, fresh water and terrestrial eutrophication, acidification and ozone depletion. Also, minimal impact can be seen on climate change, human toxicity, particulate matter and photochemical ozone formation.

Energy recovery has almost no impact because it is not a common process in Romania.

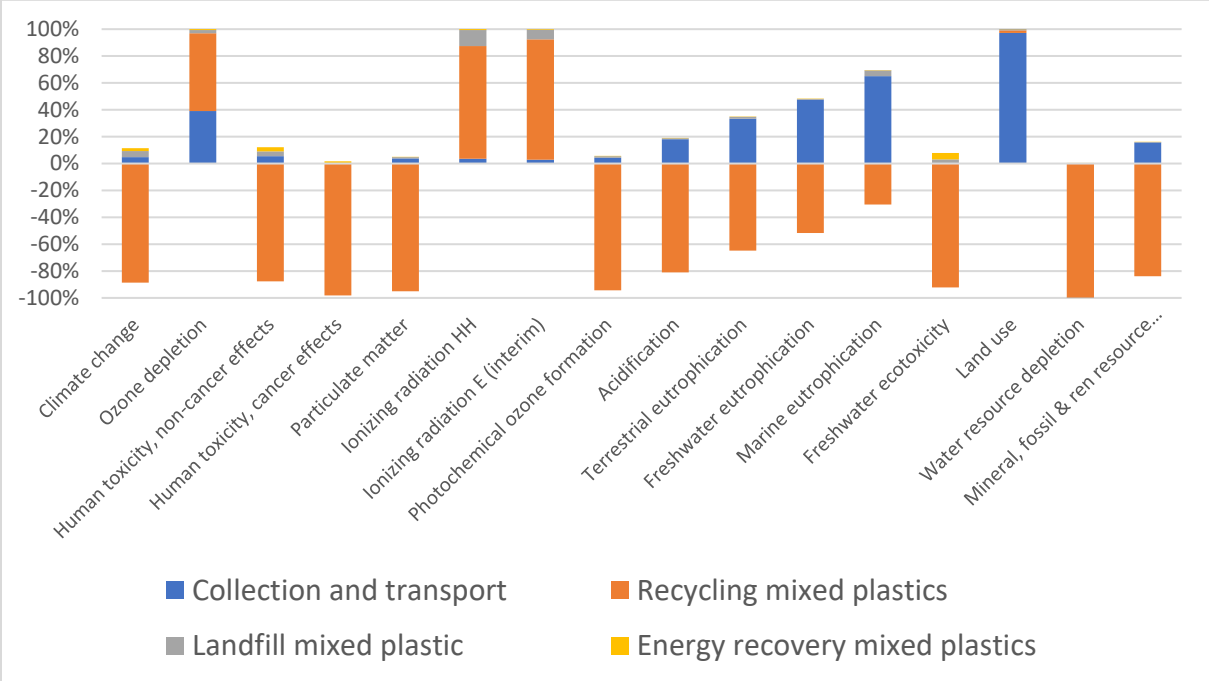

Figure 5. Alba Iulia preliminary Waste Management System life cycle assessment

It can be seen that in the three cases analysed the recycling of mixed plastics has a positive effect in almost all impacts studied. The main differences in the three cities can be observed in the energy recovery from mixed plastics which is most common in norther European countries. However, in the eastern countries barely none incineration processes can be found. It can be observed that this impact is higher than the one generated by landfilling.

2.9 Europe Socioeconomic Comparison of EU Member States

This report has identified socio-economic factors which are related to the provision and effectiveness of recycling systems in a country, and used these to compare the countries in which PlastiCircle pilots are taking place - the Netherlands, Spain, and Romania - with other European Union (EU-28) Member States, in order to assess which country's have similar socioeconomic conditions and therefore have the highest potential for replicating lessons learned by the pilot cities.

The report will consider indicators in the following categories:

- Economic
- Social
- Policy
- Infrastructure

The above indicators will then be combined in a matrix, and countries are grouped by socioeconomic characteristics impacting on waste collection, transport, sorting and recovery.

Economic indicators

Gross Domestic Product

GDP (gross domestic product) is an indicator for a nation´s economic situation. It reflects the total net value of all goods and services produced within the nation's geographic boarder. According to the European Environment Agency, there is a correlation factor of 0.65 between GDP per person and the recycling rate.[2]

Table 1 compares the GDP per capita in Purchasing Power Standards (PPS) across EU Member States.[3] Expressing GDP in PPS eliminates differences in price levels between countries, and calculations on a per head basis allows for the comparison of economies significantly different in absolute size.

[2] https://www.eea.europa.eu/themes/waste/municipal-waste/municipal-waste-management-across-european-countries

[3] Eurostat - http://ec.europa.eu/eurostat/web/national-accounts/data/main-tables

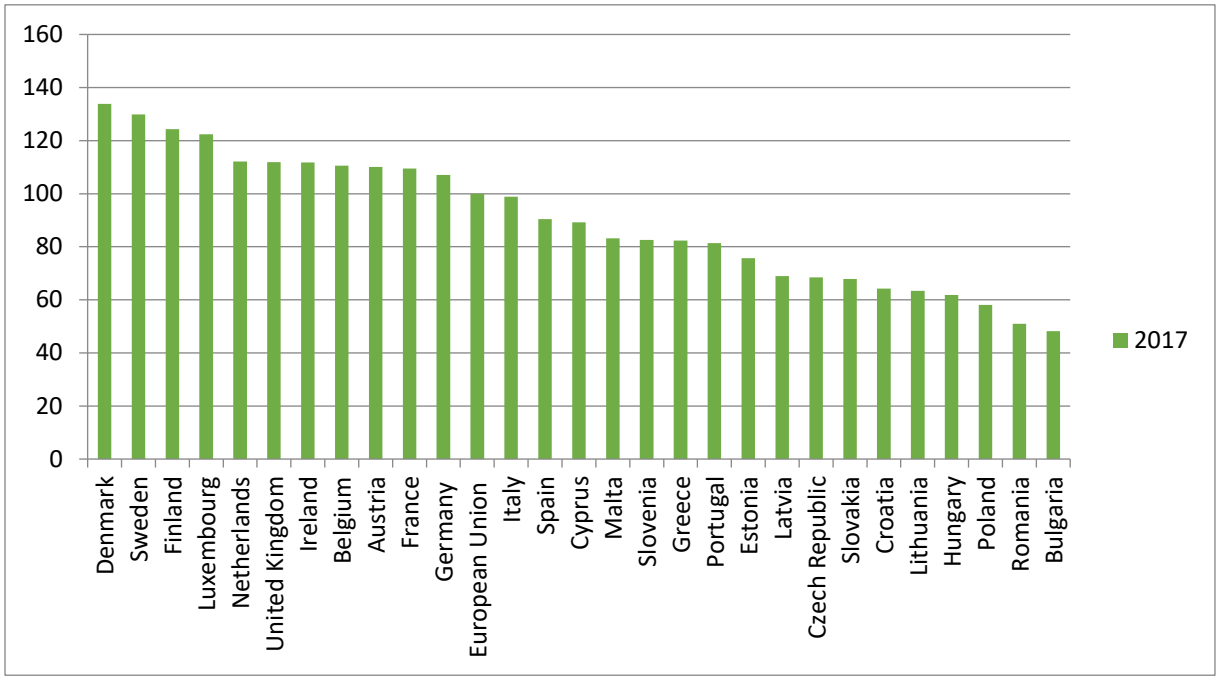

Figure 6. GDP per capita in PPS of EU Member States

The three PlastiCircle countries are spread across the range of EU Member States. The Netherlands GDP per capita in PPS (112) is higher than the EU average, and is comparable with Luxembourg, the UK, Ireland, Belgium, Austria, France and Germany. Spain has a GDP per capita of 90, which is slightly lower than the EU average. Its closest comparisons are Italy, Cyprus, Malta, Slovenia, Greece, and Portugal. Romania has the second smallest GDP per capita in PPS in the EU (51), and its closest comparisons are Poland and Bulgaria.

Personal income

Personal income level has been found to influence recycling behaviour.[4] Graph 2 shows the mean equivalised net income for EU Member States, measured by the PPS[5] in order to allow comparison between the purchasing power of national currencies of EU Member States.

[4] https://ac.els-cdn.com/S092134491500052X/1-s2.0-S092134491500052X-main.pdf?_tid=2e60a418-6c53-4a38-956e-1ac11b8836f4&acdnat=1534249284_b88605155dcc45d3ae9b670be18fd286
[5] http://appsso.eurostat.ec.europa.eu/nui/show.do

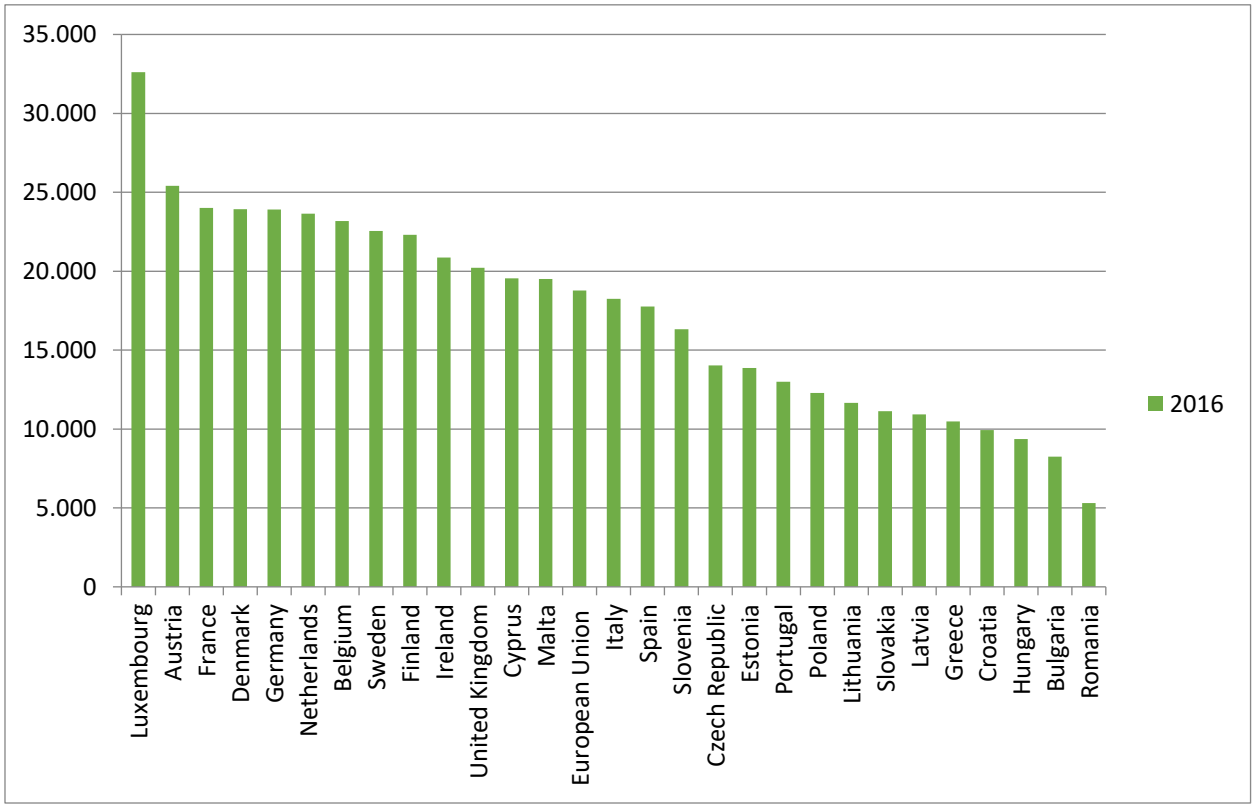

Figure 7. Mean equivalised net income (measured by PPS) of EU Member States

The Plasticircle countries span the range of average incomes across EU Member States. The Netherlands has an average net income per year of 23,911, which is higher than the EU average (18,770), and is similar to Austria, France, Denmark, Germany, Belgium, Sweden and Finland. Spain is in the middle, with an average net income of 17,755 (slightly below the EU average and comparable to Cyprus, Malta, Italy and Slovenia). Romania has the lowest average net income in the EU at 5,303. the next lowest country is Bulgaria (average annual net income of 5,303).

Social indicators

Environmental Attitudes

Convenience of recycling and social norms are important, linked factors which co-determine households' sorting behaviour. Social norms become more entrenched the more mature a county's waste management system is, and become less important when kerbside collection is available (i.e. when recycling is more convenient).[6] In 2017, Eurobarometer conducted a survey of European citizens' attitudes towards the environment, which surveyed almost 28,000 people across all

[6] https://www.sciencedirect.com/science/article/pii/S0921344916301185

EU Member States.[7] The following section examines hose environmental attitudes with relevance to recycling collection systems.

Graph 3 details responses to the question "how important is protecting the environment to you personally?". A high number of respondents from Spain and the Netherlands stated that protecting the environment is personally important (97% and 96% respectively), and 87% of Romanian respondents agreed. As there is not a very large range in the number of respondents reporting environmental protection as personally important, comparison between countries can be clustered according to 'above EU average' (i.e. comparable to Spain and the Netherlands) and 'below EU average' (i.e. comparable to Romania).

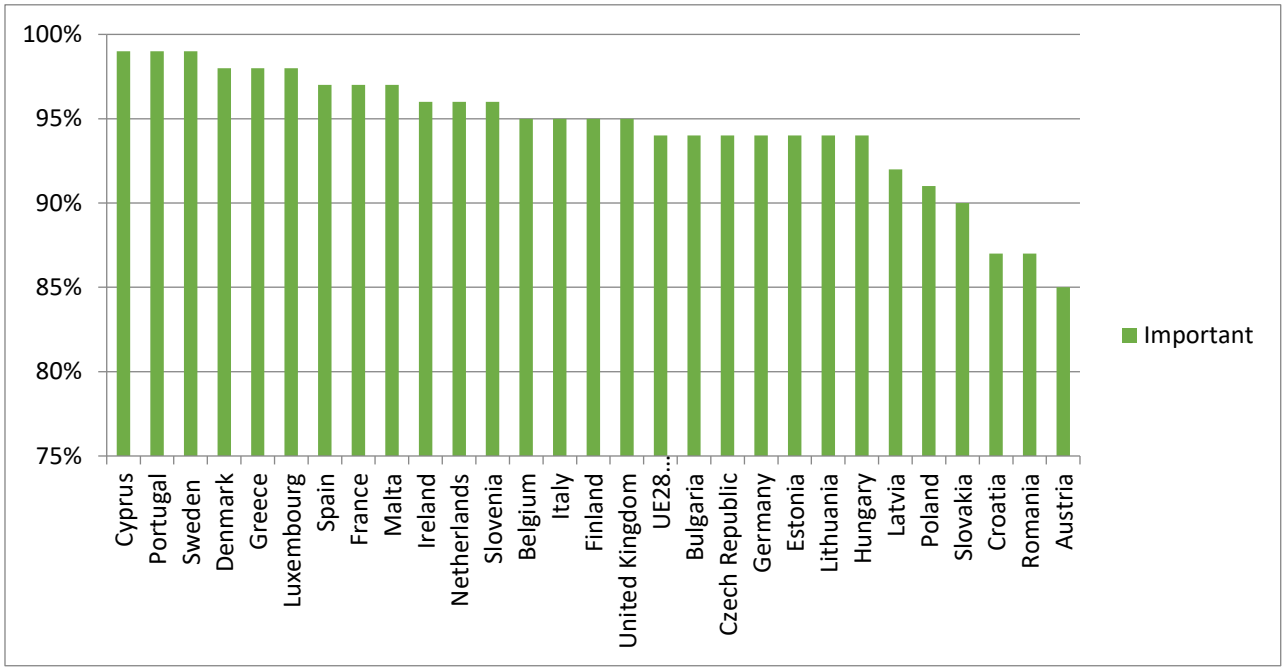

Figure 8. Percentage of respondents to Eurobarometer survey who state that protecting the environment is personally important

The Eurobarometer survey also presented a range of environmental behaviours, and respondents were asked which of these behaviours they had done in the past six months. In 23 of the 28 Member States, separating waste for recycling was the most common environmental activity. In the other five countries (Romania, Austria, Latvia, Estonia and Bulgaria), buying local products was more common.

The percentage of respondents who state they have separated most of their waste in the past 6 months is shown in Graph 4. The Netherland's had the second highest amount of respondents in the EU reporting waste separation for recycling (82%). This is comparable with Sweden, France, Slovenia, Luxembourg, and Finland. 61% of Spanish respondents reported separating waste for recycling, which is slightly below the EU average (65%) and comparable with Ireland, Portugal, Slovakia, Cyprus,

[7] http://data.europa.eu/euodp/en/data/dataset/S2156_88_1_468_ENG

Greece and Italy. Only 29% of respondents from Romania report separating waste for recycling. This is higher than Bulgaria - the lowest in the EU - where only 17% have separated waste in the last 6 months, but significantly lower than the next best country, Croatia, where 44% of people report having separated waste.

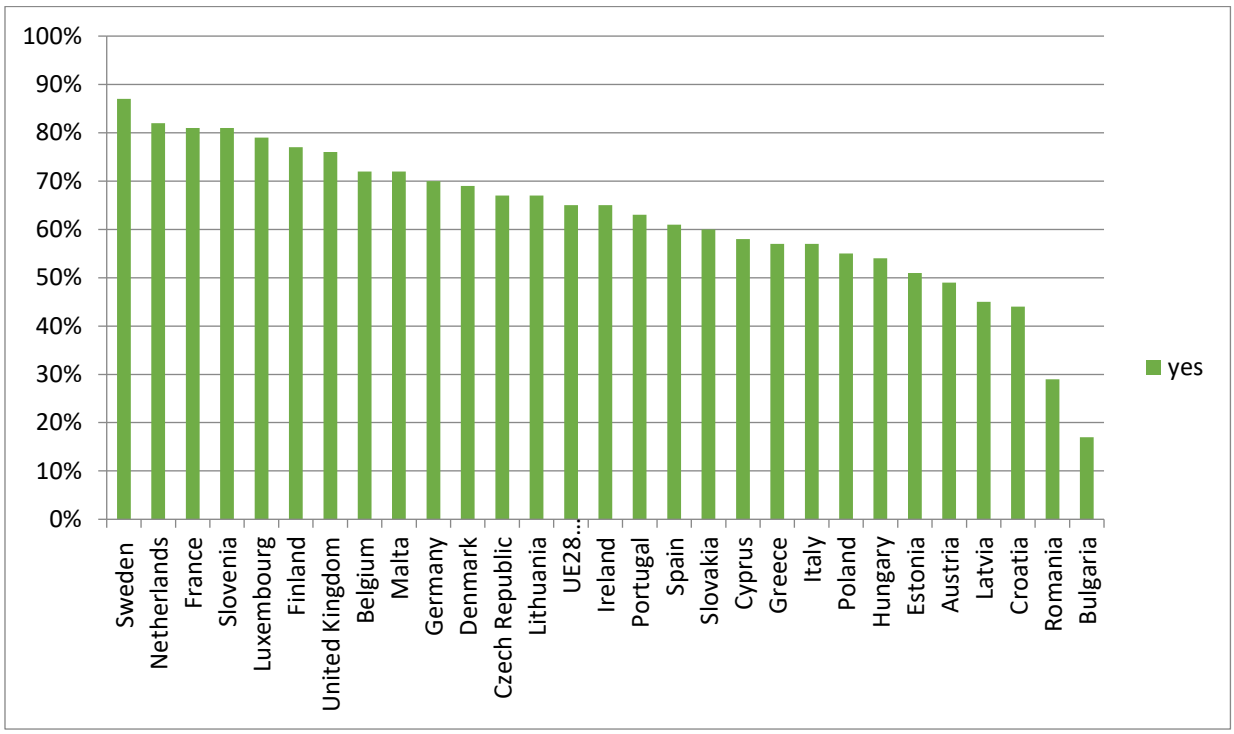

Figure 9. Percentage of respondents to Eurobarometer survey who have seperated most of their waste for recycling in the past 6 months

Eurobarometer also asked respondents if they were concerned about the impact on the environment of everyday products made of plastic - shown in Graph 5. In total, 87% of respondents to the Eurobarometer survey agreed. Of the Plasticircle countries, respondents from Spain are more likely to voice concern (88% - exactly the same amount as Denmark, Ireland, France and Lithuania), than the Netherlands (82%) or Romania (79%) (which are comparable to the United Kingdom - 81%).

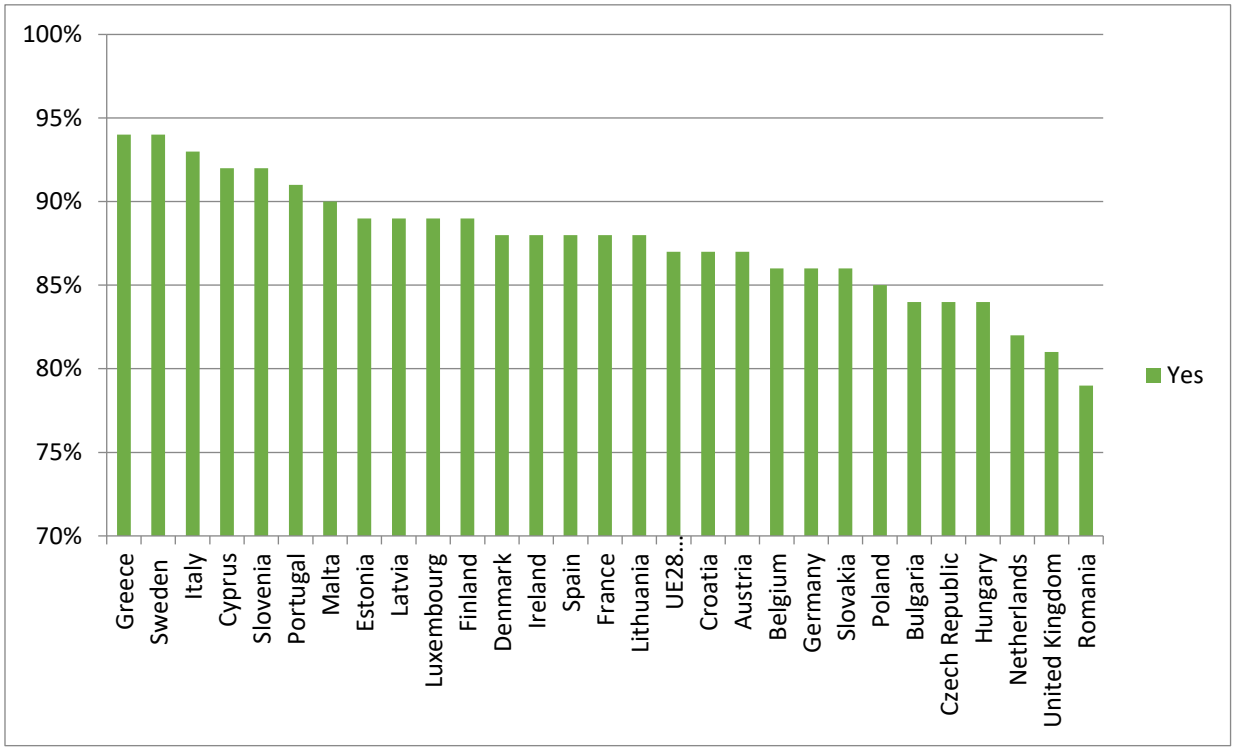

Figure 10. Percentage of respondents to Eurobarometer survey who are worried about the impact on the environment of everday products made of plastic

Tertiary Education

There is some evidence to support the notion that individuals with higher levels of education display more concern and behave in more environmentally friendly ways.[8][9] Graph 7 shows the percentage of the population educated to a tertiary level across the EU.[10]

[8] Meyer, A (2015) Does education increase pro-environmental behaviour? Evidence from Europe. *Ecological Economics* 116

[9] https://ac.els-cdn.com/S092134491500052X/1-s2.0-S092134491500052X-main.pdf?_tid=2e60a418-6c53-4a38-956e-1ac11b8836f4&acdnat=1534249284_b88605155dcc45d3ae9b670be18fd286

[10] http://ec.europa.eu/eurostat/web/gdp-and-beyond/quality-of-life/data

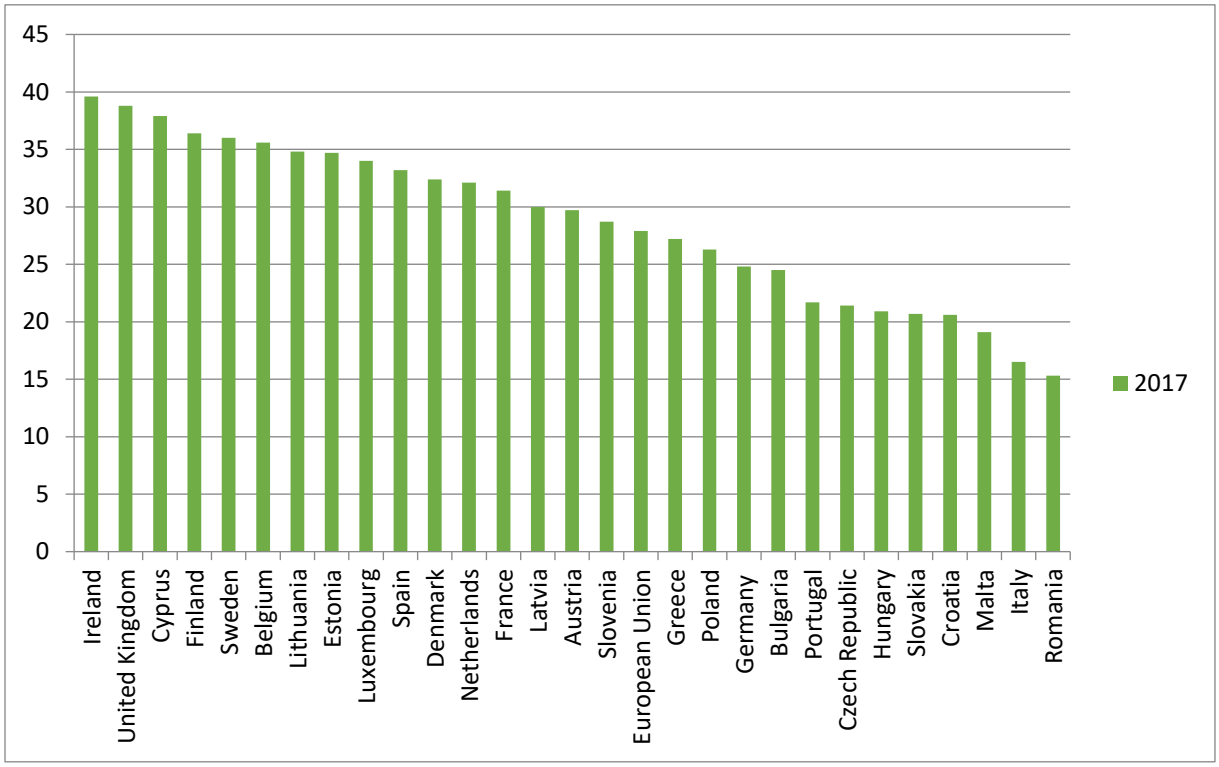

Figure 11. Percentage of the population educated to a tertiary level across EU Member States

A similar percentage of the population has been educated to a tertiary level in Spain (33%) and the Netherlands (32%), both above the EU average of 28%, and particularly comparable with Lithuania, Estonia, Luxembourg, Denmark, France, and Latvia. Romania has the lowest tertiary education level in the EU at 15%, slightly below Italy at 16%.

Waste Management Policies

EU Member States make use of a range of policy instruments for diverting waste from landfill and encouraging more recycling. Table 1 provides an overview of instruments in use (2001-2015).[11] In the table, instruments which are not mandatory or only implemented in some regions are marked with an (x).

[11] https://www.eea.europa.eu/themes/waste/municipal-waste/municipal-waste-management-across-european-countries/table-3-1-municipal-solid

Table 4. MSW managment and policy instruments. Adapted from European Environment Agency (2017)

Country	Two or more national waste management plans developed between 2001 and 2015 or latest available year	Only regional waste management plans	Landfill tax increased by more than 50% from 2001 to latest available year	Landfill tax at least EUR 30/tonne MSW, latest available year	Incineration tax	Landfill ban on organic waste or non-pretreated MSW	Mandatory separate collection of bio-waste fractions	Pay-as-you-throw or other economic incentives for recycling MSW
Austria	×		×	×	×	×	×	×
Belgium		×	(x)	×	×	×		(x)
Bulgaria	×		×				×	
Croatia	×		(No tax)	(No tax)				
Cyprus	×							
Czech Republic	×		×				×	(×)
Denmark	×			×	×	×		(×)
Estonia	×		×	×		×		×
Finland	x		×	×		×	×	×
France		×	×	×	×	×		(×)
Germany		×	(No tax)	(No tax)		×	×	×
Greece	×		(No tax)	(No tax)				(×)
Hungary	×		×			×	(×)	(×)
Ireland		×	×	×		(×)	×	×
Italy		×					(×)	(×)
Latvia	×		×					
Lithuania	×					(×)		×
Luxembourg	x		(No tax)	(No tax)		×	×	×
Malta	×		(No tax)	(No tax)				
Netherlands	×		(Tax abolished in 2012)			×	×	40 % of municipalities
Poland	×		×			×		
Portugal	×		×		×			
Romania			(No tax)	(No tax)				
Slovakia	×						×	×
Slovenia						×		×
Spain	×		(Tax only in regions of Catalonia and Castile and León)		(Only in the region of Catalonia)	Ban on the disposal of recyclable materials	In the region of Catalonia and some other municipalities of other regions	(×)
Sweden	×		×	×	Tax abolished in 2010	×		×
United Kingdom		×	×	×				

From the above table, the policy framework in the Netherlands is most similar to Luxembourg. Both have a waste management plan in place, do not have a landfill tax, have put a landfill ban in place for organic waste or non-pretreated Municipal Solid Waste (MSW), have made separate collection of bio-waste mandatory, and use economic incentives to encourage recycling like 'Pay-as-you- throw' (in the Netherlands this is only used in 40% of municipalities).

The Spanish situation is difficult to compare to other EU Member States, due to a number of regional variations. For instance, landfill tax, incineration tax, bans on organic waste or non-pretreated MSW, mandatory separate collection of bio-waste fractions and pay-as-you-throw or other economic incentives are all implemented in some regions, but not at a national level. Regions with their own waste management plan include Catalonia, Castile and Leon, Aragon, Andalucia, Asturias, the Basque Country, Galicia.[12]

Romania's waste policy framework has not yet developed, and it has no policies, taxes, landfill controls or incentives in place (at least as of 2015). Other countries with a similar waste policy framework include Croatia, Greece, and Malta: while these countries all have a national waste management plan, they do not have a landfill tax or any other instruments in place (apart from some regional or voluntary economic incentives in Greece).

Infrastructure

Population density

Population density is measured according to the ratio between the annual average population and the land area. Population density affects the provision and utilisation of infrastructure, and it is assumed that a denser population results in higher volumes of recycling to be collected with potentially less transportation. Graph 8 shows the population density of EU Member States in persons per kilometre squared (km^2).[13]

[12] http://ec.europa.eu/environment/waste/studies/pdf/Assessment_of_WMP_final_report.pdf
[13] http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tps00003&plugin=1

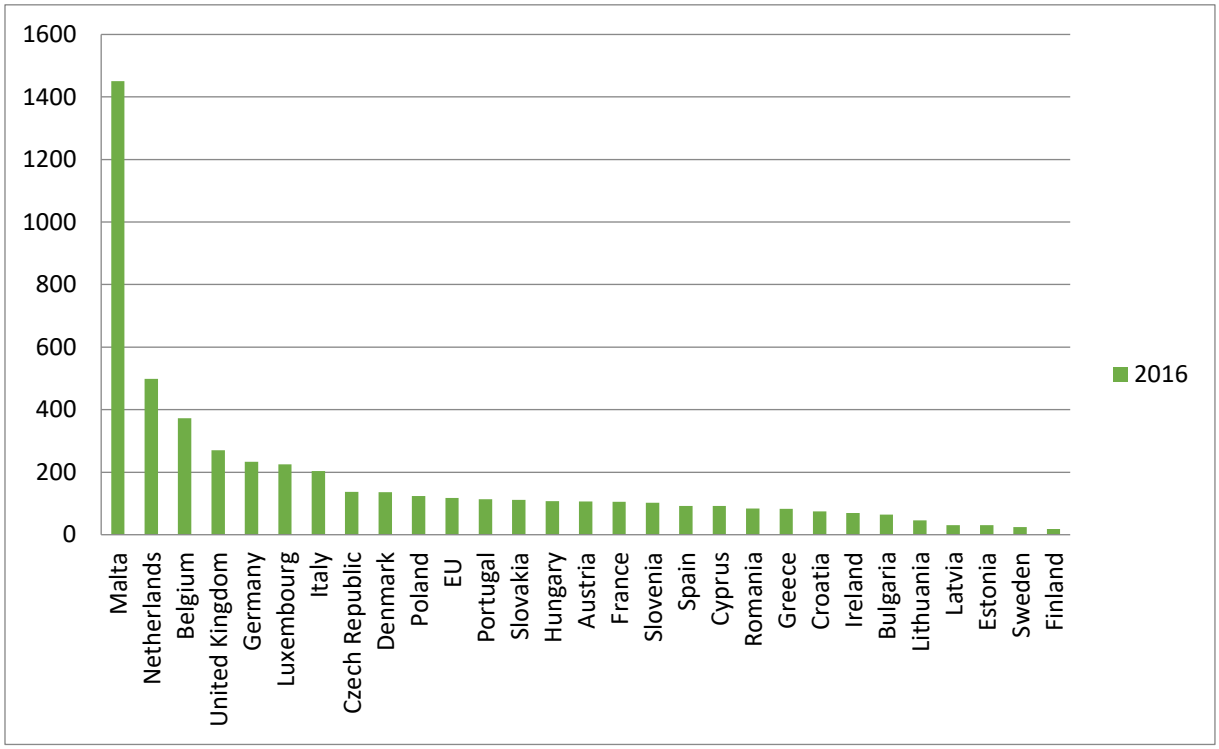

Figure 12. Persons per kilometer squared in EU Member States

The Netherlands has the second highest population density (after Malta) with 498 persons per km^2. Spain and Romania have similar population density (92.5 and 84 persons per km^2 respectively), and are comparable with Cyprus and Greece.

Collection Facilities

Eurobarometer respondents were asked their opinion about strategies for reducing plastic waste and littering.[14] One of the strategies included was "local authorities should provide more and better collection facilities for plastic waste". Graph 6 shows the percentage of respondents who agreed that this strategy was 'important'.

[14] http://data.europa.eu/euodp/en/data/dataset/S2156_88_1_468_ENG

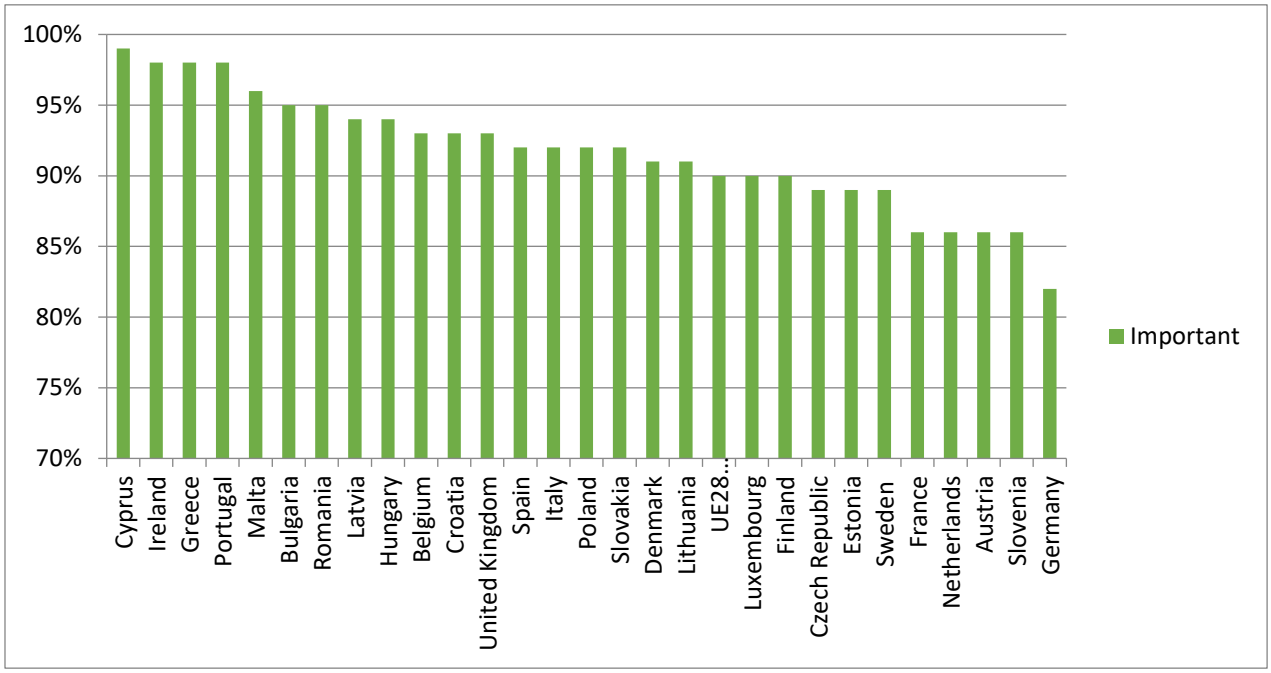

Figure 13. Percentage of respondents to Eurobarometer survey who believe that local authortieis should provide more and better collection facilities for plastic waste

Of the PlastiCircle countries, Romanian respondents were the most likely to agree that this was important (95%), comparable to Malta, Bulgaria, Latvia and Hungary. Spain (92%) was comparable to Belgium, Croatia, the UK, Italy, Poland and Slovakia. and the Netherlands (86%) was comparable to France, Austria, and Slovenia.

Municipal Waste Incineration

Proper treatment infrastructure and sufficient capacity is crucial for the implementation of waste management and circular economy strategies. Waste infrastructure is capital intensive, and requires time to be developed. Under-capacity as well as overcapacity can be an issue, particularly overcapacity of waste incineration facilities, as this can have an impact on the recycling market and on waste treatment prices.[15] Graph 9 shows the number of WtE Plants in EU Member States, and the amount of waste incinerated in total.[16]

[15] https://scp.eionet.europa.eu/publications/wp2014_8/wp/wp2014_8
[16] http://www.cewep.eu/2017/09/07/waste-to-energy-plants-in-europe-in-2015/

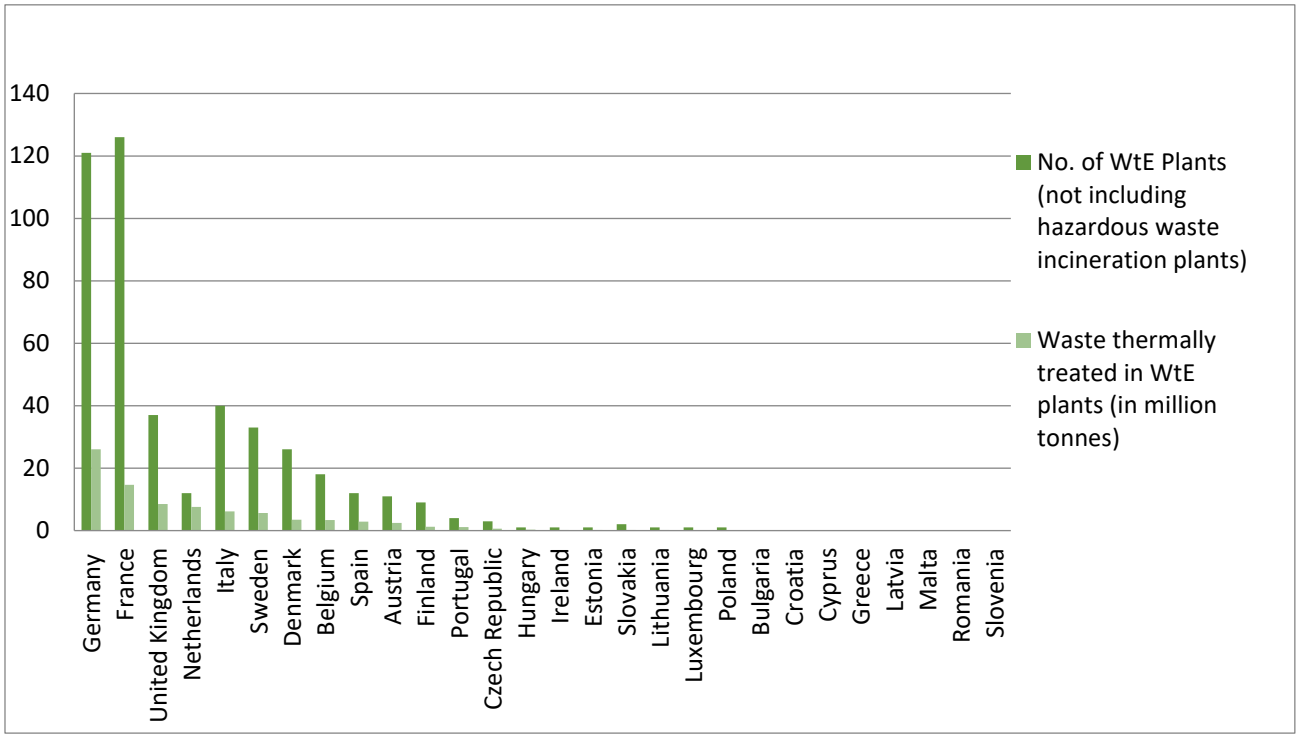

Figure 14. Number of WtE Plants and total waste incineration (in million tonnes) across EU Member States

Both Spain and the Netherlands have 12 WtE plants. The capacity of plants in the Netherlands is far higher than Spain however, at 7.5 million tonnes, and the amount of waste it is treating is comparable to the UK (which has 37 plants). Spain incinerates 2.9 million tonnes of waste per year (total incinerated waste), making it closely comparable to Austria, which incinerates 2.5 million tonnes using 11 plants. Romania has no WtE plants, as does Bulgaria, Croatia, Cyprus, Greece, Latvia, Malta. and Slovenia.

Overall Comparability

To finish this socioeconomic comparison of the Plasticircle countries with EU Member States, an effort was made to aggregate the indicators into one measure.

To do so, a matrix was compiled for each country (see annex), which collated all data from the indicators discussed above, providing an overview of how each EU Member State compared to the Netherlands, Spain and Romania in terms of economic, social, policy and infrastructure measures.

A country was considered to be similar to a Plasticircle country when it was in a 10% range of the value being measured. This range was not appropriate in all indicators (where the difference between all countries was narrower), therefore the following indicators were compared in terms of being above the EU average or below the EU average: "how important is protecting the environment to you personally?", "are you worried about the impact on the environment of everyday products made of plastic?", and "local authorities should provide more and better collection facilities for plastic waste". With regards to policy indicators, countries were compared according to whether policies were present on a national basis, regional basis, or not at all.

As a different number of indicators were available for economic, social, policy and infrastructure categories, scores were weighted so that each category had an equal overall determination on country comparability (economic indicators = 3 points, social indicators = 1.5 points, policy indicators = 1 point, and infrastructure = 2 points).

The overall comparison scores for the Netherlands, Spain and Romania are presented below.

With regards to plastic waste, the Netherlands can be argued to be most similar to France, Luxembourg and Austria in terms of its socioeconomic context (Graph 10). France has a particularly similar economic and social context, while Luxembourg has an almost identical policy framework.

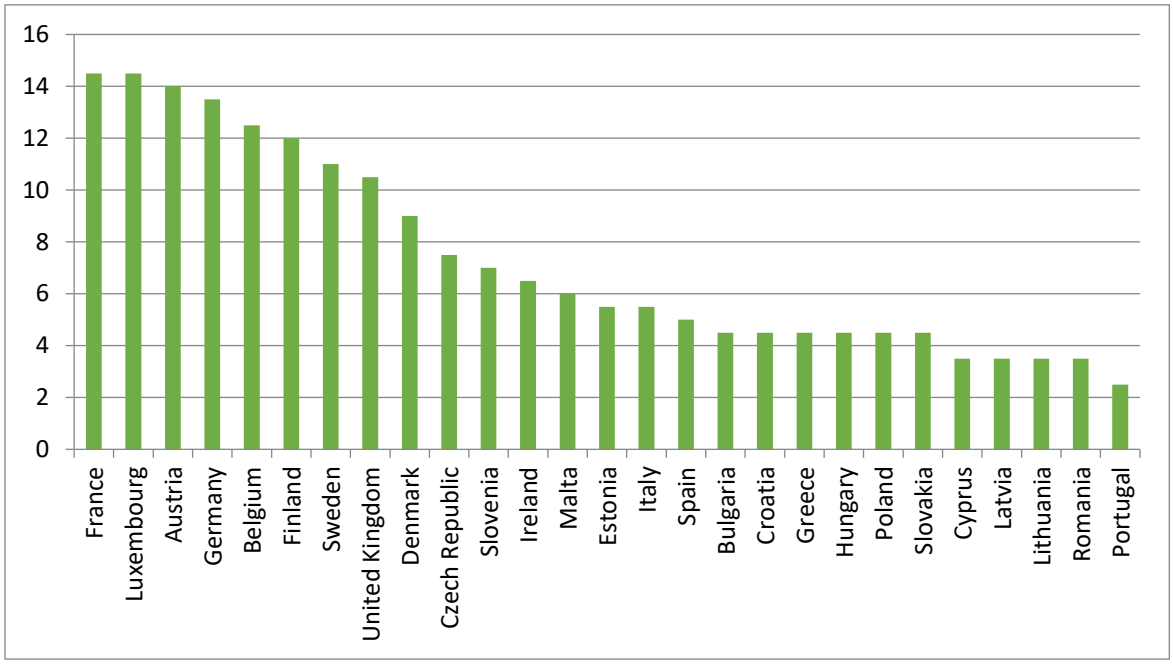

Figure 15. Overall comparability of Netherlands with EU Member States according to economic, social, policy and infrastructure indicators related to plastic waste

Spain can be considered most similar to Cyprus and Italy (Graph 11). While the policy context is quite different in Cyprus, it does have many similarities in terms of economic, social and infrastructure indicators. Italy is also similar in economic and social terms.

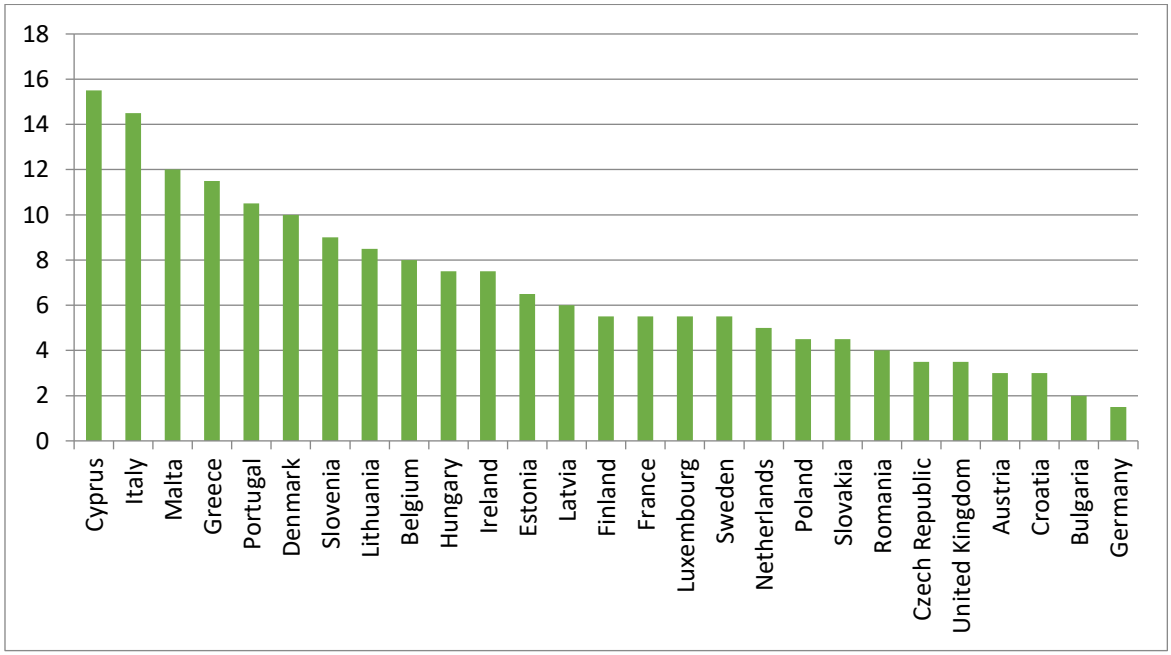

Figure 16. Overall comparability of Spain with EU Member States according to economic, social, policy and infrastructure indicators related to plastic waste

Romania is most comparable to Bulgaria and Croatia (Graph 12). the similarities with Bulgaria are spread across all indicators, as with Croatia, which also has a similar policy context.

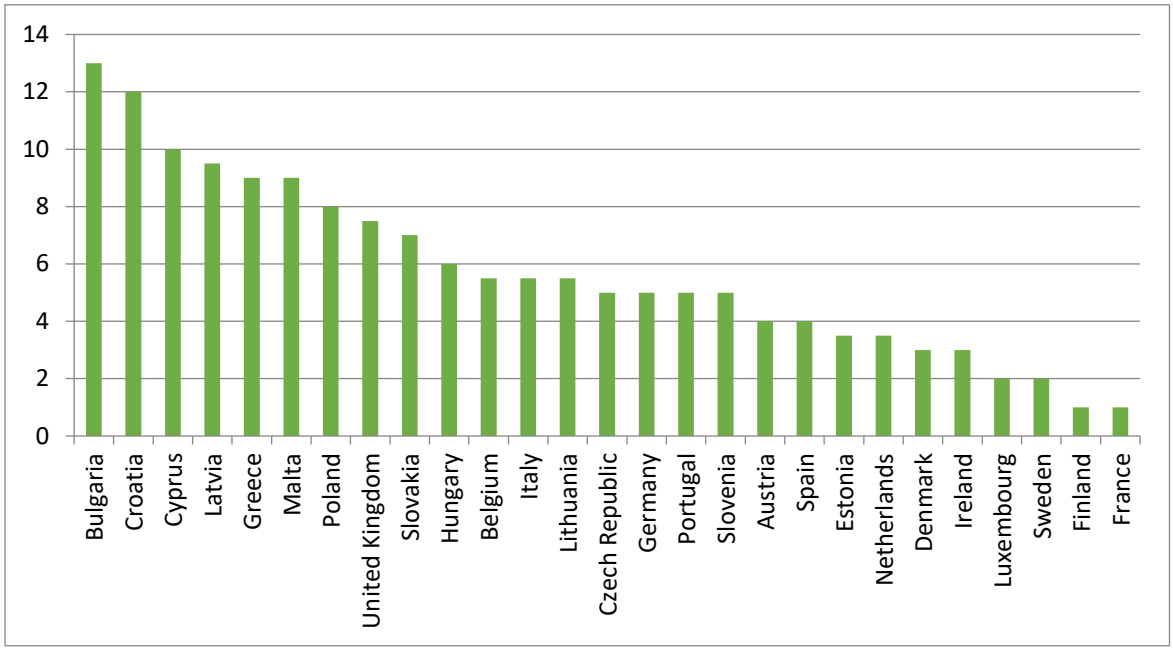

Figure 17. Overall comparability of Romania with EU Member States according to economic, social, policy and infrastructure indicators related to plastic waste

Overall, the exercise shows that there are pronounced differences in the overall socioeconomic context of each EU Member State with regards to plastic waste, and the cities participating in Plasticircle come from countries with different levels of economic strength and environmental attitudes and behaviors, as well as having different policy frameworks and infrastructure. This means that lessons derived from the Plasticircle project are highly likely to be relevant across Europe.

According to the abovementioned figures, the European countries have been divided as seen in **Table 5**, according to its socio-economic similarities with Negherlands, Spain and Romania.

Table 5. Similarities among EU countries

NETHERLANDS	SPAIN	ROMANIA
FRANCE	CYPRUS	BULGARIA
LUXEMBOURG	ITALY	CROATIA
AUSTRIA	MALTA	LATVIA
GERMANY	GREECE	POLAND
BELGIUM	PORTUGAL	SLOVAKIA
FINLAND	DENMARK	
SWEDEN	SLOVENIA	
UK	LITUANIA	
CZECH REPUBLIC	IRELAND	
	ESTONIA	
	HUNGARY	

The following maps present countries which are similar in socio-economic conditions to the Netherlands, it can be seen that is mainly north Europe. It includes France, Luxembourg, Austria, Germany, Belgium, Finland, Sweden, United Kingdom and Czech republic.

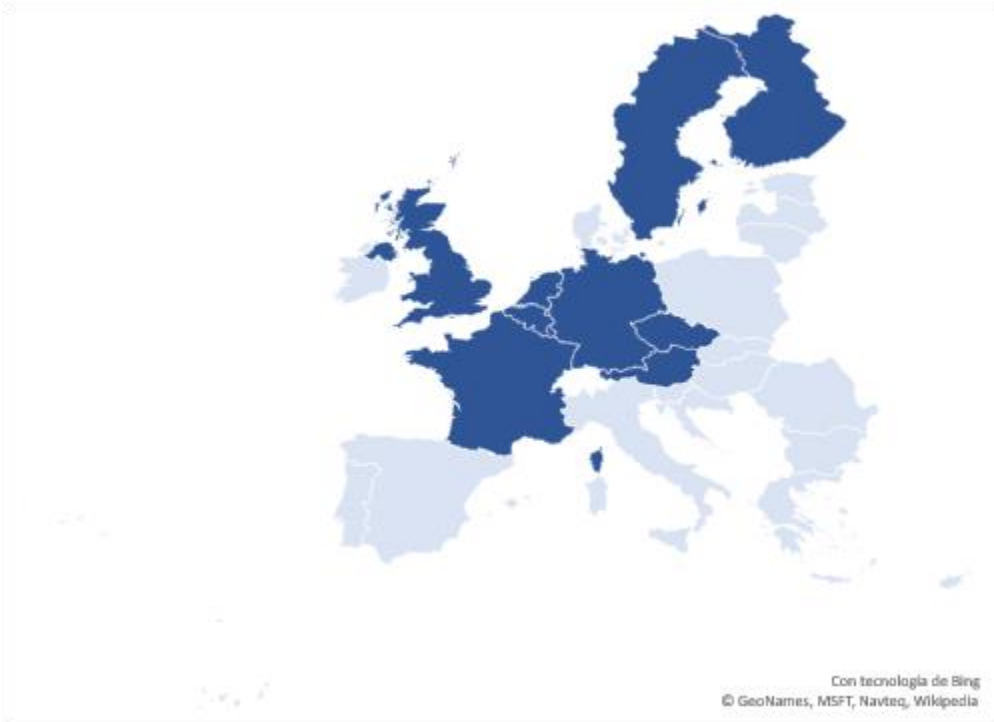

Figure 18. Netherlands similar countries (zone 1)

The following maps present countries which are similar in socio-economic conditions to the Spain, it can be seen that is mainly south Europe and some small countries in the north. It includes Cyprus, Italy, Malta, Greece, Portugal, Denmark, Slovenia, Lithuania, Ireland, Estonia and Hungary

Figure 19. Spain similar countries (zone 2)

The following maps present countries which are similar in socio-economic conditions to the Romania, it can be seen that is mainly eastern Europe. It includes Bulgaria, Croatia, Latvia, Poland and Slovakia.

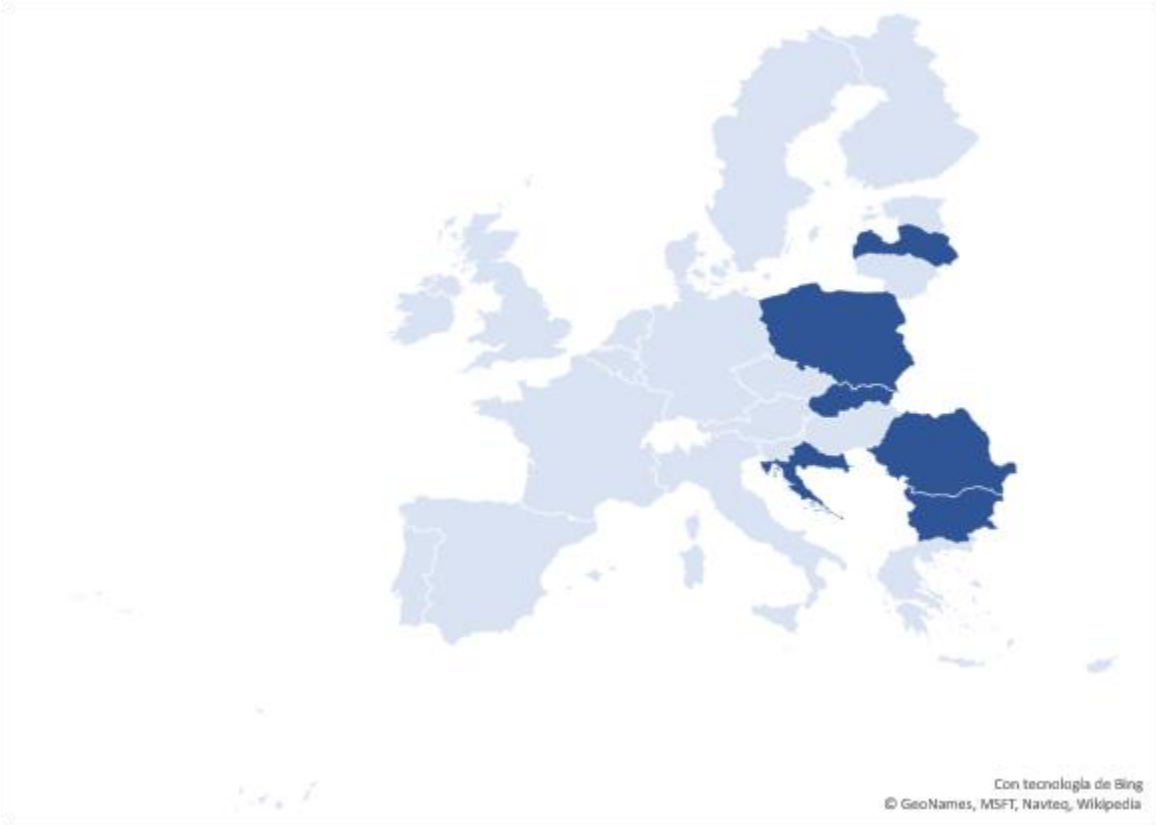

Figure 20. Romania similar countries (zone 3)

2.9.1 Life cycle impact assessment result

In the graph the different impacts to environment by the several stages of the waste management systems can be seen.

For the European case, although recycling has high impact over ozone depletion, land use, ionizing radiation HH and E, it can be seen that for the rest of impact types it has a positive and significant effect.

Collection and transport are mainly relevant in land use but also on marine, terrestrial and freshwater eutrophication and on ozone depletion and acidification.

Energy recovery has a significant impact, since in Europe the energy recovery process is common for mixed plastics. The most significant negative impacts of energy recovery are over climate change, ozone depletion, human toxicity and freshwater eutrophication. Minimal impact can also be found in the rest of impact categories.

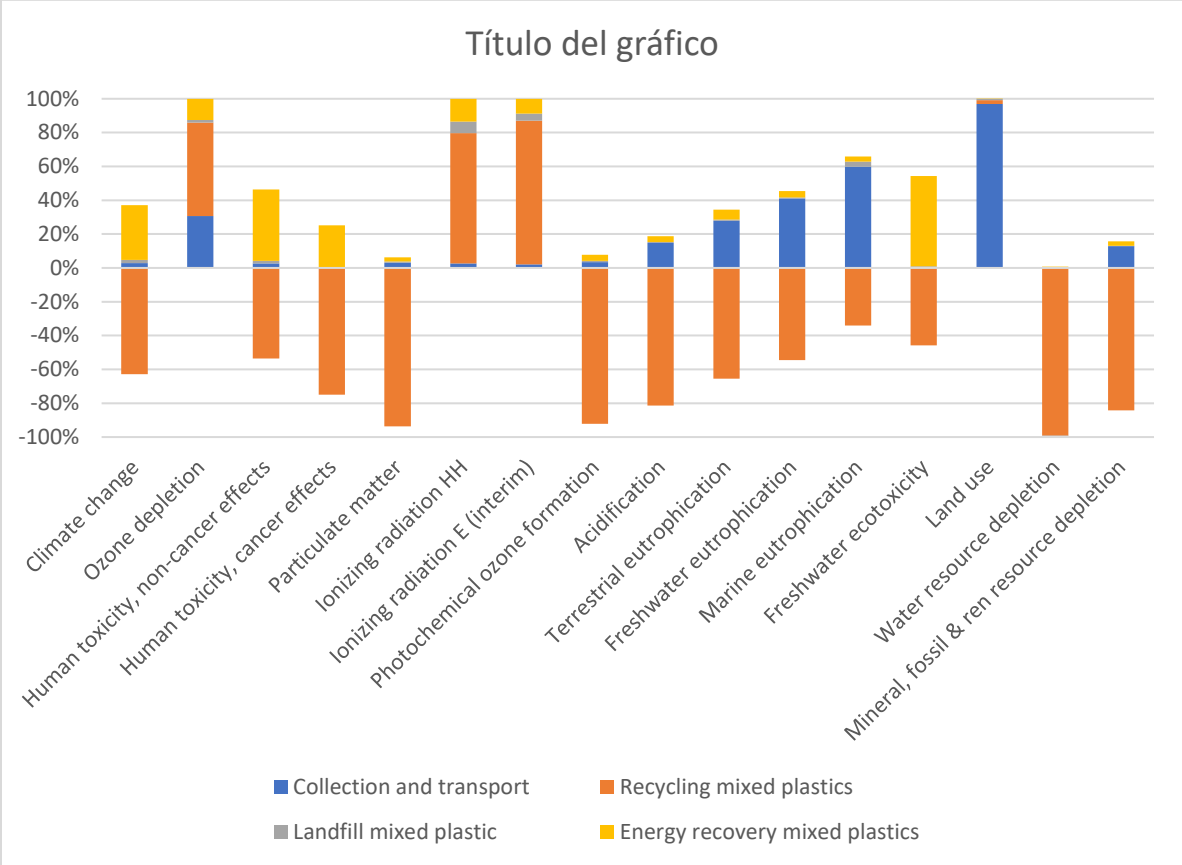

Figure 21. European preliminary waste management system life cycle assessment

2. ECONOMIC ASSESSMENT

2.1 Goal and scope

The aim of this study is to perform a preliminary evaluation of the economic impact of the plastics waste management value chain in the three cities considered in Plasticircle project. This study is meant to map the economic situation prior the implementation of innovative technologies that are developed within the project and a subsequent evaluation will be performed to estimate the impact of those implementations.

The scope of the economic assessment includes the plastics waste management value chain, beginning at the end-user's generated plastic waste until the production of final recycled plastic materials (e.g. flakes, pellets) at the output of the recycling process. Thus, the following steps are included in this evaluation (Figure 22):

1. Collection (including transportation to sorting facilities);
2. Pre-treatment and sorting into different plastic resins;
3. Transportation of the sorted plastic resins to recycling facilities and other management options;
4. Recycling by type of resin;
5. Final disposal or energy recovery of plastic waste not collected for recycling and plastic waste from pre-treatment/sorting and recycling operations.

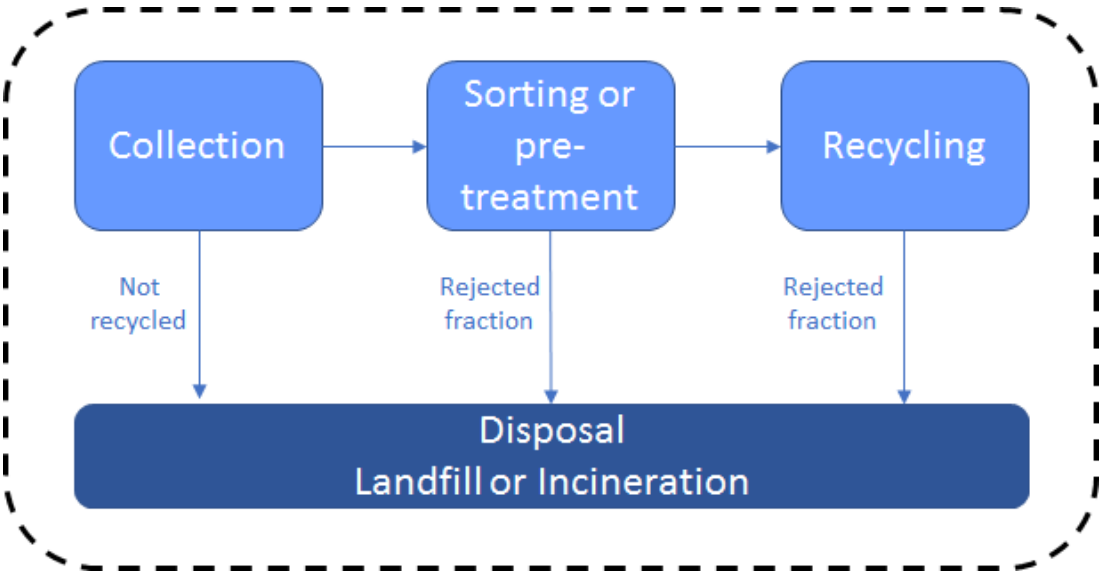

Figure 22 Value chain evaluated in the preliminary economic assessment

2.2 Method and data

A questionnaire has been prepared and sent to relevant project participants and plastic waste management actors. Unfortunately, the survey resulted in partial or reduced quality data limiting their use for this preliminary assessment. Indeed, the recycling value chain of plastics is very diverse and involves a multitude of actors in each step of the chain. This, together with the confidentiality aspect make the data gathering difficult and often impossible. Therefore, for the sake of this initial assessment, data have been collected from literature sources at EU and Member State level. Efforts will be made to improve the accuracy of these data to fit the actual case studies evaluated in Plasticircle project.

Table 6 shows the main publicly-available data and their sources.

Table 6 Fees, landfill taxes and operating costs used within this study (€/t)

	ALBA IULIA	UTRECHT	VALENCIA	Operation costs Averaged EU28	Sources
Fee producers	133	387	472	287	PRO Europe (2017)*
Landfill tax	26	13,11	41,30	41,52	Cewep (2017)
Collection	-	-	-	151	Hestin et al. (2015)
Pre-treatment	-	-	-	185	Hestin et al. (2015)
Transport	-	-	-	2/15	Hestin et al. (2015)
Recycling	-	-	-	446	Hestin et al. (2015)
Energy Recovery	-	-	-	74	Hestin et al. (2015)
Landfilling	-	-	-	73	Hestin et al. (2015)

*Data gathered from ECO-ROM AMBALAJE for Romania, AFVALFONDS VERPAKKINGEN for Netherlands and ECOEMBES for Spain

Based on the European directive on packaging and packaging waste, packaging producers are responsible to separate and recycle plastic packaging waste. In most European countries there is an entity that is responsible to collects a financial contribution paid by the retail sector and the packaging industry (based on volumes of plastic waste) and compensates the collection of household plastic waste. For example, In the Netherlands a so-called "green dot" company is in charge of meeting these legal obligations (Stichting Afvalfonds Verpakkingen, referred to as the Afvalfonds). The costs of participation in the respective national recovery systems for packaging and packaging waste for 2017 (where available)

have been gathered from: Pro Europe (2017)[17].

In order to divert waste from landfills, most of the EU Member States apply a form of landfill tax and/or a landfill ban, additionally to the requirements of the Landfill Directive. Applied taxes and bans for landfill are provided by Cewep (2017)[18].

Operating costs (including investment and employment) for the value chain have been extracted from Hestin et al. (2015)[19]. These costs are average operating costs of all steps at EU-28 aggregated. The costs of transport are given as follows: a) transport to recyclers (15 EUR/t) and transport to other waste management options (2 EUR/t). These values may differ from real data and the outcome of this study is only indicative. As aforementioned, efforts will be made to improve the accuracy of these data to fit the actual case studies evaluated in Plasticircle project.

The amount of plastics and the share of the type of management are provided in Table 2. These amounts together with the data provided in Table 6 are used to evaluate the yearly costs and revenues discussed in the following section. For the sorting and recycling, the amount are split into respective resins (Table 7) and the revenues for sorting and recycling of those resins are calculated using the reference prices per tonne (Table 8).

Table 7 Distribution of plastic resins for the three cities

	Share (%) Source: Hestin et al. (2015)	ALBA IULIA	UTRECHT	VALENCIA	EUROPE
PET	35 %	200	1734	4045	2356347
PE-HD	15%	86	743	1734	1009863
PE-LD	21%	120	1041	2427	1413808
PP	17%	97	842	1965	1144511
PS	3%	17	149	347	201973
PVC	1%	6	50	116	67324
Other plastic resins	8%	46	396	925	538594

[17] https://www.pro-e.org/files/Participation-Costs_2017.pdf

[18] http://www.cewep.eu/wp-content/uploads/2017/12/Landfill-taxes-and-bans-overview.pdf

[19] Hestin,M., Faninger, T. and Milios, L. (2015) Increased EU Plastics Recycling Targets: Environmental, Economic and Social Impact Assessment, Deloitte available at: https://www.plasticsrecyclers.eu/sites/default/files/BIO_Deloitte_PRE_Plastics%20Recycling%20Impact_Assesment_Final%20Report.pdf

Table 8 Prices of recycled and sorted plastics in €/t

	Sorted waste plastics (adapted from Hestin et al. (2015))	Recycled plastics[20]
PET	300	380
PE-HD	400	580
PE-LD	220	580
PP	300	560
PS	100	670
PVC	220	440
Other plastic resins	260	535

2.3 Results for the pilot cities

To assess the relative cost effectiveness of plastic recycling, the yearly specific revenues and costs for plastic waste management for the three cities have been compiled. For each city the results are presented in the following sections.

The plastic waste management value chain costs and revenues for Valencia, Utrecht and Alba Iulia are displayed in Figure 23, Figure 24, and Figure 25, respectively. For the three cities, the largest costs are due to collection, sorting, and recycling while energy recovery (via incineration) and landfilling have only minor costs as only small amounts are handled by these options (Figure 26). Although, sorting and recycling show higher costs, large revenues are generated through these steps and together with the producers' fees, this management option shows a positive balance for Valencia and Utrecht while it is just about being balanced for Alba Iulia.

Interestingly, one may note that operation costs for landfill are only partially covered by the landfill taxes. While energy recovery and the "gate fee" barely cover the operational costs of the incinerator.

Overall, for Valencia and Utrecht, throughout the value chain the revenues are larger than the incurred costs especially if the producer's fees are included. This in turn results in a positive balance for these two cities while the balance is slightly negative for Alba Iulia (Figure 23-25). One reason that may explain this difference is the lower contribution fee that packaging producers pay in Romania than in Spain and Netherlands (Figure 27).

[20] bvse market report on plastics, October 2018, available at: https://plasticker.de/preise/marktbericht3_en.php?id=184

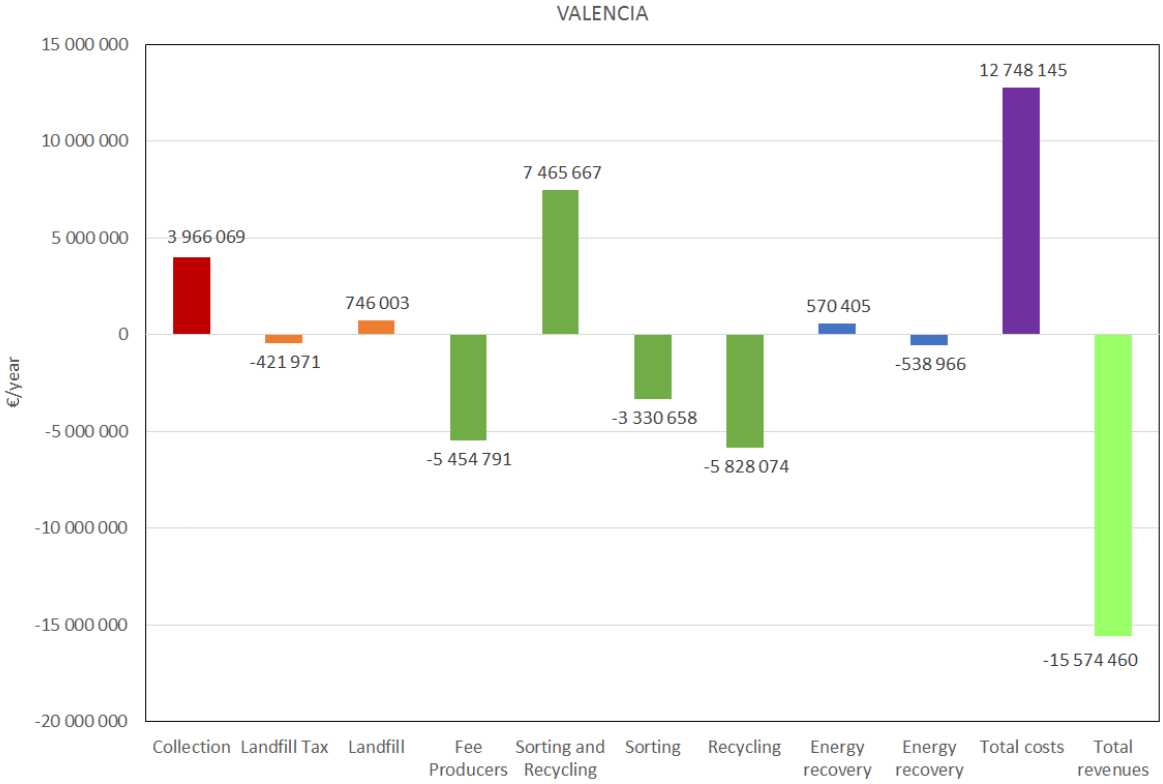

Figure 23 Costs and revenues breakdown for the plastic waste management in Valencia, where positive values are costs and negative values are revenues

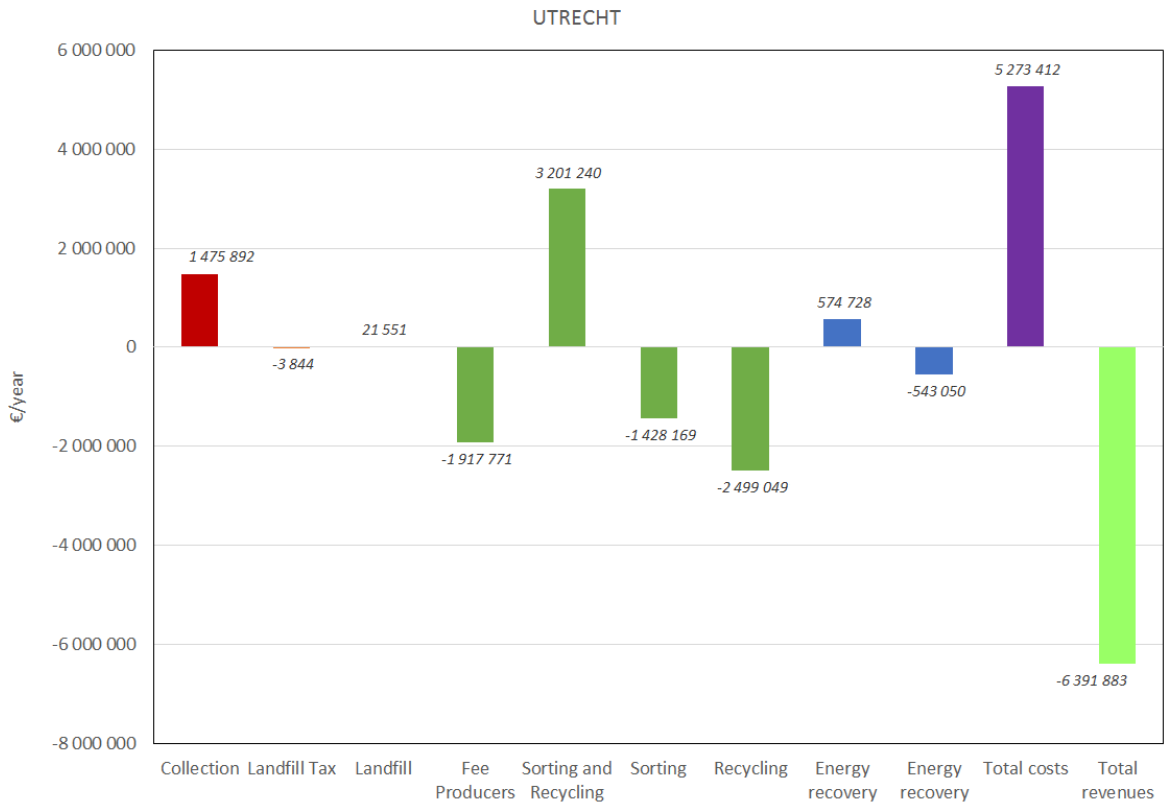

Figure 24 Costs and revenues breakdown for the plastic waste management in Utrecht, where positive values are costs and negative values are revenues

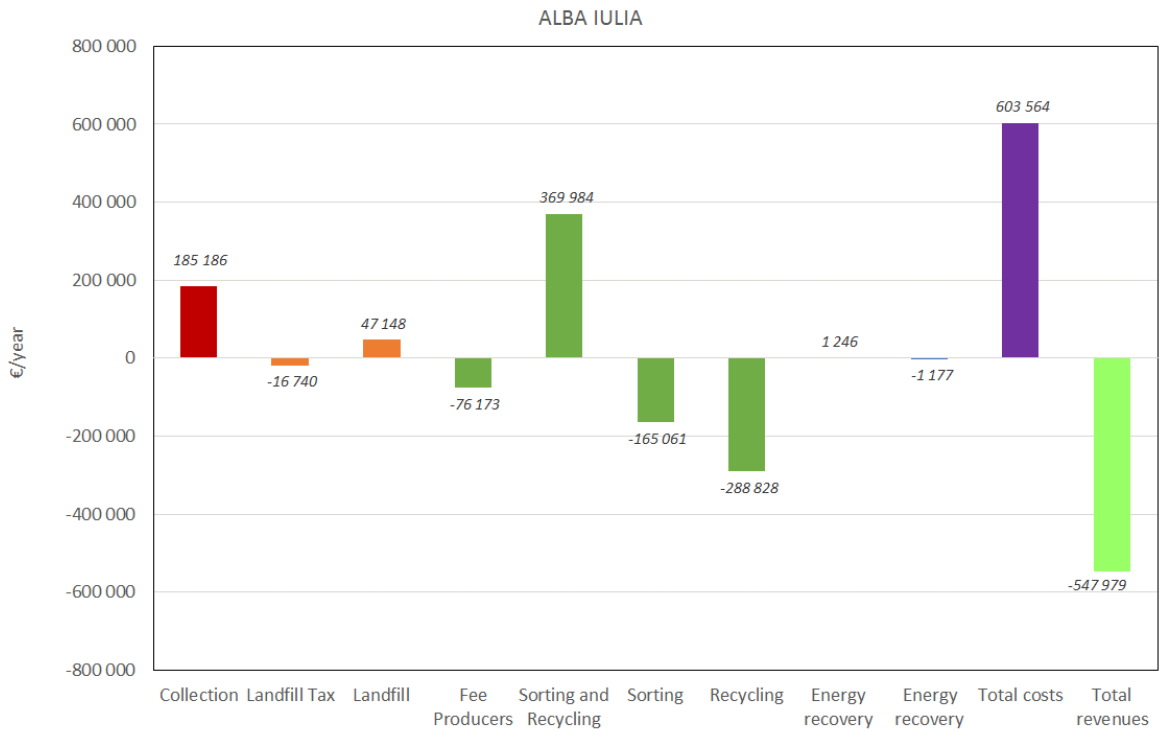

Figure 25 Costs and revenues breakdown for the plastic waste management in Alba Iulia, where positive values are costs and negative values are revenues

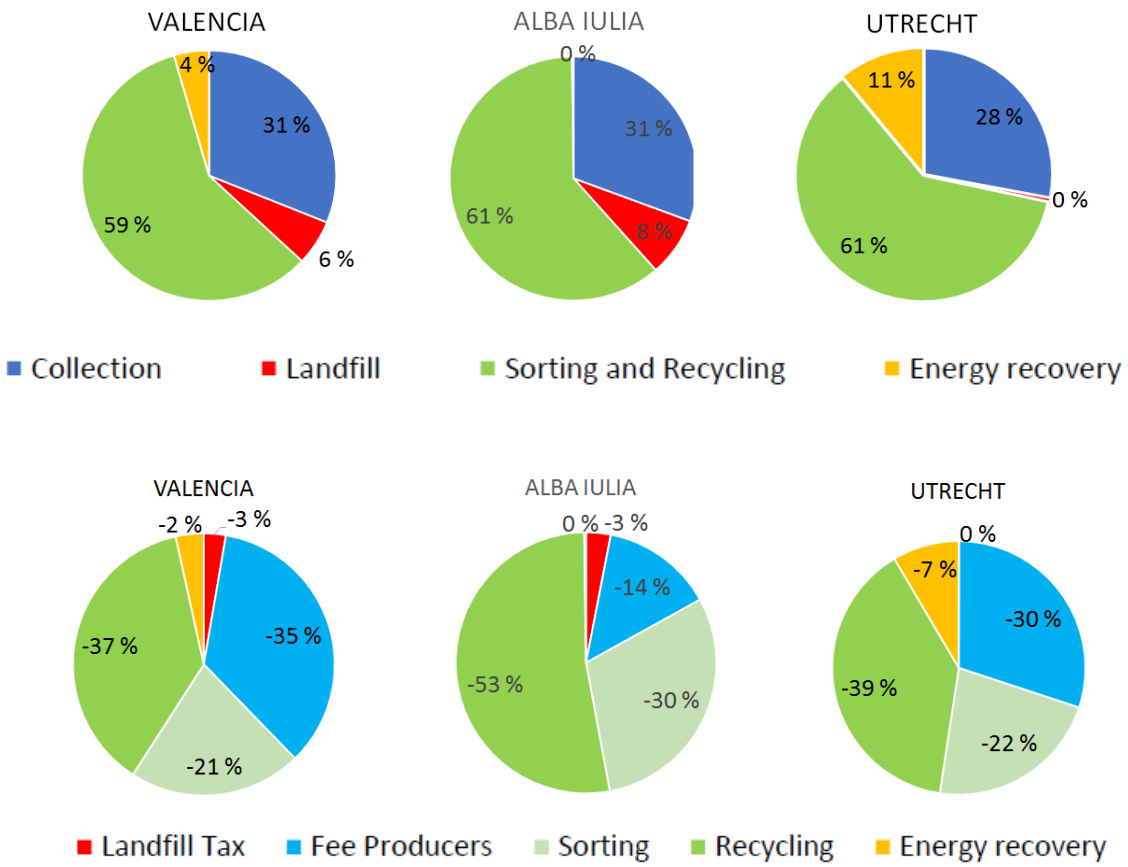

Figure 27 Revenues distribution for the plastic waste management fort he three cities

2.4 Results for Europe

The outcomes from the evaluation at European level indicate also that the largest costs are due to collection, sorting, and recycling while energy recovery (via incineration) and landfilling have only minor costs as only small amounts are handled by these options (Figures 28 and 29). With respect to revenues, large revenues are generated through sorting and recycling steps (Figure 30). The producers' fees contribute also largely to the economy of the plastic waste management. The European level shows that the revenues are larger than the incurred costs throughout the waste management value chain.

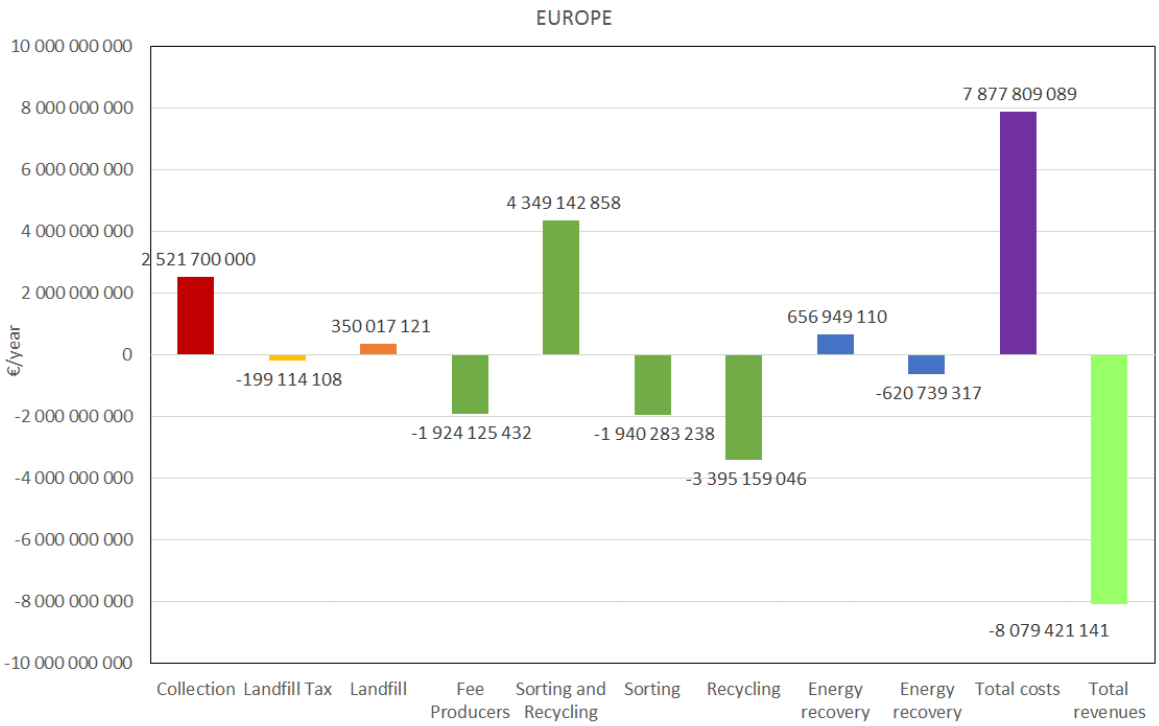

Figure 28 Costs and revenues breakdown for the plastic waste management in Europe, where positive values are costs and negative values are revenues

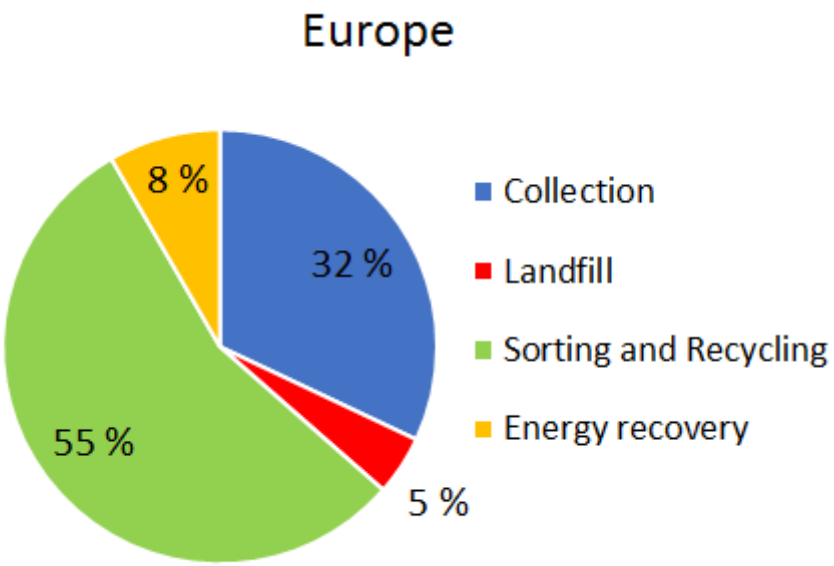

Figure 29 Costs distribution for the plastic waste management for Europe

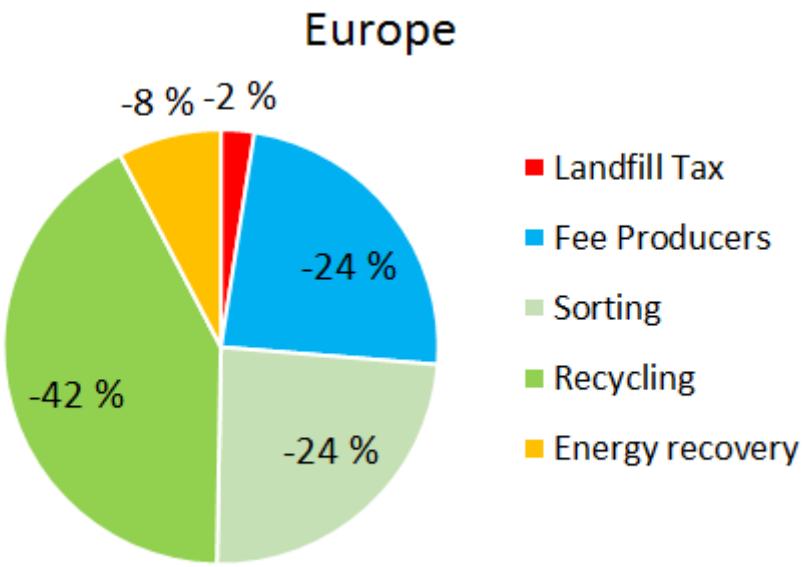

Figure 30 Revenues distribution for the plastic waste management for Europe

3. Social LCA

3.1 Introduction

The final objective of this task is to carry out a social comparative between current management plastic packaging waste and the potential management by using the PlastiCircle concept. Therefore, this social study is aligned with the Life Cycled Assessment (LCA) and Life Cycle Cost (LCC) explained in sections 1 and 2 of this deliverable. In this initial deliverable the methodology followed to achieve the final evaluation which will be handled in M44 in D7.5.

S-LCAs are surely as important as environmental ones. One core issue with S-LCA is keeping consistency among the standards between studies. Even if standards can eventually become more or less similar in criteria, differences among studies will always occur. Generally, practitioners of S-LCA will need to incorporate a large share of qualitative data, since numeric information will be less capable of addressing the issues at hand. When numeric data is useful—for example, in assessing the wages of a particular enterprise—additional data will still be needed to address its meaning: compliance with minimum wage laws does not always mean the wages are livable. Often, data may have to be collected on the spot, since databases for specific social and socio-economic impacts are at a minimum. [21]

As one might guess, the current limitations of S-LCA are many. They can be expensive, if extensive data gathering is required. They are challenging to conduct because qualitative data is often subjective and therefore must be handled by capable experts. As with environmental LCAs (E-LCA), the ripple effects in the life cycle of the product are difficult to determine. It is hard to see where the effects of social interaction finally diminish. Since the scope of the studies is quite large, it is impossible to truly assess the entire life cycle.

Two tools have been developed to assess parts of this framework. The most famous is Environmental Life Cycle Assessment (E-LCA), a very popular tool used to provide information on the externalities and internalities for the planet. In other words, it is mainly looking at the impacts on the natural environment of economic activities and, to a minor extent, impacts on human health and natural resources.

A rather new tool is Life Cycle Costing (LCC). This tool is primarily focused on the direct costs and benefits from economic activities for "people, planet and profit or prosperity."

Until now, no commonly accepted methodology for assessing internalities and externalities of the production of goods and services for "people" and "profit/prosperity" was available. That is precisely what the tool presented in these Guidelines wants to deliver on the basis of the most current and state of the art methodological developments it formulates guidelines on how to assess a product based on social and socio-economic indicators. By doing so, it is complementing the E-LCA and the LCC in contributing to the full assessment of goods and services

[21] UNEP / SETAC, 2009

within the context of sustainable development. In the text, social LCA will be used as a synonym for social and socio-economic LCA and S-LCA will be used as an acronym.

A social and socio-economic Life Cycle Assessment (S-LCA) is a social impact (and potential impact) assessment technique that aims to assess the social and socio-economic aspects of products and their potential positive and negative impacts along their life cycle encompassing extraction and processing of raw materials; manufacturing; distribution; use; re-use; maintenance; recycling; and final disposal. S-LCA complements E-LCA with social and socio-economic aspects. It can either be applied on its own or in combination with E-LCA.

S-LCA assesses social and socio-economic impacts found along the life cycle (supply chain, including the use phase and disposal) with generic and site specific data. It differs from other social impacts assessment techniques by its objects: products and services, and its scope: the entire life cycle. Social and socioeconomic aspects assessed in S-LCA are those that may directly affect stakeholders positively or negatively during the life cycle of a product. They may be linked to the behaviors of enterprises, to socio-economic processes, or to impacts on social capital. Depending on the scope of the study, indirect impacts on stakeholders may also be considered. [22]

S-LCA does not have the goal nor pretends to provide information on the question of whether a product should be produced or not. S-LCA documents the product utility but does not have the ability nor the function to inform decision making at that level. It is correct that information on the social conditions of production, use and disposal may provide elements for thoughts on the topic, but will, in itself, seldom be a sufficient basis for decision.

In theory, S-LCA may be conducted on any products, even those that are knowingly harmful to society (e.g. weapons). It is recommended to use S-LCA ethically and it is assumed that peer review will prevent using the methodology inappropriately. Socially responsible investing firms often provide lists of product categories being excluded for ethical reasons. If the product category studied is listed, it is recommended to detail, in the goal and scope phase of the study, the reason why it is ethical and reasonable to conduct a S-LCA of this particular product. Documentation of the product utility and assessment of the use phase of the life cycle will also generally reflect the unethical or harmful nature of the product.

S-LCA is a technique that helps inform incremental improvements but does not in itself provide a breakthrough solution for sustainable consumption and sustainable living. Those topics go well beyond the scope of the tool.

S-LCA provides information on social and socio-economic aspects for decision making, instigating dialogue on the social and socio-economic aspects of production and consumption, in the prospect to improve performance of organizations and ultimately the well-being of stakeholders.

[22] UNEP / SETAC, 2009

3.2 Goal and scope

The objective of this report is to make a social comparison of the current management of plastic packaging waste compared to the potential results in waste management of plastic packaging after pilots of PlastiCircle project. The ultimate objective is to know if the perception of people improves with the new waste management system offered by PlastiCircle.

In this way, the objective is in the same line as those established in the study of environmental life cycle (ELCA) and economic (LLC) analysis, using, in this case, the methodology proposed by Guidelines for Social Life Cycle Assessment of Products "(UNEP / SETAC, 2009).

The intended application of a S-LCA are to identify social "hotspots" and the options for reducing the potential negative impacts and risks through waste management using PlastiCircle model.

The scope of this report will be focused on the part of collection of plastic packaging waste:

3.2.1 Functional Unit

The functional unit is to collect and manage 1000 kg of plastic packaging waste.

3.2.2 Selection of Stakeholders and Subcategories

Three stakeholders have been selected for this analysis:

- Consumers: As the final users of PlastiCircle system (citizens). The specific questionnaires for citizens will be done before and after the pilots in each city, once the people that is going to participate is identified. And results will be shown in D7.5 (M44).
- Local communities: Taking into account communities of people living in the three pilot cities.
- Society: how PlastiCircle will improve society perception of waste management.

The stakeholders that have been left out in this analysis have been:

- Workers: workers have been taken out for this initial Deliverable but will be taken into account for D7.5 in M44. Pre-pilot and post-pilot information will be gathered and results will be shown in D7.5 (M44).
- Value chain actors: value chain actors have been taken out for this initial Deliverable but will be taken into account for D7.5 in M44

Stakeholders	Subcategory
Consumer (citizens)	Health and safety
	Service satisfaction
	Consumer privacy
	Feedback Mechanism
	Transparency
	End of life responsibility
Local community	Health and safety living conditions
	Local Employement
	Community engagement
	Acces to inmaterial resources
Society	Public commitment to sustainability issues
	Technology development
	Contribution to economic development

Figure 31. Stakeholders and subcategories chosen for this report

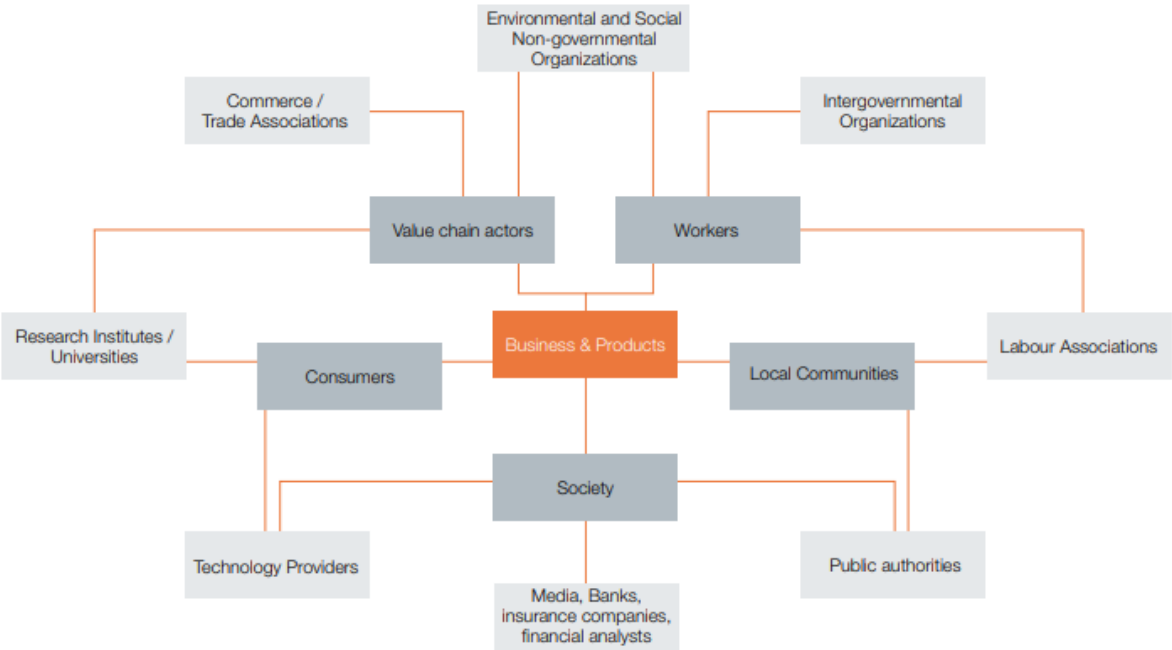

Figure 32. Hub and spoke stakeholder diagram

3.3 Boundaries and Assumptions

Both S-LCA and E-LCA seek to minimize the uncertainty in their results, in order to provide clearer support to decision making. While they share this orientation towards uncertainty, they have very different orientations towards the use of subjective information, and its role in reducing uncertainty in the final results.

Inventory data in E-LCA is limited to physical quantities, ideally measured, or estimated based on models, prior measurements, and published data; it does not include subjective information. Impact assessment methods in E-LCA attempt to delay value-based aggregation and to keep it separate from what is considered science-based characterization within an impact category, and possible science-based aggregation of impacts within (broader, more encompassing) damage categories.

Sometimes in S-LCA, subjective data is the most appropriate information to use. Sometimes the data that is sought (because of its empirically demonstrated relevance to social outcomes of interest) is inherently subjective, such as worker reports of their perceived degree of control over their schedules and working environment. In these cases, bypassing data on worker impressions in favour of more "objective" data (such as variability in observed worker arrival times, or other attempted proxies for perceived degree of control) would introduce greater uncertainty in the results, not less.

3.3.1 Data inventory

Data is collected from groups of citizens, citizens associations, waste managers and municipalities (city hall workers).

Questionnaires have been done in order to ask this groups of people questions to assess the social impact of the waste management systems in each city (Annex 2).

Questions have been prepared according to the guidelines for social life cycle assessment of products - UNEP DTIE

Only results from Alba Iulia have been collected. In the next deliverables of WP7, results from Valencia and Utrecht will be included with the comparisons between the situation before and after PlastiCircle.

Stakeholders	Subcategory	What does it evaluate?	Inventory indicator	Questions (citizens)	Questions citizens associations	Questions (waste managers)	Questions municipality
Consumer (citizens)	Health and safety	Existence of policies in favour of consumer protection	Satisfaction of citizens regarding health and safety issues	A.1 Waste management system in my municipality ensures health and safety living conditions	B.1 Waste management system in my municipality ensures health and safety living conditions	C.1 Waste management system in my municipality ensures health and safety living conditions	D.1 Waste management system in my municipality ensures health and safety living conditions
			Number of complaints identified regarding waste management service within 6 months period		B.2 Number of complaints identified regarding waste management service within 6 months period	C.2 Number of complaints identified regarding waste management service within 6 months period	D.2 Number of complaints identified regarding waste management service within 6 months period
			Accomplishment of legal requirements			C.3 Which legal requirements / standards regarding environment are being accomplished (ISO 14000, EMAS…)?	D.3 Which legal requirements / standards regarding environment are being accomplished (ISO 14000, EMAS…)?
	Service satisfaction	Level of consumer's satisfaction with the waste management service	Level of waste management system acceptability by citizens	A.2 I have access to an adequate system of waste management	B.3 Citizens have access to an adequate system of waste management	C.4 Citizens have access to an adequate system of waste management	D.4 Citizens have access to an adequate system of waste management
				A.3 I am satisfied with the recycling system of my municipality			
				A.4 I have access to an adequate system of plastic packaging waste management	B.4 Citizens have access to an adequate system of plastic packaging waste management	C.5 Citizens have access to an adequate system of plastic packaging waste management	D.5 Citizens have access to an adequate system of plastic packaging waste management
				A.5 I have regular waste collection in my area			
	Consumer privacy	Consumers personal data is well stored and managed	Number of consumer complaints related to breach of privacy or loss of data within 6 months period	A.6 I believe that my personal data and information is well stored	B.5 Number of consumer complaints related to breach of privacy or loss of data within 6 months period	C.6 Number of consumer complaints related to breach of privacy or loss of data within 6 months period	D.6 Number of consumer complaints related to breach of privacy or loss of data within 6 months period
	Feedback Mechanism	Existence of Feedback channels to support consumers queries	Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)	A.7 I am able to give feedback on the system and give my opinion on different matters on the waste management field	B6. Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)	C.7 Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)	D.7 Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)
			Existence of consumer satisfaction questionnaires.	A.8 I have access to consumers' satisfaction questionnaires.	B.7 Existence of consumer satisfaction questionnaires.	C.8 Existence of consumer satisfaction questionnaires.	D.8 Existence of consumer satisfaction questionnaires.
	Transparency	If the organization clearly communicates its social responsibility and the aspects	Number of consumer complaints regarding transparency within 6 months period		B.8 Number of consumer complaints regarding transparency within 6 months period	C.9 Number of consumer complaints regarding transparency within 6 months period	D.9 Number of consumer complaints regarding transparency within 6 months period
			Communication of the results of social and environmental life cycle impact assessment	A.9 I believe that waste management system in my municipality is transparent	B.9 The results of social and environmental life cycle impact assessment have been communicated	C.10 The results of social and environmental life cycle impact assessment have been communicated	D.10 The results of social and environmental life cycle impact assessment have been communicated

Stakeholders	Subcategory	What does it evaluate?	Inventory indicator	Questions (citizens)	Questions citizens associations	Questions (waste managers)	Questions municipality
	End of life responsibility	if the organization communicates clearly to consumers how they should properly manage their waste	Degree of improvement of the social awareness of consumers on issues of effectiveness and efficiency of recycling	A.10 Recycling helps to conserve the environment			
				A.11 Recycling reduces the amount of waste going to landfill			
				A.12 Landfilling waste harms the environment			
				A.13 Waste incineration discourages recycling			
				A.14 I know how to separate waste according to the directives of my country			
			Do internal management systems ensure that clear information is provided to consumers on end-of-life options (if applicable)?	A.15 Transforming plastic packaging to other products is a good way to obtain valuable resources			
				A.16 I know how to separate all plastic packaging			
				A.17 Internal management systems ensure that clear information is provided to consumers on end-of-life options	B.10 Internal management systems ensure that clear information is provided to consumers on end-of-life options	C.11 Internal management systems ensure that clear information is provided to consumers on end-of-life options	D.11 Internal management systems ensure that clear information is provided to consumers on end-of-life options
Local community	Health and safety living conditions	Existence of policies in favor of consumer protection or consumer complaints	If the service affect the local comunity's health and safe living conditions (or not)	A.1 Waste management system in my municipality ensures health and safety living conditions	B.11 Waste management system in my municipality ensures health and safety living conditions		
			Pollution levels in the municipality				
	Local Employement	How does the organization's role affect local employment? Evaluate if the organization hires local people	Number of new jobs created			C.12 Number of new jobs created in the last 6 months	
			Number of jobs lost during the reporting period			C.13 Number of jobs lost during the lasts 6 months	
	Community engagement	Level of engagement of the community with sustainability issues	Level of awareness of citizens in waste management options	A.14 I know how to separate waste according to the directives of my country			
				A.16 I know how to separate all plastic packaging			
				A20. Whether I recycle or not does NOT make a difference			
				A.21 Recycling is rewarding			
				A.22 Suistainability issues are relevant to our daily life			
				A.23 Recycling of plastic packaging is relevant to our daily lives			
				A.24 Recycling is rewarding			

Stakeholders	Subcategory	What does it evaluate?	Inventory indicator	Questions (citizens)	Questions citizens associations	Questions (waste managers)	Questions municipality
				A.25 I would prefer to receive individual/collective incentives for recycling			
				A.26 I believe my efforts in sorting plastic packaging have a direct benefit			
				A.27 I feel guilty if I don't recycle			
			Number of meetings with community stakeholders	A.18 I have participate in workshops and awareness campaigns and meetings on waste management	B.11 Number of meetings with community stakeholders	C.14 Number of meetings with community stakeholders	D.12 Number and quality of meetings with community stakeholders
	Acces to inmaterial resources	Level of organizations working to give the Community greater access to intangible resources (services, intellectual property rights, freedom of expression and access to information)	Presence/strength of community education initiatives	A.19 I am a aware of education initiatives on waste management in my municipality	B.12 Number of community education initiatives regarding waste management or environement (last 6 months period)	C.15 Number of community education initiatives (last 6 months period)	D.13 Number of community education initiatives (last 6 months period)
Society	Public commitment to sustainability issues	Evaluates if the company is carrying out actions to improve its sustainability and reduce its environmental impact. Existence of commitments …	Level of engagement of society regarding sustainability due to changes in waste management systems		B.13 Number of public commitment actions by waste management stakeholders	C.16 I believe that citizens are commited with sustainability issues	B.13 I believe that citizens are commited with sustainability issues
	Technology development	Evaluates if the organization participates in joint research and the development of safe, efficient and environmental technologies	Sector efforts in technology development	A.28 I believe that waste managers are making an effort to improve technology development		C.17 Economic effort by the company in the development of new technologies compared to the sector	
				A.29 I believe that the waste manager in my municipality is working to reduce their environmental impact		C.18 Percentage of employees of the company assigned to I + D + I with respect to the total number of employees	
	Contribution to economic development	Evalúa en qué medida la organización, producto o servicio contribuye al desarrollo económico del país.	Contribution of the service to economic development	A.30 I believe that plastic recycling can contribute to economic development of the municipality	B.14 I believe that the waste management system in my municipality boosts economic development	C.19 I believe that plastic recycling can contribute to economic development of the municipality	C.19 I believe that plastic recycling can contribute to economic development of the municipality
				A.31 I believe that the waste management system in my municipality boosts economic development		C.20 I believe that the waste management system in my municipality boosts economic development	C.20 I believe that the waste management system in my municipality boosts economic development

Results of evaluation of social impact

2.10 Alba Iulia

2.10.1 Social life cycle assessment results

Only data from Alba Iulia has been collected until this moment, in the next deliverables of WP7, Valencia and Utrecht results will be shown.

The abovementioned questions have been evaluated as it can be seen in Table xx

PERCENTAGE	COMPLAINS	COMMUNICATION CHANELS	MEETINGS /INITIATIVES
0-30	<5	>3	>2
30-60	5 -> 15	1 -> 3	1 -> 2
60-100	>15	<1	<1

ALBA IULIA RESULTS

Stakeholders	Subcategory	What does it evaluate?	Inventory indicator	Questions citizens associations	Impact	Questions (waste managers)	Impact	Questions municipality	Impact
Consumer (citizens)	Health and safety	Existence of policies in favor of consumer protection or consumer complaints	Satisfaction of citizens regarding health and safety issues	B.1 Waste management system in my municipality ensures health and safety living conditions	33,1%	C.1 Waste management system in my municipality ensures health and safety living conditions	11%	D.1 Waste management system in my municipality ensures health and safety living conditions	31,0%
			Number of complaints identified regarding waste management service within 6 months period	B.2 Number of complaints identified regarding waste management service within 6 months period	6	C.2 Number of complaints identified regarding waste management service within 6 months period	20	D.2 Number of complaints identified regarding waste management service within 6 months period	49
			Accomplishment of legal requirements			C.3 Which legal requirements / standards regarding environment are being accomplished (ISO 14000, EMAS…)?	TSO 19001 TSO 14001 TSO 9001 OHSAS 18001	D.3 Which legal requirements / standards regarding environment are being accomplished (ISO 14000, EMAS…)?	ISO 14001
	Service satisfaction	Level of consumer's satisfaction with the waste management service	Level of waste management system acceptability by citizens	B.3 Citizens have access to an adequate system of waste management	48,20%	C.4 Citizens have access to an adequate system of waste management	7%	D.4 Citizens have access to an adequate system of waste management	45,5%
				B.4 Citizens have access to an adequate system of plastic packaging waste management	61,10%	C.5 Citizens have access to an adequate system of plastic packaging waste management	13%	D.5 Citizens have access to an adequate system of plastic packaging waste management	42,8%
	Consumer privacy	Consumers personal data is well stored and managed	Number of consumer complaints related to breach of privacy or loss of data within 6 months period	B.5 Number of consumer complaints related to breach of privacy or loss of data within 6 months period	0	C.6 Number of consumer complaints related to breach of privacy or loss of data within 6 months period	0	D.6 Number of consumer complaints related to breach of privacy or loss of data within 6 months period	0
	Feedback Mechanism	Existence of Feedback channels to support consumers queries	Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)	B6. Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)	1,16	C.7 Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)	2	D.7 Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)	2,42
			Existence of consumer satisfaction questionnaires.	B.7 Existence of consumer satisfaction questionnaires.	No	C.8 Existence of consumer satisfaction questionnaires.	No	D.8 Existence of consumer satisfaction questionnaires.	Inconclusive
	Transparency	If the organization clearly communicates its social responsibility and the aspects	Number of consumer complaints regarding transparency within 6 months period	B.8 Number of consumer complaints regarding transparency within 6 months period	10	C.9 Number of consumer complaints regarding transparency within 6 months period	5	D.9 Number of consumer complaints regarding transparency within 6 months period	0
			Communication of the results of social and environmental life cycle impact assessment	B.9 The results of social and environmental life cycle impact assessment have been communicated	No	C.10 The results of social and environmental life cycle impact assessment have been communicated	Yes	D.10 The results of social and environmental life cycle	Inconclusive

Stakeholders	Subcategory	What does it evaluate?	Inventory indicator	Questions citizens associations	Impact	Questions (waste managers)	Impact	Questions municipality	Impact
								impact assessment have been communicated	
	End of life responsibility	if the organization communicates clearly to consumers how they should properly manage their waste	Degree of improvement of the social awareness of consumers on issues of effectiveness and efficiency of recycling						
			Do internal management systems ensure that clear information is provided to consumers on end-of-life options (if applicable)?						
				B.10 Internal management systems ensure that clear information is provided to consumers on end-of-life options	40,58%	C.11 Internal management systems ensure that clear information is provided to consumers on end-of-life options	13%	D.11 Internal management systems ensure that clear information is provided to consumers on end-of-life options	48,2%
Local community	Health and safety living conditions	Existence of policies in favor of consumer protection or consumer complaints	If the service affect the local comunity's health and safe living conditions (or not)						
			Pollution levels in the municipality						
	Local Employement	How does the organization's role affect local employment? Evaluate if the organization hires local people	Number of new jobs created			C.12 Number of new jobs created in the last 6 months	12		
			Number of jobs lost during the reporting period			C.13 Number of jobs lost during the lasts 6 months	12		
	Community engagement	Level of engagement of the community with sustainability issues	Level of awareness of citizens in waste management options						
			Number of meetings with community stakeholders	B.11 Number of meetings with community stakeholders	0	C.14 Number of meetings with community stakeholders	5	D.12 Number and quality of meetings with community stakeholders	5
	Acces to inmaterial resources	Level of organizations working to give the Community greater access to intangible resources (services, intellectual	Presence/strength of community education initiatives	B.12 Number of community education initiatives regarding waste management or environement (last 6 months period)	1	C.15 Number of community education initiatives (last 6 months period)	5	D.13 Number of community education initiatives (last 6 months period)	3

Stakeholders	Subcategory	What does it evaluate?	Inventory indicator	Questions citizens associations	Impact	Questions (waste managers)	Impact	Questions municipality	Impact
		property rights, freedom of expression and access to information)							
Society	Public commitment to sustainability issues	Evaluates if the company is carrying out actions to improve its sustainability and reduce its environmental impact. Existence of commitments …	Level of engagement of society regarding sustainability due to changes in waste management systems	B.13 Number of public commitment actions by waste management stakeholders	0				
						C.16 I believe that citizens are commited with sustainability issues	Yes	D.14 I believe that citizens are committed with sustainability issues	Yes/No
	Technology development	Evaluates if the organization participates in joint research and the development of safe, efficient and environmental technologies	Sector efforts in technology development			C.17 Economic effort by the company in the development of new technologies compared to the sector	14%		
						C.18 Percentage of employees of the company assigned to I + D + I with respect to the total number of employees	7,80%		
	Contribution to economic development	Evalúa en qué medida la organización, producto o servicio contribuye al desarrollo económico del país.	Contribution of the service to economic development			C.19 I believe that plastic recycling can contribute to economic development of the municipality	11%	D.15 I believe that plastic recycling can contribute to economic development of the municipality	7%
				B.14 I believe that the waste management system in my municipality boosts economic development	48,23%	C.20 I believe that the waste management system in my municipality boosts economic development	3%	D.16 I believe that the waste management system in my municipality boosts economic development	12%

2.10.2 Social life cycle assessment results

The social conditions of the groups of people who answered the questionnaires form Alba Iulia can be seen in the next table:

CITIZENS ASSOCIATIONS							
GENDER		**AGE**		**WORKING CONDITIONS**		**LEVEL OF STUDIES**	
Females	16	55-65	5	Employed full-time	17	College	11
No declared	2	45-55	4	No declared	1	No studies	1
		35-45	6			High school	5
		No declared	2			No declared	1
WASTE MANAGER							
GENDER		**AGE**				**LEVEL OF STUDIES**	
Females	8	55-65	1			College	6
Males	2	45-55	5			High school	4
		35-45	4				
		No declared					
PUBLIC AUTHORITY							
GENDER		**AGE**		**WORKING CONDITIONS**		**LEVEL OF STUDIES**	
Females	19	55-65	6	Employed full-time	28	College	26
Males	10	45-55	4	Other	1	PHd	1
		35-45	9			High school	1
		25-35	8			Other	1
		18-25	1				
		No declared					

4. Conclusions

This deliverable provides preliminary information on environmental, economic and social impact of plastic packaging waste management, including the following stages: collection, transport, recycling and end of life options.

A questionnaire has been prepared and sent to relevant project participants and plastic waste management actors. Unfortunately, the survey resulted in partial or reduced quality data limiting their use for this preliminary assessment. Indeed, the recycling value chain of plastics is very diverse and involves a multitude of actors in each step of the chain together with the confidentiality aspect of requested data make the data gathering difficult and often impossible. Therefore, for the sake of this initial assessment, data have been collected from literature sources at EU and Member State level. Efforts will be made to improve the accuracy of these data to fit the actual case studies evaluated in Plasticircle project.

The comparison between the situation before and after PlastiCircle will provide information on the environmental, economic and social benefits of applying the PlastiCircle concept to the waste management systems in the European countries.

5. Annexes

ANNEX 1. EUROPEAN INDICATORS

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Austria	Economic	GDP	3		
		Personal Income	3		
		Economic total	**6**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste			
		Worries - plastic and environment	1,5		1,5
		Tertiary Education	1,5		
		Social total	**3**	**0**	**3**
	Policy	Waste Management Plan	1	1	1
		Landfill tax			
		Incineration tax			
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste	1		
		Economic incentives			
		Policy total	**3**	**1**	**1**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe		2	
		Infrastructure total	**2**	**2**	**0**
	Austria	**TOTAL**	14	3	4

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Bulgaria	Economic	GDP			3
		Personal Income			
		Economic total	**0**	**0**	**3**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste			
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**1,5**	**0**	**3**
	Policy	Waste Management Plan	1		
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste	1		

		Economic incentives			1
		Policy total	**3**	**0**	**3**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			2
		Infrastructure total	**0**	**2**	**4**
	Bulgaria	**TOTAL**	4,5	2	13

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Croatia	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste			
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**1,5**	**0**	**3**
	Policy	Waste Management Plan	1	1	
		Landfill tax	1		1
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste			1
		Economic incentives			1
		Policy total	**3**	**1**	**5**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			2
		Infrastructure total	**0**	**2**	**4**
	Croatia	**TOTAL**	4,5	3	12

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Cyprus	Economic	GDP		3	
		Personal Income		3	
		Economic total	**0**	**6**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education			
		Social total	**1,5**	**4,5**	**0**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1

		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste			1
		Economic incentives			1
		Policy total	**2**	**1**	**4**
	Infrastructure	Population Density		2	2
		Collection facilties		2	2
		Waste-to-Energy in Europe			2
		Infrastructure total	**0**	**4**	**6**
	Cyprus	**TOTAL**	3,5	15,5	10

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Czech Republic	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**1,5**	**1,5**	**3**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste	1		
		Economic incentives	1	1	
		Policy total	**4**	**2**	**2**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			
		Infrastructure total	**2**	**0**	**0**
	Czech Republic	**TOTAL**	7,5	3,5	5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Denmark	Economic	GDP			
		Personal Income	3		
		Economic total	**3**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education	1,5	1,5	
		Social total	**3**	**6**	**0**

	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax			
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste			1
		Economic incentives	1	1	
		Policy total	**3**	**2**	**1**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**2**	**2**
	Denmark	**TOTAL**	9	10	3

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Estonia	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education	1,5	1,5	
		Social total	**1,5**	**4,5**	**1,5**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax		1	1
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste			1
		Economic incentives			
		Policy total	**2**	**2**	**2**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			
		Infrastructure total	**2**	**0**	**0**
	Estonia	**TOTAL**	5,5	6,5	3,5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Finland	Economic	GDP			
		Personal Income	3		
		Economic total	**3**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste	1,5		
		Worries - plastic and environment		1,5	

		Tertiary Education		1,5	
		Social total	**3**	**4,5**	**0**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste	1		
		Economic incentives			
		Policy total	**4**	**1**	**1**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			
		Infrastructure total	**2**	**0**	**0**
	Finland	**TOTAL**	12	5,5	1

Country	Indicator type	Indicator	Netherlands	Spain	Romania
France	Economic	GDP	3		
		Personal Income	3		
		Economic total	**6**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste	1,5		
		Worries - plastic and environment		1,5	
		Tertiary Education	1,5	1,5	
		Social total	**4,5**	**4,5**	**0**
	Policy	Waste Management Plan			
		Landfill tax			
		Incineration tax			
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste			1
		Economic incentives	1	1	
		Policy total	**2**	**1**	**1**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			
		Infrastructure total	**2**	**0**	**0**
	France	**TOTAL**	14,5	5,5	1

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Germany	Economic	GDP	3		
		Personal Income	3		
		Economic total	**6**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5

		Behaviour - recycle waste		1,5	
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**1,5**	**1,5**	**3**
	Policy	Waste Management Plan			
		Landfill tax	1		1
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste	1		
		Economic incentives			
		Policy total	**4**	**0**	**2**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			
		Infrastructure total	**2**	**0**	**0**
	Germany	**TOTAL**	13,5	1,5	5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Greece	Economic	GDP		3	
		Personal Income			
		Economic total	**0**	**3**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education			
		Social total	**1,5**	**4,5**	**0**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste			1
		Economic incentives	1	1	
		Policy total	**3**	**2**	**3**
	Infrastructure	Population Density			2
		Collection facilties		2	2
		Waste-to-Energy in Europe			2
		Infrastructure total	**0**	**2**	**6**
	Greece	**TOTAL**	4,5	11,5	9

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Hungary	Economic	GDP			
		Personal Income			

		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**1,5**	**1,5**	**3**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax		1	1
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste		1	
		Economic incentives	1	1	
		Policy total	**3**	**4**	**1**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**2**	**2**
	Hungary	**TOTAL**	4,5	7,5	6

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Ireland	Economic	GDP	3		
		Personal Income			
		Economic total	**3**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education			
		Social total	**1,5**	**4,5**	**0**
	Policy	Waste Management Plan			
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW		1	
		Mandatory seperate collection of biowaste	1		
		Economic incentives			
		Policy total	**2**	**1**	**1**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**2**	**2**
	Ireland	**TOTAL**	6,5	7,5	3

Country	Indicator type	Indicator	Netherlands	Spain	Romania

Italy	Economic	GDP		3	
		Personal Income		3	
		Economic total	**0**	**6**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education			1,5
		Social total	**1,5**	**4,5**	**1,5**
	Policy	Waste Management Plan			
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste		1	
		Economic incentives	1	1	
		Policy total	**2**	**2**	**2**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe	2		
		Infrastructure total	**2**	**2**	**2**
	Italy	**TOTAL**	5,5	14,5	5,5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Latvia	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste			
		Worries - plastic and environment		1,5	
		Tertiary Education	1,5	1,5	
		Social total	**1,5**	**3**	**1,5**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste			1
		Economic incentives			1
		Policy total	**2**	**1**	**4**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			2
		Infrastructure total	**0**	**2**	**4**
	Latvia	**TOTAL**	3,5	6	9,5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Lithuania	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education	1,5	1,5	
		Social total	**1,5**	**4,5**	**1,5**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW		1	
		Mandatory seperate collection of biowaste			1
		Economic incentives			
		Policy total	**2**	**2**	**2**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**2**	**2**
	Lithuania	**TOTAL**	3,5	8,5	5,5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Luxembourg	Economic	GDP	3		
		Personal Income			
		Economic total	**3**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste	1,5		
		Worries - plastic and environment		1,5	
		Tertiary Education	1,5	1,5	
		Social total	**4,5**	**4,5**	**0**
	Policy	Waste Management Plan	1	1	
		Landfill tax	1		1
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste	1		
		Economic incentives			
		Policy total	**5**	**1**	**2**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			

		Infrastructure total	**2**	**0**	**0**
	Luxembourg	**TOTAL**	14,5	5,5	2

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Malta	Economic	GDP		3	
		Personal Income		3	
		Economic total	**0**	**6**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste	1,5		
		Worries - plastic and environment		1,5	
		Tertiary Education			
		Social total	**3**	**3**	**0**
	Policy	Waste Management Plan	1	1	
		Landfill tax	1		1
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste			1
		Economic incentives			1
		Policy total	**3**	**1**	**5**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			2
		Infrastructure total	**0**	**2**	**4**
	Malta	**TOTAL**	6	12	9

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Poland	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**1,5**	**1,5**	**3**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste			1
		Economic incentives			1
		Policy total	**3**	**1**	**3**
	Infrastructure	Population Density			

		Collection facilties		2	2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**2**	**2**
	Poland	**TOTAL**	4,5	4,5	8

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Portugal	Economic	GDP		3	
		Personal Income			
		Economic total	**0**	**3**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment		1,5	
		Tertiary Education			
		Social total	**1,5**	**4,5**	**0**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax			
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste			1
		Economic incentives			1
		Policy total	**1**	**1**	**3**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**2**	**2**
	Portugal	**TOTAL**	2,5	10,5	5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Slovakia	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			1,5
		Behaviour - recycle waste		1,5	
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**1,5**	**1,5**	**3**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste	1		
		Economic incentives			

		Policy total	**3**	**1**	**2**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**2**	**2**
	Slovakia	**TOTAL**	4,5	4,5	7

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Slovenia	Economic	GDP		3	
		Personal Income		3	
		Economic total	**0**	**6**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste	1,5		
		Worries - plastic and environment		1,5	
		Tertiary Education			
		Social total	**3**	**3**	**0**
	Policy	Waste Management Plan			1
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW	1		
		Mandatory seperate collection of biowaste			1
		Economic incentives			
		Policy total	**2**	**0**	**3**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			2
		Infrastructure total	**2**	**0**	**2**
	Slovenia	**TOTAL**	7	9	5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Sweden	Economic	GDP			
		Personal Income	3		
		Economic total	**3**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste	1,5		
		Worries - plastic and environment		1,5	
		Tertiary Education		1,5	
		Social total	**3**	**4,5**	**0**
	Policy	Waste Management Plan	1	1	
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW	1		

		Mandatory seperate collection of biowaste			1
		Economic incentives			
		Policy total	**3**	**1**	**2**
	Infrastructure	Population Density			
		Collection facilties	2		
		Waste-to-Energy in Europe			
		Infrastructure total	**2**	**0**	**0**
	Sweden	**TOTAL**	11	5,5	2

Country	Indicator type	Indicator	Netherlands	Spain	Romania
United Kingdom	Economic	GDP	3		
		Personal Income			
		Economic total	**3**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5	1,5	
		Behaviour - recycle waste	1,5		
		Worries - plastic and environment	1,5		1,5
		Tertiary Education			
		Social total	**4,5**	**1,5**	**1,5**
	Policy	Waste Management Plan			
		Landfill tax			
		Incineration tax	1		1
		Landfill ban on organic/non-pretreated MSW			1
		Mandatory seperate collection of biowaste			1
		Economic incentives			1
		Policy total	**1**	**0**	**4**
	Infrastructure	Population Density			
		Collection facilties		2	2
		Waste-to-Energy in Europe	2		
		Infrastructure total	**2**	**2**	**2**
	United Kingdom	**TOTAL**	10,5	3,5	7,5

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Spain	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment	1,5		
		Behaviour - recycle waste			
		Worries - plastic and environment			
		Tertiary Education	1,5		
		Social total	**3**	**0**	**0**
	Policy	Waste Management Plan	1		
		Landfill tax			

		Incineration tax			
		Landfill ban on organic/non-pretreated MSW			
		Mandatory seperate collection of biowaste			
		Economic incentives	1		
		Policy total	**2**	**0**	**0**
	Infrastructure	Population Density			2
		Collection facilties			2
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**0**	**4**
	Spain	**TOTAL**	5	0	4

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Romania	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment			
		Behaviour - recycle waste			
		Worries - plastic and environment	1,5		
		Tertiary Education			
		Social total	**1,5**	**0**	**0**
	Policy	Waste Management Plan			
		Landfill tax	1		
		Incineration tax	1		
		Landfill ban on organic/non-pretreated MSW			
		Mandatory seperate collection of biowaste			
		Economic incentives			
		Policy total	**2**	**0**	**0**
	Infrastructure	Population Density		2	
		Collection facilties		2	
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**4**	**0**
	Romania	**TOTAL**	3,5	4	0

Country	Indicator type	Indicator	Netherlands	Spain	Romania
Netherlands	Economic	GDP			
		Personal Income			
		Economic total	**0**	**0**	**0**
	Social	Attitude - Importance of protecting environment		1,5	
		Behaviour - recycle waste			
		Worries - plastic and environment			1,5
		Tertiary Education		1,5	
		Social total	**0**	**3**	**1,5**

	Policy	Waste Management Plan		1	
		Landfill tax			1
		Incineration tax			1
		Landfill ban on organic/non-pretreated MSW			
		Mandatory seperate collection of biowaste			
		Economic incentives		1	
		Policy total	**0**	**2**	**2**
	Infrastructure	Population Density			
		Collection facilties			
		Waste-to-Energy in Europe			
		Infrastructure total	**0**	**0**	**0**
	Netherlands	**TOTAL**	0	5	3,5

ANNEX 2. SLCA QUESTIONNAIRES

PLASTICIRCLE - Social Life Cycle Assessment: CITIZENS (participants)

In order to compile information about the Social Impact that implementing PLASTICIRCLE is going to have in a municipality, we would be very grateful if you could answer the following questions. You will have to answer these questions again, once the pilot has been implemented in your municipality.

1. *Mark only one oval.*

   ◯ Option 1

Terms and conditions

Please, before answering this questionnaire, read the PARTICIPANT INFORMATION SHEET which will be attached to this questionnaire

2. **MUNICIPALITY'S NAME**
   Mark only one oval.

   ◯ Valencia
   ◯ Alba Iulia
   ◯ Utrectht

HEALTH AND SAFETY

3. **A.1 Waste management system in my municipality ensures health and safety living conditions**
   Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

4. **A.2 I have access to an adequate system of waste management**
   Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

5. **A.3 I am satisfied with the recycling system of my municipality**
   Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

6. **A.4 I have access to an adequate system of plastic packaging waste management**
Mark only one oval

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

7. **A.5 I have regular waste collection in my area**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

CONSUMER'S PRIVACY

8. **A.6 I believe that my personal data and information is well stored**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

FEEDBACK MECHANISM

9. **A.15 Transforming plastic packaging to other products is a good way to obtain valuable resources**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

10. **A.8 I have access to consumers' satisfaction questionnaires**
Mark only one oval.

- ◯ Yes
- ◯ No

TRANSPARENCY

11. **A.9 I believe that waste management system in my municipality is transparent**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

END OF LIFE RESPONSIBILITY

12. **A.10 Recycling helps to conserve the environment**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

13. **A.11 Recycling reduces the amount of waste going to landfill**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

14. **A.12 Landfilling waste harms the environment**
Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Yes, but I would like to learn more

15. **A.13 Waste incineration discourages recycling**
Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Yes, but I would like to learn more

16. **A.14 I know how to separate waste according to the directives of my country**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

17. **A.15 Transforming plastic packaging to other products is a good way to obtain valuable resources**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

18. **A.16 I know how to separate all plastic packaging**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

19. **A.17 Internal management systems ensure that clear information is provided to consumers on end-of-life options**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

COMMUNITY ENGAGEMENT

20. **A.18 I have participate in workshops and awareness campaigns and meetings on waste management**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

21. **A.19 I am a aware of education initiatives on waste management in my municipality**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

22. **A.20 Whether I recycle or not does NOT make a difference**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

23. **A.21 Recycling is rewarding**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

24. **A.22 Suistainability issues are relevant to our daily life**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

25. **A.23 Recycling of plastic packaging is relevant to our daily lives**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

26. **A.24 Recycling is rewarding**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

27. **A.25 I would prefer to receive individual/collective incentives for recycling**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

28. **A.26 I believe my efforts in sorting plastic packaging have a direct benefit**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

29. **A.27 I feel guilty if I don't recycle**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

30. **A.28 I believe that waste managers are making an effort to improve technology development**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

31. **A.29 I believe that the waste manager in my municipality is working to reduce their environmental impact**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

32. **A.30 I believe that plastic recycling can contribute to economic development of the municipality**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

33. **A.31 I believe that the waste management system in my municipality boosts economic development**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

34. **Additional Comments**

35. **Describe any complaints you have**

36. **Gender**
Mark only one oval.

- ◯ Male
- ◯ Female

37. **Age**
Mark only one oval.

- 18 - 25
- 25 - 35
- 35 - 45
- 45 - 55
- 55 - 65
- Over 65

38. **Working conditions**
Mark only one oval.

- Employed full-time
- Employed part-time
- Unemployed
- Student
- Other

39. **Level of studies**
Mark only one oval.

- No studies
- Elementary school
- High school
- College
- PhD
- Other

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PLASTICIRCLE - Social Life Cycle Assessment: Stakeholder: CONSUMERS / CITIZENS ASSOCIATION

In order to compile information about the Social Impact that implementing PLASTICIRCLE is going to have in a municipality, we would be very grateful if you could answer the following questions.

Terms and conditions

Please, before answering this questionnaire, read the PARTICIPANT INFORMATION SHEET which will be attached to this questionnaire

1. **NAME OF THE ORGANISATION**

2. **MUNICIPALITY'S NAME**
Mark only one oval.
   - Alba Iulia
   - Valencia
   - Utrecht

HEALTH AND SAFETY

3. **B.1 Waste management system in my municipality ensures health and safety living conditions**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree											Totally agree

4. **B.2 Number of complaints identified regarding waste management service within 6 months period**

5. **B.3 Citizens have access to an adequate system of waste management**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree											Totally agree

6. **B.4 Citizens have access to an adequate system of plastic packaging waste management**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

CONSUMER'S PRIVACY

7. **B.5 Number of consumer complaints related to breach of privacy or loss of data within 6 months period**

_____

FEEDBACK MECHANISM

8. **B6. Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)**
Tick all that apply.

- ☐ Phone number (general)
- ☐ Email
- ☐ Incident sheets
- ☐ Technical service phone number
- ☐ Other: _____

9. **B.7 Existence of consumer satisfaction questionnaires**
Mark only one oval.

- ◯ Yes
- ◯ No

TRANSPARENCY

10. **B.8 Number of consumer complaints regarding transparency within 6 months period**
Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Yes, but I would like to learn more

11. **B.9 The results of social and environmental life cycle impact assessment have been communicated**
Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Some

END OF LIFE RESPONSIBILITY

12. **B.10 Internal management systems ensure that clear information is provided to consumers on end-of-life options**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

13. **B.11 Number of meetings with community stakeholders regarding waste management**

14. **B.12 Number of community education initiatives regarding waste management or environment (last 6 months period)**

15. **B.13 Number of public commitment actions by waste management stakeholders**

16. **B.14 I believe that the waste management system in my municipality boosts economic development**
Mark only one oval.

1	2	3	4	5	6	7	8	9	10
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

17. **Additional Comments**

18. **Describe any complaints you have**

19. **Gender**
Mark only one oval.

- Male
- Female

20. **Age**
Mark only one oval.

- 18 - 25
- 25 - 35
- 35 - 45
- 45 - 55
- 55 - 65
- Over 65

21. **Working conditions**
Mark only one oval.

- Employed full-time
- Employed part-time
- Unemployed
- Student
- Other

22. **Level of studies**
Mark only one oval.

- No studies
- Elementary school
- High school
- College
- PhD
- Other

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PLASTICIRCLE - Social Life Cycle Assessment: Stakeholder: WASTE MANAGER

In order to compile information about the Social Impact that implementing PLASTICIRCLE is going to have in a municipality, we would be very grateful if you could answer the following questions. You will have to answer these questions again, once the pilot has been implemented in your municipality.

1. **ORGANISATION'S NAME**

_____

HEALTH AND SAFETY

2. **C.1 Waste management system in the municipality ensures health and safety living conditions**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

3. **C.4 Citizens have access to an adequate system of plastic packaging waste management**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

END OF LIFE RESPONSIBILITY

4. **C.11 Internal management systems ensure that clear information is provided to consumers on end-of-life options**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

5. **C.16 I believe that citizens are committed with sustainability issues**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

6. **C.17 Economic effort by the company in the development of new technologies compared to the sector**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

7. **C.19 I believe that plastic recycling can contribute to economic development of the municipality**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

8. **C.20 I believe that the waste management system in my municipality boosts economic development**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

9. **Additional Comments**

10. **Describe any complaints you have**

11. **Gender**
Mark only one oval.

- ◯ Male
- ◯ Female

12. **Age**
Mark only one oval.

- 18 - 25
- 25 - 35
- 35 - 45
- 45 - 55
- 55 - 65
- Over 65

13. **Role in the organisation**

14. **Level of studies**
Mark only one oval.

- No studies
- Elementary school
- High school
- College
- PhD
- Other

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PLASTICIRCLE - Social Life Cycle Assessment: Stakeholder: WASTE MANAGER

In order to compile information about the Social Impact that implementing PLASTICIRCLE is going to have in a municipality, we would be very grateful if you could answer the following questions. You will have to answer these questions again, once the pilot has been implemented in your municipality.

1. **ORGANISATION'S NAME**

_____

HEALTH AND SAFETY

2. **C.2 Number of complaints identified regarding waste management service within 6 months period**

_____

3. **C.3 Which legal requirements / standards regarding environment are being accomplished (ISO 14000, EMAS…)?**

_____

_____

_____

_____

_____

CONSUMER'S PRIVACY

4. **C.6 Number of consumer complaints related to breach of privacy or loss of data within 6 months period**

_____

FEEDBACK MECHANISM

5. **C.7 Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)**
Tick all that apply.

- ☐ Phone number (general)
- ☐ Email
- ☐ Incident sheets
- ☐ Technical service phone number
- ☐ Other: _____

6. **C.8 Existence of consumer satisfaction questionnaires**
Mark only one oval

- Yes
- No

TRANSPARENCY

7. **C.9 Number of consumer complaints regarding transparency within 6 months period**

8. **C.10 The results of social and environmental life cycle impact assessment have been communicated**
Mark only one oval.

- Yes
- No
- Some

END OF LIFE RESPONSIBILITY

9. **C.12 Number of jobs created in the last 6 months**

10. **C.13 Number of jobs lost during the lasts 6 months**

11. **C.14 Number of meetings with community stakeholders regarding waste management**

12. **C.15 Number of community education initiatives regarding waste management or environment (last 6 months period)**

13. **Additional Comments**

14. **Describe any complaints you have**

15. **Gender**
Mark only one oval.

- Male
- Female

16. **Age**
Mark only one oval.

- 18 - 25
- 25 - 35
- 35 - 45
- 45 - 55
- 55 - 65
- Over 65

17. **Role in the organisation**

18. **Level of studies**
Mark only one oval.

- No studies
- Elementary school
- High school
- College
- PhD
- Other

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PLASTICIRCLE - Social Life Cycle Assessment: Stakeholder: PUBLIC AUTHORITY

In order to compile information about the Social Impact that implementing PLASTICIRCLE is going to have in a municipality, we would be very grateful if you could answer the following questions. You will have to answer these questions again, once the pilot has been implemented in your municipality.

1. **MUNICIPALITY'S NAME**
   Mark only one oval.

   - ( ) Alba Iulia
   - ( ) Valencia
   - ( ) Utrecht

HEALTH AND SAFETY

2. **D.1 Waste management system in the municipality ensures health and safety living conditions**
   Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	Totally agree

3. **D.2 Number of complaints identified regarding waste management service within 6 months period**

   _____

4. **D.3 Which legal requirements / standards regarding environment are being accomplished (ISO 14000, EMAS…)?**

   _____
   _____
   _____
   _____
   _____

5. **D.4 Citizens have access to an adequate system of plastic packaging waste management**
   Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	Totally agree

6. **D.5 Citizens have access to an adequate system of plastic packaging waste management**
Mark only one oval

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

CONSUMER'S PRIVACY

7. **D.6 Number of consumer complaints related to breach of privacy or loss of data within 6 months period**

_____

FEEDBACK MECHANISM

8. **D.7 Number of communication channels with the citizen (Email, phone number, incident sheets, fax, technical service, etc.)**
Tick all that apply.

- ☐ Phone number (general)
- ☐ Email
- ☐ Incident sheets
- ☐ Technical service phone number
- ☐ Other: _____

9. **D.8 Existence of consumer satisfaction questionnaires**
Mark only one oval.

- ◯ Yes
- ◯ No

TRANSPARENCY

10. **D.9 Number of consumer complaints regarding transparency within 6 months period**

_____

11. **D.10 The results of social and environmental life cycle impact assessment have been communicated**
Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Some

END OF LIFE RESPONSIBILITY

12. **D.11 Internal management systems ensure that clear information is provided to consumers on end-of-life options**
Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Totally disagree	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Totally agree

13. **D.12 Number of meetings with community stakeholders regarding waste management**

14. **D.13 Number of community education initiatives regarding waste management or environment (last 6 months period)**

15. **D.14 I believe that citizens are committed with sustainability issues**
Mark only one oval.

1	2	3	4	5	6	7	8	9	10
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

16. **C.15 I believe that plastic recycling can contribute to economic development of the municipality**
Mark only one oval.

1	2	3	4	5	6	7	8	9	10
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

17. **C.16 I believe that the waste management system in my municipality boosts economic development**
Mark only one oval.

1	2	3	4	5	6	7	8	9	10
◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

18. **Additional Comments**

19. **Describe any complaints you have**

20. **Gender**
Mark only one oval.

- Male
- Female

21. **Age**
Mark only one oval.

- 18 - 25
- 25 - 35
- 35 - 45
- 45 - 55
- 55 - 65
- Over 65

22. **Working conditions**
Mark only one oval.

- Employed full-time
- Employed part-time
- Unemployed
- Student
- Other

23. **Level of studies**
Mark only one oval.

- No studies
- Elementary school
- High school
- College
- PhD
- Other

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